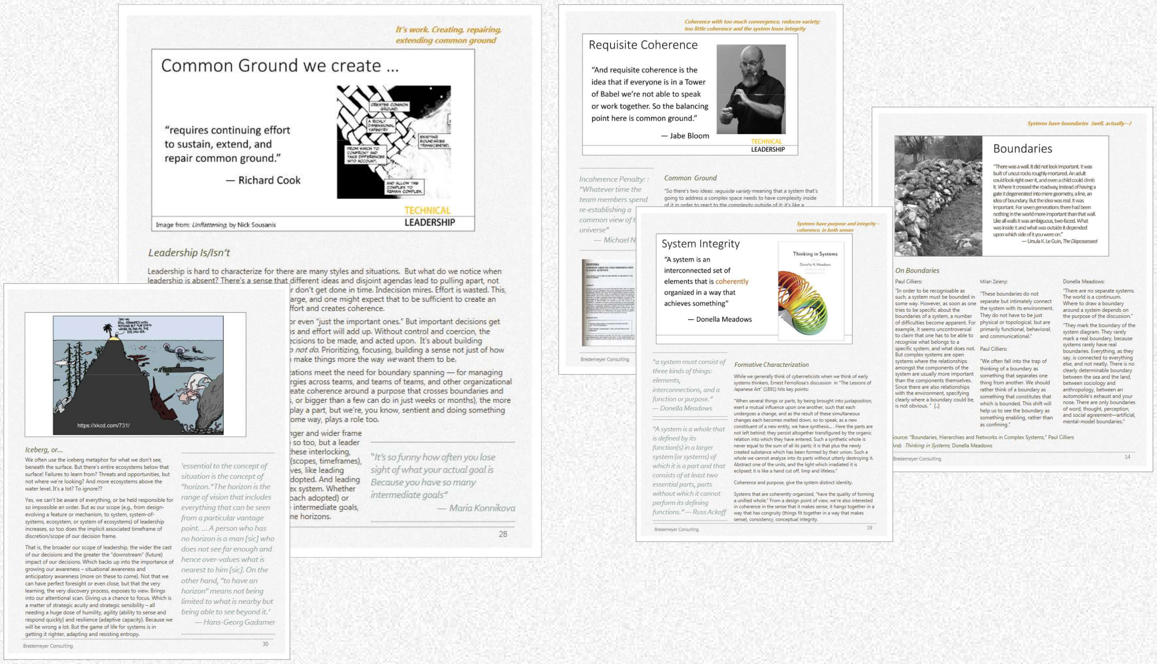
# TECHNICAL LEADERSHIP

*Ruth Malan*



*It's work. Creating, repairing, extending common ground*

Common Ground we create …

"requires continuing effort to sustain, extend, and repair common ground."

— Richard Cook

CREATES COMMON GROUND.
A RICHLY DIMENSIONAL TAPESTRY
EXISTING BOUNDARIES TRANSCENDED,
FROM WHICH TO CONFRONT AND TAKE DIFFERENCES INTO ACCOUNT,
AND ALLOW THE COMPLEX TO REMAIN COMPLEX.
TECHNICAL LEADERSHIP

Image from: *Unflattening*, by Nick Sousanis

*Leadership Is/Isn't*

Leadership is hard to characterize for there are many styles and situations. But what do we notice when leadership is absent? There's a sense that different ideas and disjoint agendas lead to pulling apart, not
r don't get done in time. Indecision mires. Effort is wasted. This,
arge, and one might expect that to be sufficient to create an
ffort and creates coherence.

or even "just the important ones." But important decisions get
s and effort will add up. Without control and coercion, the
ecisions to be made, and acted upon. It's about building
*o not do.* Prioritizing, focusing, building a sense not just of how
make things more the way *we* want them to be.

zations meet the need for boundary spanning — for managing
rgies across teams, and teams of teams, and other organizational
eate coherence around a purpose that crosses boundaries and
, or bigger than a few can do in just weeks or months), the more
play a part, but we're, you know, sentient and doing something
ome way, plays a role too.

nger and wider frame
so too, but a leader
these interlocking,
(scopes, timeframes),
ves, like leading
dopted. And leading
ex system. Whether
oach adopted) or
intermediate goals,
ne horizons.

*"It's so funny how often you lose sight of what your actual goal is Because you have so many intermediate goals"*
*— Maria Konnikova*

28

DAY 46:
STILL STRANDED WITH NOTHING BUT FLAT EMPTY WATER AS FAR AS THE EYE CAN SEE.

https://xkcd.com/731/

*Iceberg, or…*

We often use the iceberg metaphor for what we don't see, beneath the surface. But there's entire ecosystems below that surface! Failures to learn from? Threats and opportunities, but not where we're looking? And more ecosystems above the water level. It's a lot? To ignore??

Yes, we can't be aware of everything, or be held responsible for so impossible an order. But as our scope (e.g., from design-evolving a feature or mechanism, to system, system-of-systems, ecosystem, or system of ecosystems) of leadership increases, so too does the implicit associated timeframe of discretion/scope of our decision frame.

That is, the broader our scope of leadership, the wider the cast of our decisions and the greater the "downstream" (future) impact of our decisions. Which backs up into the importance of growing our awareness – situational awareness and anticipatory awareness (more on these to come). Not that we can have perfect foresight or even close, but that the very learning, the very discovery process, exposes to view. Brings into our attentional scan. Giving us a chance to focus. Which is a matter of strategic acuity and strategic sensibility – all needing a huge dose of humility, agility (ability to sense and respond quickly) and resilience (adaptive capacity). Because we will be wrong a lot. But the game of life for systems is in getting it righter, adapting and resisting entropy.

*'essential to the concept of situation is the concept of "horizon." The horizon is the range of vision that includes everything that can be seen from a particular vantage point. … A person who has no horizon is a man [sic] who does not see far enough and hence over-values what is nearest to him [sic]. On the other hand, "to have an horizon" means not being limited to what is nearby but being able to see beyond it.'*
*— Hans-Georg Gadamer*

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*Coherence with too much convergence, reduces variety; too little coherence and the system loses integrity*

Requisite Coherence

"And requisite coherence is the idea that if everyone is in a Tower of Babel we're not able to speak or work together. So the balancing point here is common ground."

— Jabe Bloom

*Incoherence Penalty: : "Whatever time the team members spend re-establishing a common view of t universe"*
*— Michael N*

*Common Ground*

"So there's two ideas: *requisite variety* meaning that a system that's going to address a complex space needs to have complexity inside of it in order to react to the complexity outside of it; it's like a

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*Systems have purpose and integrity – coherence, in both senses*

System Integrity

"A system is an interconnected set of elements that is coherently organized in a way that achieves something"

— Donella Meadows

*"a system must consist of three kinds of things: elements, interconnections, and a function or purpose."*
*— Donella Meadows*

*"A system is a whole that is defined by its function(s) in a larger system (or systems) of which it is a part and that consists of at least two essential parts, parts without which it cannot perform its defining functions." — Russ Ackoff*

*Formative Characterization*

While we generally think of cyberneticists when we think of early systems thinkers, Ernest Fenollosa's discussion in "The Lessons of Japanese Art" (1891) hits key points:

"When several things or parts, by being brought into juxtaposition, exert a mutual influence upon one another, such that each undergoes a change, and as the result of these simultaneous changes each becomes melted down, so to speak, as a new constituent of a new entity, we have synthesis… . Here the parts are not left behind; they persist altogether transfigured by the organic relation into which they have entered. Such a synthetic whole is never equal to the sum of all its parts; it is that plus the newly created substance which has been formed by their union. Such a whole we cannot analyze into its parts without utterly destroying it. Abstract one of the units, and the light which irradiated it is eclipsed; it is like a hand cut off, limp and lifeless."

Coherence and purpose, give the system distinct identity.

Systems that are coherently organized, "have the quality of forming a unified whole." From a design point of view, we're also interested in coherence in the sense that it makes sense, it hangs together in a way that has congruity (things fit together in a way that makes sense), consistency, conceptual integrity.

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*Systems have boundaries (well, actually…)*

Boundaries

"There was a wall. It did not look important. It was built of uncut rocks roughly mortared. An adult could look right over it, and even a child could climb it. Where it crossed the roadway, instead of having a gate it degenerated into mere geometry, a line, an idea of boundary. But the idea was real. It was important. For seven generations there had been nothing in the world more important than that wall. Like all walls it was ambiguous, two-faced. What was inside it and what was outside it depended upon which side of it you were on."
— Ursula K. Le Guin, *The Dispossessed*

*On Boundaries*

Paul Cilliers:

"In order to be recognisable as such, a system must be bounded in some way. However, as soon as one tries to be specific about the boundaries of a system, a number of difficulties become apparent. For example, it seems uncontroversial to claim that one has to be able to recognise what belongs to a specific system, and what does not. But complex systems are open systems where the relationships amongst the components of the system are usually more important than the components themselves. Since there are also relationships with the environment, specifying clearly where a boundary could be, is not obvious. " [..]

Milan Zeleny:

"These boundaries do not separate but intimately connect the system with its environment. They do not have to be just physical or topological, but are primarily functional, behavioral, and communicational."

Paul Cilliers:

"We often fall into the trap of thinking of a boundary as something that separates one thing from another. We should rather think of a boundary as something that constitutes that which is bounded. This shift will help us to see the boundary as something enabling, rather than as confining."

Donella Meadows:

"There are no separate systems. The world is a continuum. Where to draw a boundary around a system depends on the purpose of the discussion."

"They mark the boundary of the system diagram. They rarely mark a real boundary, because systems rarely have real boundaries. Everything, as they say, is connected to everything else, and not neatly. There is no clearly determinable boundary between the sea and the land, between sociology and anthropology, between an automobile's exhaust and your nose. There are only boundaries of word, thought, perception, and social agreement—artificial, mental-model boundaries."

Source: "Boundaries, Hierarchies and Networks in Complex Systems," Paul Cilliers
And: *Thinking in Systems*, Donella Meadows

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October 2025

## Technical Leadership Workshops

Remote:

- March 24 and 31, 2026, 12pm-3pm Eastern Time (US/Canada).

## System Design and Software Architecture Workshops

Remote:

- 2026 open enrollment dates tba

Inhouse architecture and leadership workshops and team development days: contact training@bredemeyer.com

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# Decisions

*Leadership and decision making*

*Decisions constrain and enable*

*When do we make them?*

*Forces and Tradeoffs*

*Mental Models*

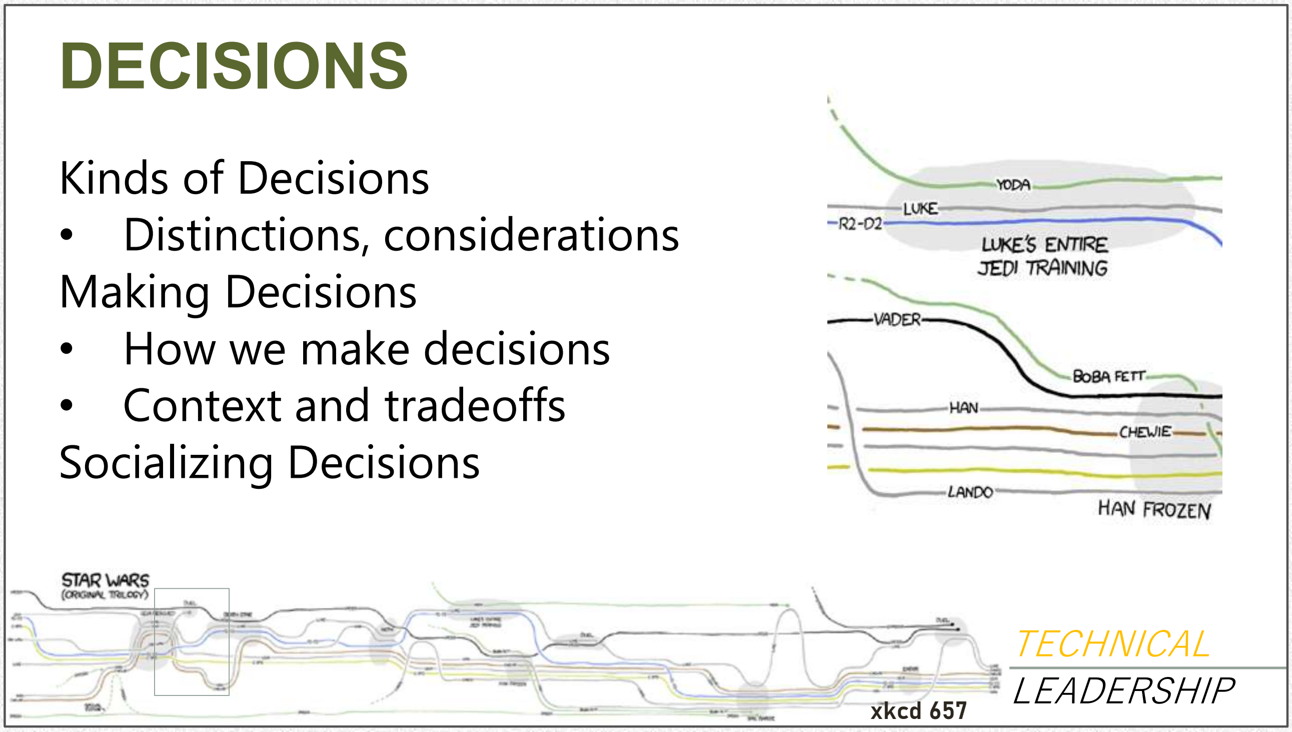
*Context*

*How do we make decisions?*

*Significance*

*Experiments and Feedback*

*Communication*



# DECISIONS

Kinds of Decisions
- Distinctions, considerations

Making Decisions
- How we make decisions
- Context and tradeoffs

Socializing Decisions

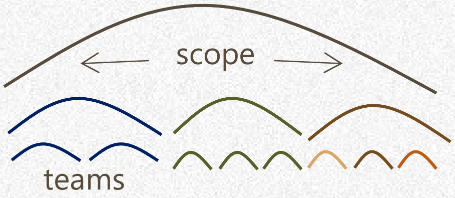
xkcd 657

## Decisions Across Boundaries

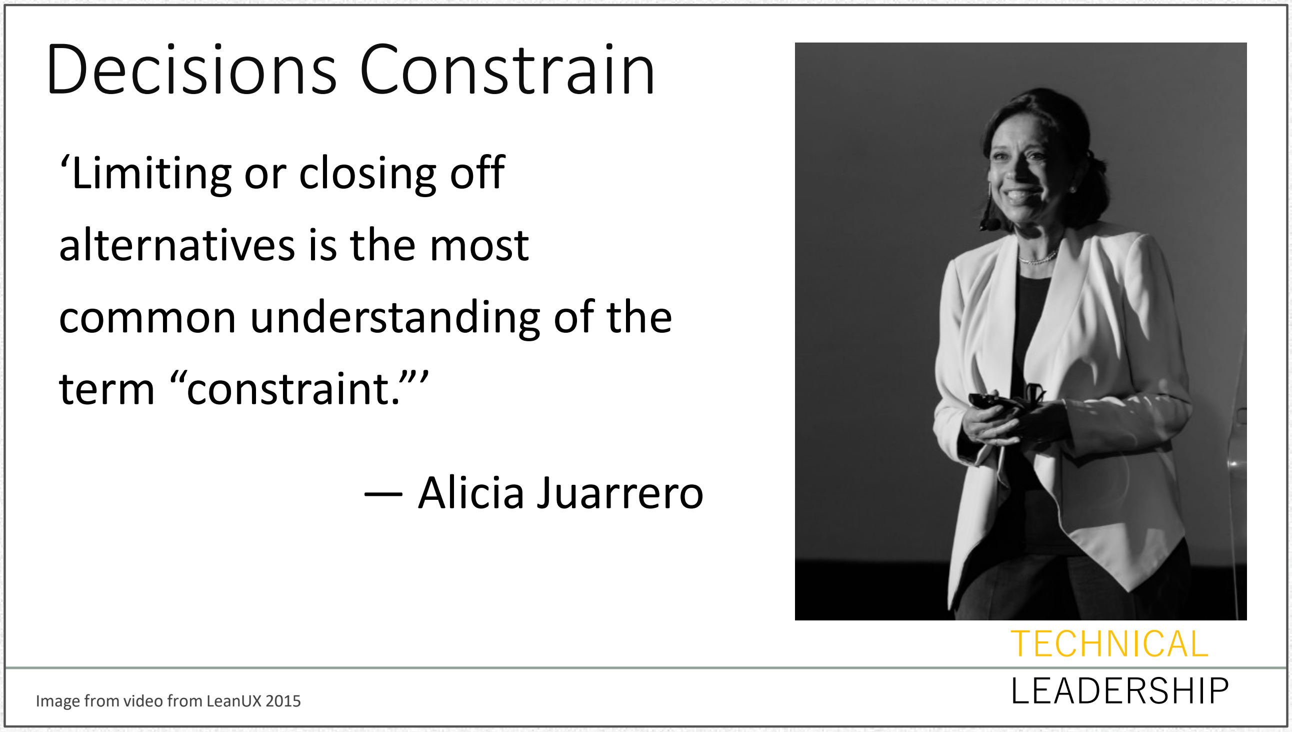
Recall: Leadership plays a role when we're trying to do something bigger than what we can accomplish alone.

In complex situations with many people, we can't have everyone making every decision; it's not feasible or practical or desirable. And, typically, we value moving decision making to those who have  necessary perspective and insight into the situation, options and impact. This also means that some decisions — those that need perspective across boundaries — need to be made at broader scope.

As the scope of a decision increases (to impact across organizational or system boundaries), even "technical" decisions have organizational implications. Decisions with organizational (strategy, team, etc.) impact, need to be made with wisdom (understand the effects and side-effects of choices), strategic acuity, as well as organizational sensibility.  In addition to technical experience and expertise, as relevant to identifying and shaping the decision.



These "across scope" decisions set context for further decisions. They enable something strategic, but also constrain and shape — but only as essential to system outcomes. And decisions that cross contexts or boundaries, need leadership — to bring perspectives and expertise together in making the decision, and to help others understand the need and outcomes, and consequences, and what their role is in making the decision effective. Leaders communicate strategic intent and decisions, and foster organizational will and goodwill, to facilitate work towards coherent strategic outcomes.



# Decisions Constrain

‘Limiting or closing off alternatives is the most common understanding of the term “constraint.”’

— Alicia Juarrero

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Image from video from LeanUX 2015

*Constraints are limitations we need to be aware of. They restrict choices open to us.*

*"The notion of a constraint is not a negative one. It's not something which merely limits possibilities, constraints are also enabling."*
*— Paul Cilliers*

## *Decisions Reduce the Options Space*

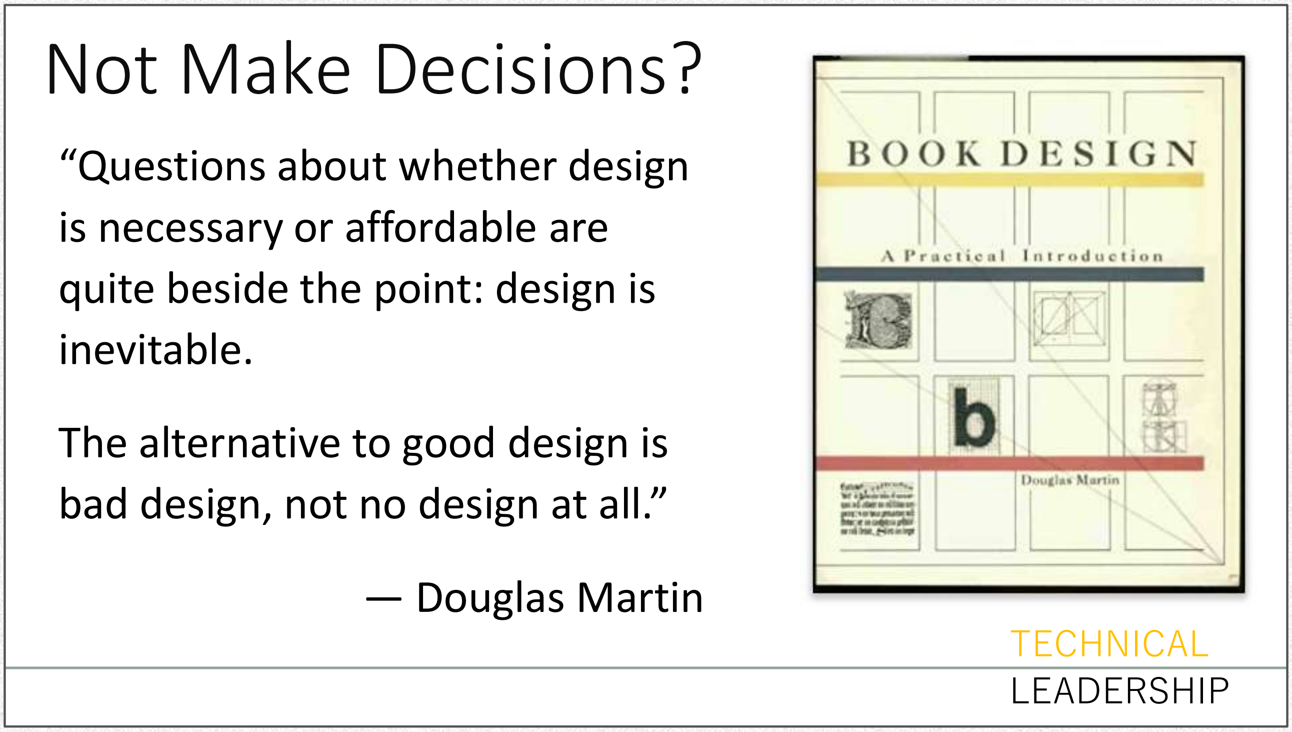
Decisions constrain—they eliminate options. Alicia Juarrero observes that this is what we commonly mean by constraint—this limiting or closing off of alternatives; this altering of the probability distribution of available alternatives. But! In so doing, Alicia notes, they make the system "diverge from chance, from randomness."

## *Illustration of Constraints that Limit*

“The connection of the tibia and the peronei to the knee joint constrains the movement of the lower leg in such a way that it makes no sense to examine the tibia's physiology, for example, independently of the knee. The tibia's connection to the knee gives the former characteristics which it wouldn't have otherwise: it can move in some ways but not others. The constraints which the connections subject the lower leg to reduce the number of ways in which the leg can move: it can bend backwards but not forwards, for example. In this example a constraint is a reduction of the leg's state space. This is the most common understanding of the term "constraint" . “

— Alicia Juarrero, “Causality as Constraint”

***Just not make them…?***



## Not Make Decisions?

"Questions about whether design is necessary or affordable are quite beside the point: design is inevitable.

The alternative to good design is bad design, not no design at all."

— Douglas Martin

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### *Decisions will be made — Implicitly or Explicitly; Intentionally or Accidentally,*

The question is not "do we have a strategy?" or "does the organization, product or system have an architecture?" What we have is more or less intentional, more or less emergent, and more or less accidental.  If we're not making big decisions (intentionally), we're allowing a myriad small decisions, some implicit and not reflectively weighed and checked, to add up, to determine strategy or architecture. So the question is not do we have a strategy or design. But rather "how good is it?" Can it be better? How so?

For example, if we want agility, we need to design and guide evolution for agility, for change and for responsiveness. We need to do this for the organization (teams, organizational and team dynamics, ..) and for the systems (architecture and design) and for the development, deployment and operations environment.

While the slide uses the Martin quote, we might acknowledge that our situations aren't that extreme. We are doing design (often more locally to the team's realm of focus, and in the medium of code), and teams work on improving the design. It's more a matter of anticipatory design and responsive design at the system level, so system outcomes versus locally maximizing due to local scope of attention and focus of work (objectives and pressures and realm of attention).

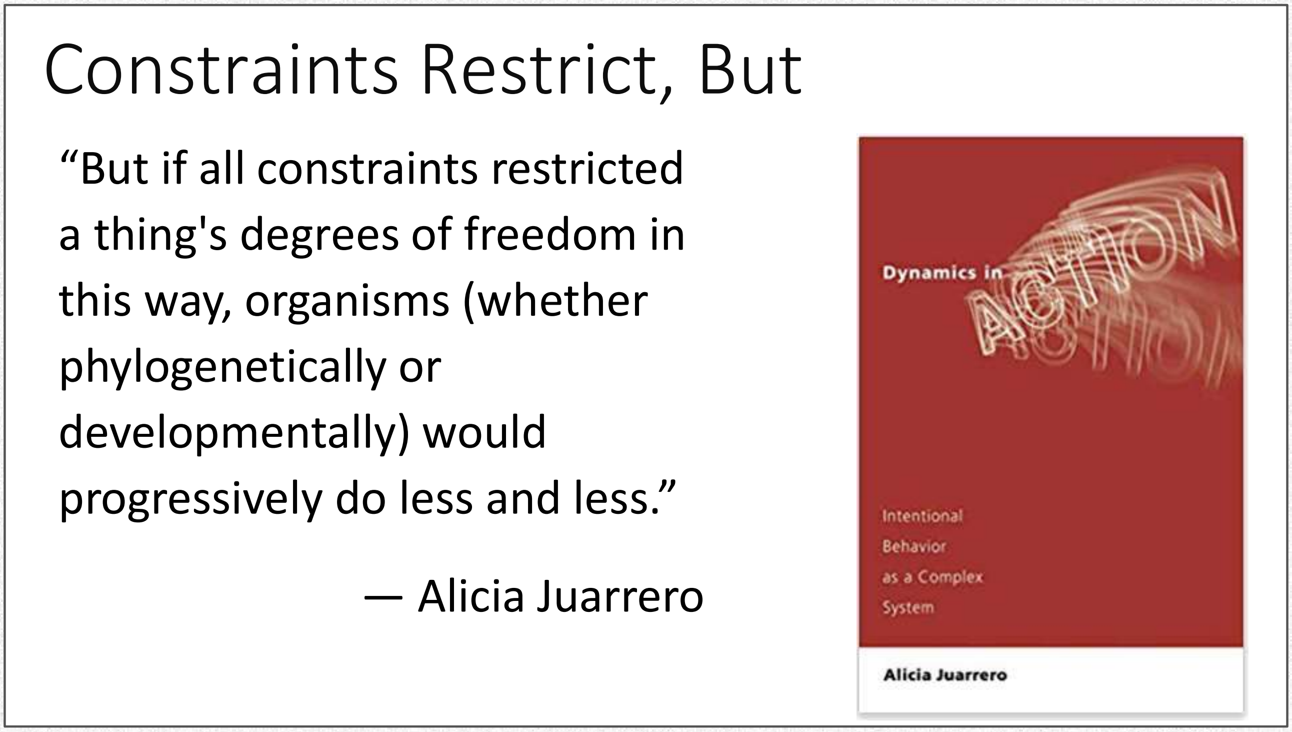
*"Every software-intensive system has an architecture. In some cases that architecture is intentional, while in others it is accidental. Most of the time it is both"*

*— Grady Booch*

*" Like most tech debt, we didn't **make** this decision, we just did not **not** make this decision."*

*— Jack Lindamood**

* Quote source: *(Almost) Every infrastructure decision I endorse or regret after 4 years running infrastructure at a startup, 2/1/2024* https://cep.dev/posts/every-infrastructure-decision-i-endorse-or-regret-after-4-years-running-infrastructure-at-a-startup/



# Constraints Restrict, But

"But if all constraints restricted a thing's degrees of freedom in this way, organisms (whether phylogenetically or developmentally) would progressively do less and less."

— Alicia Juarrero

Dynamics in
ACTION
Intentional
Behavior
as a Complex
System
Alicia Juarrero

## *While True, ...*

Constraints close off avenues, restrict the degrees of freedom, but if this was all they did, systems, including organisms, would just do less and less, as they became more constrained (Alicia Juarrero).

> *"Think of constraints not just as a restrictions, but as changes in probability of what's going on, changes in the likelihood of something"*
>
> *— Alicia Juarrero*

From Alicia Juarrero's talk (Deliberate Complexity Conference):

Constraints are conditions or factors that raise or lower barriers to energy, matter, and information flow – without themselves directly transferring energy. Example: an organisms vasculature does not impart energy directly; it channels and organizes energy flow.

Context dependent constraints enable complexity: some constraints link separate and independent elements and processes such that they become conditional on one another. They become inherently context-dependent. Enabling constraints facilitate the weaving together of interdependencies (among parts, and between parts and context). Examples: synchrony, entrainment, alignment. Enabling constraints self-organize interdependent, coherent, coordination dynamics (to create/enable new coherent dynamics). As a result, a complex system is embedded (not just plunked) in a context (temporal as well as spatial).

Source: Video of Alicia Juarrero's talk at the Deliberate Complexity online conference in 2022: Complexity is not Complication, https://www.youtube.com/watch?v=WmtjQZCIsqY

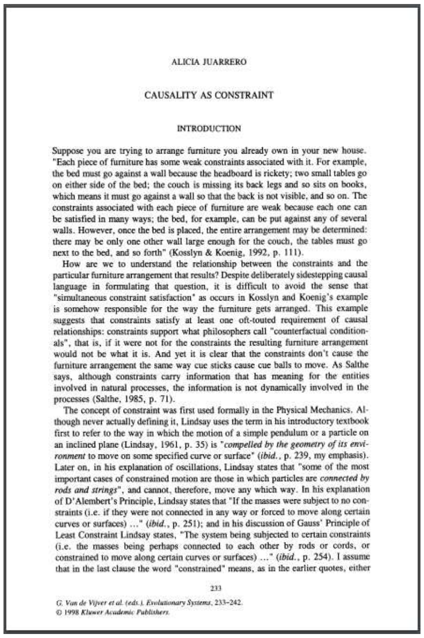
Also recommended: Constraints that Enable Innovation - Alicia Juarrero https://vimeo.com/128934608

**Constraints reduce some options, and create others**

# Constraints Enable

"constraints not only reduce the alternatives — they also create alternatives. Constraints, that is, can also create properties which a component exhibits in virtue of its embeddedness in a system, properties it would otherwise not have."

— Alicia Juarrero
"Causality as Contraint"



ALICIA JUARRERO

CAUSALITY AS CONSTRAINT

INTRODUCTION

Suppose you are trying to arrange furniture you already own in your new house. "Each piece of furniture has some weak constraints associated with it. For example, the bed must go against a wall because the headboard is rickety; two small tables go on either side of the bed; the couch is missing its back legs and so sits on books, which means it must go against a wall so that the back is not visible, and so on. The constraints associated with each piece of furniture are weak because each one can be satisfied in many ways; the bed, for example, can be put against any of several walls. However, once the bed is placed, the entire arrangement may be determined: there may be only one other wall large enough for the couch, the tables must go next to the bed, and so forth" (Kosslyn & Koenig, 1992, p. 111).

How are we to understand the relationship between the constraints and the particular furniture arrangement that results? Despite deliberately sidestepping causal language in formulating that question, it is difficult to avoid the sense that "simultaneous constraint satisfaction" as occurs in Kosslyn and Koenig's example is somehow responsible for the way the furniture gets arranged. This example suggests that constraints satisfy at least one oft-touted requirement of causal relationships: constraints support what philosophers call "counterfactual conditionals", that is, if it were not for the constraints the resulting furniture arrangement would not be what it is. And yet it is clear that the constraints don't cause the furniture arrangement the same way cue sticks cause cue balls to move. As Salthe says, although constraints carry information that has meaning for the entities involved in natural processes, the information is not dynamically involved in the processes (Salthe, 1985, p. 71).

The concept of constraint was first used formally in the Physical Mechanics. Although never actually defining it, Lindsay uses the term in his introductory textbook first to refer to the way in which the motion of a simple pendulum or a particle on an inclined plane (Lindsay, 1961, p. 35) is "*compelled by the geometry of its environment* to move on some specified curve or surface" (*ibid.*, p. 239, my emphasis). Later on, in his explanation of oscillations, Lindsay states that "some of the most important cases of constrained motion are those in which particles are *connected by rods and strings*", and cannot, therefore, move any which way. In his explanation of D'Alembert's Principle, Lindsay states that "If the masses were subject to no constraints (i.e. if they were not connected in any way or forced to move along certain curves or surfaces) ..." (*ibid.*, p. 251); and in his discussion of Gauss' Principle of Least Constraint Lindsay states, "The system being subjected to certain constraints (i.e. the masses being perhaps connected to each other by rods or cords, or constrained to move along certain curves or surfaces) ..." (*ibid.*, p. 254). I assume that in the last clause the word "constrained" means, as in the earlier quotes, either

233

*G. Van de Vijver et al. (eds.), Evolutionary Systems*, 233–242.
© 1998 *Kluwer Academic Publishers.*

## *Constraints Create Alternatives*

"Constraints not only reduce alternatives—they also create alternatives." If we take (Alicia Juarrero's example of) language, the constraints of syntax allow meaning to emerge.

## *Wholes arise from Constraints, and Wholes give rise to Constraints*

"parts interact to produce novel, emergent wholes; in turn, these distributed wholes as wholes regulate and constrain the parts that make them up"

— Alicia Juarrero, "Dynamics in Action: Intentional Behavior as a Complex System"

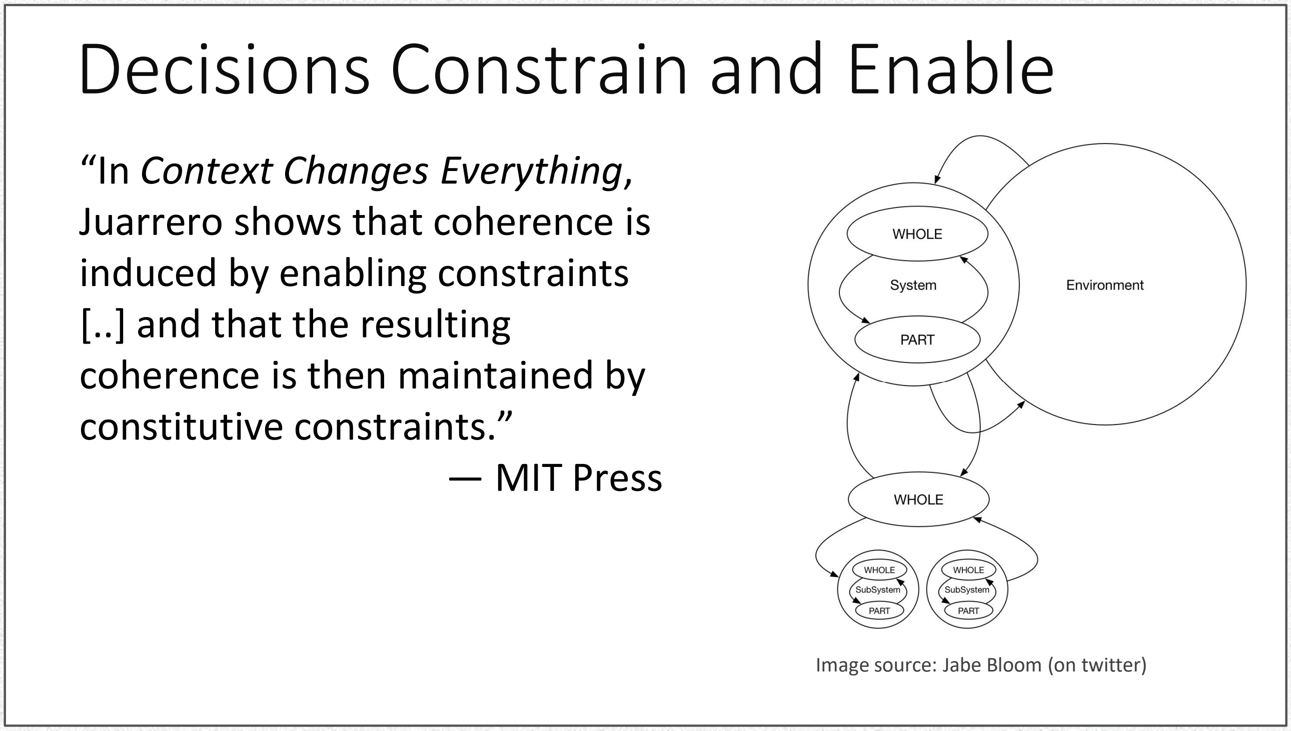
Juarrero (1999) distinguishes governing from enabling constraints: governing constraints regulate and restrict, while enabling constraints make a new level of complexity possible.

> *Context-sensitive constraints [..] synchronize and correlate previously independent parts into a systemic whole*
>
> *— Alicia Juarrero*

> *By curtailing the potential variation of component behavior, [..] context-dependent constraints paradoxically also create new freedoms for the overall system.*
>
> *— Alicia Juarrero*

**We need to make decisions. But when…?**

***Architecture is decisions! Decision constrain, and in constraining, enable***



Decisions Constrain and Enable

"In *Context Changes Everything*, Juarrero shows that coherence is induced by enabling constraints [..] and that the resulting coherence is then maintained by constitutive constraints."
— MIT Press

Image source: Jabe Bloom (on twitter)

## *Systems – but make it Wicked!*

The systems we are designing interact within environments, that act back on the system. As the system begins to emerge, it also starts to act back on itself, placing constraints on its elements, to enable connections and flows, and so on. This "placing constraints on" may be more intentional and considered, or more accidental. The sociotechnical system is also placing constraints on itself, to foster coherence. Protocols, standards, decisions and other agreements. Creating common ground by collaboratively modeling, so that a shared language and shared understandings emerge.

## *Decisions*

Decisions, making choices and constraining the subsequent design space, is both inevitable and necessary. Decisions about modularity and coupling, decisions about mechanisms to support capabilities, decisions about technology we will integrate and depend on (within the system, or our development and operations environments), all contribute to our ability to create and evolve a system that is sufficiently stable to exist, yet dynamic and evolving.

> *"The causal mechanism at work between levels of hierarchical organization can best be understood as the operations of constraint"*
>
> *— Alicia Juarrero*

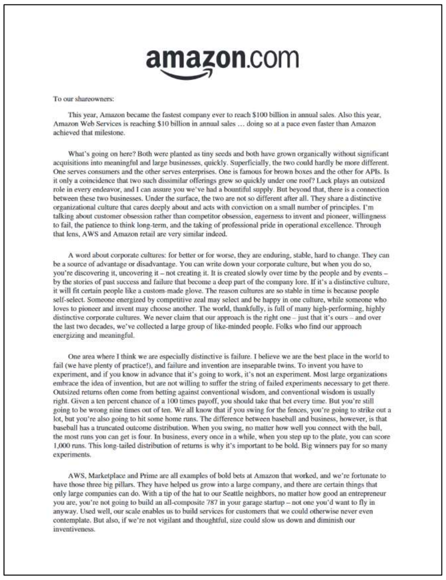
> *"coherence is induced by enabling constraints, not forceful causes, and that the resulting coherence is then maintained by constitutive constraints. Constitutive constraints, in turn, become governing constraints that regulate and modulate the way coherent entities behave."*

***Some decisions are irreversible***

# Irreversible Decisions

"Some decisions are consequential and irreversible or nearly irreversible [..] and these decisions must be made methodically, carefully, slowly, with great deliberation and consultation."

— Jeff Bezos



amazon.com

To our shareowners:

This year, Amazon became the fastest company ever to reach $100 billion in annual sales. Also this year, Amazon Web Services is reaching $10 billion in annual sales … doing so at a pace even faster than Amazon achieved that milestone.

What's going on here? Both were planted as tiny seeds and both have grown organically without significant acquisitions into meaningful and large businesses, quickly. Superficially, the two could hardly be more different. One serves consumers and the other serves enterprises. One is famous for brown boxes and the other for APIs. Is it only a coincidence that two such dissimilar offerings grew so quickly under one roof? Luck plays an outsized role in every endeavor, and I can assure you we've had a bountiful supply. But beyond that, there is a connection between these two businesses. Under the surface, the two are not so different after all. They share a distinctive organizational culture that cares deeply about and acts with conviction on a small number of principles. I'm talking about customer obsession rather than competitor obsession, eagerness to invent and pioneer, willingness to fail, the patience to think long-term, and the taking of professional pride in operational excellence. Through that lens, AWS and Amazon retail are very similar indeed.

A word about corporate cultures: for better or for worse, they are enduring, stable, hard to change. They can be a source of advantage or disadvantage. You can write down your corporate culture, but when you do so, you're discovering it, uncovering it – not creating it. It is created slowly over time by the people and by events – by the stories of past success and failure that become a deep part of the company lore. If it's a distinctive culture, it will fit certain people like a custom-made glove. The reason cultures are so stable in time is because people self-select. Someone energized by competitive zeal may select and be happy in one culture, while someone who loves to pioneer and invent may choose another. The world, thankfully, is full of many high-performing, highly distinctive corporate cultures. We never claim that our approach is the right one – just that it's ours – and over the last two decades, we've collected a large group of like-minded people. Folks who find our approach energizing and meaningful.

One area where I think we are especially distinctive is failure. I believe we are the best place in the world to fail (we have plenty of practice!), and failure and invention are inseparable twins. To invent you have to experiment, and if you know in advance that it's going to work, it's not an experiment. Most large organizations embrace the idea of invention, but are not willing to suffer the string of failed experiments necessary to get there. Outsized returns often come from betting against conventional wisdom, and conventional wisdom is usually right. Given a ten percent chance of a 100 times payoff, you should take that bet every time. But you're still going to be wrong nine times out of ten. We all know that if you swing for the fences, you're going to strike out a lot, but you're also going to hit some home runs. The difference between baseball and business, however, is that baseball has a truncated outcome distribution. When you swing, no matter how well you connect with the ball, the most runs you can get is four. In business, every once in a while, when you step up to the plate, you can score 1,000 runs. This long-tailed distribution of returns is why it's important to be bold. Big winners pay for so many experiments.

AWS, Marketplace and Prime are all examples of bold bets at Amazon that worked, and we're fortunate to have those three big pillars. They have helped us grow into a large company, and there are certain things that only large companies can do. With a tip of the hat to our Seattle neighbors, no matter how good an entrepreneur you are, you're not going to build an all-composite 787 in your garage startup – not one you'd want to fly in anyway. Used well, our scale enables us to build services for customers that we could otherwise never even contemplate. But also, if we're not vigilant and thoughtful, size could slow us down and diminish our inventiveness.

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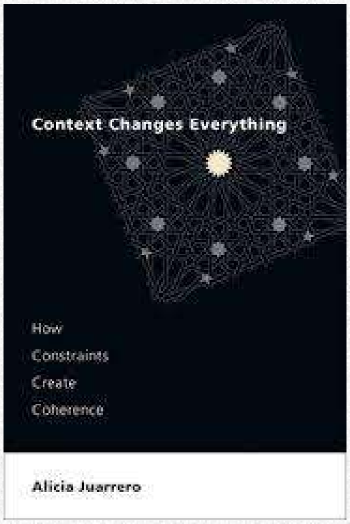
*"One common pitfall for large organizations – one that hurts speed and inventiveness – is "one-size-fits-all" decision making."*

*– Jeff Bezos*



### *No "One Time to Rule Them All" Decision Making*

So, strategy and architecture are about scope and impact, and not something that is simply determined by being done upfront — that is, by timing. Rather, the other way round. If it's strategically or structurally significant, we want timing to factor in decision making. Is this something we need to pay attention to now?  Why?

We're using judgment to decide on the timing of decisions. And one way to inform this judgment, as pointed out by Sidharth Masaldaan, is to consider risk.  What is highest risk and needs our (scarce!) expertise, perspective, attention and time now? And what do we need to enable (by deciding and building)? Yes, in the sense of enabling constraints.

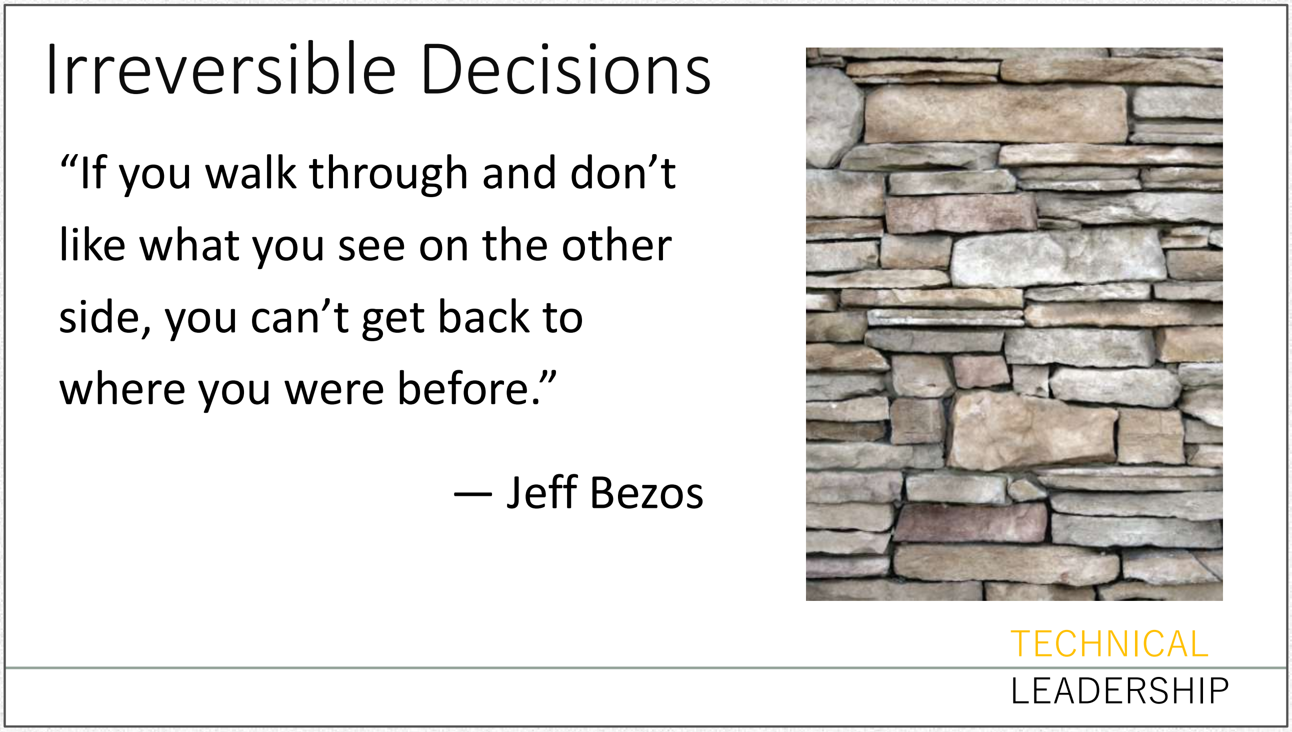
### *No "One-Size Fits All" Decision Making Either*

In his 2015 letter to Amazon shareholders, Jeff Bezos made this important distinction between irreversible and reversible decisions, emphasizing that consequential irreversible decisions need to be made with great deliberation and consultation.

Source: https://www.sec.gov/Archives

***Not all decisions are equal. What differences make a difference?***

***They change consequential things, we can't undo***



# Irreversible Decisions

"If you walk through and don't like what you see on the other side, you can't get back to where you were before."

— Jeff Bezos

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***We need to make those decisions deliberately, attentively***

## *Attending to Irreversible, Consequential Decisions*

Shane Parrish collected together a useful series of decision making heuristics in a twitter thread. Here are several (the numbers are Parrish's) that we've selected for their bearing in the case of more consequential decisions [and we've added a few notes]:

17. Put things on a reversibility/consequence grid — irreversible and high consequence decisions likely require more time. The rest of the time you can usually go fast.

10. The rule of 5. Think about what the decision looks like 5 days, 5 weeks, 5 months, 5 years, 5 decades.

11. Let other people's hindsight become your foresight. [Do the research; draw on expertise.]

13. Ask what information would cause you to change your mind. If you don't have that information, find it. If you do, track [it] religiously.

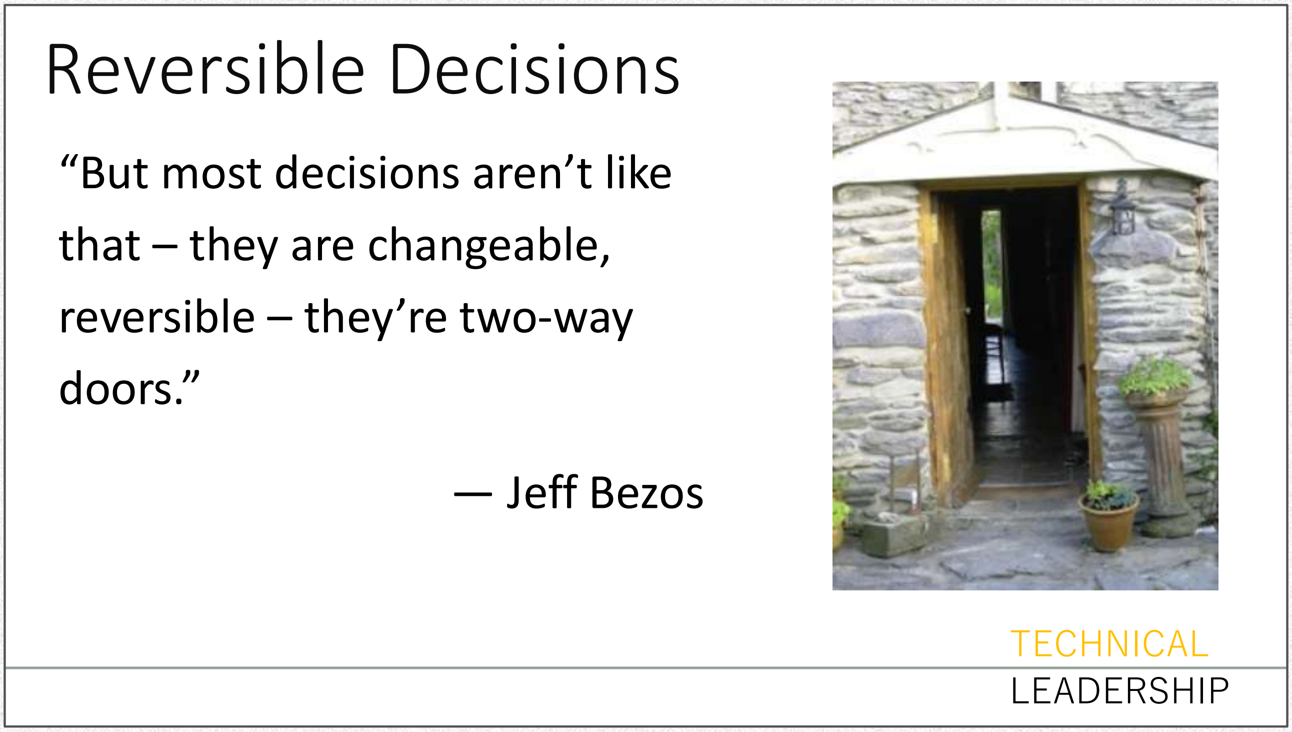
22. Walk around the decision from the perspective of everyone implicated (shareholders, employees, regulators, customers, partners, etc.)

26. Ask yourself "and then what?" [and "what if?" and "what else?"]

Source: Shane Parrish (@farnamstreet), on twitter, 5 Aug, 2018

Source: https://twitter.com/farnamstreet/status/1026105498372845571

> *'Legacy code is often defined as "code that makes more design decisions than the team working on it".'*
>
> *— Ángel Siendones Sillero*



Reversible Decisions

"But most decisions aren't like that – they are changeable, reversible – they're two-way doors."

— Jeff Bezos

TECHNICAL LEADERSHIP

## *Reversible Decisions*

It's worth highlighting two takeaways from Bezos's insights here:

- where we can, make decisions reversible — reduce the cost of change.
- pay particular attention to consequential irreversible decisions — attend to those that have high cost of change

> *"If you're good at course correcting, being wrong may be less costly than you think" — Jeff Bezos*

## *Reversibility Approaches*

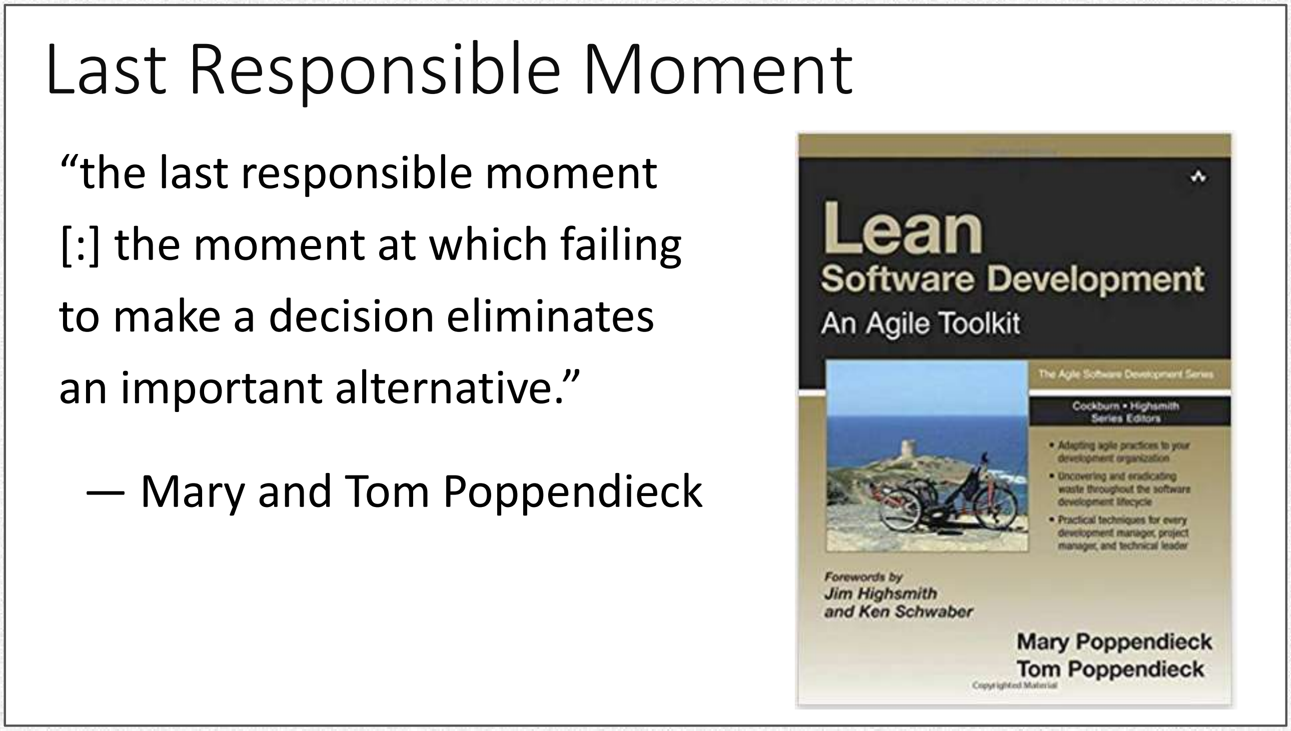
In *Taming Complexity with Reversibility*, Kent Beck outlines several approaches used at Facebook for making changes smaller, and getting feedback more rapidly, so decisions can be tried out and assessed, and reversed if they don't pan out well (enough), before they become entangled in other decisions, expectations and habits. These include:

- *Development servers*. Each engineer has their own copy of the entire site. Engineers can make a change, see the consequences, and reverse the change in seconds without affecting anyone else.
- *Code review*. Engineers can propose a change, get feedback, and improve or abandon it in minutes or hours, all before affecting any people using Facebook.
- *Internal usage*. Engineers can make a change, get feedback from thousands of employees using the change, and roll it back in an hour.

Source: Kent Beck, *Taming Complexity with Reversibility*

In part, these satisfy the second of Palchinsky's Principles:

"when trying something new, do it on a scale where failure is survivable" — Peter Palchinsky



# Last Responsible Moment

"the last responsible moment [:] the moment at which failing to make a decision eliminates an important alternative."

— Mary and Tom Poppendieck

Lean
Software Development
An Agile Toolkit
The Agile Software Development Series
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• Adapting agile practices to your development organization
• Uncovering and eradicating waste throughout the software development lifecycle
• Practical techniques for every development manager, project manager, and technical leader
Forewords by
Jim Highsmith
and Ken Schwaber
Mary Poppendieck
Tom Poppendieck
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## *Last Responsible Moment*

Jeremy Miller on delaying decisions until the last responsible moment:
"The key is to make decisions as late as you can responsibly wait because that is the point at which you have the most information on which to base the decision."

And Jeff Atwood*:
"Deciding too late is dangerous, but deciding too early in the rapidly changing world of software development is arguably even more dangerous. Let the principle of Last Responsible Moment be your guide."

Eb Rechtin and Mark Maier:
"Build in and maintain options as long as possible in the design and implementation of complex systems. You will need them."

> *"delay commitment until the* ***last responsible moment, that is, the moment at which failing to make a decision eliminates an important alternative****. If commitments are delayed beyond the last responsible moment, then decisions are made by default, which is generally not a good approach to making decisions."*
>
> *— Mary and Tom Poppendieck*

**YouArentGonnaNeedIt** (often abbreviated YAGNI, or YagNi on this wiki) is an ExtremeProgramming practice which states:

> "Always implement things when you *actually* need them, never when you just *foresee* that you need them."

Source: http://c2.com/xp/YouArentGonnaNeedIt.html

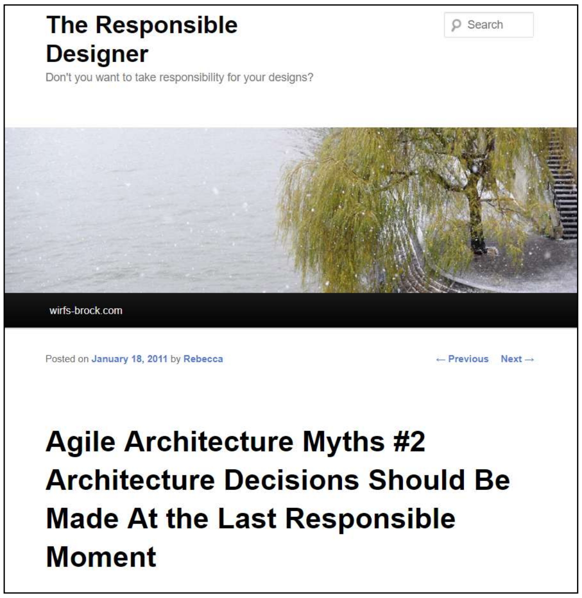
* Source: https://blog.codinghorror.com/the-last-responsible-moment/

## When? Earliest Responsible Moment

"I prefer to make decisions when they have positive impacts. Making decisions early that are going to have huge implications isn't bad or always wasteful. Just be sure they are vetted and revisited if need be."

— Rebecca Wirfs-Brock

"I prefer calling that opportune moment of when it is reasonable to decide, the Most Responsible moment ... as it is based on your judgment of the context, the situation, the risks, and everyone impacted by that decision." — Rebecca Wirfs-Brock



The Responsible Designer

Don't you want to take responsibility for your designs?

Posted on January 18, 2011 by Rebecca

**Agile Architecture Myths #2 Architecture Decisions Should Be Made At the Last Responsible Moment**

### *Creating Ground Under the Feet*

Some decisions, like strategy and architecture decisions, create context for further decisions, establishing relationships, and reducing the decision space. This is good. It reduces the overload of overwhelming ambiguity and uncertainty, by narrowing the space and putting stakes in the ground. Now we can probe and test, to see how we're doing. We make certain key decisions early, to "put ground under our feet." Huh? Ground? Metaphorically speaking, but to be able to move forward, we have to start to shape the space, gain traction. More metaphors.

We need to decide what we are going to do (next, and at all, and if we want to be proactive about cohesive and concerted action, where we are headed), and how.

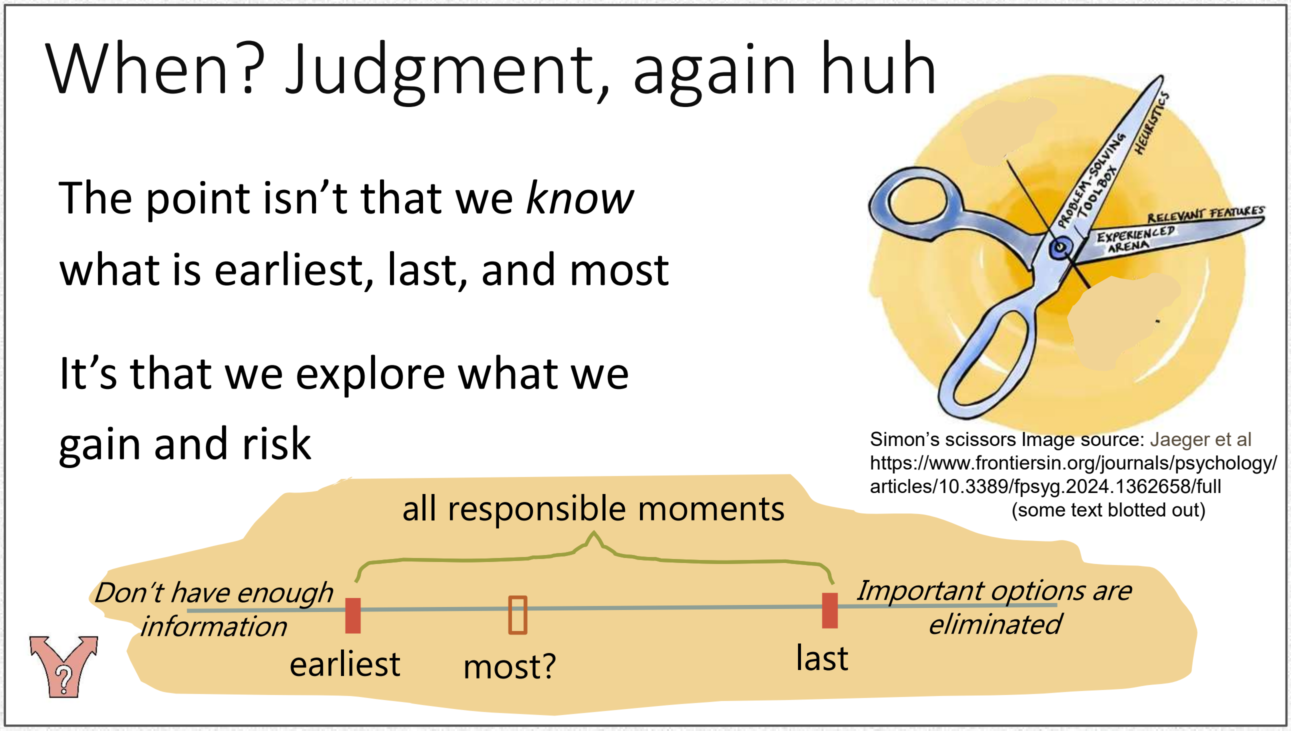
> *"I believe that you can and should look ahead. And that most developers, given half a chance, are pretty good at incorporating past experiences and making anticipatory design choices."*
>
> *— Rebecca Wirfs-Brock*

We may make ad hoc decisions implicitly on the fly without considered reflection, but some of our decisions are going to cleave the design space, ruling some opportunities out. This will be true whether they are implicit or explicit, considered, reasoned and probed, or made on the fly on guesses or without even knowing there were other choices we could have made. Better, if we anticipate they'll be highly consequential, if well considered.

You know the adage: "What's the best time to plant a tree? 20 years ago. What's the second best time? Now." Well, that's true, unless we don't need a tree. And there isn't something more critical to do now. But the point is important too — trees can't be moved so they constrain and set context for other landscaping decisions and they take a long time to grow, so to have the benefit of a bigger tree, we need to start as soon as we can.

As Mayoor Salva pointed out, opportunity cost is a useful concept to draw on here.

***When to make significant decisions is a significant decision?***



When? Judgment, again huh

The point isn't that we *know* what is earliest, last, and most

It's that we explore what we gain and risk

Simon's scissors Image source: Jaeger et al https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1362658/full (some text blotted out)

all responsible moments

*Don't have enough information*

earliest

most?

last

*Important options are eliminated*

## *When? Think About It*

If there is some time frame in which we can "responsibly" make (significant) design decisions, there is some "earliest" and some "last" "responsible moment" — conceptually, anyway. We don't *know* where those points are (and may differ in our assessments), but the point is more about (for significant decisions) exploring (just enough) the tradeoffs… of earlier benefit from the decision (being put into play) versus knowing more later, and retaining degrees of freedom longer. What depends on the decision, and is held up? What is risky to defer, or to move forward on without learning more?

"What skills would we need in order to *not* have to make this decision until later?" (Kent Beck)

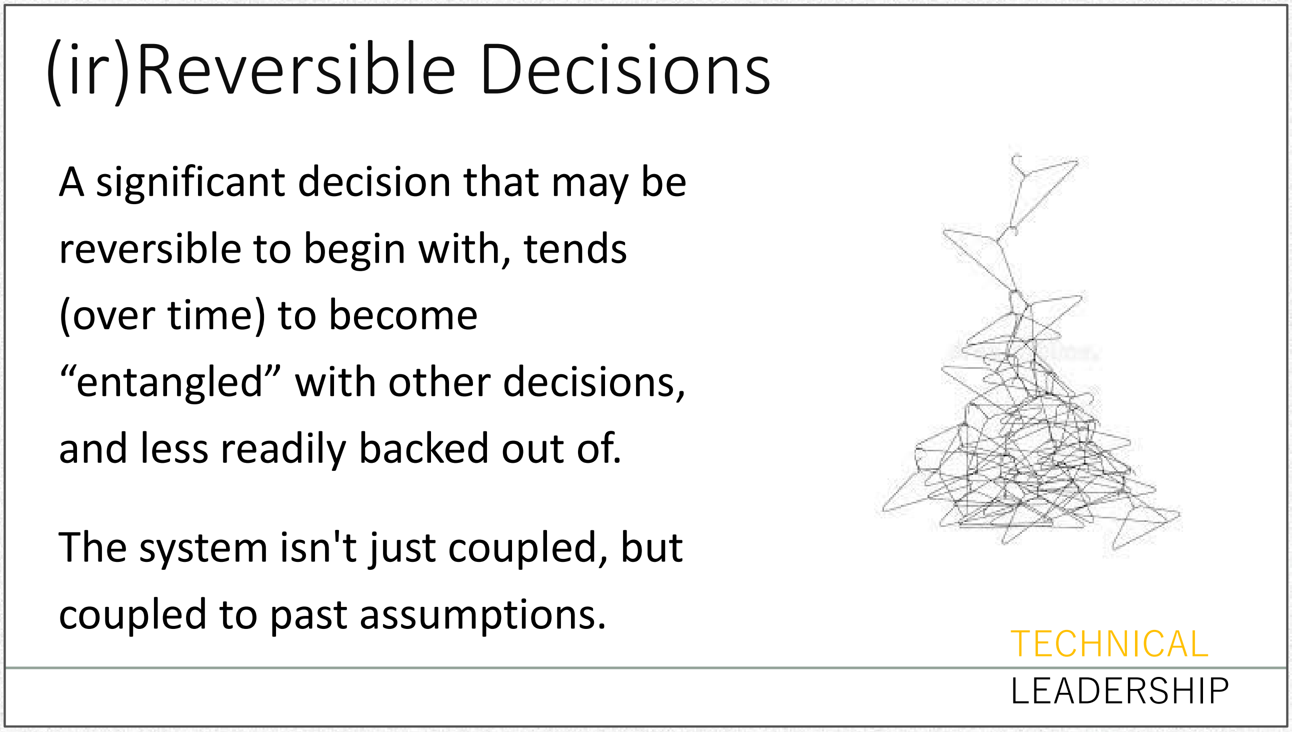
And! What should we bring forward, and for what reason? And some of those reasons are engineering reasons and some are market/user facing reasons. So what skills do we need to develop, to think strategically about the difference that makes a difference here? (Where "strategically" is relative to the scope at which we are designing.)

"To make sense of such an ill-defined and open-ended world — in order to survive, thrive, and evolve — the organism must first realize what is relevant in its environment. It needs to solve the problem of relevance." — Johannes Jaeger et al, 2024 (https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1362658/full)

*What do we pull forward because it underpins, and what do we push out, because we need to learn more, etc.…*

*"Oh yeah, this is a golden year for least responsible decisions."*

*— Einar W. Høst*



# (ir)Reversible Decisions

A significant decision that may be reversible to begin with, tends (over time) to become "entangled" with other decisions, and less readily backed out of.

The system isn't just coupled, but coupled to past assumptions.

TECHNICAL
LEADERSHIP

## *(ir)Reversible Decisions*

We have this interplay between decisions made early or next, to bring the benefit of those decisions forward, and decisions deferred to retain options. Even decisions about where we start, have consequences. We canalize pretty quickly. That is, we reduce the space of designs that are reachable. We gain an identity, internally and in the market. That shapes in ways we notice and don't — we make assumptions about value to customers and users, about system capabilities we're creating and so need to build in our teams, and so on. Sure, we (or the market) test(s) our theory of value — in so doing, shoring up the assumptions we proceed on. As users integrate our system into their workflows and systems, they build up expectations or assumptions about how things work, and ought to. As do we. There are a myriad ways our systems become coupled and resist change.  Pretty soon, we call them "legacy systems" in that wry sense of a legacy we both value (or at least depend on) and regret. Change becomes costly (in various terms, including economic, but also factors such as capabilities and expertise we've built and not longer need which has technical, social and emotional impacts that require substantive organizational/political will) and hard. It rends and ripples through the systems of interconnected, inter-reliant systems.

Leading is about creating conditions for decision courage (we need to make some, now and soon) and decision scrutiny (we need to bring impacts into view and figure out what to do).  Judgement and discernment factors. Including discernment about the scale and scope of the decision and its impacts. We're talking here about decisions of substantive consequence and non-local impacts.

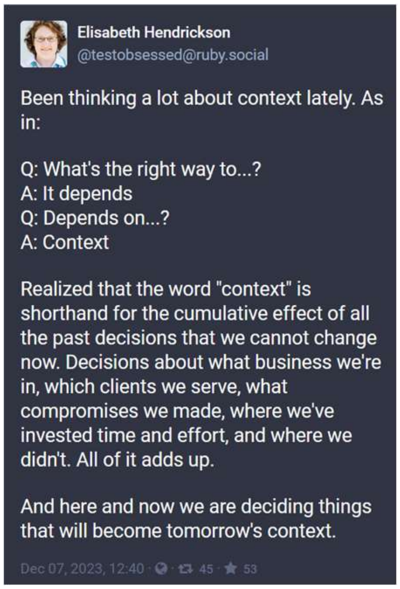
*The challenges of "modernizing" aging systems go well beyond "the technology" — the entanglements that create inertia are not just in "the code" and "the stack"... They run deep — into assumptions about our very identity, even.*

# (Ir)reversible Decisions

“Realized that the word "context" is shorthand for the cumulative effect of all the past decisions that we cannot change now. Decisions about what business we're in, which clients we serve, what compromises we made, where we've invested time and effort, and where we didn't. All of it adds up.

And here and now we are deciding things that will become tomorrow's context.”

— Elisabeth Hendrickson



Elisabeth Hendrickson
@testobsessed@ruby.social

Been thinking a lot about context lately. As in:

Q: What's the right way to...?
A: It depends
Q: Depends on...?
A: Context

Realized that the word "context" is shorthand for the cumulative effect of all the past decisions that we cannot change now. Decisions about what business we're in, which clients we serve, what compromises we made, where we've invested time and effort, and where we didn't. All of it adds up.

And here and now we are deciding things that will become tomorrow's context.

Dec 07, 2023, 12:40 · 45 · 53

## *Adaptive Capacity ... and Entanglements*

Software is highly mutable. Humans lend adaptive capacity to our sociotechnical systems, allowing us to evolve them into astonishingly complex, and useful systems. One characterization of legacy systems:

> “Legacy systems are valuable because they continue to exist; they wouldn't continue to exist if they weren't valuable.” — Kevlin Henney

Nonetheless, our systems tend to canalize – internal structures are adapted to fit shifts in context, but that fit comes at a cost, including becoming embedded in other systems that rely on them, and resist change. The 737 MAX story is illustrative of forces in tension···

> “So when Boeing designed the 737 MAX, they were trying to balance two conflicting requirements. [Accounts differ: bigger engines for fuel efficiency or for range.] The other was to keep the design sufficiently similar to the existing 737 aircraft that pilots wouldn’t need a new type rating [which aircraft pilots are allowed to fly]. But it turns out those new engines on the 737 MAX were actually so big they wouldn’t quite fit under the wings. They couldn’t redesign the airframe to make the wings higher, otherwise it wouldn’t have been a 737 any more, so instead they mounted those new engines a little further forward and a little higher than the old ones. And this is where it gets complicated. That new engine placement introduced handling problems – it meant that when you open the throttle, the aircraft had a tendency to stick its nose up in the air. And that’s bad, because if the nose goes up too high the plane is going to stall. And so the solution to this was software. Specifically, a software system called the MCAS – the Maneouvering Characteristics Augmentation System.” — Dylan Beattie, The Cost of Code, 2019

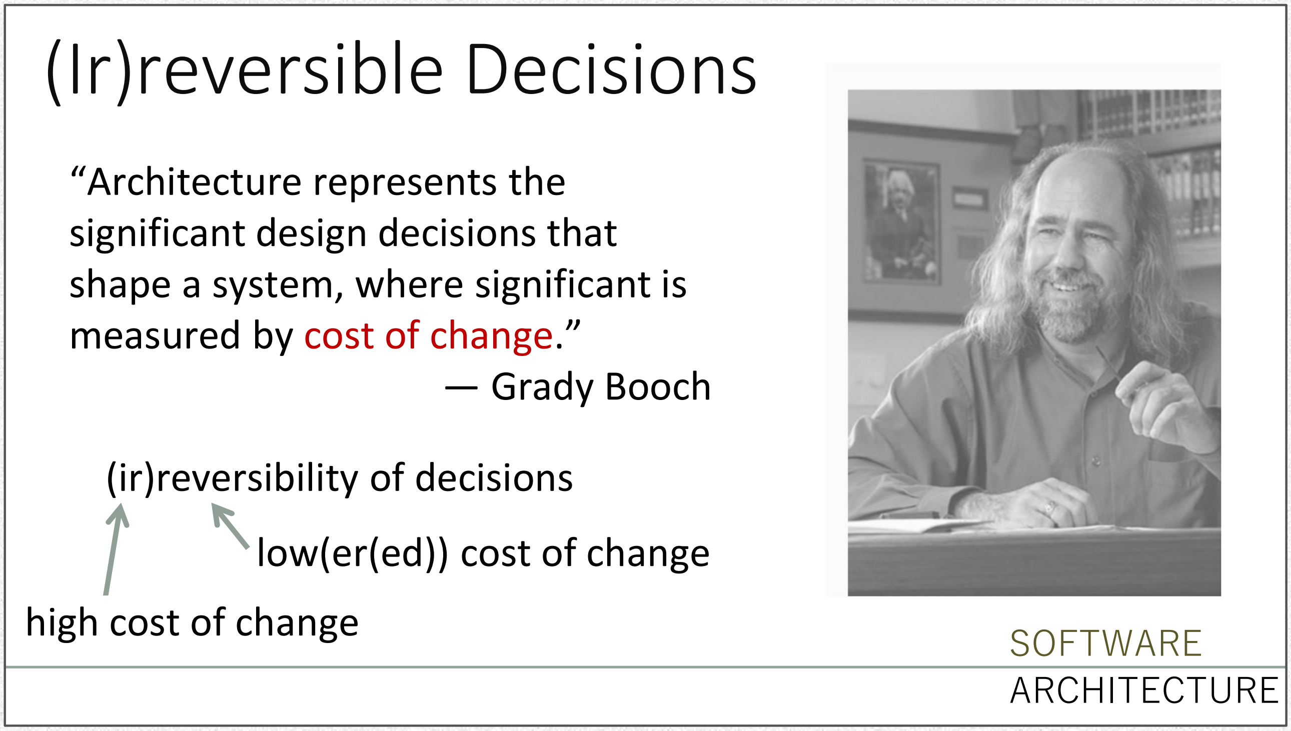
Continually adapting, but the possibility envelope is shaped by prior decisions.

*“The law of stretched systems:*

*every system is stretched to operate at its capacity; as soon as there is some improvement, for example in the form of new technology, it will be exploited to achieve a new intensity and tempo of activity.*

*— David Woods*

David Woods, Laws that Govern Cognitive Work, 2002



# (Ir)reversible Decisions

"Architecture represents the significant design decisions that shape a system, where significant is measured by cost of change."

— Grady Booch

(ir)reversibility of decisions

low(er(ed)) cost of change

high cost of change

SOFTWARE ARCHITECTURE

## *The Point?*

When we talk about cost of change in the context of architecture, we're typically thinking about the cost to make changes to the system. But cost of change plays in, in different ways. As the system takes shape, other systems develop expectations of our system – some implicit and some explicit, some critical and constraining, others not so much. As our system becomes embedded in expectations and commitments and reliance on its role in the broader ecosystem, it becomes hard to "reverse" or back out of shaping decisions. We might want to relate this to "sheering layers," but its at least good to recognize that we seek stabilities, even as we seek to adapt and evolve.

We have this interplay between decisions made early or next, to bring the benefit of those decisions forward, and decisions deferred to retain options. Even decisions about where we start, have consequences. We canalize pretty quickly. That is, we reduce the space of designs that are reachable. We gain an identity, internally and in the market. That shapes in ways we notice and don't — we make assumptions about value to customers and users, about system capabilities we're creating and so need to build in our teams, and so on. Sure, we (or the market) test(s) our theory of value — in so doing, shoring up the assumptions we proceed on. As users integrate our system into their workflows and systems, they build up expectations or assumptions about how things work, and ought to. As do we. There are a myriad ways our systems become coupled and resist change. Pretty soon, we call them "legacy systems" in that wry sense of a legacy we both value (or at least depend on) and regret.

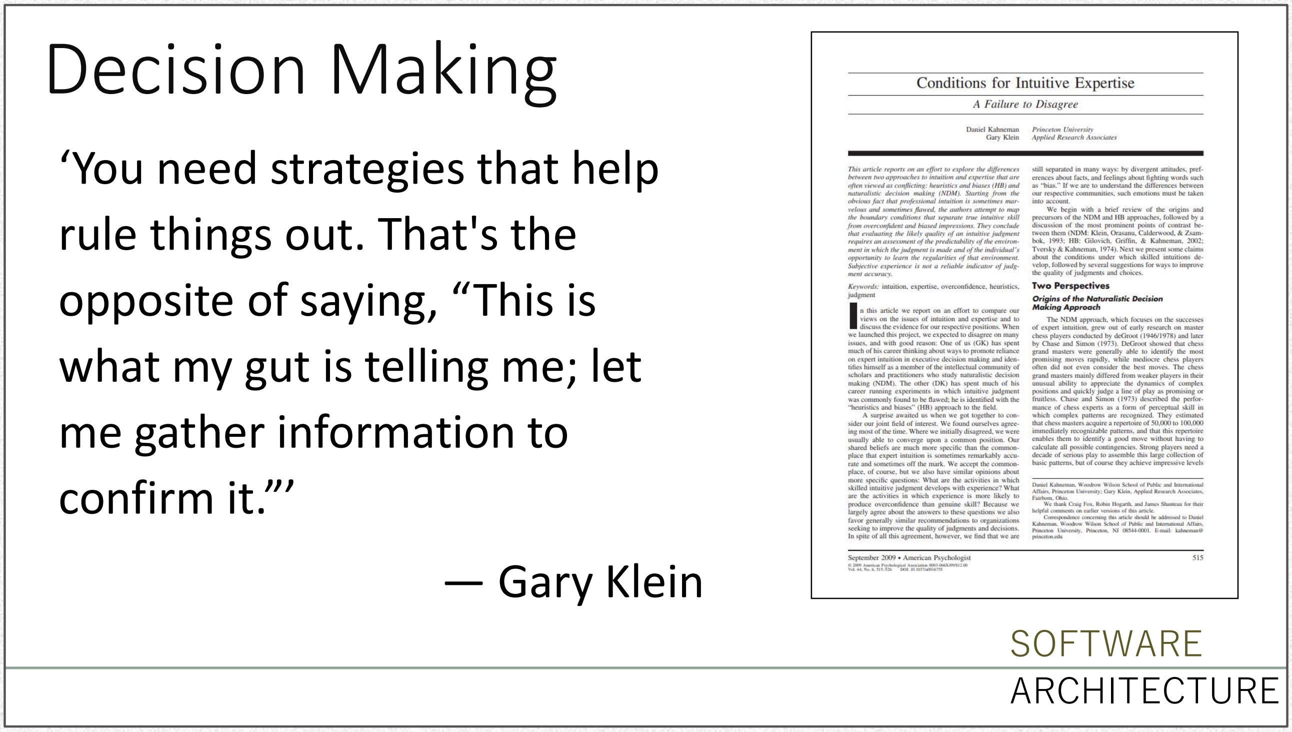
*"A good architecture reduces disruptive change. For example, if a on-the-wire protocol has version support you can do this. If it was forgotten in the architecture then the change is more disruptive or very inefficient."*

*— Martin Thompson*

*"When reversibility is important to you, that's part of your context. The decision section should state what you're doing in light of that context. (Pilot project, wrapping interface, abstraction layer, etc.)*

*— Michael Nygard*

***So how do we approach consequential decisions?***



# Decision Making

‘You need strategies that help rule things out. That's the opposite of saying, “This is what my gut is telling me; let me gather information to confirm it.”’

— Gary Klein

## Conditions for Intuitive Expertise

*A Failure to Disagree*

Daniel Kahneman *Princeton University*
Gary Klein *Applied Research Associates*

*This article reports on an effort to explore the differences between two approaches to intuition and expertise that are often viewed as conflicting: heuristics and biases (HB) and naturalistic decision making (NDM). Starting from the obvious fact that professional intuition is sometimes marvelous and sometimes flawed, the authors attempt to map the boundary conditions that separate true intuitive skill from overconfident and biased impressions. They conclude that evaluating the likely quality of an intuitive judgment requires an assessment of the predictability of the environment in which the judgment is made and of the individual's opportunity to learn the regularities of that environment. Subjective experience is not a reliable indicator of judgment accuracy.*

*Keywords:* intuition, expertise, overconfidence, heuristics, judgment

In this article we report on an effort to compare our views on the issues of intuition and expertise and to discuss the evidence for our respective positions. When we launched this project, we expected to disagree on many issues, and with good reason: One of us (GK) has spent much of his career thinking about ways to promote reliance on expert intuition in executive decision making and identifies himself as a member of the intellectual community of scholars and practitioners who study naturalistic decision making (NDM). The other (DK) has spent much of his career running experiments in which intuitive judgment was commonly found to be flawed; he is identified with the “heuristics and biases” (HB) approach to the field.

A surprise awaited us when we got together to consider our joint field of interest. We found ourselves agreeing most of the time. Where we initially disagreed, we were usually able to converge upon a common position. Our shared beliefs are much more specific than the commonplace that expert intuition is sometimes remarkably accurate and sometimes off the mark. We accept the commonplace, of course, but we also have similar opinions about more specific questions: What are the activities in which skilled intuitive judgment develops with experience? What are the activities in which experience is more likely to produce overconfidence than genuine skill? Because we largely agree about the answers to these questions we also favor generally similar recommendations to organizations seeking to improve the quality of judgments and decisions. In spite of all this agreement, however, we find that we are still separated in many ways: by divergent attitudes, preferences about facts, and feelings about fighting words such as “bias.” If we are to understand the differences between our respective communities, such emotions must be taken into account.

We begin with a brief review of the origins and precursors of the NDM and HB approaches, followed by a discussion of the most prominent points of contrast between them (NDM: Klein, Orasanu, Calderwood, & Zsambok, 1993; HB: Gilovich, Griffin, & Kahneman, 2002; Tversky & Kahneman, 1974). Next we present some claims about the conditions under which skilled intuitions develop, followed by several suggestions for ways to improve the quality of judgments and choices.

### Two Perspectives

#### *Origins of the Naturalistic Decision Making Approach*

The NDM approach, which focuses on the successes of expert intuition, grew out of early research on master chess players conducted by deGroot (1946/1978) and later by Chase and Simon (1973). DeGroot showed that chess grand masters were generally able to identify the most promising moves rapidly, while mediocre chess players often did not even consider the best moves. The chess grand masters mainly differed from weaker players in their unusual ability to appreciate the dynamics of complex positions and quickly judge a line of play as promising or fruitless. Chase and Simon (1973) described the performance of chess experts as a form of perceptual skill in which complex patterns are recognized. They estimated that chess masters acquire a repertoire of 50,000 to 100,000 immediately recognizable patterns, and that this repertoire enables them to identify a good move without having to calculate all possible contingencies. Strong players need a decade of serious play to assemble this large collection of basic patterns, but of course they achieve impressive levels

Daniel Kahneman, Woodrow Wilson School of Public and International Affairs, Princeton University; Gary Klein, Applied Research Associates, Fairborn, Ohio.

We thank Craig Fox, Robin Hogarth, and James Shanteau for their helpful comments on earlier versions of this article.

Correspondence concerning this article should be addressed to Daniel Kahneman, Woodrow Wilson School of Public and International Affairs, Princeton University, Princeton, NJ 08544-0001. E-mail: kahneman@princeton.edu

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515

SOFTWARE
ARCHITECTURE

## *Decisions Are Perfectly Rational, Right?*

How we think decisions are made: we list and weigh reasons. And demonstrate the superior approach to take. Gary Klein makes the case that experts tend not to do this (though novices might), especially not under (time) pressure. Still, when it comes to decisions of consequence to organizations and system design, we do well to better understand what’s at stake, what’s impacted and how, as well as what options or solution approaches we might take.

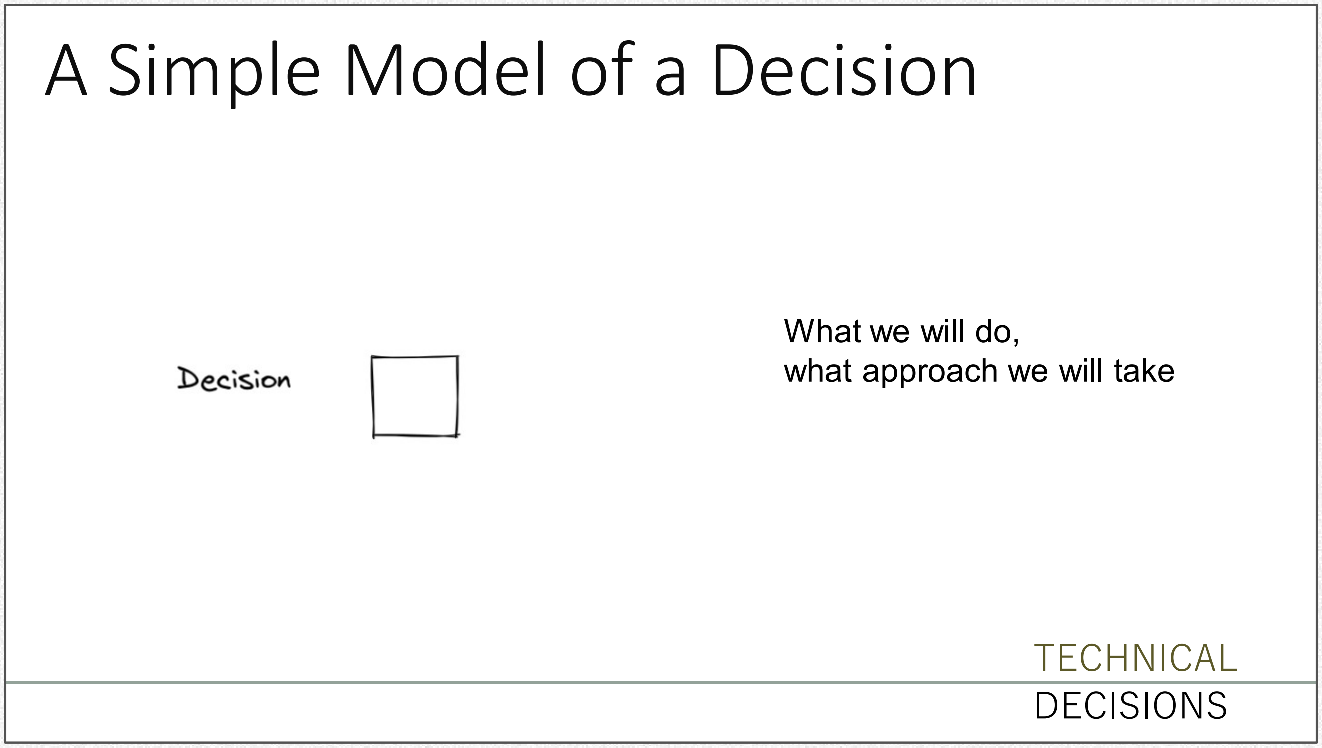
The rational in rationalize is a head-fake. And yet. We want to develop our reasons and reasoning. Make decisions with significant impact explicit, and probe and improve them.

*”Rigor is not a substitute for imagination.”*

*— Gary Klein*

*” I worry about leaders in complex situations who don't have enough experience, who are just going with their intuition and not monitoring it, not thinking about it.”*

*— Gary Klein*



A Simple Model of a Decision

What we will do,
what approach we will take

TECHNICAL
DECISIONS

## Decisions

So we're talking about how we make better consequential (system architecture, organizational architecture, strategic, etc.) decisions. So let's start there. With a decision, which we'll model, as one does, with black box or abstraction.

How does a decision come into view? In the previous module (Sense/Make Sense), we explored situation or context awareness and orienting to the landscape, identifying where action and leadership is needed.  It is helpful (as we explore and clarify, and also as we document, the decision) to briefly describe the situation prompting the decision.

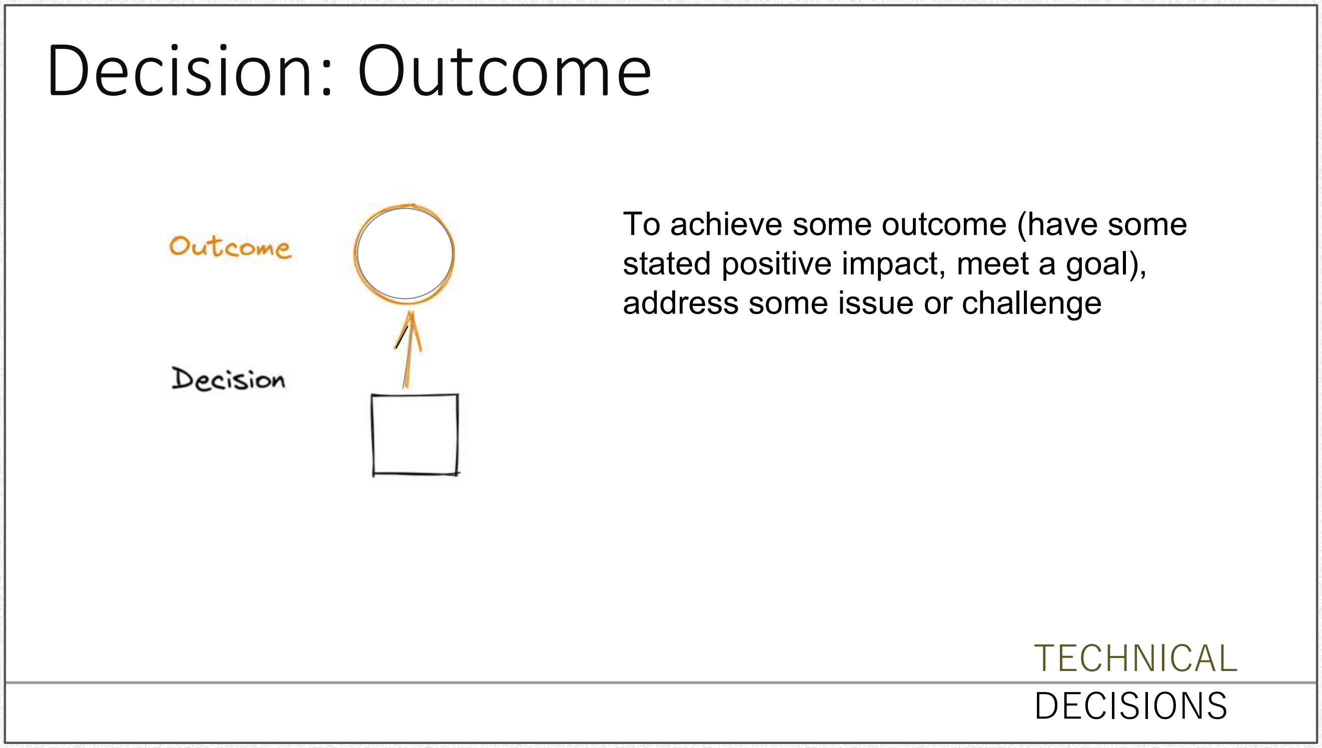
## The Anatomy of a Decision

To understand something like a decision, and what factors in making a consequential decision, the structure (and diagram of structure) isn't enough — though how we structure our thinking about decisions, focuses attention and indicates what we seek to bring into view, for consideration. It helps to understand and frame the problem or situation, separately from identifying the solution or decision options, and determining relative fitness to the situation.

Of course, whether a decision "sinks or swims," depends on much, including the socio-political context, and how we influence and are influenced.

*Image Source: https://en.wikipedia.org/wiki/Anatomy*

*If our decision is about our response, about what we will do, the outcome is about what we want to achieve*



# Decision: Outcome

To achieve some outcome (have some stated positive impact, meet a goal), address some issue or challenge

TECHNICAL DECISIONS

## *Outcomes*

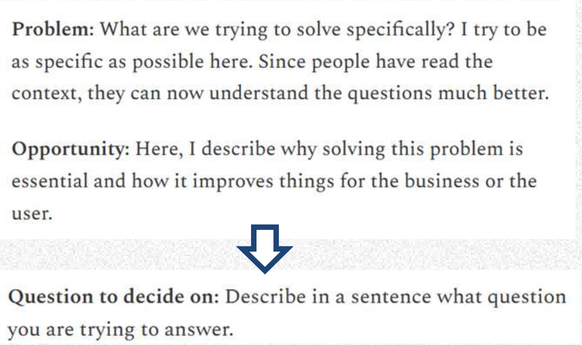
In the context of a technical decision, an outcome may be a capability we need to build for users or the business or for the system (logging, or co-ordination and consistency mechanism, etc.), or a system property (quality attribute) we want to improve (scaling or latency or some other aspect of availability as we improve as demand grows or grows in new regions, etc.). Or it may be some issue (or risk) we face in the dev or devOps organization, that we want to address for ourselves, and see benefit to others in the organization. (This is often enough the case, that some decision templates use “issue” or “problem” rather than “outcome” and it may even be separated out.)

The outcome sought, frames the question, problem, or challenge that the decision addresses. It identifies what we are concerning ourselves with (as we explore and make this decision), and why.

The framing of the outcome or problem is itself a (set of) judgment call(s), as it helps bound the consideration space or frame the situation that we are attending to. Because it bounds the consideration space, we want to hold the frame somewhat loosely, at least to begin with, as we explore options (and possible reframings that bring other options into view).

Speaking of judgment calls, how much should we write down? See Indu Alagarsamy’s shift in the column alongside.

*For intentional, considered decisions, what is our intended outcome, goal, or objective? What does the decision seek to make true in this context or situation?*



**Problem:** What are we trying to solve specifically? I try to be as specific as possible here. Since people have read the context, they can now understand the questions much better.

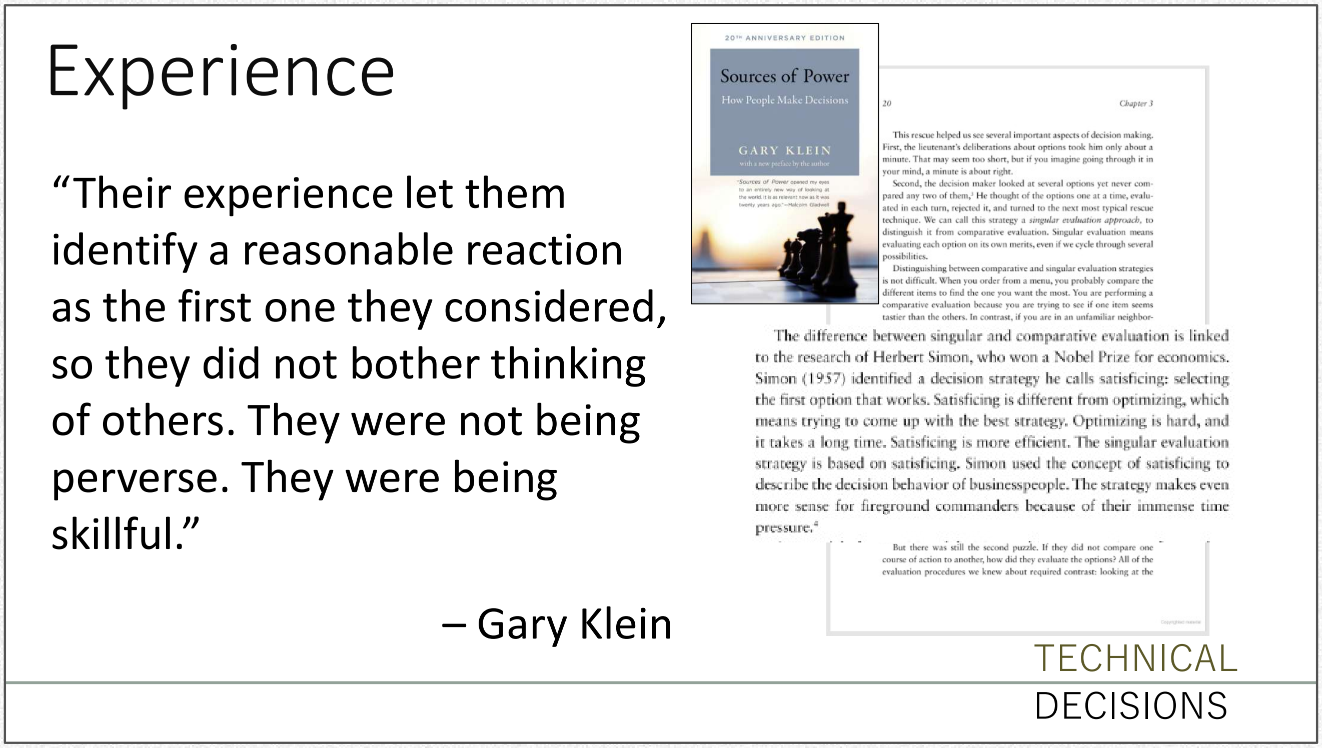
**Opportunity:** Here, I describe why solving this problem is essential and how it improves things for the business or the user.

⇩

**Question to decide on:** Describe in a sentence what question you are trying to answer.

From Indu Alagarsamy, *Document your product and software architecture decisions,* https://domainanalysis.io/p/document-your-product-and-software

***Naturalist decision making and Recognition-primed decisions (RPD).***



# Experience

"Their experience let them identify a reasonable reaction as the first one they considered, so they did not bother thinking of others. They were not being perverse. They were being skillful."

– Gary Klein

20TH ANNIVERSARY EDITION
Sources of Power
How People Make Decisions
GARY KLEIN
with a new preface by the author
"Sources of Power opened my eyes to an entirely new way of looking at the world. It is as relevant now as it was twenty years ago."—Malcolm Gladwell

20 *Chapter 3*

This rescue helped us see several important aspects of decision making. First, the lieutenant's deliberations about options took him only about a minute. That may seem too short, but if you imagine going through it in your mind, a minute is about right.

Second, the decision maker looked at several options yet never compared any two of them,[3] He thought of the options one at a time, evaluated in each turn, rejected it, and turned to the next most typical rescue technique. We can call this strategy a *singular evaluation approach,* to distinguish it from comparative evaluation. Singular evaluation means evaluating each option on its own merits, even if we cycle through several possibilities.

Distinguishing between comparative and singular evaluation strategies is not difficult. When you order from a menu, you probably compare the different items to find the one you want the most. You are performing a comparative evaluation because you are trying to see if one item seems tastier than the others. In contrast, if you are in an unfamiliar neighbor-

The difference between singular and comparative evaluation is linked to the research of Herbert Simon, who won a Nobel Prize for economics. Simon (1957) identified a decision strategy he calls satisficing: selecting the first option that works. Satisficing is different from optimizing, which means trying to come up with the best strategy. Optimizing is hard, and it takes a long time. Satisficing is more efficient. The singular evaluation strategy is based on satisficing. Simon used the concept of satisficing to describe the decision behavior of businesspeople. The strategy makes even more sense for fireground commanders because of their immense time pressure.[4]

But there was still the second puzzle. If they did not compare one course of action to another, how did they evaluate the options? All of the evaluation procedures we knew about required contrast: looking at the

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TECHNICAL

DECISIONS

## *Expertise and Decisions*

Gary Klein and colleagues have studied experts and the way they make decisions, coming to the conclusion that often experts make decisions not by extensive analysis, but based on experience recognizing situations, and reaching for a workable solution in that situation, and proceeding. And he points out this isn't being perverse, it's being skillful. So where we have seen something play out multiple times, and have learned a reliable response set, that may be enough. We make all manner of satisficing decisions in the course of doing things.

In an interview with McKinsey's *The Quarterly*:

Gary Klein: It depends on what you mean by "trust." If you mean, "My gut feeling is telling me this; therefore I can act on it and I don't have to worry," we say you should never trust your gut. You need to take your gut feeling as an important data point, but then you have to consciously and deliberately evaluate it, to see if it makes sense in this context. You need strategies that help rule things out. That's the opposite of saying, "This is what my gut is telling me; let me gather information to confirm it."

The Quarterly*: "Is intuition more reliable under certain conditions?"

Gary Klein: "We identified two. First, there needs to be a certain structure to a situation, a certain predictability that allows you to have a basis for the intuition. If a situation is very, very turbulent, we say it has low validity, and there's no basis for intuition. [..] The second factor is whether decision makers have a chance to get feedback on their judgments, so that they can strengthen them and gain expertise. If those criteria aren't met, then intuitions aren't going to be trustworthy.

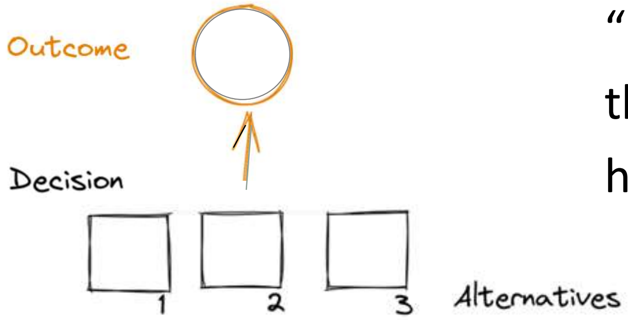
Most corporate decisions aren't going to meet the test of high validity. But they're going to be way above the low-validity situations that we worry about. Many business intuitions and expertise are going to be valuable; they are telling you something useful, and you want to take advantage of them."

Daniel Kahneman: "One of the problems with expertise is that people have it in some domains and not in others. So experts don't know exactly where the boundaries of their expertise are."

*Source*: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/strategic-decisions-when-can-you-trust-your-gut*

*The discipline of creating options and evaluating choices*

# Decision: Alternatives



"If you haven't thought of three possibilities, you haven't thought enough."

— Jerry Weinberg

TECHNICAL
DECISIONS

## *Architecturally Significant*

However. For strategically or architecturally significant decisions, we want to explore what our options are.

'"architecturally significant" decisions: those that affect the structure, non-functional characteristics, dependencies, interfaces, or construction techniques'

"One ADR describes one significant decision for a specific project. It should be something that has an effect on how the rest of the project will run."

— Michael Nygard, Documenting Architecture Decisions

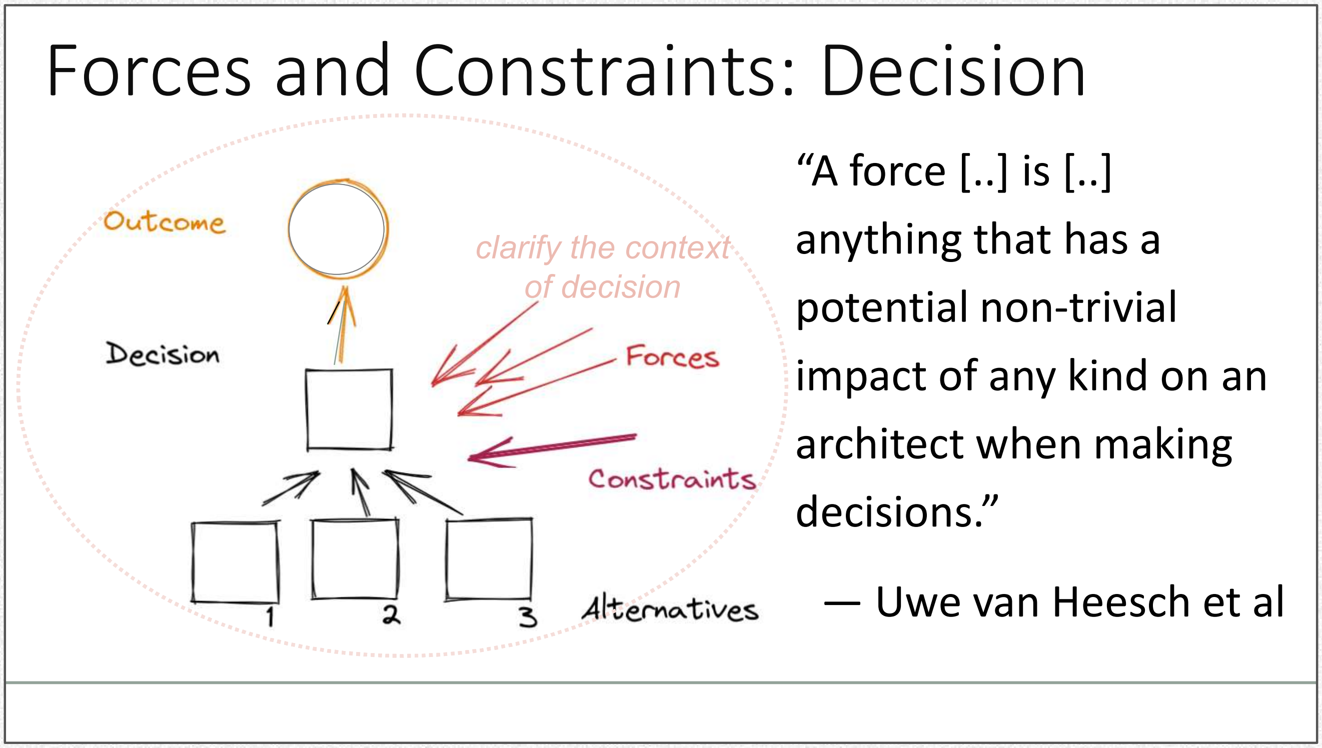
That is, if we're making a technology choice that will shape other choices in an impactful way, or we're coming up with, designing, an approach to building a system capability or mechanism, or addressing some critical issue or challenge, we want to be intentional about it, to bring consideration to bear, and also to be able to visit and revisit our reasoning. So we bring options or alternatives into view. Moreover, as pointed out by Wisen Tanasa, it's helpful to consider whether a hybrid of what we've thought of as alternatives, positions us better in the tradeoff space.

Each option considered, is described briefly, outlining trade-offs, and impact. Typically the option proposed/adopted comes first in this list. You may want to describe why the other alternatives were not chosen, as it is part of the reasoning/argumentation (later when looking back at the decision, others can see which objections were already taken into account). — source?

While we're at it, think of 3 ways we might be wrong!

> *" Eric Evans had recommended having at least 3 options in a proposal*
>
> *1 option leads to evaluation of that option: yes/no*
>
> *2 options lead to comparisons of A vs B*
>
> *3 options suggest there are a set of possible solutions, of which there may be more."*
>
> *— James Maier*

*Identify forces; what are the shaping considerations in this situation*



Forces and Constraints: Decision

"A force [..] is [..] anything that has a potential non-trivial impact of any kind on an architect when making decisions."

— Uwe van Heesch et al

## *Forces, Considerations, What Impinges*

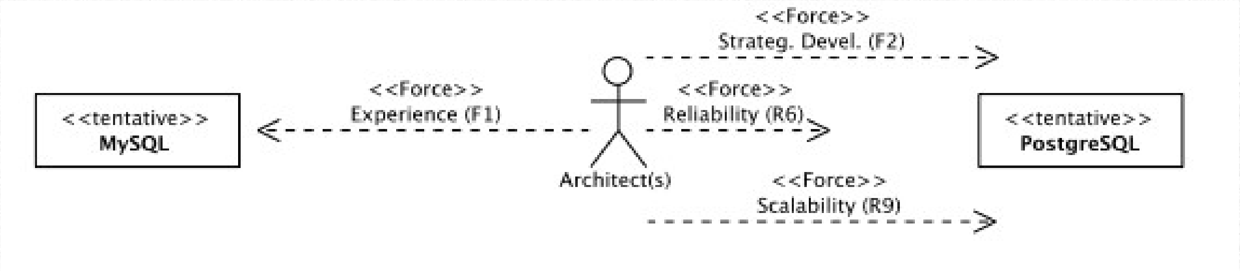
Whether we're weighing options or developing alternative approaches, the situation has a bearing — we need to identify and characterize the relevant forces, contributing factors, governing variables, complications, assumptions, constraints.

"A force [..] is [..] anything that has a potential non-trivial impact of any kind on an architect when making decisions." We're using force to mean something *impactful*, impinging on an architectural problem. Forces arise in the system or its environment — the operational, development, business, organizational, political, economic, legal, regulatory, ecological, social, etc.) context or situation.

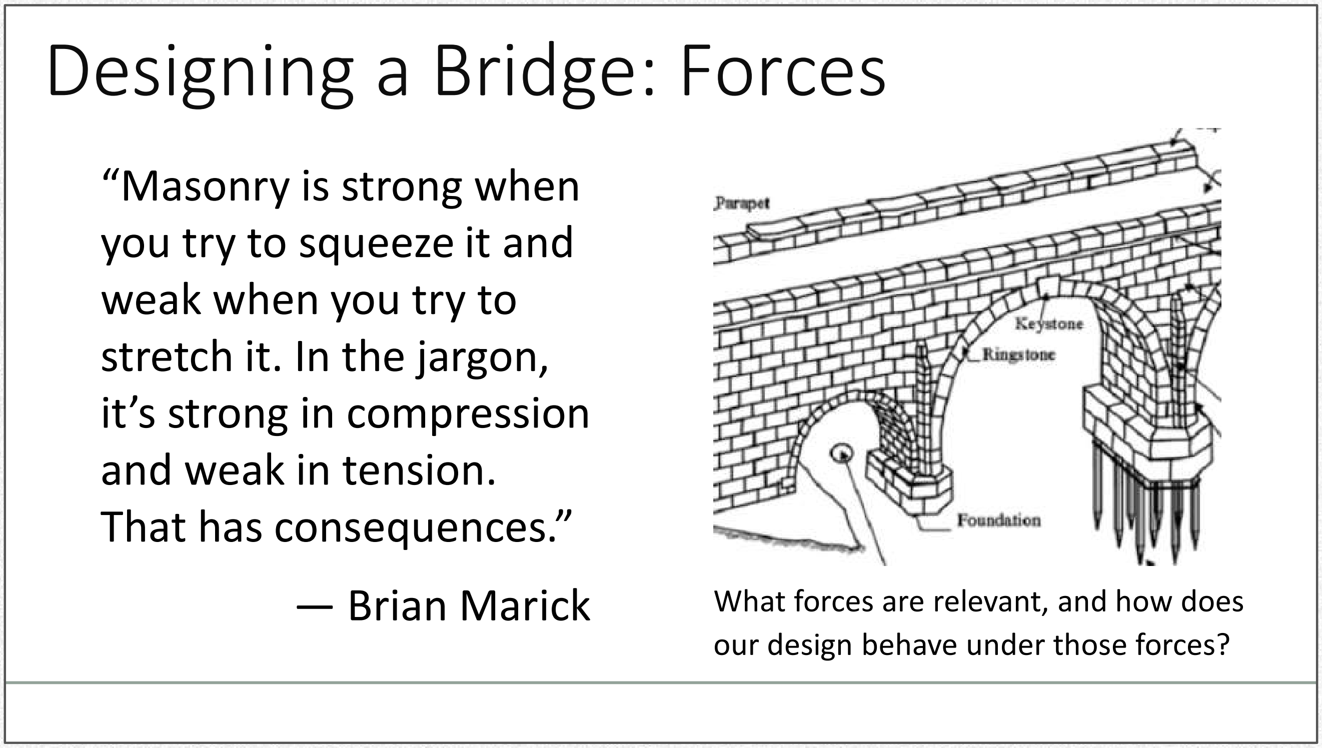
"Forces arise from many sources; most often from requirements, but also from constraints, architecture principles and other "intentions" imposed upon the system; including personal preferences or experience of the architect(s) and the development team; and business goals such as quick-time-to market, low price, or strategic orientations towards specific technologies (see [9] for an empirical study on influence factors on software architecture)."

"The architect evaluates each architectural decision alternative in the context of the forces. As a result of the evaluation, a force can have a positive, negative, currently unknown, or neutral impact on the architect with respect to a decision; it either attracts the decision maker towards a specific decision alternative, or it repels the decision maker from an alternative, or it has no effect."

— Uwe van Heesch, Paris Avgeriou, Rich Hilliard
Forces on Architecture Decisions – A Viewpoint



***A quick look at forces in physical structures, to understand by analogy***



## Designing a Bridge: Forces

> "Masonry is strong when you try to squeeze it and weak when you try to stretch it. In the jargon, it's strong in compression and weak in tension. That has consequences."
>
> — Brian Marick

Parapet
Keystone
Ringstone
Foundation

What forces are relevant, and how does our design behave under those forces?

### *Forces (in bridges and buildings)*

"Suppose you're required to build a bridge, meaning a horizontal surface over some empty space. The simple solution would be a series of walls to hold up the floor of the bridge. OK, but now consider a horizontal floor span going from one wall to its neighbor. The span is supported on its ends, but unsupported in the middle. Gravity pulls down on the middle, creating tension. Since masonry is weak in tension, you'd have to have short spans and a lot of walls, which would be expensive, plus awkward if you want any traffic to go under the bridge — like, say, boats going down a river that it spans.

The arch is a clever solution to this problem. Consider an arch made out of bricks. Each brick mostly presses down on the brick next to and below it, meaning that all the bricks are in compression. The full weight of the structure supported by the arch is delivered to the feet of the arch. Some of the force is vertical, which is opposed because the arch is sitting on the ground. Some of the force is horizontal, which can be opposed if there's the leg of another arch of the same weight pushing against it - like in a bridge with multiple arches. Or, for the end two arches of the bridge, by anchoring them to a strong enough foundation. Essentially the forces transferred down the arch to the ground are balanced by forces *from* the ground, and it's all compression, all the time."

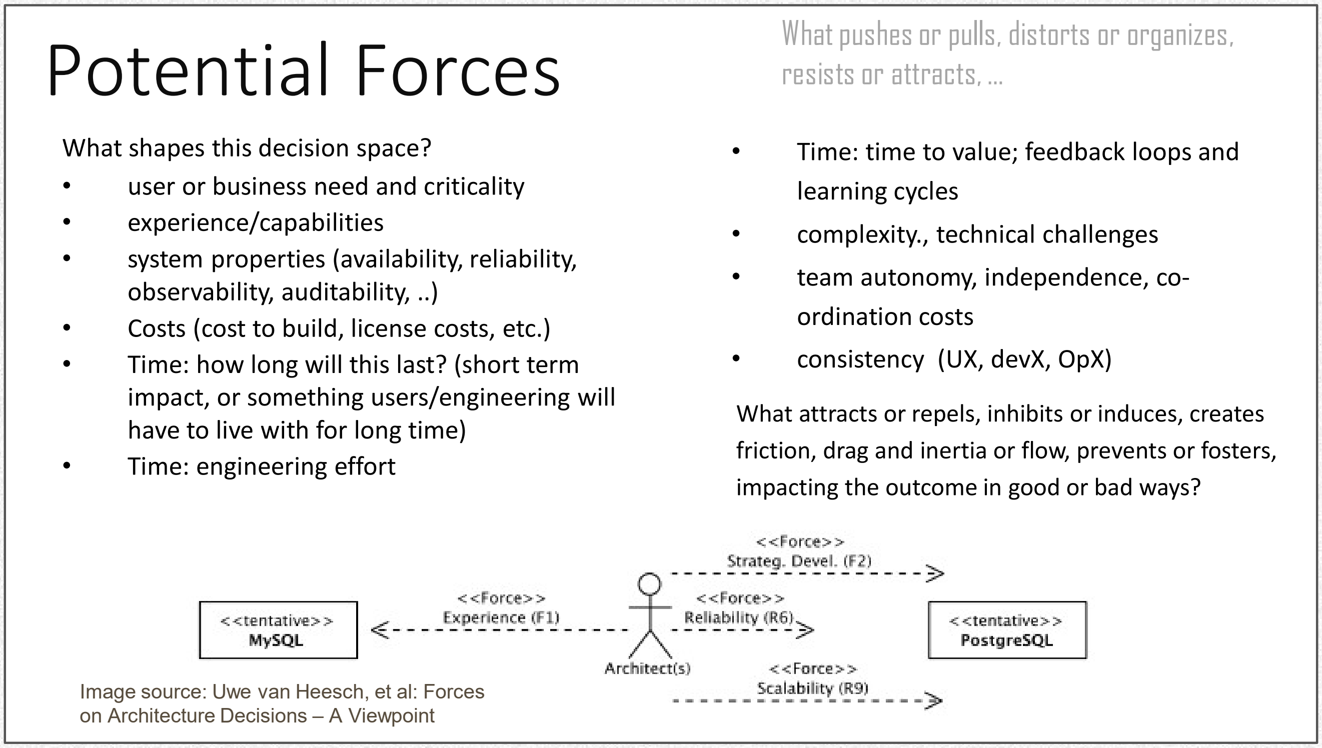
Source: Brian Marick, "Christopher Alexander's forces"

*Forces push or pull, attract (gravity) or repel, inhibit (friction or drag, resistance) or propel (applied, spring), can be used to hold in place (tension, compression, ..)*

*"a flying buttress [..] uses the power of downward compression to balance an outward force. (Or something like that — I'm not an architect.)"*

*— Brian Marick*

***Identify what matters, what characterizes the "problem" or situation and impacts the solution or decision we're proposing***



# Potential Forces

What pushes or pulls, distorts or organizes, resists or attracts, …

What shapes this decision space?

- user or business need and criticality
- experience/capabilities
- system properties (availability, reliability, observability, auditability, ..)
- Costs (cost to build, license costs, etc.)
- Time: how long will this last? (short term impact, or something users/engineering will have to live with for long time)
- Time: engineering effort
- Time: time to value; feedback loops and learning cycles
- complexity., technical challenges
- team autonomy, independence, co-ordination costs
- consistency (UX, devX, OpX)

What attracts or repels, inhibits or induces, creates friction, drag and inertia or flow, prevents or fosters, impacting the outcome in good or bad ways?

Image source: Uwe van Heesch, et al: Forces on Architecture Decisions – A Viewpoint

## *Forces, Considerations, What Impinges*

As we're making a decision, and then as part of conveying it, we want to understand (and convey) what has substantive bearing on the decision. This means characterizing the situation in terms that are relevant to the decision.

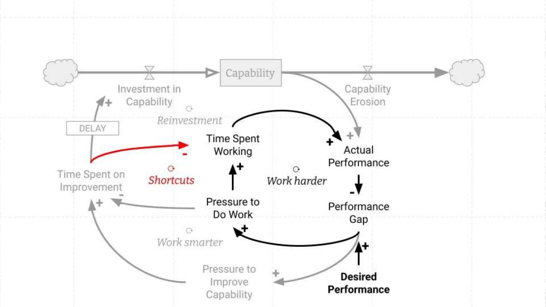
Whether we call them forces (or "forces" as an analogy) or factors or criteria, we're exploring what matters (in the use, development, operations, or broader context or situation), and how much it matters. And how that interacts. And what doesn't matter, that we thought might, and why.

What concerns do stakeholders have, that we need to take into account and address with this decision? Now, and as various stakeholders have to "live with" it. What makes a difference to the outcome and attributes of the solution, and how do the various alternatives we're weighing impact these concerns and goals (and objections)?

We want to identify what is consequential or significant to this decision, and get this out where we can see it, and reason about it and do so together, and bring others in to the process of identifying what matters and what interacts, and how we can best resolve the forces and tradeoffs (due to interacting and even conflicting goals and constraints).

Note about the diagram on slide: F2 is development of strategically important capability — it will become critical to the business, given the evolution of the system (increasingly large datasets, complicated queries, ⋯).

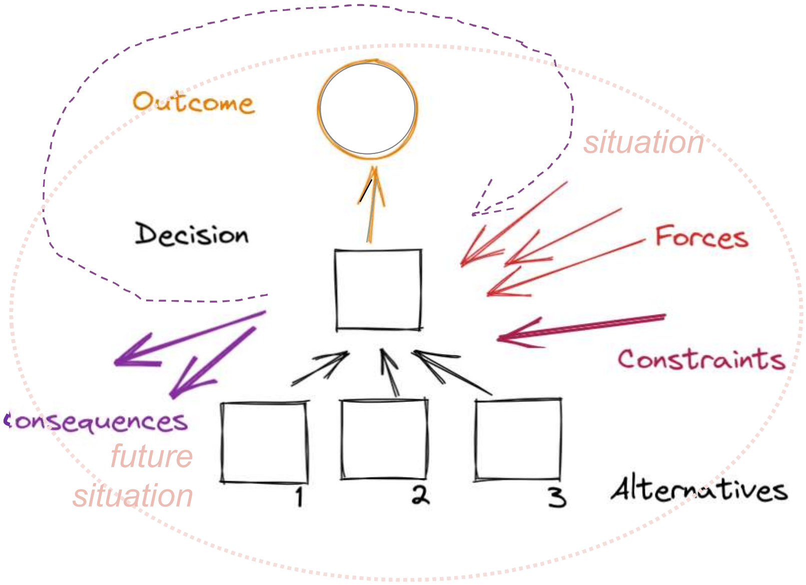
*What matters to our situation?To our stakeholders, now and over time?*



*Causal loop diagrams can be used to explore effects (what is impacted, and how). Image source: Xavier Briand, What is technical debt? And how to talk about it?*

***In creating and evaluating options, we're thinking about forces and consequences***

# Decision: Consequences



"nothing you do has just one effect"

— Michael Nygard

## *Consequences and Second Order Effects*

In addition to the outcome or positive impact we're directing our attention to achieve by making this decision, and the forces and demands impinging on it, we also need to take into account, and weigh, the effects or consequences of the decision and arguably, the consequences of the consequences or second order effects.

"Second-order thinking is the practice of not just considering the consequences of our decisions but also the consequences of those consequences. Everyone can manage first-order thinking, which is just considering the immediate anticipated result of an action. It's simple and quick, usually requiring little effort. By comparison, second-order thinking is more complex and time-consuming. The fact that it is difficult and unusual is what makes the ability to do it such a powerful advantage." — fs.blog

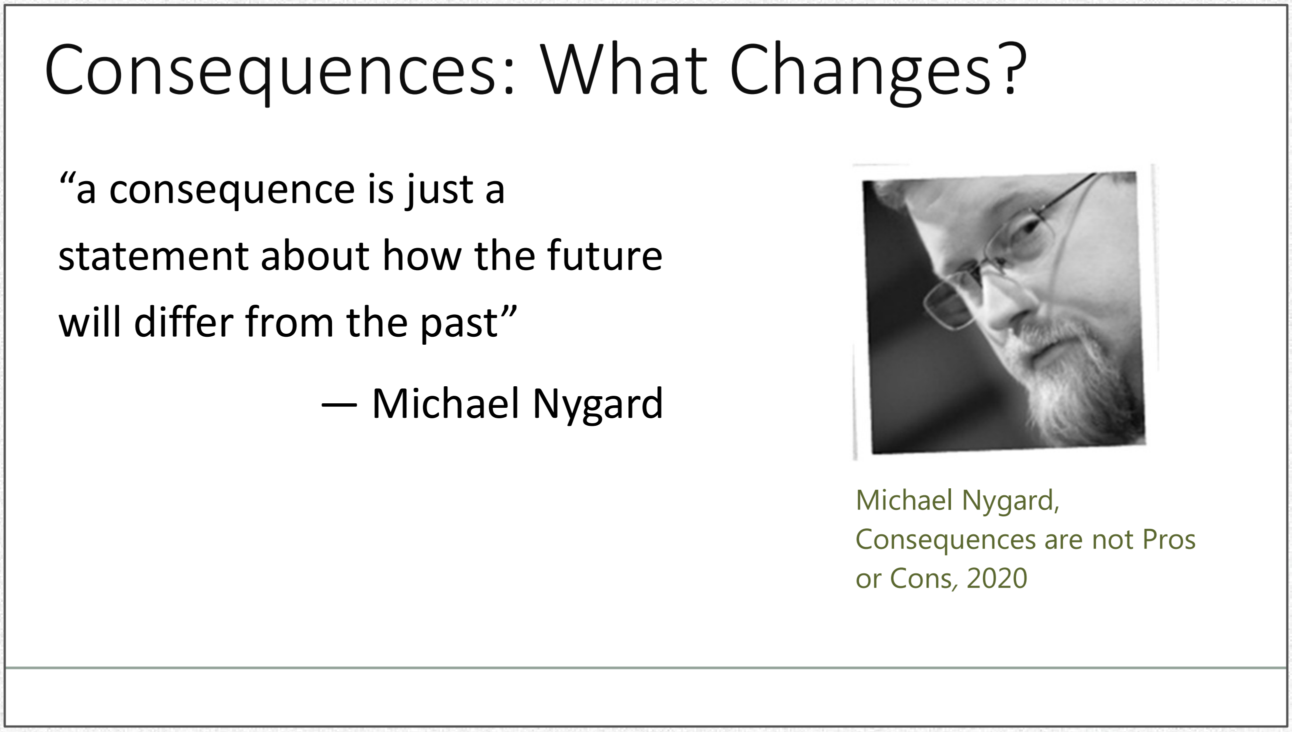
*Consequence Scanning* is an important approach to discovering the wider impacts of our technical products and choices. Ask:

- What are the intended and unintended consequences of this product or feature?
- What are the positive consequences we want to focus on?
- What are the consequences we want to mitigate?

More at https://doteveryone.org.uk/project/consequence-scanning/

> *"If you give a mouse a cookie,"*
> *"he's going to ask for a glass of milk."*
> *"When you give him the milk,"*
> *"he'll probably ask for a straw"*
> *"When he's finished, he'll ask for a napkin."*
> *"Then he'll want to look in the mirror*
> *To make sure he doesn't have a milk mustache."*
> *— Laura Numeroff*

***To think more clearly about consequences, start with "what will be different, for whom?"***



# Consequences: What Changes?

"a consequence is just a statement about how the future will differ from the past"

— Michael Nygard

Michael Nygard, Consequences are not Pros or Cons, 2020

> *"As you make this list of consequences, try to avoid coloring your thoughts about the consequences by what your intentions are. [..] once the change is made your intentions are irrelevant. Only the resulting system state matters."*
>
> *— Michael Nygard**

## *How Does the Decision Change Things?*

In a blog post* that is a great companion to his post describing how he recommends documenting architecture decisions, Michael Nygard observes that we tend to focus on pros and cons, and can lean into justifying the choice we have or want to make. He notes:

"Instead, I suggest we first describe simply consequences, not benefits or problems. That's because a consequence is just a statement about how the future will differ from the past. [..]

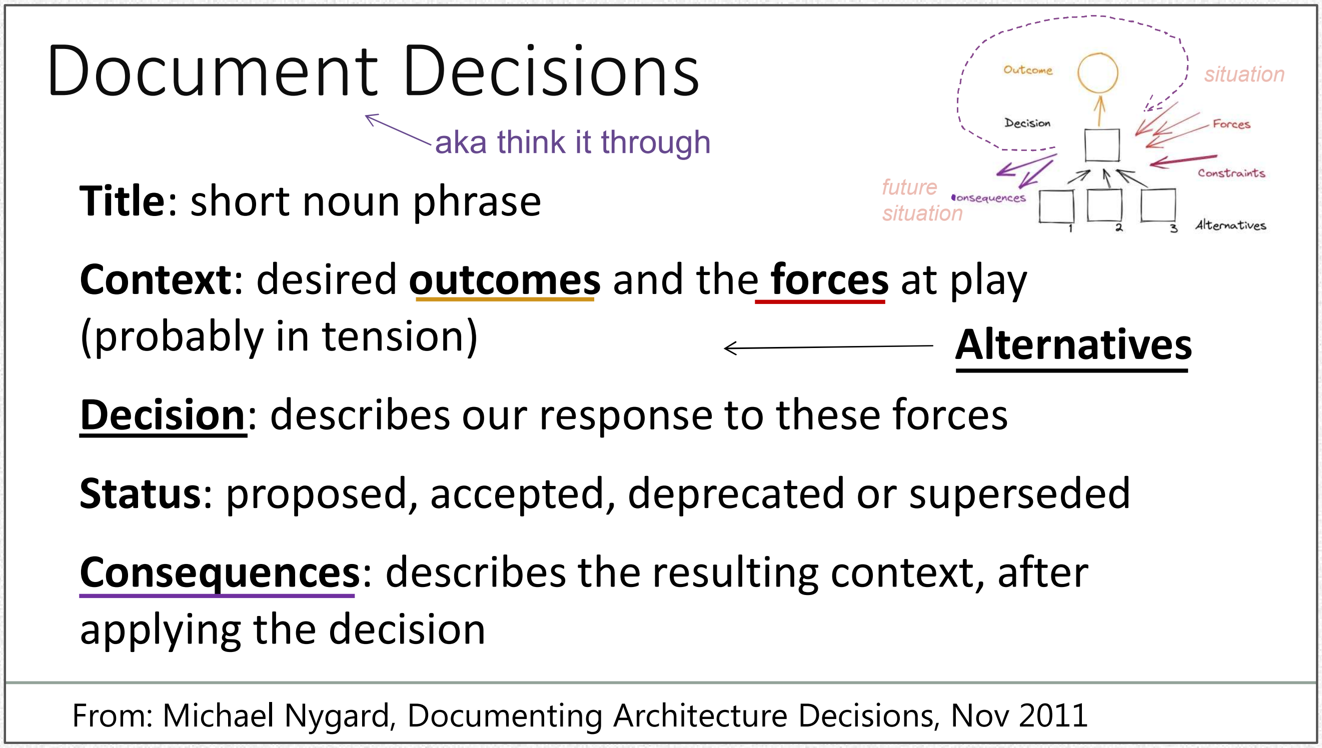
Whether you judge that consequence to be a "pro" or "con" depends entirely on your relationship to the change. If you perceive the change as an improvement to status quo then you call it a "pro". If you don't like the version of the future which includes that consequence, then you call it a "con". That means labelling a consequence as a benefit is subjective. It describes the relationship of you and the change.

What about the changes that you don't particularly like or dislike? The ones that are neither "pro" nor "con"? Most of the time those don't get written down at all!

I recommend that you begin by listing the consequences. Find all the ways that the future will be unlike the past, if we choose that path. Look for second-order effects — the consequences of the consequences."

* Michael Nygard, Consequences are not Pros or Cons, *https://www.michaelnygard.com/blog/2020/06/consequences-are-not-pros-or-cons/*

***All of this is summarized in Michael Nygard's template for recoding architecture decisions***



# Document Decisions

aka think it through

**Title**: short noun phrase

**Context**: desired **outcomes** and the **forces** at play (probably in tension)

**Alternatives**

**Decision**: describes our response to these forces

**Status**: proposed, accepted, deprecated or superseded

**Consequences**: describes the resulting context, after applying the decision

From: Michael Nygard, Documenting Architecture Decisions, Nov 2011

## *Architecture Decision Records*

ADRs are a way to share decision reasoning. Examples of ADRs at: https://web.archive.org/web/20210506014629/https://upmo.com/dev/decisions/0010-som-synthetic-monitoring.html

***Michael Nygard's Template***:

**Title** These documents have names that are short noun phrases. For example, "ADR 1: Deployment on Ruby on Rails 3.0.10" or "ADR 9: LDAP for Multitenant Integration"

**Context** This section describes the forces at play, including technological, political, social, and project local. These forces are probably in tension, and should be called out as such. The language in this section is value-neutral. It is simply describing facts.

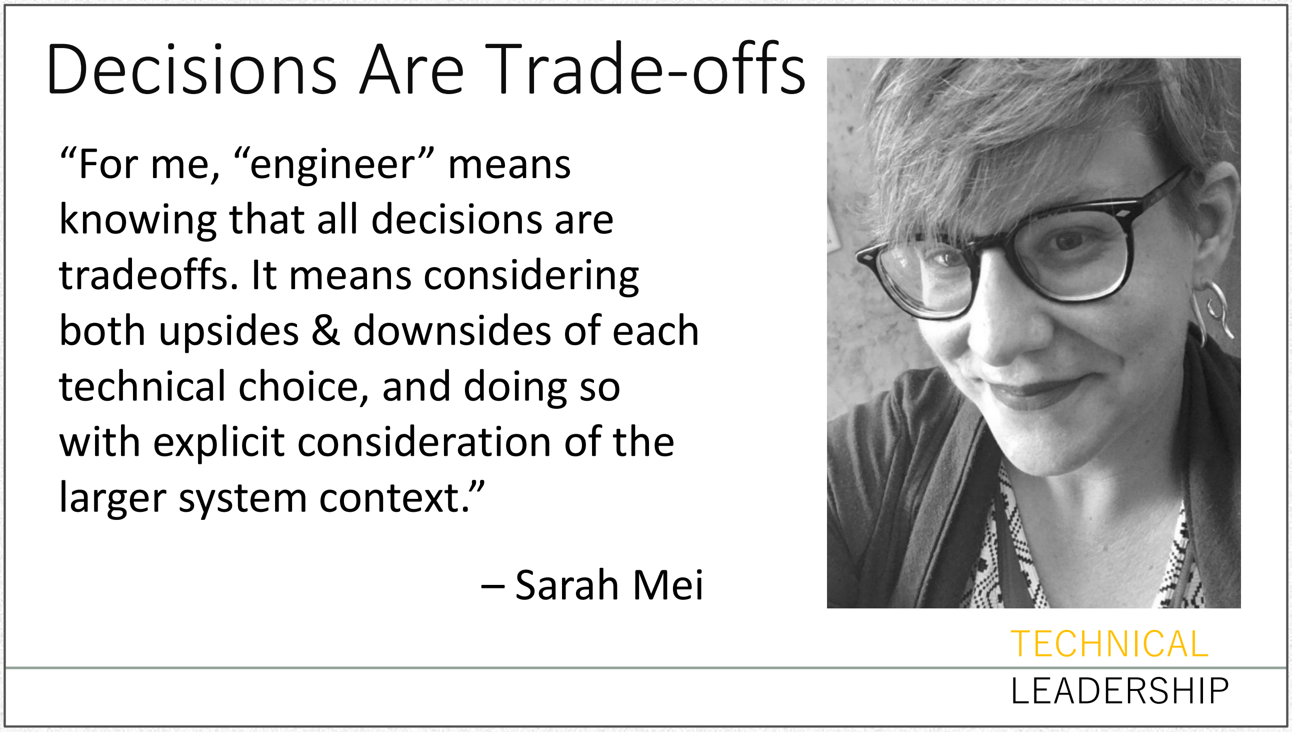
**Decision** This section describes our response to these forces. It is stated in full sentences, with active voice. "We will …" Justify the decision.

**Consequences** This section describes the resulting context, after applying the decision. All consequences should be listed here, not just the "positive" ones. A particular decision may have positive, negative, and neutral consequences, but all of them affect the team and project in the future.

The consequences of one ADR are very likely to become the context for subsequent ADRs. This is also similar to Alexander's idea of a pattern language: the large-scale responses create spaces for the smaller scale to fit into.

> *"In practice, our projects almost all live in GitHub private repositories, so we can exchange links to the latest version in master. Since GitHub does markdown processing automatically, it looks just as friendly as any wiki page would."*
>
> *— Michael Nygard*

> *"Writing about your decision forces you to explain your thinking." — fs.blog, Creating a Decision Journal*



# Decisions Are Trade-offs

"For me, "engineer" means knowing that all decisions are tradeoffs. It means considering both upsides & downsides of each technical choice, and doing so with explicit consideration of the larger system context."

– Sarah Mei

TECHNICAL
LEADERSHIP

## *Decisions Entail Tradeoffs and Tradeoffs Don't Stay Their Lane ¯_( ツ)_/¯*

As a manager in IT or product development, our decisions don't just impact teams but the systems they create. We see this in Conway's Law:

> "The basic thesis [..] is that organizations which design systems [..] are constrained to produce designs which are copies of the communication structures of these organizations."
>
> -- Melvin Conway, How Do Committees Invent?, 1968

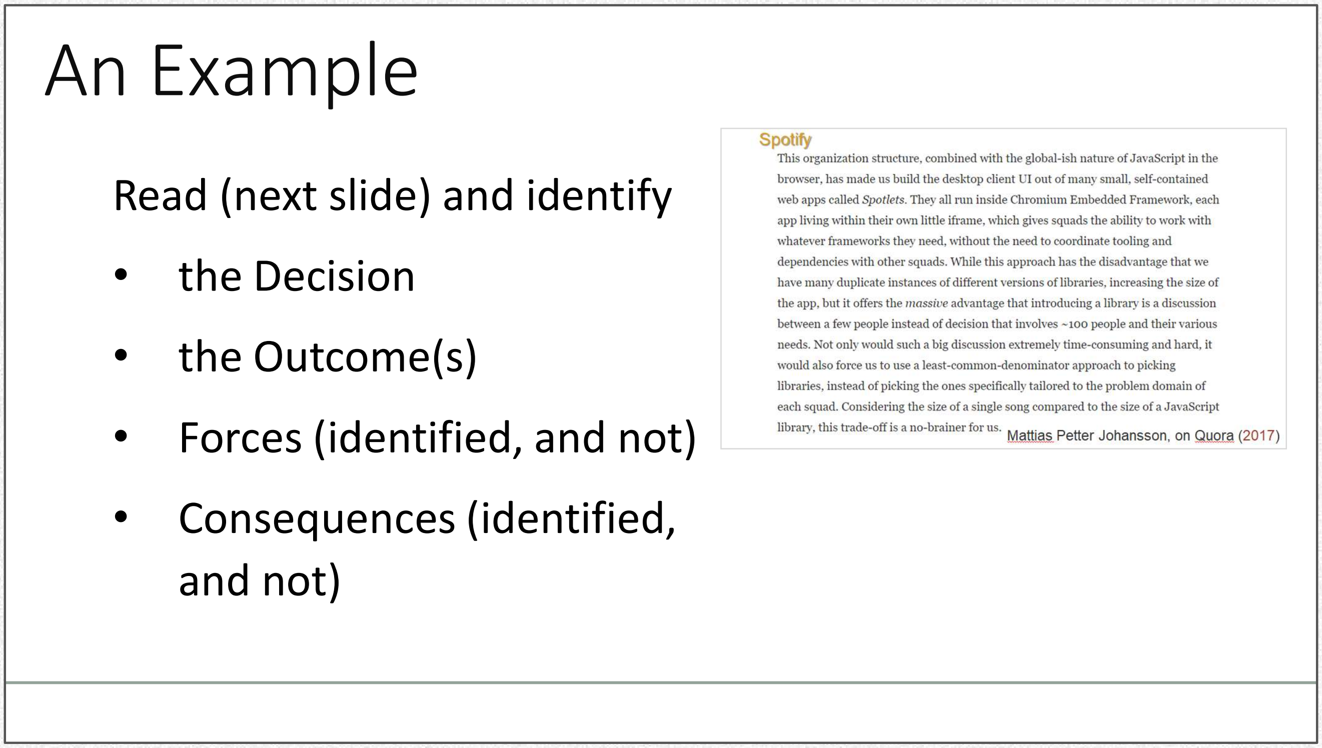
Likewise, as an architect, the choices we're making are technical, but the impacts don't remain neatly in the technical space. The tradeoff space isn't just about qualities that impact developer experience, or security properties or operational complexity, but user experience and partner experience through properties of the system in use. And more. So we investigate the upsides and downsides of our technical decisions, in these various contexts.

We want to surface the trade-offs inherent in our decisions, both to better understand the decision space, and because we may be able, or need, to contend with the downsides of these decisions explicitly, to offset them.

*"When you build a bridge, you don't build it as a perfect structure that will never collapse. Instead you build it to withstand 500 year winds, 200 year floods, 300% expected maximum load, etc. If you didn't make these design trade-offs, every bridge would be solid concrete [..] Engineering is all about making these compromises"*

*Pragprog.com/articles/the-art-of-tradeoffs*

***Leadership isn't inherently about hierarchy. Though hierarchy is not irrelevant.***



# An Example

Read (next slide) and identify

- the Decision
- the Outcome(s)
- Forces (identified, and not)
- Consequences (identified, and not)

Spotify

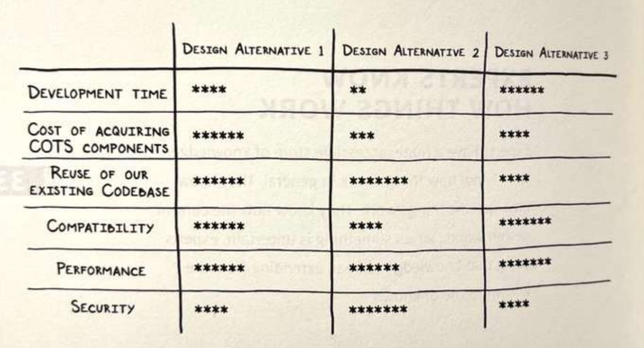
This organization structure, combined with the global-ish nature of JavaScript in the browser, has made us build the desktop client UI out of many small, self-contained web apps called *Spotlets*. They all run inside Chromium Embedded Framework, each app living within their own little iframe, which gives squads the ability to work with whatever frameworks they need, without the need to coordinate tooling and dependencies with other squads. While this approach has the disadvantage that we have many duplicate instances of different versions of libraries, increasing the size of the app, but it offers the *massive* advantage that introducing a library is a discussion between a few people instead of decision that involves ~100 people and their various needs. Not only would such a big discussion extremely time-consuming and hard, it would also force us to use a least-common-denominator approach to picking libraries, instead of picking the ones specifically tailored to the problem domain of each squad. Considering the size of a single song compared to the size of a JavaScript library, this trade-off is a no-brainer for us.

Mattias Petter Johansson, on Quora (2017)

## *Weigh tradeoffs*

To make better decisions, we need to weigh and resolve the inherent tradeoffs — the upsides and downsides of the choice or approach.

That is, to make tradeoffs intentionally, we need to identify and characterize the tradeoff space. What is relevant to the decision is a (set) of judgment calls. How we balance and resolve the tradeoffs is again a set of judgment calls (though of course there may be precedent in the industry, or in our experience, that gives us more to go on).



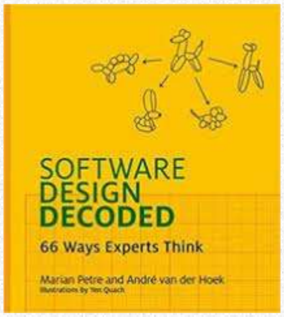
| | Design Alternative 1 | Design Alternative 2 | Design Alternative 3 |
|---|---|---|---|
| Development time | **** | ** | ****** |
| Cost of acquiring COTS components | ****** | *** | **** |
| Reuse of our existing Codebase | ****** | ******* | **** |
| Compatibility | ****** | **** | ******* |
| Performance | ****** | ****** | ******* |
| Security | **** | ******* | **** |

## *We're going to consider an example (next slide)*

A remote presentation like this has some advantages in terms of screen distance, but for those who can't read the screen we will recap some of the main points in just a bit. Now, though, we will take a moment to allow a chance to read the text on the next slide, and identify the decision, the outcome, the forces impinging on this situation (those identified in the description, and those your experience is prompting) and consequences or effects of this decision.

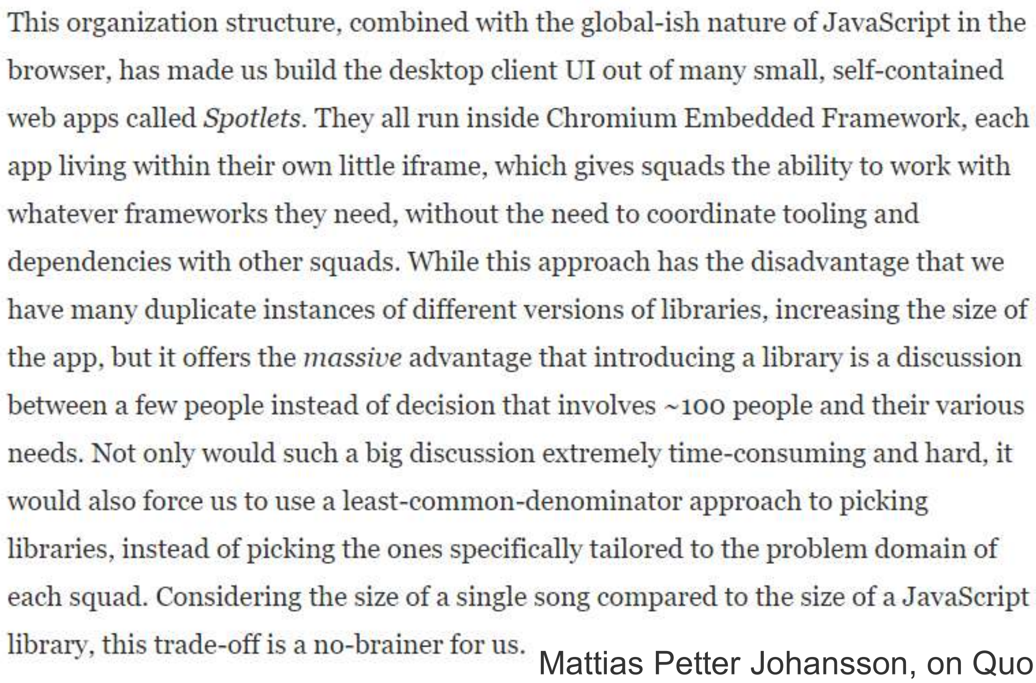
> *"strive for the least worst combination of trade-offs"*
>
> *— Neal Ford et al*

Design Alternatives image from:


SOFTWARE DESIGN DECODED
66 Ways Experts Think
Marian Petre and André van der Hoek
Illustrations by Yen Quach

***Exercise: Read this narrative description of a decision***

## Spotify



This organization structure, combined with the global-ish nature of JavaScript in the browser, has made us build the desktop client UI out of many small, self-contained web apps called *Spotlets*. They all run inside Chromium Embedded Framework, each app living within their own little iframe, which gives squads the ability to work with whatever frameworks they need, without the need to coordinate tooling and dependencies with other squads. While this approach has the disadvantage that we have many duplicate instances of different versions of libraries, increasing the size of the app, but it offers the *massive* advantage that introducing a library is a discussion between a few people instead of decision that involves ~100 people and their various needs. Not only would such a big discussion extremely time-consuming and hard, it would also force us to use a least-common-denominator approach to picking libraries, instead of picking the ones specifically tailored to the problem domain of each squad. Considering the size of a single song compared to the size of a JavaScript library, this trade-off is a no-brainer for us.

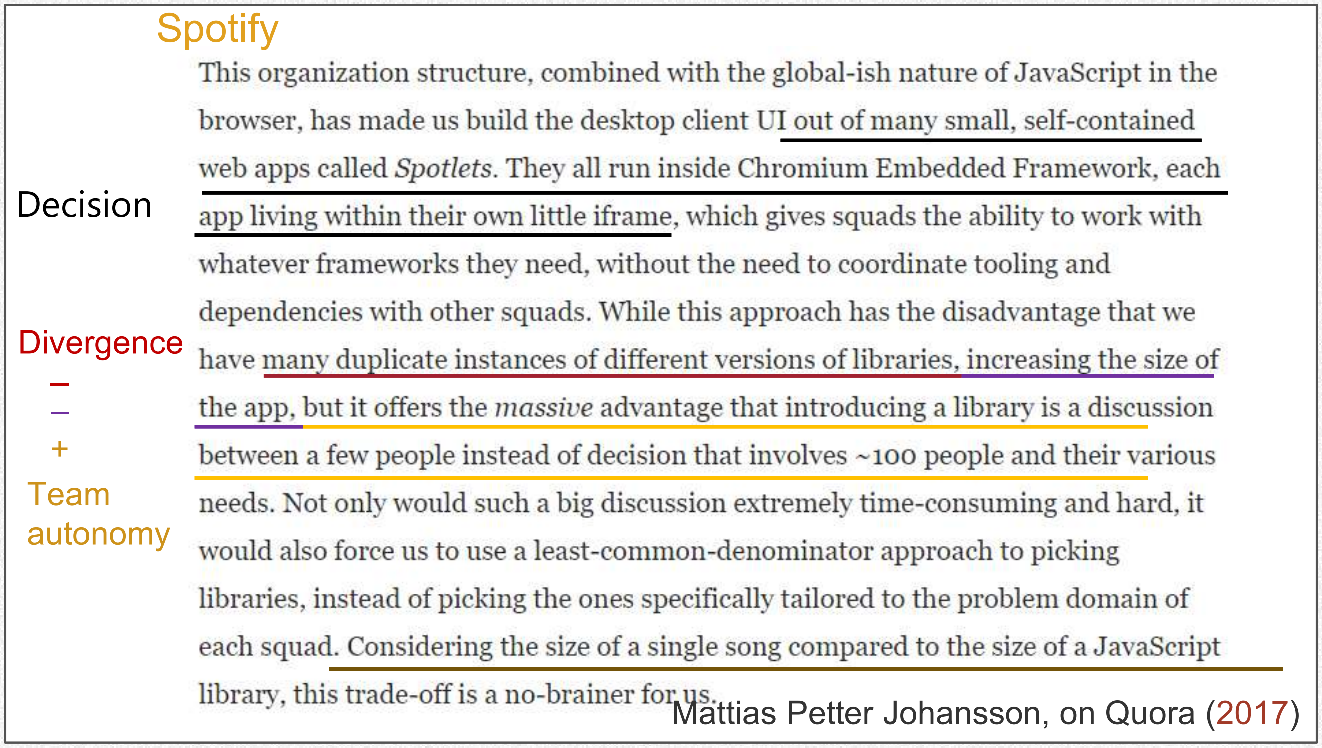
Mattias Petter Johansson, on Quora (2017)

## *Example*

Let's spend a moment and read the discussion (see slide above) from Mattias Peter Johansson on Quora, about Spotify (written in 2017). Ref: https://www.quora.com/How-is-JavaScript-used-within-the-Spotify-desktop-application-Is-it-packaged-up-and-run-locally-only-retrieving-the-assets-as-and-when-needed-What-JavaScript-VM-is-used

One thing to note, is that this was written several years ago, about the past; things changed.

*What did you notice?*



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Mattias Petter Johansson, on Quora (2017)

## *What do we Notice?*

Our point here isn't to criticize Spotify's choices in that timeframe and point of the evolution (in the market and of the technology and organization), but to appreciate how, even in this narrative format, so much of the decision and considerations are being conveyed, and to explore the decision.

The decision: to use Spotlets, or small, self-contained apps within their own iframe

The outcome: increased team independence or autonomy

Positive effects (or forces): reduced cross-team co-ordination; speed of movement (so speed of learning)

Negative effect (or force): duplicate instances of different versions of libraries

Negative consequence: reduced cross-team communication; divergence among teams as a result

(These social costs and consequences are not just as a result of this decision, but the decision is part of a reinforcing loop.)

Negative consequence (not surfaced; potentially future): multiple versions of licenses and purchasing and security headaches (knowing what patches to roll out where)

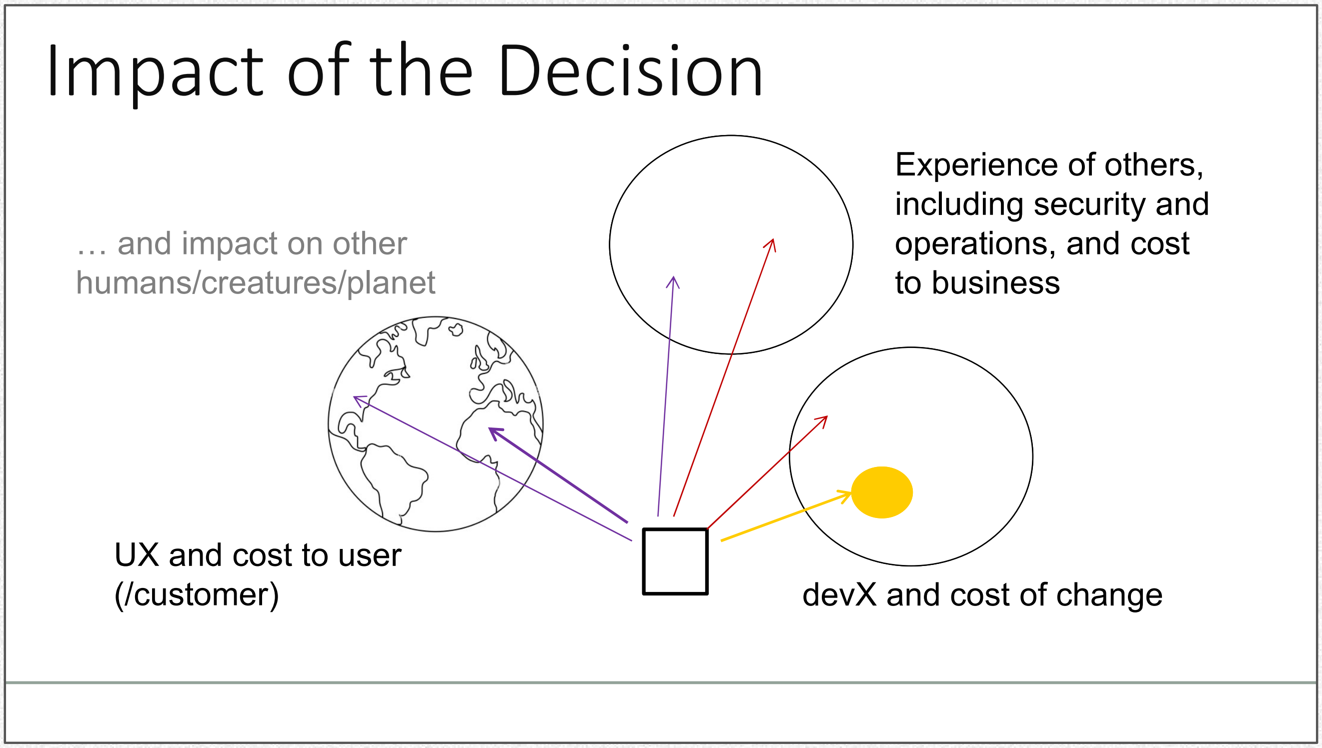
Tradeoff? size of songs so dominates size of app, that they could make this decision to support team autonomy without perceived cost to user.

We see that allowing duplicate instances of different versions of various libraries enabled Spotify squads (teams) considerable independence, removing the need to coordinate with other squads on libraries and versions. Because song size so dominates considerations that it generally falls beneath the threshold of sensitivity for the user, the tradeoff of team freedom for app size is easily (in their view) within the design acceptance envelope.

So in this case, a technical decision is being made for organizational gain (lowering team coordination costs and increasing team's degrees of freedom) at the expense of app size, which works as long as it's below the app user's tolerance threshold for resource consumption.

We're building econo-sociotechnical systems, within econo-sociotechnical systems, and we need to factor this in, as we scan for forces, constraints and consequences (that we factor in as forces).

***Leadership isn't inherently about hierarchy. Though hierarchy is not irrelevant.***



# Impact of the Decision

… and impact on other humans/creatures/planet

Experience of others, including security and operations, and cost to business

UX and cost to user (/customer)

devX and cost of change

## *Different Impact in Different Areas*

What this example highlights, is "what's going on" in terms of what is being paid attention to in the decision, what the forces and tradeoffs are and what has not been drawn into explicit consideration, possibly because it isn't yet a significant noticed force.  And in particular, this important point: impacts (positive outcomes, as well as other positive and negative effects) and consequences (including downstream and future consequences) are borne by different sets of "stakeholders" – not just different persons or internal groups, but users (downloading the app and listening to songs), customers (paying bills), these people in different regions of the world, with different bandwidth and cost constraints. As well as different stakeholders within the organization, and not limited to developers.

But we would draw on experience to point out what to be watching for, as the situation evolves.

> *"Good engineering is less about finding the "perfect" solution and more about understanding the tradeoffs and being able to explain them."*
> *— Jaana B. Dogan*

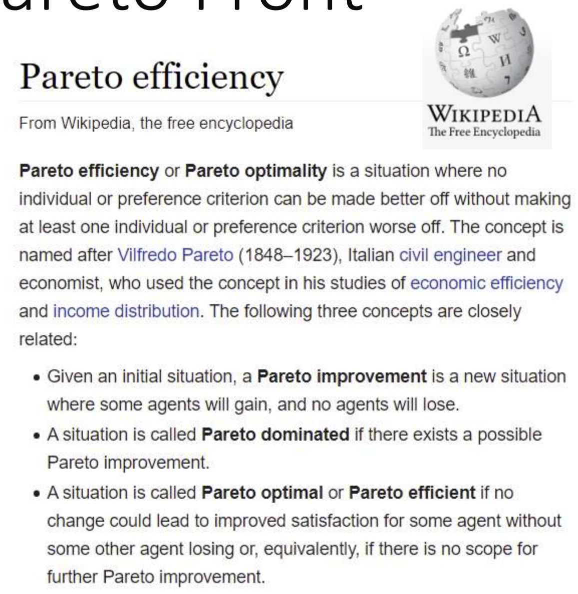
> *[Reflecting on the Ackoff video] "The systemic cultural and societal impacts of the software we build: I feel that especially in venture capital backed startups, the software industry is prone to not thinking in systems when it comes to the impact of what their products are doing — as opposed to the return on investment they have. From the harms of social media on mental health, to discriminatory bias in AI, I see many parallels with the notion of "doing the wrong thing right."   — Mike Stallard*

***Leadership isn't inherently about hierarchy. Though hierarchy is not irrelevant.***

# Decision Space and Pareto Front

"Tradeoffs only occur when you reach [a] Pareto frontier."

— Donald Reinertsen



Pareto efficiency

From Wikipedia, the free encyclopedia

**Pareto efficiency** or **Pareto optimality** is a situation where no individual or preference criterion can be made better off without making at least one individual or preference criterion worse off. The concept is named after Vilfredo Pareto (1848–1923), Italian civil engineer and economist, who used the concept in his studies of economic efficiency and income distribution. The following three concepts are closely related:

- Given an initial situation, a **Pareto improvement** is a new situation where some agents will gain, and no agents will lose.
- A situation is called **Pareto dominated** if there exists a possible Pareto improvement.
- A situation is called **Pareto optimal** or **Pareto efficient** if no change could lead to improved satisfaction for some agent without some other agent losing or, equivalently, if there is no scope for further Pareto improvement.

## *Pareto Front*

What we're seeing in this example, is that, with respect to team degrees of freedom and app size on the one hand, and song size and by implication user experience and space and cost concerns, a Pareto Front has not being reached. These things aren't being traded off for one another. We can improve team independence without decreasing user experience in an appreciable way.

## *Experts*

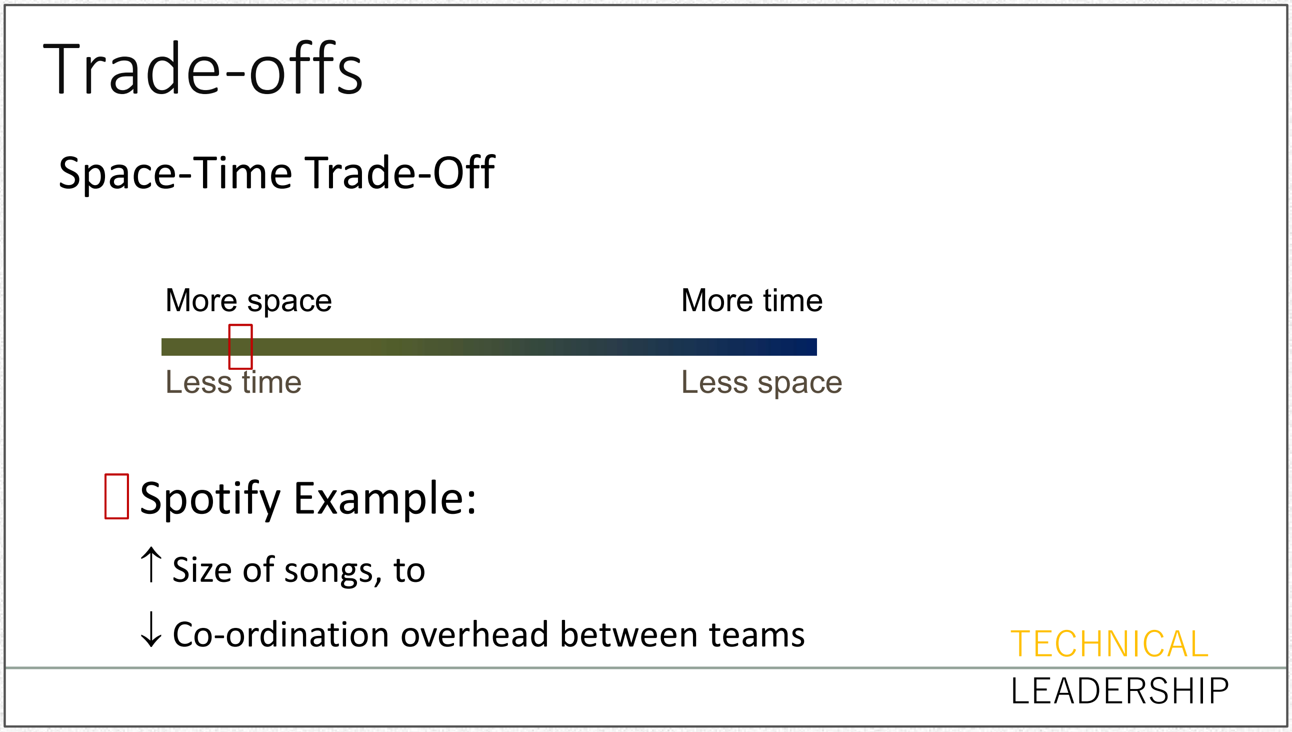
John Cutler makes this point about how experts and those with less experience perceive the trade-off space:

> 'Ask an everyday driver about driving tradeoffs, and you'll likely hear "When you go around a corner, you need to trade off speed and control." The mental model is something like, "slow down just enough to keep control around the corner."
>
> A professional driver will think differently. Their mental model revolves around tire grip and temperature, the optimal racing line, throttle control, suspension, aero settings, brake balance, tuning the car for the track, and weight transfer management. '

John Cutler https://cutlefish.substack.com/p/tbm-250-dear-executive

*"A threshold effect exists when there is a critical level of effort necessary to affect the system. Levels of effort below this threshold have little payoff."*

*— Richard Rumelt*



# Trade-offs

## Space-Time Trade-Off

More space　　　　　　　　More time

Less time　　　　　　　　Less space

□ Spotify Example:

↑ Size of songs, to

↓ Co-ordination overhead between teams

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*"A trade-off (or tradeoff) is a situational decision that involves diminishing or losing one quality, quantity or property of a set or design in return for gains in other aspects. In simple terms, a tradeoff is where one thing increases and another must decrease."*

*— wikipedia*

## *Space-Time or Time-Memory Trade-Off*

"Usually, a TMTO is developed to improve the speed of an algorithm by utilizing one-time work, which results in increased storage (memory) requirements when the resulting algorithm is executed. Of course, it is also possible to work in the opposite direction by reducing the one-time work at the expense of more work each time the algorithm is executed. The goal is to balance the one-time work (memory) requirement with the speed of the algorithm (time)."

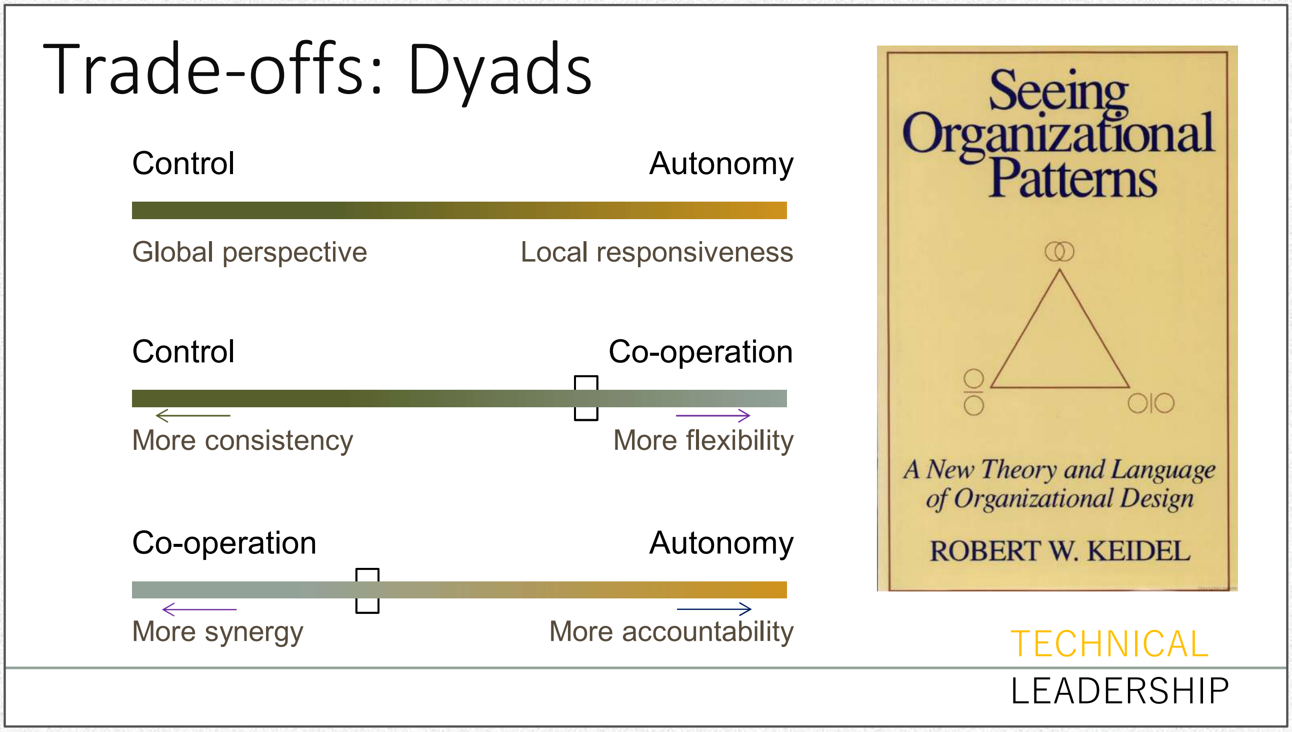
— Mark Stamp, Once Upon a Time-Memory Tradeoff

A classic illustration of the trade-off entails using a lookup table (uses upfront work and a lot of space to enable a fast lookup when the result is needed) versus calculating on demand (uses little space, but can take a long time at the point of demand, depending on the calculation).

Another space-time trade-off arises in data storage. If data is stored uncompressed, it takes more space but less time than if the data were stored compressed.

We're talking about this as a space-time trade-off, but it translates into a cost-performance (i.e., user experience) trade-off.

***What are we giving up and what are we gaining?***



## Trade-offs: Dyads

Control — Autonomy

Global perspective — Local responsiveness

Control — Co-operation

More consistency — More flexibility

Co-operation — Autonomy

More synergy — More accountability

Seeing Organizational Patterns

*A New Theory and Language of Organizational Design*

ROBERT W. KEIDEL

TECHNICAL LEADERSHIP

> *"For example, continuous evolution pulls against product stability[..]. Low-level decisions pull against strict process control"*
>
> *— Eberhardt Rechtin and Mark Maier*

### *Trade-Off Dyads (Picturing the Dilemma)*

We have a trade-off when design variations improve one dimension (something we value, like a performance metric), but diminish another. Factor in multiple of these trade-off dimensions, and there is no unique optimal design; the choice lies in what is valued in that context.

By drawing the trade-offs out — making them visible — we can make judgments, and subject them to discourse to better assess impact and value.

Many trade-offs can usefully be thought of in terms of dyads: performance and cost (another way to frame the space-time trade-off); data confidentiality or security (via encryption) and performance; safety and cost; structural mass (for physical structures) and safety; usability or convenience and security; etc.

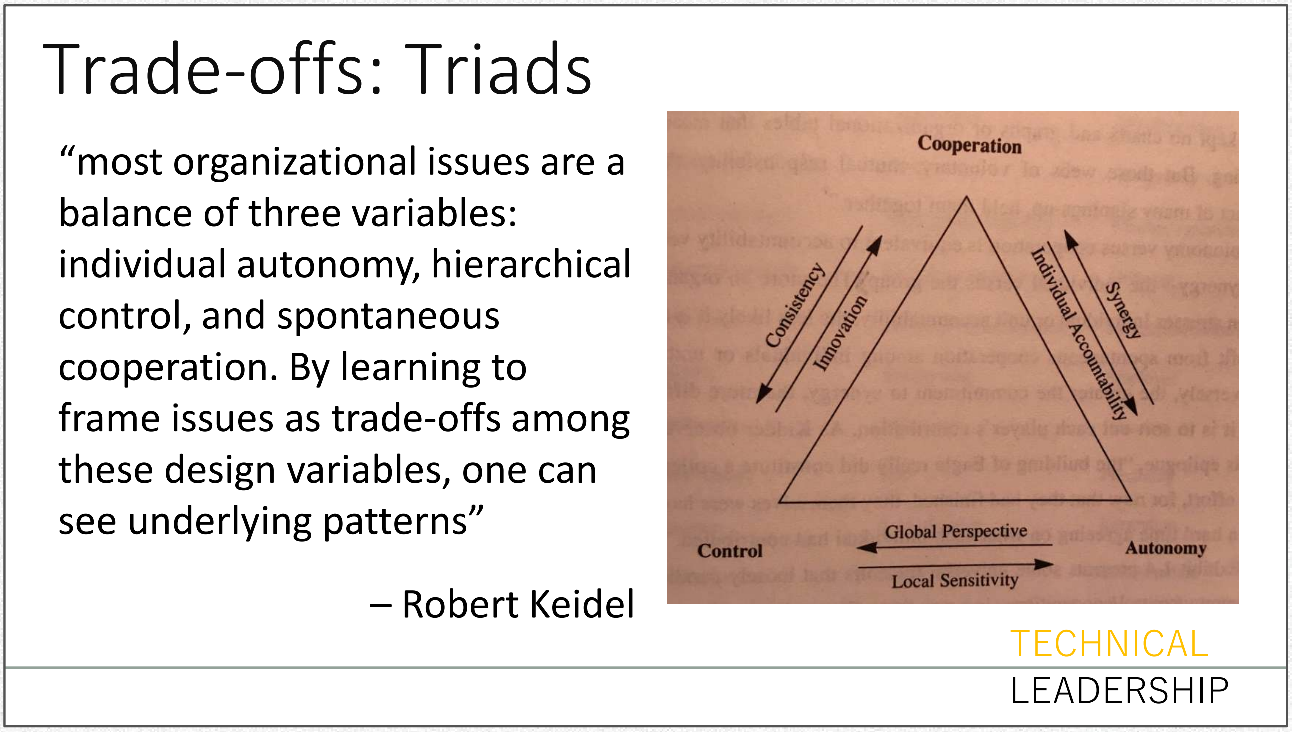
In *Seeing Organizational Patterns*, Robert Keidel considers organizational structures and interaction dynamics, and pivotal trade-offs underlying organizing choices.

These could be presented as the dyads shown (slide above).

While considering pair-wise trade-offs can help understand the design space, it can obscure the tensions when multiple variables are simultaneously in play. Keidel points out that "every organization must blend autonomy, control, and cooperation." The trade-off space (the design options), is more usefully visualized as a triad, or triangle.

The multiple library versions example earlier, is missing impacts (eg security implications).

***But really, it's a trade-off space. An example with more than two variables***



# Trade-offs: Triads

"most organizational issues are a balance of three variables: individual autonomy, hierarchical control, and spontaneous cooperation. By learning to frame issues as trade-offs among these design variables, one can see underlying patterns"

– Robert Keidel

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## *A Trilemma of Trade-offs*

According to Keidel, any particular organization will focus on at most two of autonomy, control, and co-ordination. (Attempting all three is an unstable form.) These are the organizational forms he identifies:

Organizations that are autonomy-based have as their distinctive competence adding value through solo performers; they are truly star systems. Example: any first-rate university.

Control-based organizations compete on the basis of their ability to reduce costs and/or complexity through global coordination. Authority, information, and initiative reside chiefly at the top levels.

A cooperation-based organization builds synergy across teams. The distinctive organizational competence is innovation through cooperation.

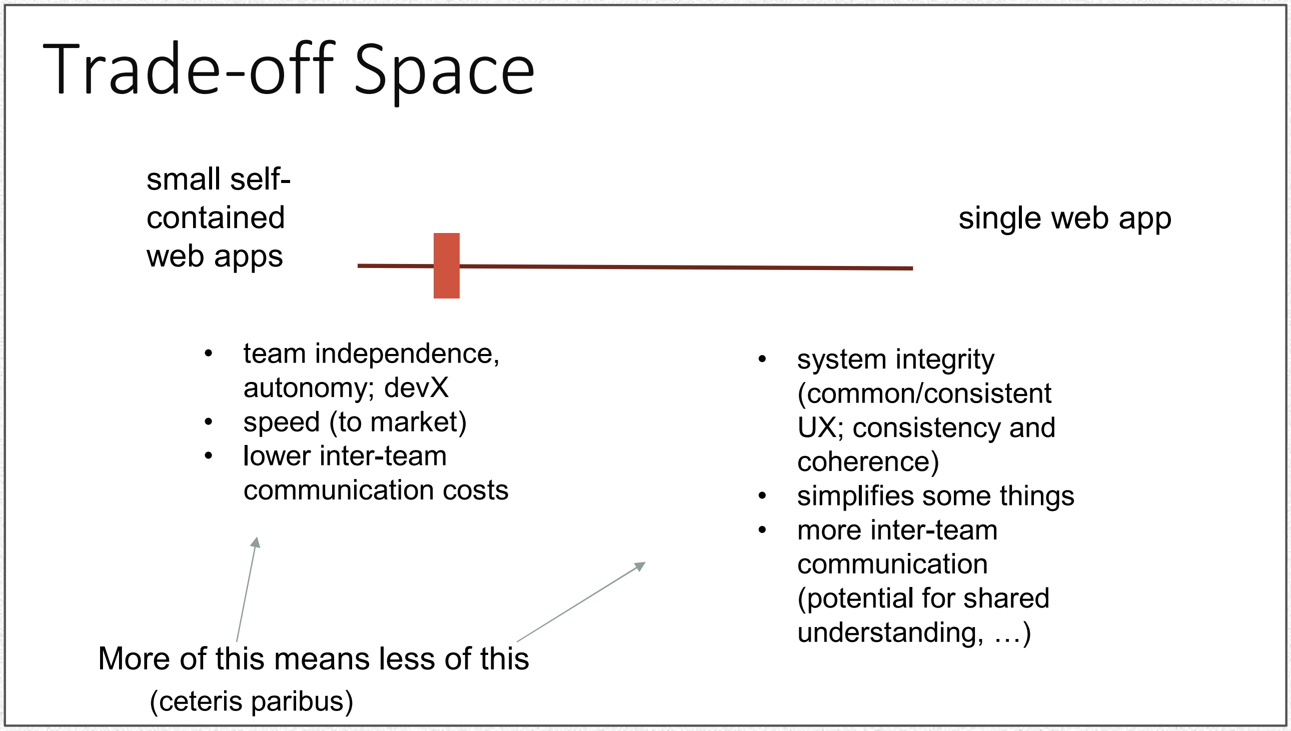
Probably the most familiar example of an autonomy/control hybrid is the divisionalized corporation.

A control/cooperation hybrid may be described as a "humanistic hierarchy." Top-down control remains essential but every effort is made to meld it with voluntary, lateral processes among individuals, functions, and units.

The autonomy/cooperation has the oldest roots. This combination goes back to the craft organizations of the late 18th century, which featured a blend of individual initiative and informal cooperation.

*"Equally dangerous is an overemphasis on a single variable to the point that the other two are neglected. Autonomy becomes problematic when a relatively freestanding part-individual or organizational unit-overdoes its own thing."*
*— Robert Keidel*

*Seeing Organizational Patterns*, Robert Keidel



Trade-off Space

small self-contained web apps

single web app

- team independence, autonomy; devX
- speed (to market)
- lower inter-team communication costs

- system integrity (common/consistent UX; consistency and coherence)
- simplifies some things
- more inter-team communication (potential for shared understanding, …)

More of this means less of this

(ceteris paribus)

## *Choices Among Options*

When we are deciding among alternatives, we're deciding among the clusters of effects and consequences of those alternatives (like modular monolith or microservices; small self-contained web apps or single web app; etc.).

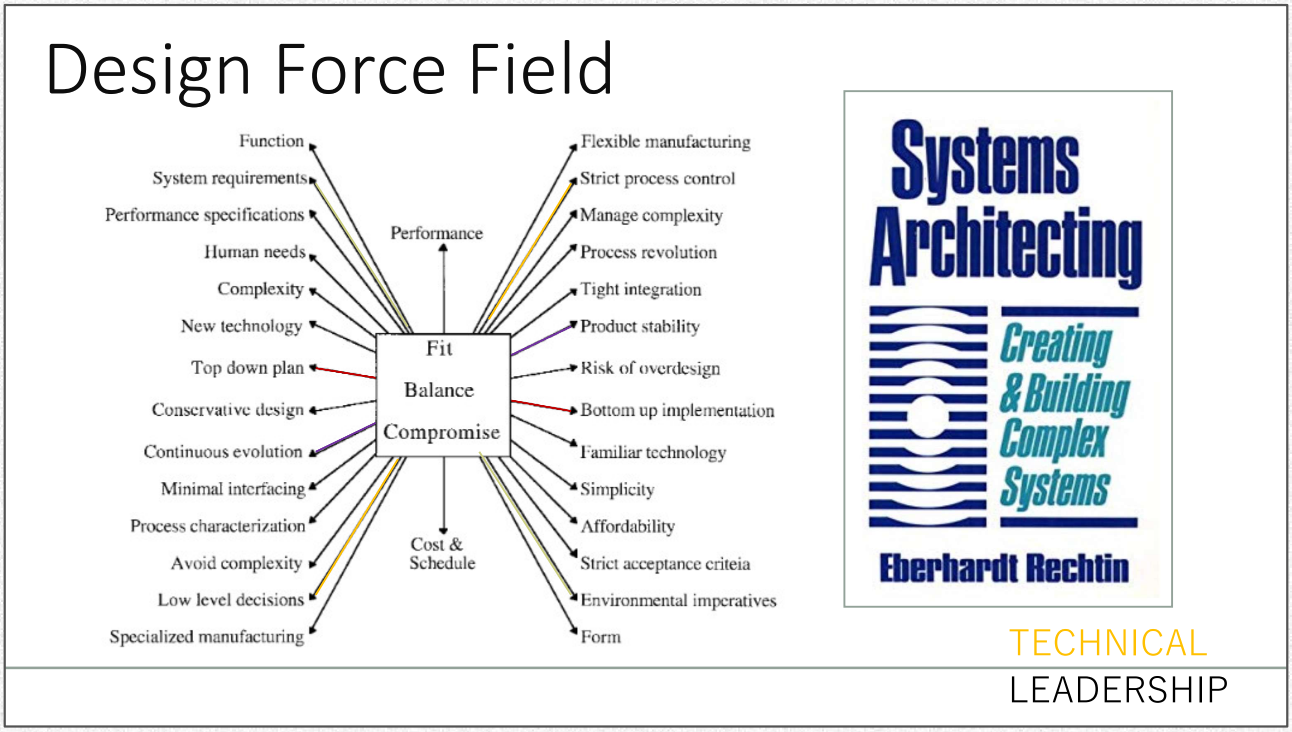
While the concept of "to decide" holds within it the notion of what we're deciding *not* to do, along with what we are deciding *to* do, part of (what we factor in) the trade-off space may include what it takes to mitigate the negative effects or downsides of the approach we go with.

*Examples*

We might seek to minimize downtime with rapid failure detection and recovery, but this incurs the overhead of continuous monitoring and detection. Additionally, automated detection and recovery mechanisms may be triggered by false positives (for example, a node acting as if it has failed, when it's just running slowly for a moment) or introduce performance degradation during failover. Balancing the trade-offs involves optimizing detection sensitivity and response times while minimizing false alarms and impact on performance.

> *"Two key questions I always advise people to reflect on [..]:*
> *1. What happens if this succeeds? Does it make the [..] world better?*
> *2. Who is harmed by the changes this causes? What would you choose to do if you loved them?*
> *Every single choice gets easier if you know those answers.'*
> *— Anil Dash*

> *"A central tenant of the ecosystem approach is that the path to sustainability is one of tradeoffs. Science can illuminate the tradeoffs but a resolution, that is, the choice of path, is a political decision" — Michelle Boyle, et al*



# Design Force Field

Function
System requirements
Performance specifications
Human needs
Complexity
New technology
Top down plan
Conservative design
Continuous evolution
Minimal interfacing
Process characterization
Avoid complexity
Low level decisions
Specialized manufacturing

Performance

Fit
Balance
Compromise

Cost &
Schedule

Flexible manufacturing
Strict process control
Manage complexity
Process revolution
Tight integration
Product stability
Risk of overdesign
Bottom up implementation
Familiar technology
Simplicity
Affordability
Strict acceptance criteia
Environmental imperatives
Form

Systems Architecting
Creating & Building Complex Systems
Eberhardt Rechtin

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## *Tensions*

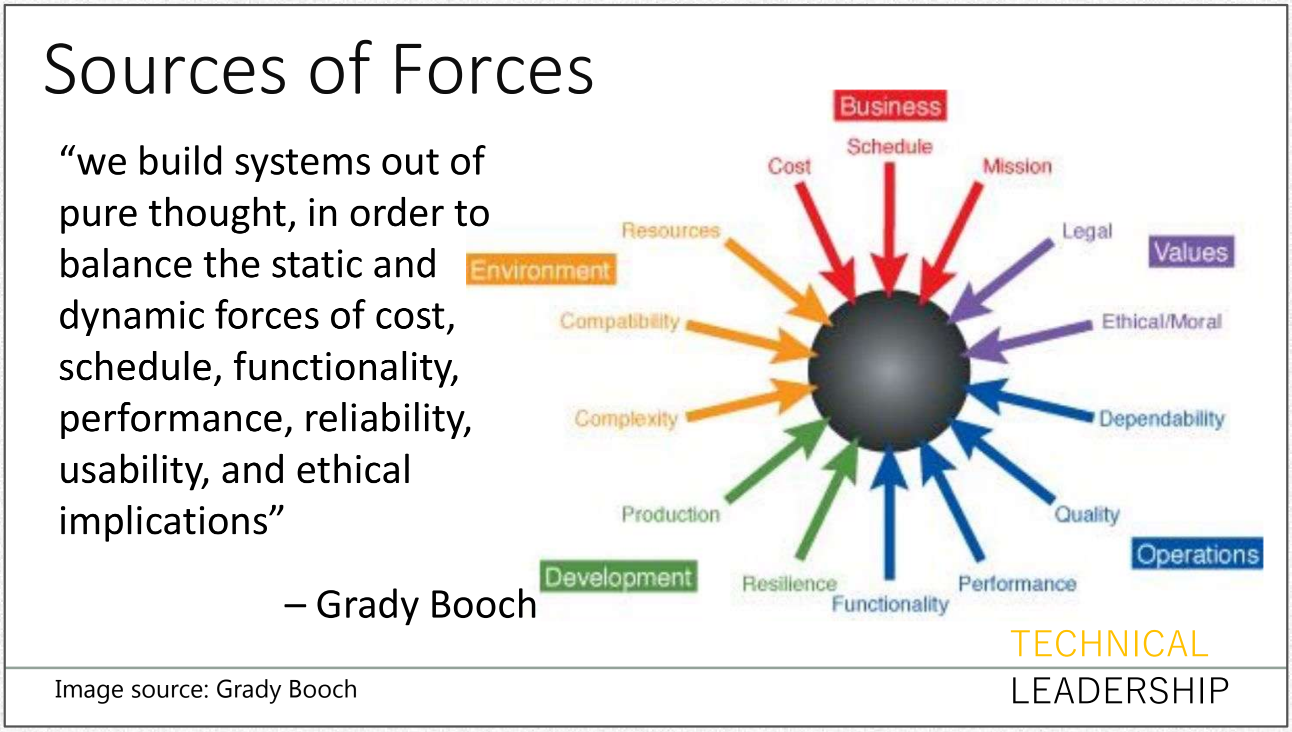
Design has to balance tensions caused by different imperatives, needs, and perceptions.

"Some of competing technical factors are shown in [the figure in the slide above]. This figure was drawn such that directly opposing factors pull in exactly opposite directions on the chart. For example, continuous evolution pulls against product stability; a typical balance is that of an architecturally stable, evolving product line. Low-level decisions pull against strict process control, which can often be relieved by systems architectural partitioning, aggregation, and monitoring. Most of these tradeoffs can be expressed in analytic terms, which certainly helps, but some cannot"

Eberhardt Rechtin and Mark Maier

> *"design is the [..] structure or behavior of a system whose presence resolves or contributes to the resolution of a force or forces on that system. A design thus represents one point in a potential decision space."*
>
> *— Grady Booch*

> *"We're trying to find habitable zones in a large multidimensional space, in which we're forced to make regrettable, but necessary, tradeoffs."*
>
> *— Robert Smallshire*



## Sources of Forces

"we build systems out of pure thought, in order to balance the static and dynamic forces of cost, schedule, functionality, performance, reliability, usability, and ethical implications"

– Grady Booch

Image source: Grady Booch

## *Sources of Forces*

"We do not analyze requirements; we construct them from our own perspective. This perspective is affected by our personal priorities and values, by the methods we use as orientation aids, and by our interaction with others" — Christiane Floyd

'The word "requirements" represents a fundamental misunderstanding of software. They're theories, at best.' — Sarah Mei

## *Design Envelopes*

In engineering, we contemplate, weigh, and experiment to find the boundaries of the design envelope.

"Hard" requirements tend to be areas where our design envelope has less "give", so other parts of the requirements design have to flex.

"The better you understand the problem, the closer you can design to tolerances." — Dana Bredemeyer

We innovate by pushing the design envelope — extending the range of possible, into the adjacent possible.

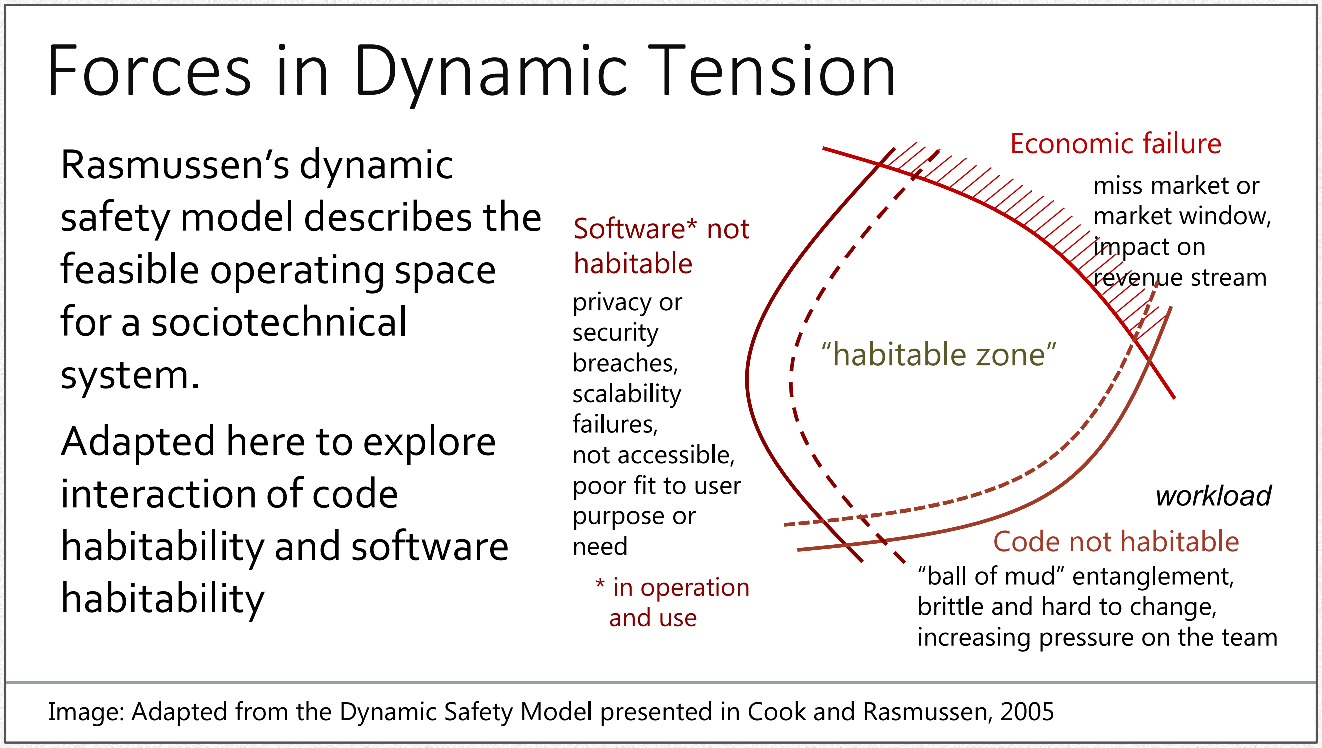
[with reference to the slide:] "Of course they are categories: each describing a class of forces. For example, compatibility encompasses pressures that arise from legacy, frameworks, and standards" — Grady Booch

"Architecture is the set of design decisions that provide a reasonably satisfying resolution to the static and dynamic forces on the system." — Grady Booch

There is a multidimensional decision *space.* We want to surface not just options, but assumptions about forces in play.

> *"the force field of a software project starts with Requirements. Requirements are often categorized in some way, like "functional" and "nonfunctional", or "user requirements" and "system requirements. However, requirements of any kind [..] contribute to shape the overall field."*
>
> *— Carlo Pescio*

***We're, in effect, investigating the  failure boundaries of the design decision space***



# Forces in Dynamic Tension

Rasmussen's dynamic safety model describes the feasible operating space for a sociotechnical system.

Adapted here to explore interaction of code habitability and software habitability

Software* not habitable
privacy or security breaches, scalability failures, not accessible, poor fit to user purpose or need
* in operation and use
Economic failure
miss market or market window, impact on revenue stream
"habitable zone"
workload
Code not habitable
"ball of mud" entanglement, brittle and hard to change, increasing pressure on the team

Image: Adapted from the Dynamic Safety Model presented in Cook and Rasmussen, 2005

## *Habitable Zone*

The dynamic safety model was developed by Jens Rasmussen; adapted by Cook, Rasmussen, and others.  It is described by Richard Cook in his presentation titled "Resilience In Complex Adaptive Systems" (Velocity 2013). This talk is available to watch on Youtube (under 19 minutes), and highly recommended.

We can combine the notion of habitable code and habitable software, adapting Rasmussen's dynamic safety model to design, to illustrate Rob Smallshire's point that "We're trying to find habitable zones in a large multidimensional space, in which we're forced to make regrettable, but necessary, tradeoffs." I'm not sure of the origin of the notion of code habitability, but it was Rebecca Wirfs-Brock who drew my attention to it. And in his keynote at OOPSLA in 1995, Christopher Alexander pleaded with our field to pay attention to the habitability of the software we create.

The idea that is being illustrated here is that if we push too hard to get features to market to stay away from the economic failure boundary, we may defer investments in code habitability and repair and in so doing increase developer decision fatigue and stress because of an overload of conceptual and decision burden with entangled code and hard to predict consequences of changing the code.

But some of the things we do to keep the code habitable may also keep us away from failures on the boundary of operation and use.

> *"Most software architects do not think of themselves accounting for social issues, but that is one of the characteristics of good architecture. Accounting for social issues gives designers an easier life, which gives the software a longer life."*
>
> *— Alistair Cockburn*

*We also investigate the boundaries of the design decision space looking for where these shift over time*

# Over Time

'I've used 100% stacked area graphs to visualize tradeoffs or strategic allocation of "fixed" resources, where the allocation changes over time.'

— Juno Suárez

'I tend to use "graphic equalizer" with scaler x-axis so that you can overlay to compare and contrast snapshot values for variables for trade off.'

— Dawn Ahukanna

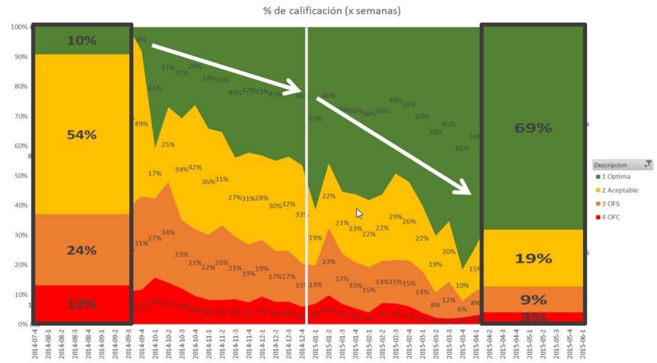


Image source: Juno Suárez, https://hachyderm.io/@juno/110945173941162351

## *Where the Forces Change over Time*

I asked folk on mastodon what other visual forms they use to bring tradeoffs into view.

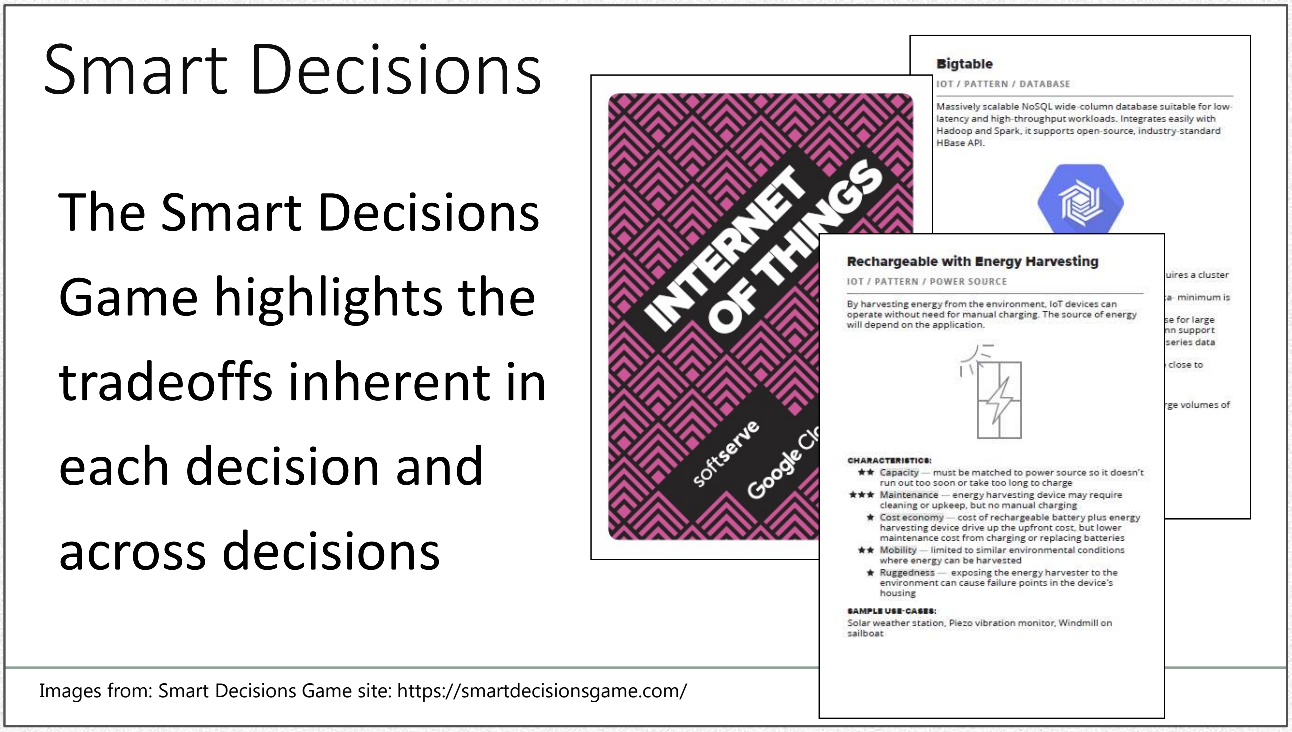
Dawn Ahukanna pointed out that many of our representations tend to be at a point in time.  Dawn suggested: ""instance in time" snapshot metric for contrast and comparison with other snapshots. It's like taking a time-lapsed set of photographs/ sampling of a specific spot and turning it into an motion interaction where you can "pan through time."'

Peter Gassner pointed to a neat prototype they developed for visualizing project constraints and dependencies:

https://lab.interactivethings.com/confluence-diagram/#/

And James Fairbairn: "I ask people more and more these days about their theory of change — like, understanding the complexity of this space, and how everything is a chain of causes and conditions, let's walk through how we think "X leads to Y" *actually* works…"

> *"Eg: on a platform team driving an enterprise technology migration, focusing time between focus areas like maintenance, new development, and support/training/customer success. Conditions and opportunities change over the migration lifecycle (adoption curve), and capturing these requires tradeoffs of team attention."*
>
> *— Juno Suárez*



# Smart Decisions

The Smart Decisions Game highlights the tradeoffs inherent in each decision and across decisions

**Bigtable**

IOT / PATTERN / DATABASE

Massively scalable NoSQL wide-column database suitable for low-latency and high-throughput workloads. Integrates easily with Hadoop and Spark, it supports open-source, industry-standard HBase API.

**Rechargeable with Energy Harvesting**

IOT / PATTERN / POWER SOURCE

By harvesting energy from the environment, IoT devices can operate without need for manual charging. The source of energy will depend on the application.

**CHARACTERISTICS:**

- ★★ Capacity — must be matched to power source so it doesn't run out too soon or take too long to charge
- ★★★ Maintenance — energy harvesting device may require cleaning or upkeep, but no manual charging
- ★ Cost economy — cost of rechargeable battery plus energy harvesting device drive up the upfront cost, but lower maintenance cost from charging or replacing batteries
- ★★ Mobility — limited to similar environmental conditions where energy can be harvested
- ★ Ruggedness — exposing the energy harvester to the environment can cause failure points in the device's housing

**SAMPLE USE-CASES:**

Solar weather station, Piezo vibration monitor, Windmill on sailboat

Images from: Smart Decisions Game site: https://smartdecisionsgame.com/

## *The Smart Decisions Game*

"Smart Decisions is a game that simulates the design process of software systems and promotes learning about it in a fun way." -- from the Smart Decisions Game website; but having played the game at SATURN, I agree. The game can be downloaded, and used in a team learning activity.

It's a good way to highlight for the team that each technology and related decision has its strengths and weaknesses, and architectures are not just about individual decisions, but weighing across the decisions for a fit to the context and purpose of the system. Further, there will not always be agreement on the approach to take, because the nature of tradeoffs is that they entail judgment about the strengths/weakness as well as the value of the outcomes, and the degree to which the consequences (in other areas of the system, or its containing systems) need to be taken into account.

The SEI team has done important work in the system qualities and trade-offs space, including developing the Architecture Tradeoff Analysis Method:

"ATAM gets its name because it not only reveals how well an architecture satisfies particular quality goals, but it also provides insight into how those quality goals interact—how they trade off against each other"

## *Judgment Factors*

We may notice where we're being constrained (that's where we've hit a point of tension in the tradeoff space). But discerning tradeoffs is very much a matter of experience and judgment.

> *"Because the situation is ill-structured, the goal cannot be optimization. The architect seeks satisfactory and feasible problem-solution pairs."*
>
> *— Mark Maier and Eb Rechtin*

*Smart Decisions Game site: https://smartdecisionsgame.com/*

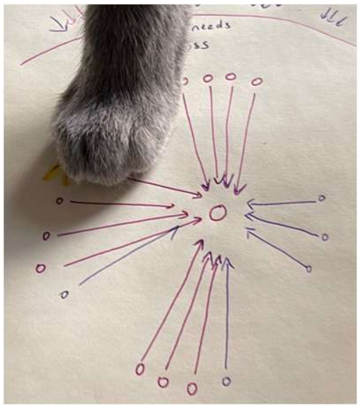
***Acknowledging that it's hard; there's risk and uncertainty, and uneven willingness to make hard calls***

# Real Talk

What (really) shapes this decision space?

- What are we avoiding (talking about)?
- What consequences are in "don't go there" zones?
- What forces feel too career-dangerous to write down?

Besides, we're addressing future impacts that are uncertain



*… pawlitical forces…*

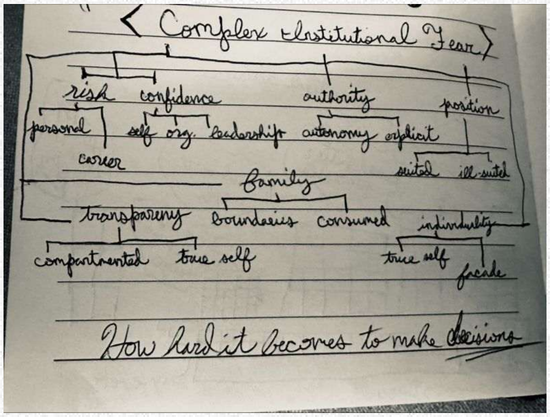
## *When Consequences have Consequences*

Significant decisions impact the paths or options we have, but also change the possibility space of some areas of system context or environment. They create paths, and close off paths, for ourselves, for users, for others impacted. Decisions and situations have reciprocal effects on one another; design acts back as consequences, that we (may) take into account in making the decision. When this has to do with action now, and possible future consequences, it may cause indecision, or be costly, in organizational terms, to probe and discuss openly. There are no pat answers here. The culture of the organization overall, and the part of the organization involved, plays a role. We can point to the importance of psychological (or social) safety in creating a learning environment where implications can be probed, and responded to together. And we're weighing positive outcomes (intended direct effects, and as side effects or positive externalities) along with negative. In the context of uncertainty. Sometimes avoiding real talk may be about uncertainty/ambiguity or conflict avoidance, but restricting the consideration space may be due to decisions made elsewhere… Similar to learning from incidents, we need to be able to seek even conflicting perspectives, and explore options and impacts, and feed that learning back into the decision. While being pragmatic about uncertainty and the need to make decisions.

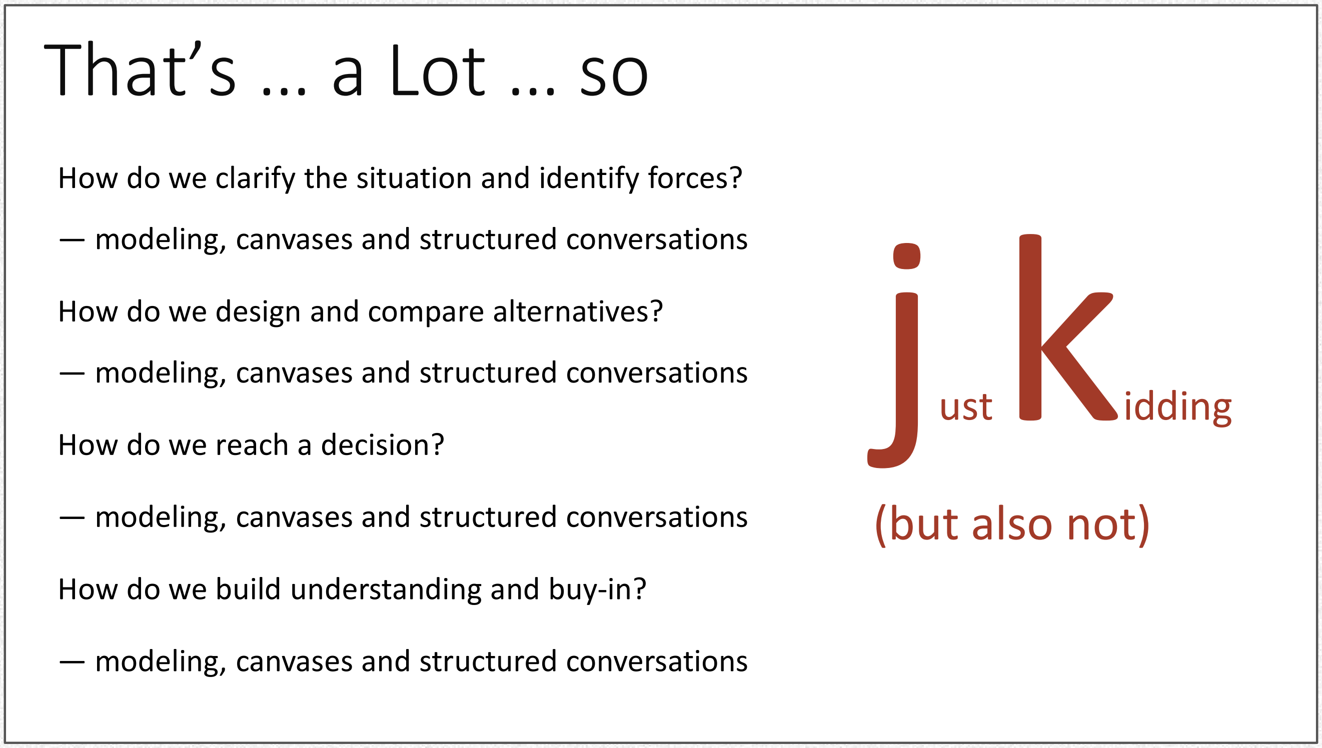
Part of what makes leadership and experience important here, is the willingness and ability to discern and take on these kinds of organizational challenges, and navigating them. (Caveats apply; alternately put: there is more to say, or nuance to add.)

*decision (n.) from decidere "to decide, determine," literally "to cut off," from de "off" (see de-) + caedere "to cut" (from PIE root *kae-id- "to strike")*

etymonline.com



https://www.linkedin.com/posts/christopherwilliams2018_complexsystems-journals-systemsexploring-activity-7159612234229301248-l4ip/



## That’s … a Lot … so

How do we clarify the situation and identify forces?

— modeling, canvases and structured conversations

How do we design and compare alternatives?

— modeling, canvases and structured conversations

How do we reach a decision?

— modeling, canvases and structured conversations

How do we build understanding and buy-in?

— modeling, canvases and structured conversations

**j**ust **k**idding

(but also not)

## *How We Work is Part of the Work*

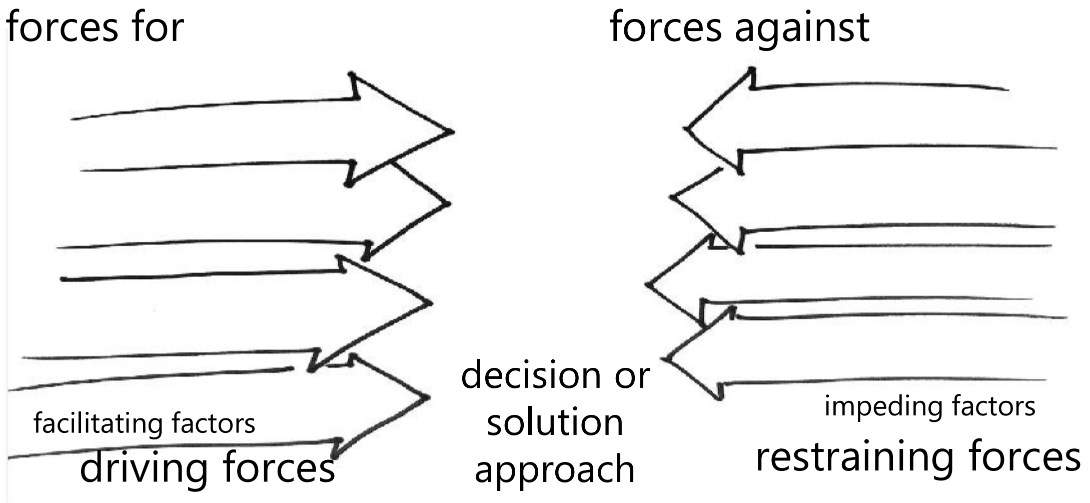
We’ve covered a fair bit of conceptual ground. The “what” of the Architecture (or other strategically significant) Decision Record indicates areas of work that are separable but intertwined. There’s exploring the context or situation (sometimes this goes by “the problem”), with an emphasis on forces (or criteria) so that when we evaluate alternative approaches (“solutions”) we can identify tradeoffs (identifying pains or costs we incur for what gains) and consider approaches against the desiderata we’ve established. But how?

Ideally, we do this in a collaborative way, together with those who have perspectives and experience that inform our understanding of the situation, its challenges, and options. An informal session at a white board is generative, but canvases (such as the Force Field canvas from *Gamestorming* on the next page) and diagrams focus the discussion, while also drawing attention to areas the discussion might otherwise avoid or neglect. It’s good to have them in the mix. It also builds a deeper understanding of the decision than one made in a ”hub-and-spoke” way, where one person is the main center of thinking about the decision and puts ideas out for response. How we work, can get a good part of the larger work done, if we’re strengthening the decision and building understanding and “buy-in” organically.

> *“You cannot coordinate purpose without developing purpose, it is part of the same process.” — Mary Parker Follett*

> *“I get it. Meeting culture sucks. It’s too easy for people to thoughtlessly take each others’ time, occupy standing slots, show off with performative teamwork, and generally suck your energy. Meetings feel like dead time. Meetings are time spent with people yet strangely devoid of social gratification. Meetings typically bore most participants — the greatest sin in knowledge work — and when they’re over, nothing has changed except us all being that much closer to retirement. [..]*
>
> *But what if, hear me out, what if the *only* work that matters in a knowledge economy happens when we are together?.”*
>
> *— Elizabeth Ayer, Meetings *are* the work*

## Force Field Canvas



forces for

forces against

facilitating factors

driving forces

decision or solution approach

impeding factors

restraining forces

Adapted from: Gamestorming.com, by Dave Gray, et al

### *Force Field Analysis*

Kurt Lewin did pioneering work in group dynamics, Action Research, and organizational development.

Of particular interest to us here, is Force Field Analysis, using Force Field Diagrams, developed by Kurt Lewin. Lewin was interested in group and organizational change or adaptation, and forces holding the organization in quasi-equilibrium.  Force field analysis is useful in the context of organizational change, but can also help visualize  forces  that any decision balances or compromises across.

‘According to Kurt Lewin "An issue is held in balance by the interaction of two opposing sets of forces - those seeking to promote change (driving forces) and those attempting to maintain the status quo (restraining forces)." Lewin viewed organizations as systems in which the present situation was not a static pattern, but a dynamic balance ("equilibrium") of forces working in opposite directions. In order for any change to occur, the driving forces must exceed the restraining forces, thus shifting the equilibrium.

The Force Field Diagram is a model built on this idea that forces - persons, habits, customs, attitudes - both drive and restrain change.’

http://www.valuebasedmanagement.net/methods_lewin_force_field_analysis.html

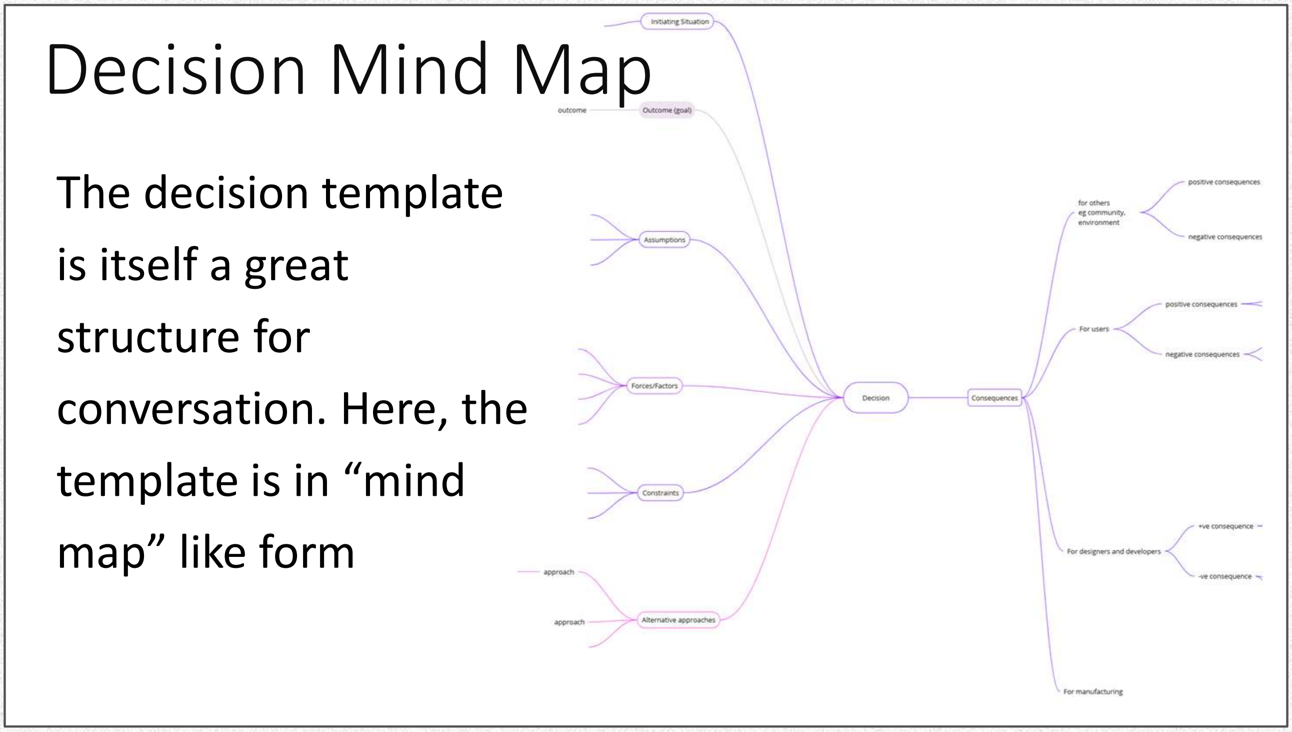
*“If you want truly to understand something, try to change it.”*

*— Kurt Lewin**

* this quote is attributed to Kurt Lewin by Charles Tolman in *Problems of Theoretical Psychology,*

*“Any given change may be a positive for some people and a negative for others.  Who benefits from they way things are now? Who will benefit from a change? Who will experience the negative space, and what will that negative be?*

*— Esther Derby*



Decision Mind Map

The decision template is itself a great structure for conversation. Here, the template is in “mind map” like form

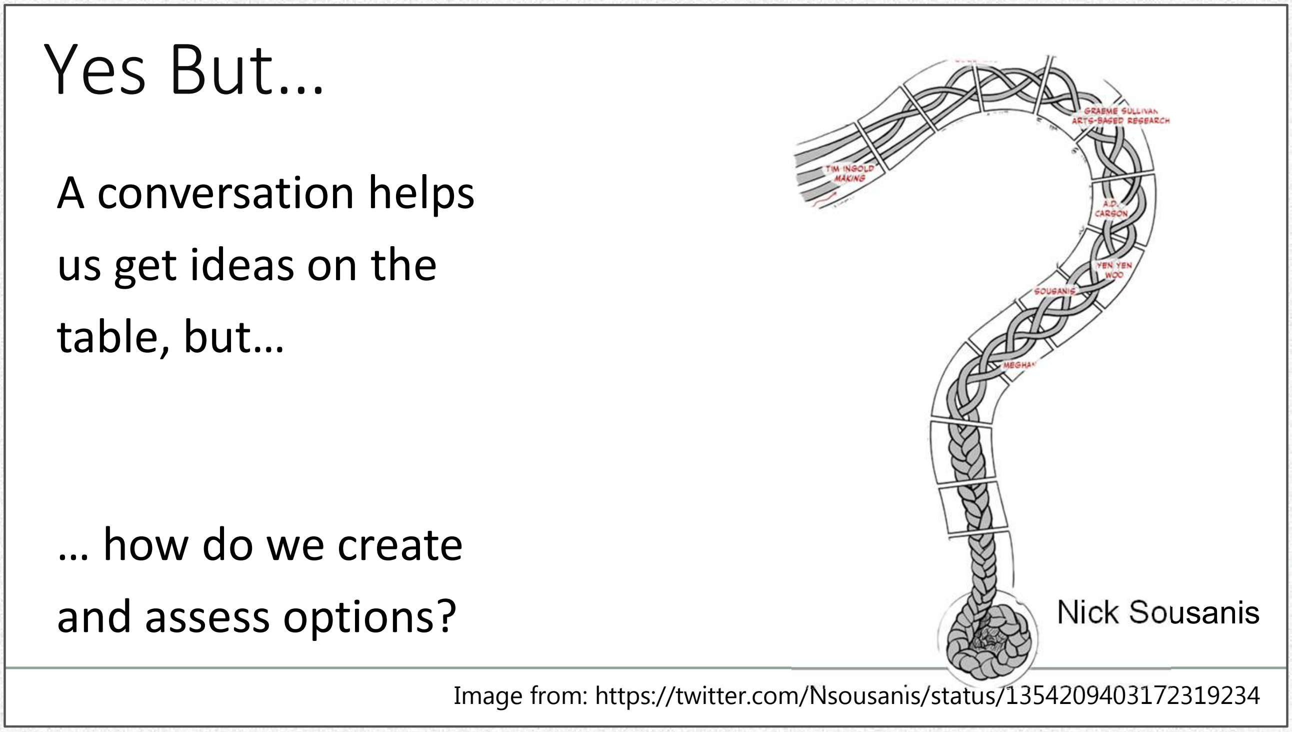
## *Decision Template as Mind Map*

Using the decision template in textual form, or mind map* form, encourages attention to the different facets of the decision. Starting with the context (or situation) and sought outcome, and identifying forces, constraints, assumptions, before turning to alternatives and describing options or design ideas. (We will return to explore this more fully later in this module). The idea with the mind map, is to tease out — adding tendrils and following threads, exploring down a path. By having the emerging picture on a whiteboard or (miro, etc.) frame, we’re encouraged to add relevant detail to other areas of the map, whenever such a detail emerges in the course of the conversation. For example, if we notice we’re making some assumptions while we explore forces or alternatives, we add those in. It is just as well to notice that as we explore the decision space, the outcome may come into clearer focus (and even shift, as we understand the problem better). As we explore consequences, we might find ourselves revisiting alternatives and exploring trade-offs and consequences further. The “how” is non-linear. We document the decision so that it reads in a way that conveys clarity. But getting to clarity means some holding space for ambiguity that uncertainty and complex interactions kicks up.

> *"Our job [..] how to devise methods by which we can best discover the order integral to a particular situation."*
>
> *— Mary Parker Follett*

* Mind Maps were popularized by Tony Buzan. Simon Wardley protests such a use of the word “map.” Perhaps we can call it a Decision Root Ball (haha).

***We've explored clarifying the situation, but what about options?***



# Yes But…

A conversation helps us get ideas on the table, but…

… how do we create and assess options?

Nick Sousanis

Image from: https://twitter.com/Nsousanis/status/1354209403172319234

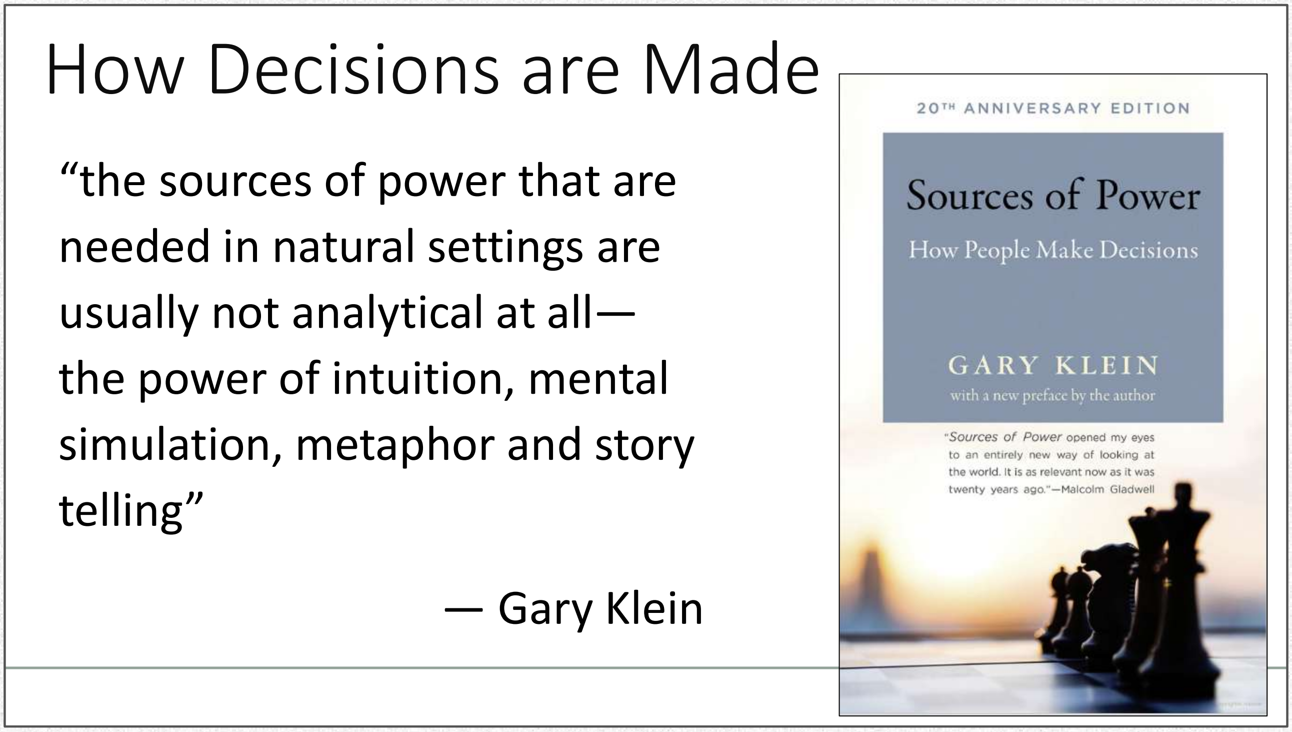
## *Options*

The following pages identify some of the ways we envisage and explore options.

*Klee said: art does not render what is visible, but renders visible (via Dan Klyn).*

*Visual design (diagrams, models, descriptions) renders visual.*

*Puts thought into the world.*



## How Decisions are Made

"the sources of power that are needed in natural settings are usually not analytical at all—the power of intuition, mental simulation, metaphor and story telling"

— Gary Klein

20TH ANNIVERSARY EDITION
Sources of Power
How People Make Decisions
GARY KLEIN
with a new preface by the author
"Sources of Power opened my eyes to an entirely new way of looking at the world. It is as relevant now as it was twenty years ago."—Malcolm Gladwell

> *"In many cases, the problem isn't about having or noticing insights; it is about acting on them. The organization lacks the willpower to make changes."*
>
> *— Gary Klein*

### *Sources of Power*

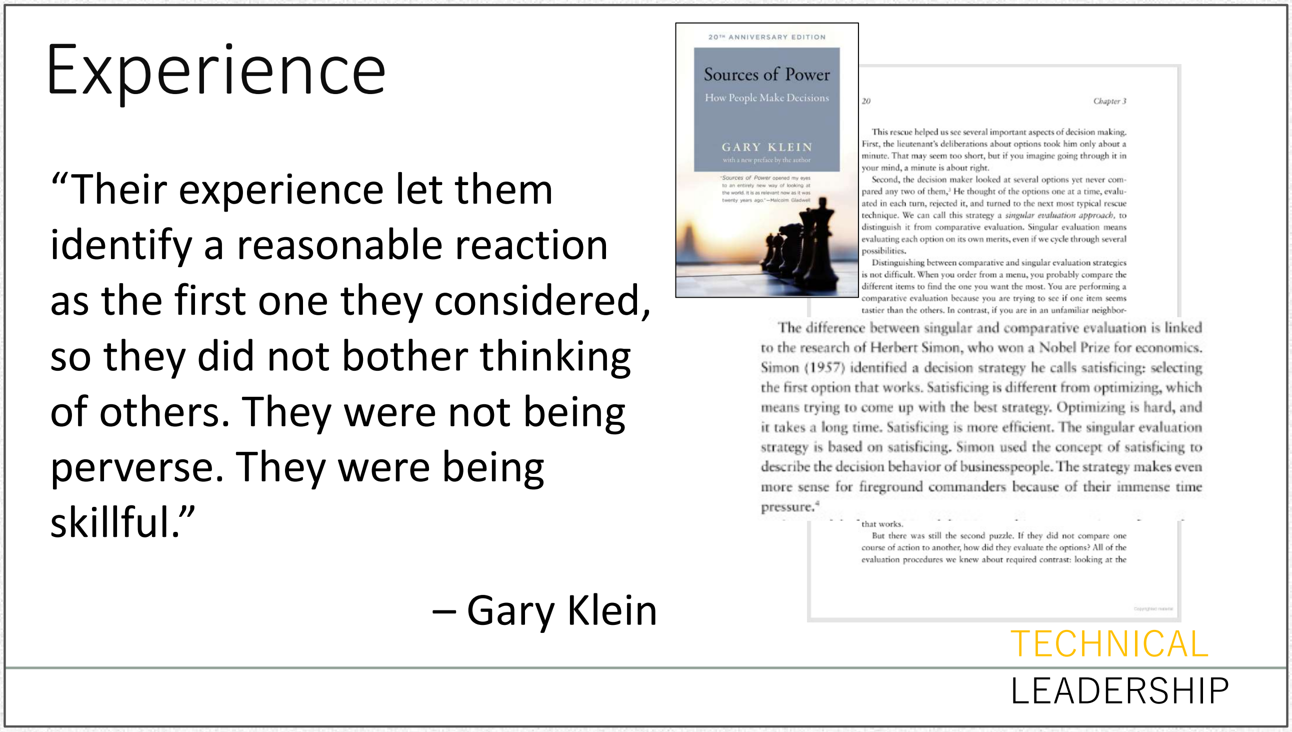
Gary Klein (*Sources of Power: How People Make Decisions*) studied decision making in settings that he characterizes as naturalistic decision making:

> "Features that help define a naturalistic decision-making setting are time pressure, high stakes, experienced decision making, inadequate information, ill-defined goals, poorly defined goals and procedures, and dynamic conditions."

Here, rather than deductive analysis and statistical methods, other "powers" were used:

> "The power of intuition enables us to size up a situation quickly. The power of mental simulation lets us imagine how a course of action might be carried out. The power of metaphor lets us draw on our experience by suggesting parallels between the current situation and something else we come across. The power of storytelling helps us consolidate our experiences to make them available in the future, either to ourselves or others."

***Experience lets us recognize situations and identify actions to take, intuitively***



# Experience

"Their experience let them identify a reasonable reaction as the first one they considered, so they did not bother thinking of others. They were not being perverse. They were being skillful."

– Gary Klein

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Sources of Power

How People Make Decisions

GARY KLEIN

with a new preface by the author

"*Sources of Power* opened my eyes to an entirely new way of looking at the world. It is as relevant now as it was twenty years ago."—Malcolm Gladwell

20 *Chapter 3*

This rescue helped us see several important aspects of decision making. First, the lieutenant's deliberations about options took him only about a minute. That may seem too short, but if you imagine going through it in your mind, a minute is about right.

Second, the decision maker looked at several options yet never compared any two of them,[3] He thought of the options one at a time, evaluated in each turn, rejected it, and turned to the next most typical rescue technique. We can call this strategy a *singular evaluation approach*, to distinguish it from comparative evaluation. Singular evaluation means evaluating each option on its own merits, even if we cycle through several possibilities.

Distinguishing between comparative and singular evaluation strategies is not difficult. When you order from a menu, you probably compare the different items to find the one you want the most. You are performing a comparative evaluation because you are trying to see if one item seems tastier than the others. In contrast, if you are in an unfamiliar neighbor-

The difference between singular and comparative evaluation is linked to the research of Herbert Simon, who won a Nobel Prize for economics. Simon (1957) identified a decision strategy he calls satisficing: selecting the first option that works. Satisficing is different from optimizing, which means trying to come up with the best strategy. Optimizing is hard, and it takes a long time. Satisficing is more efficient. The singular evaluation strategy is based on satisficing. Simon used the concept of satisficing to describe the decision behavior of businesspeople. The strategy makes even more sense for fireground commanders because of their immense time pressure.[4]

that works.

But there was still the second puzzle. If they did not compare one course of action to another, how did they evaluate the options? All of the evaluation procedures we knew about required contrast: looking at the

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## *Experts Tend to Make Good (Enough) Decisions, Based on Experience*

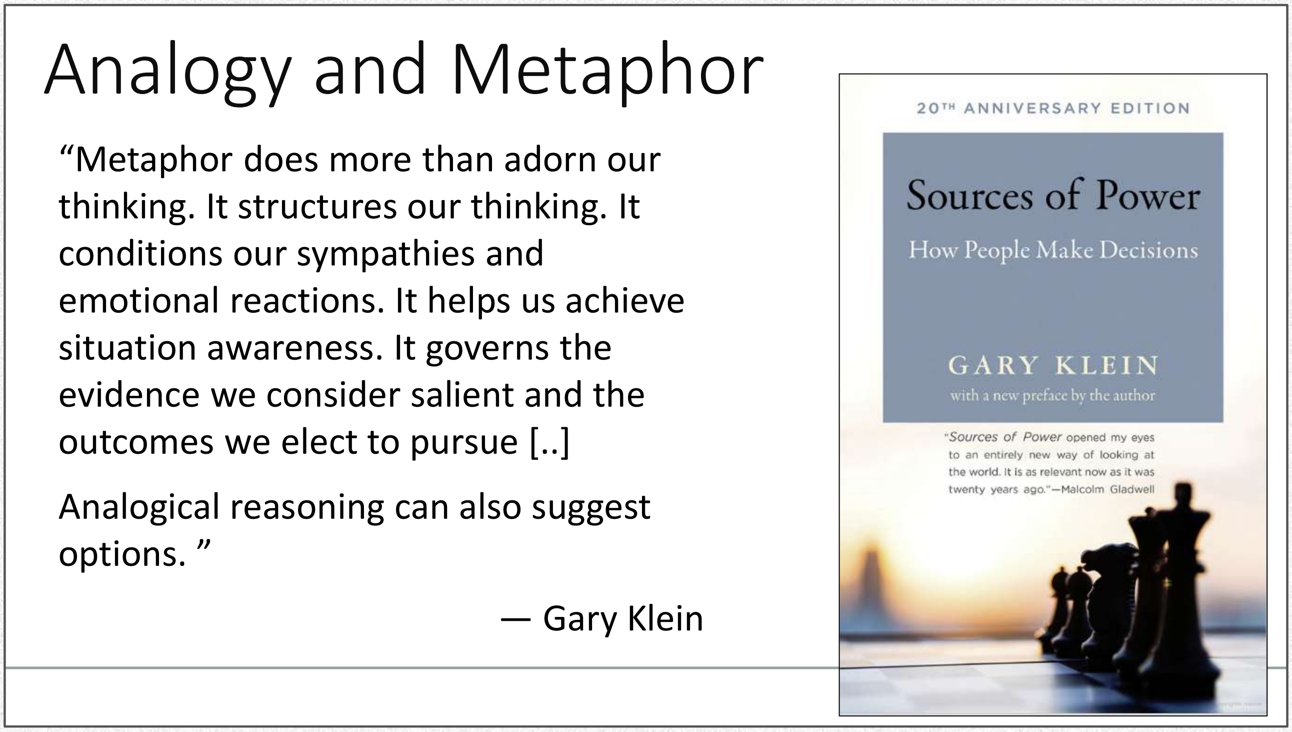
"The standard advice for making better decisions is to identify all the relevant options, define all the important evaluation criteria, weight the importance of each evaluation criterion, evaluate each option on each criterion, tabulate the results, and select the winner. In one form or another, this paradigm finds its way into training programs the world over. Again and again, the message is repeated: careful analysis is good, incomplete analysis is bad. And again and again, the message is ignored; trainees listen dutifully, then go out of the classes and act on the first option they think of. The reasons are clear. First, the rigorous, analytical approach cannot be used in most natural settings. Second, the recognitional strategies that take advantage of experience are generally successful, not as a substitute for the analytical methods, but as an improvement on them. The analytical methods are not the ideal; they are the fallback for those without enough experience to know what to do."

"*Intuition* depends on the use of experience to recognize key patterns that indicate the dynamics of the situation. This is one basis for what we call intuition: recognizing things without knowing how we do the recognizing." "If you want people to size up situations quickly and accurately, you need to expand their experience base."

*Satisficing*: "selecting the first option that works. Satisficing is different from optimizing, which means trying to come up with the best strategy. Optimizing is hard, and it takes a long time. Satisficing is more efficient." — Gary Klein, *Sources of Power*

> *"decision makers can satisfice either by finding optimum solutions for a simplified world, or by finding satisfactory solutions for a more realistic world"*
> *— Herbert Simon**

* in his Nobel Prize in Economics speech



# Analogy and Metaphor

"Metaphor does more than adorn our thinking. It structures our thinking. It conditions our sympathies and emotional reactions. It helps us achieve situation awareness. It governs the evidence we consider salient and the outcomes we elect to pursue [..]

Analogical reasoning can also suggest options. "

— Gary Klein

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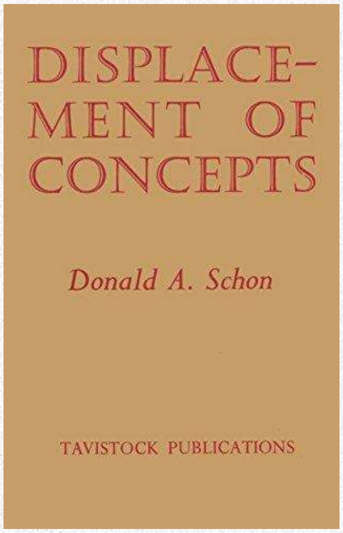
"Sources of Power opened my eyes to an entirely new way of looking at the world. It is as relevant now as it was twenty years ago."—Malcolm Gladwell

*"Analogues provide the problem solver with a recommendation about what to do."*

*— Gary Klein*



## *Using Analogies To Solve Problems*

"If we did not want to use analogical reasoning for tasks like these, we would be stuck. We would not know enough to construct formulas or to use them or have enough hard information to proceed. By using analogues, we are tapping into the same source of power for stories. We are applying an informal experiment, using a prior case with a known outcome and a semi-known set of causes to make predictions about a new case."

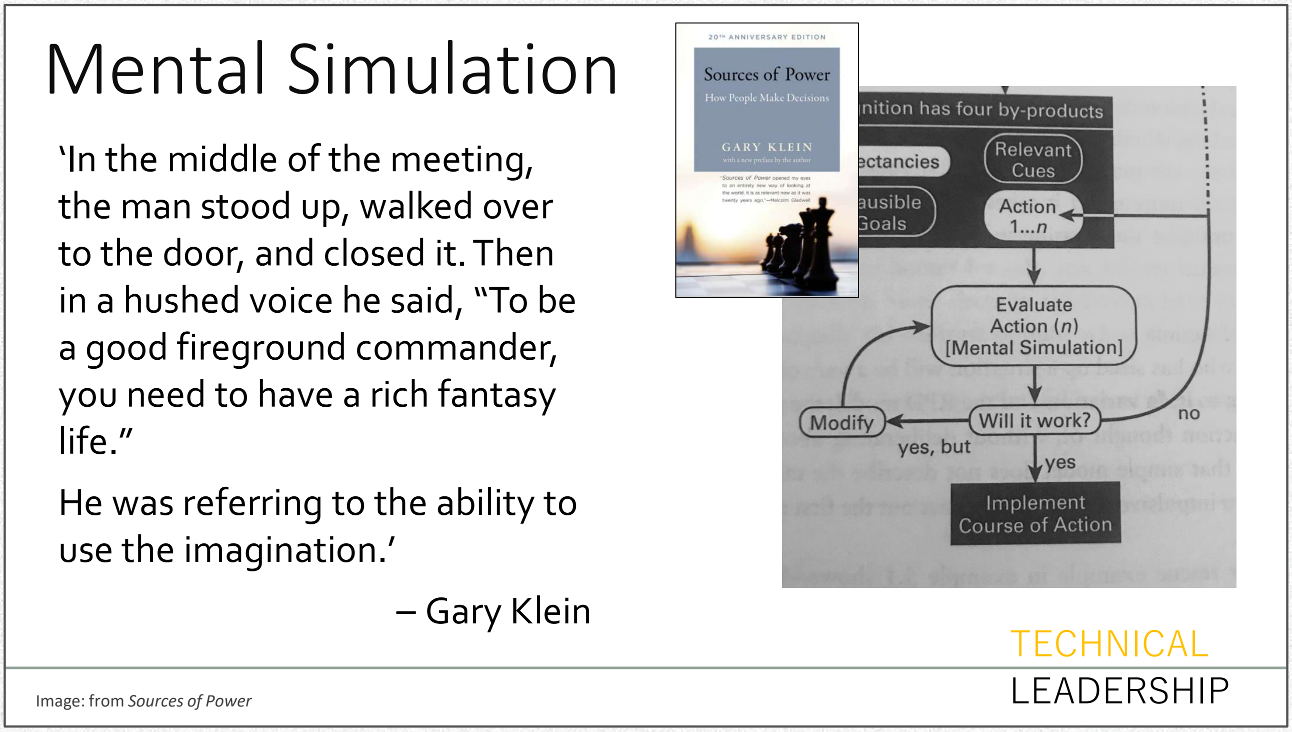
"First, we learned that they do not select analogues just based on similarity. [..] You would select an analogue that shares the same dynamics [..] If you do not have enough experience to take causal factors into account, you can get into trouble. The engineers we studied were all knowledgeable.

Second, we learned that some causal factors are easy to adjust for, and others are not.

Third, we learned that the logic of reasoning by analogy is similar to the logic of an experiment: to draw a conclusion without having to know all of the important factors operating."

— Gary Klein, *Sources of Power*

Analogies help us shape the problem (what we're addressing, and how we conceive of it) and get ideas for solutions (how we approach it).



# Mental Simulation

'In the middle of the meeting, the man stood up, walked over to the door, and closed it. Then in a hushed voice he said, "To be a good fireground commander, you need to have a rich fantasy life."

He was referring to the ability to use the imagination.'

– Gary Klein

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Image: from *Sources of Power*

## *Thought Experiments*

The quote in the slide above, is in the introductory paragraph in Gary Klein's chapter on mental simulation (in *Sources of Power*). It is a reminder that we tend too much to treat soft skills, and imagination in particular, as less than professional – less than "rational" or "objective" reasoning. Klein reminds us that we play out scenarios and alternatives in mind, to understand, to discover, to decide on courses of action.

Foresight is the application of imagination, of anticipating. I used to annoy my kids (don't judge me; repetition to the point of absurdity is the stuff of humor) when they'd say "I didn't mean to" and I'd respond "You've got to mean not to" – meaning, we need to try to anticipate the likely or even the possible, when it has bad consequences. Foresight is not a direct application of hindsight or learning from the past, but a willingness to take the risk of playing threads of the present forward, staying creative under uncertainty. Experience is valuable in giving us practice in recognizing cues and applying "muscle-memory" and tested-through-trial approaches, as well as in giving us the ability to anticipate, to "look ahead" and "look around" in an imaginative playing out of features and forces in a design or (other) decision moment. *Project premortems* (Gary Klein, Performing a Project Premortem, HBR, 2007; also Gary Klein, The Pre-Mortem Method, Psychology Today, 2021) asks us to imagine, during design, say, that a project *has* gone wrong, and to explore the reasons.

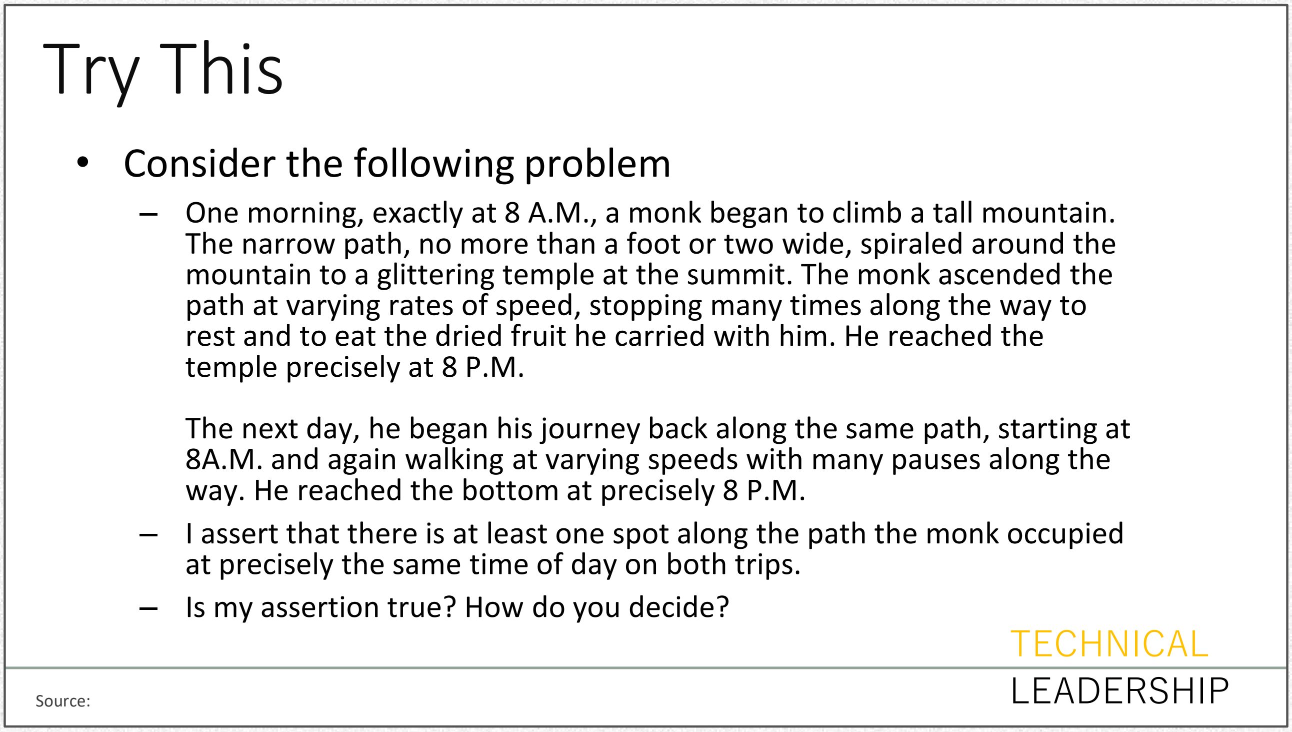
"*Code wins arguments*" (from Zuckerberg's "Hacker Way" letter to investors included in Facebook's IPO filing). Sure, but are all arguments worth having? Out beyond not valuing design/anticipation/etc. and not valuing making stuff, there is a field... (apologies to Rumi, etc.)

"To me, the real challenge is getting teams to slow down for a moment and think about what's going to be built, why, what the risks are, and what might change." — Phillip Johnston

*"mental anticipation.. pulls the future into the present"*

*— Erich Jantsch*

*Don't turn the page*



# Try This

- Consider the following problem
  - One morning, exactly at 8 A.M., a monk began to climb a tall mountain. The narrow path, no more than a foot or two wide, spiraled around the mountain to a glittering temple at the summit. The monk ascended the path at varying rates of speed, stopping many times along the way to rest and to eat the dried fruit he carried with him. He reached the temple precisely at 8 P.M.

    The next day, he began his journey back along the same path, starting at 8A.M. and again walking at varying speeds with many pauses along the way. He reached the bottom at precisely 8 P.M.
  - I assert that there is at least one spot along the path the monk occupied at precisely the same time of day on both trips.
  - Is my assertion true? How do you decide?

Source:

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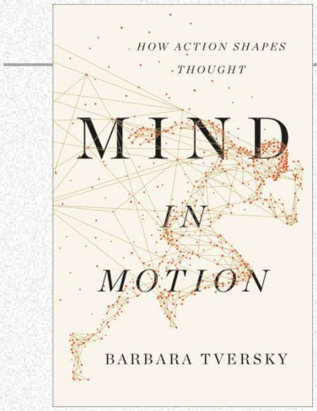
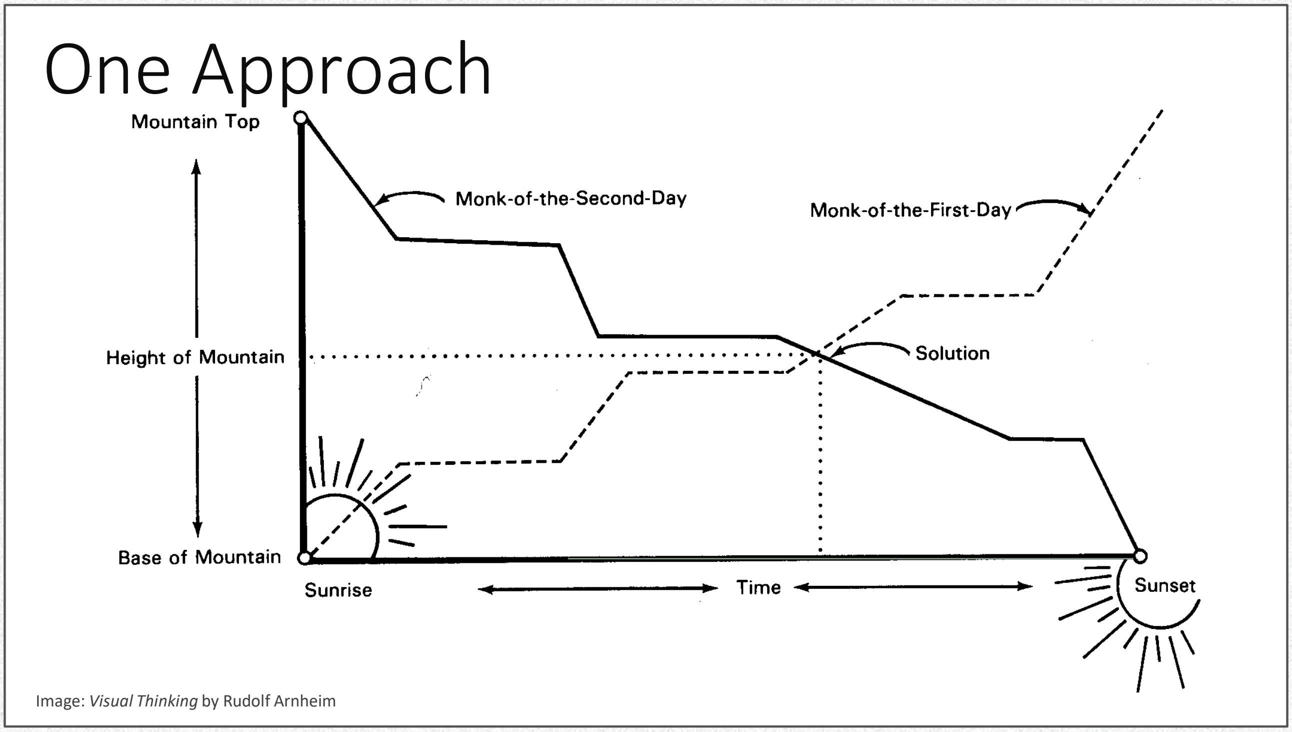
## *Exercise: Read the slide*

And don't turn the page until you've had a chance to think about it.

> *"Principle of Correspondence: The content and form of the representation should match the content and form of the targeted concepts"*
>
> — *Barbara Tversky*



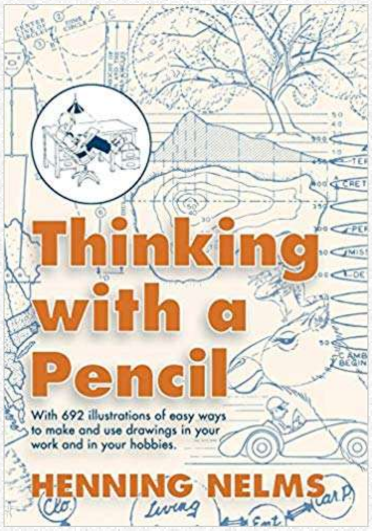


# One Approach

Image: *Visual Thinking* by Rudolf Arnheim

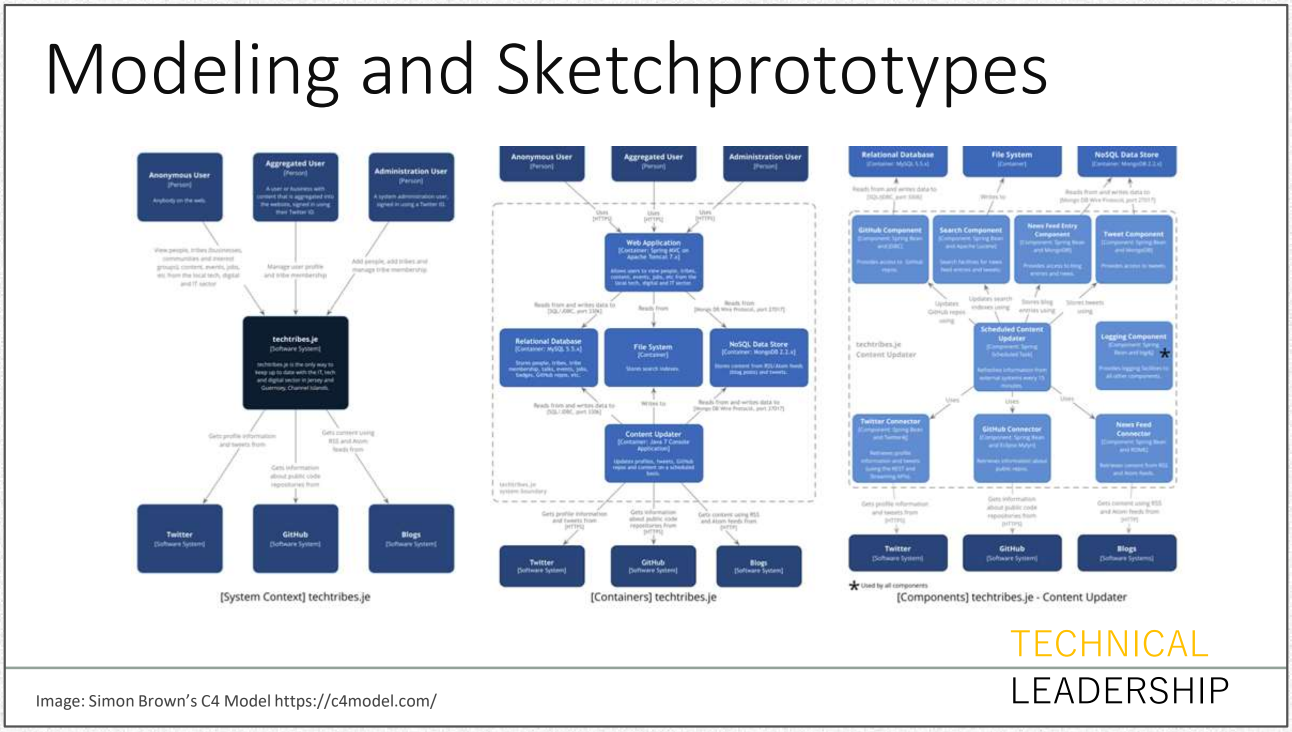
## *(Mental) Simulation Illustration*

One way to think, is to draw, and the diagram illustrates that we can say yes. Another way to think about it is each of my hands is the monk on the two days, and one hand will move along the path in one direction, and the other hand is the monk starting at the other end of the path, and moving in the other direction on the same path. My hands have to meet at some point, at the same time. As important as the illustrations are to the point that we can put something in the world to help us think, it's also illuminating that some people will still not see it, and these people are important too. We can try to illuminate the solution different ways, but our perspectives differ, we're looking for a catch, and trust and credibility may factor, etc.



Thinking with a Pencil
With 692 illustrations of easy ways to make and use drawings in your work and in your hobbies.
HENNING NELMS

> *"We have misfiled the significance of drawing because we see it as a professional skill instead of a personal capacity [..] This essential confusion has stunted our understanding of drawing and kept it from being seen as a tool for learning above all else." — D.B. Dowd*


Anonymous User
[Person]
Anybody on the web.
Aggregated User
[Person]
A user or business with content that is aggregated into the website, signed in using their Twitter ID.
Administration User
[Person]
A system administration user, signed in using a Twitter ID.
View people, tribes (businesses, communities and interest groups), content, events, jobs, etc from the local tech, digital and IT sector
Manage user profile and tribe membership
Add people, add tribes and manage tribe membership
techtribes.je
[Software System]
techtribes.je is the only way to keep up to date with the IT, tech and digital sector in Jersey and Guernsey, Channel Islands.
Gets profile information and tweets from
Gets information about public code repositories from
Gets content using RSS and Atom feeds from
Twitter
[Software System]
GitHub
[Software System]
Blogs
[Software System]
Uses
[HTTPS]
Web Application
[Container: Spring MVC on Apache Tomcat 7.x]
Allows users to view people, tribes, content, events, jobs, etc from the local tech, digital and IT sector
Reads from and writes data to
[SQL/JDBC, port 3306]
Reads from
Reads from
[MongoDB Wire Protocol, port 27017]
Relational Database
[Container: MySQL 5.5.x]
Stores people, tribes, tribe membership, talks, events, jobs, badges, GitHub repos, etc.
File System
[Container]
Stores search indexes.
NoSQL Data Store
[Container: MongoDB 2.2.x]
Stores content from RSS/Atom feeds (blog posts) and tweets.
Writes to
Reads from and writes data to
[MongoDB Wire Protocol, port 27017]
Content Updater
[Container: Java 7 Console Application]
Updates profiles, tweets, GitHub repos and content on a scheduled basis.
techtribes.je
system boundary
[HTTPS]
[HTTP]
GitHub Component
[Component: Spring Bean and JDBC]
Provides access to GitHub repos.
Search Component
[Component: Spring Bean and Apache Lucene]
Search facilities for news feed entries and tweets.
News Feed Entry Component
[Component: Spring Bean and MongoDB]
Provides access to blog entries and news.
Tweet Component
[Component: Spring Bean and MongoDB]
Provides access to tweets.
Updates GitHub repos using
Updates search indexes using
Stores blog entries using
Stores tweets using
techtribes.je
Content Updater
Scheduled Content Updater
[Component: Spring Scheduled Task]
Refreshes information from external systems every 15 minutes.
Logging Component
[Component: Spring Bean and log4j]
Provides logging facilities to all other components.
*
Uses
Twitter Connector
[Component: Spring Bean and Twitter4j]
Retrieves profile information and tweets (using the REST and Streaming APIs).
GitHub Connector
[Component: Spring Bean and Eclipse Mylyn]
Retrieves information about public repos.
News Feed Connector
[Component: Spring Bean and ROME]
Retrieves content from RSS and Atom feeds.
[Software Systems]
* Used by all components

Modeling and Sketchprototypes

[System Context] techtribes.je

[Containers] techtribes.je

[Components] techtribes.je - Content Updater

Image: Simon Brown's C4 Model https://c4model.com/

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## *Thought Experiments, Sketchprototypes, and Heuristics*

Whether you're using an ad hoc approach, or *Visual Architecting* with UML and/or C4 (from Simon Brown), or something else, diagrams, models, views of the system, are ways to explore "decisions in formation" — sets of related decisions, as well as formative ideas — to probe and assess them.

We take a guess as a starting point, and improve on it:  model, and run thought experiments across it. For example, take use cases or user stories or focus on one property, then another, etc., and "run" (imagine and talk through)  behavior across the structure models, to flush out component responsibilities we overlooked in our initial guess.  Lists of responsibilities (for elements of a system — technical, strategic or organizational) are a powerful and largely overlooked/under used tool in the architect's toolbelt. If the responsibilities don't cohere within an overarching responsibility, or purpose, that should trip the architect's boundary bleed detectors. Interactions at the boundaries are essential to making a system more than the sum of its parts, but introduce coupling and (inter)dependencies.

As we do this exploration with the aid of models (just as we do when doing design in the medium of code), we're applying heuristics we've developed through experience, and exposure to other people's work (books, and such). Heuristics don't take away the need to think, to reason and try things out. They help us identify what to think about, as we do so, and may suggest how to go about it (better).

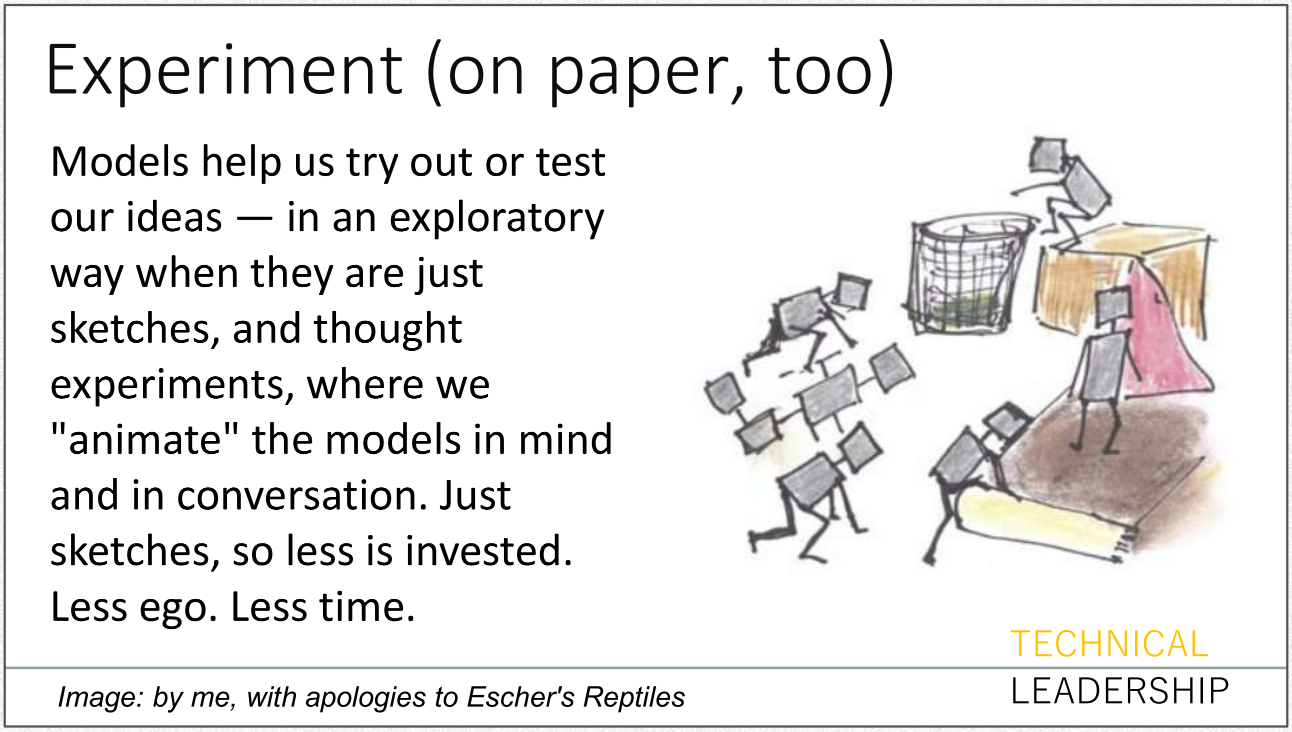
"Heuristics offer plausible approaches to solving problems, not infallible ones."  — Rebecca Wirfs-Brock

To illustrate, let's turn to Parnas and his criteria (heuristics) for decomposing, and hence coping with complex systems despite our bounded rationality:

> "[begin] with a list of difficult design decisions [..] Each module is then designed to hide such a decision from the others ."

*Be deliberate and deliberate all the things"*
*— Dawn Ahukanna*

*Experiments shed light on tradeoffs and relative strengths and weaknesses*



## Experiment (on paper, too)

Models help us try out or test our ideas — in an exploratory way when they are just sketches, and thought experiments, where we "animate" the models in mind and in conversation. Just sketches, so less is invested. Less ego. Less time.

*Image: by me, with apologies to Escher's Reptiles*

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## *Experiment, On Paper Too*

Fred Brooks wrote "Plan to throw one away. You will, anyway." I'd say: that too, but plan to throw several away — on paper. It's quick and cheap. We sketch-prototype to come up with alternatives and try them out in the cheapest medium that fits what we're trying to understand and improve. We seek to probe, to learn, to verify the efficacy of the design elements we're considering, under multiple simultaneous demands. We acknowledge we can misperceive and deceive ourselves, and hold our work to scrutiny, seeing it from different perspectives, from different vantage points but also with different demands in mind. We make trade-offs and judgment calls. We bring in others with fresh perspective to help us find flaws. We simulate. We figure out what to probe further, what to build and instrument.

We need to come up with and try out alternatives in the cheapest medium we can learn more in; sometimes that's code, but not if a sketch will do. We don't learn what we learn in the medium of code, but we can at least start to try ideas out, and explore and bat at them, investigate how they could work, in sketch-driven-dialog.

Three possibilities (Gerald Weinberg)? For everything? That smacks of BDUF FUD (fear, uncertainty and doubt)?? Can't we just YAGNI that? Well, remember, these are make or break decisions. Game shapers and game changers.

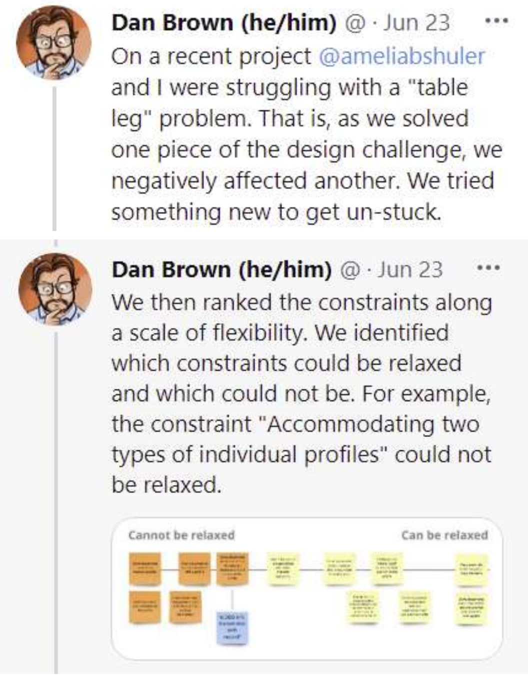
> *"Thought happens not only inside the skull but out in the world, too; it's an act of continuous assembly and reassembly that draws on resources external to the brain. For another: the kinds of materials available to "think with" affect the nature and quality of the thought that can be produced."*
>
> *— Annie Murphy Paul*

***Identifying constraints and degrees of freedom.***

## Constraints

1. Make a list of constraints
2. Rank constraints by flexibility
3. Evaluate design concepts by how many constraints they address
4. Discuss the right balance of constraints
5. Sketch ideas based on that balance

— Dan Brown



**Dan Brown (he/him)** @ · Jun 23 ···
On a recent project @ameliabshuler and I were struggling with a "table leg" problem. That is, as we solved one piece of the design challenge, we negatively affected another. We tried something new to get un-stuck.

**Dan Brown (he/him)** @ · Jun 23 ···
We then ranked the constraints along a scale of flexibility. We identified which constraints could be relaxed and which could not be. For example, the constraint "Accommodating two types of individual profiles" could not be relaxed.

### *Constraints and the Design Envelope*

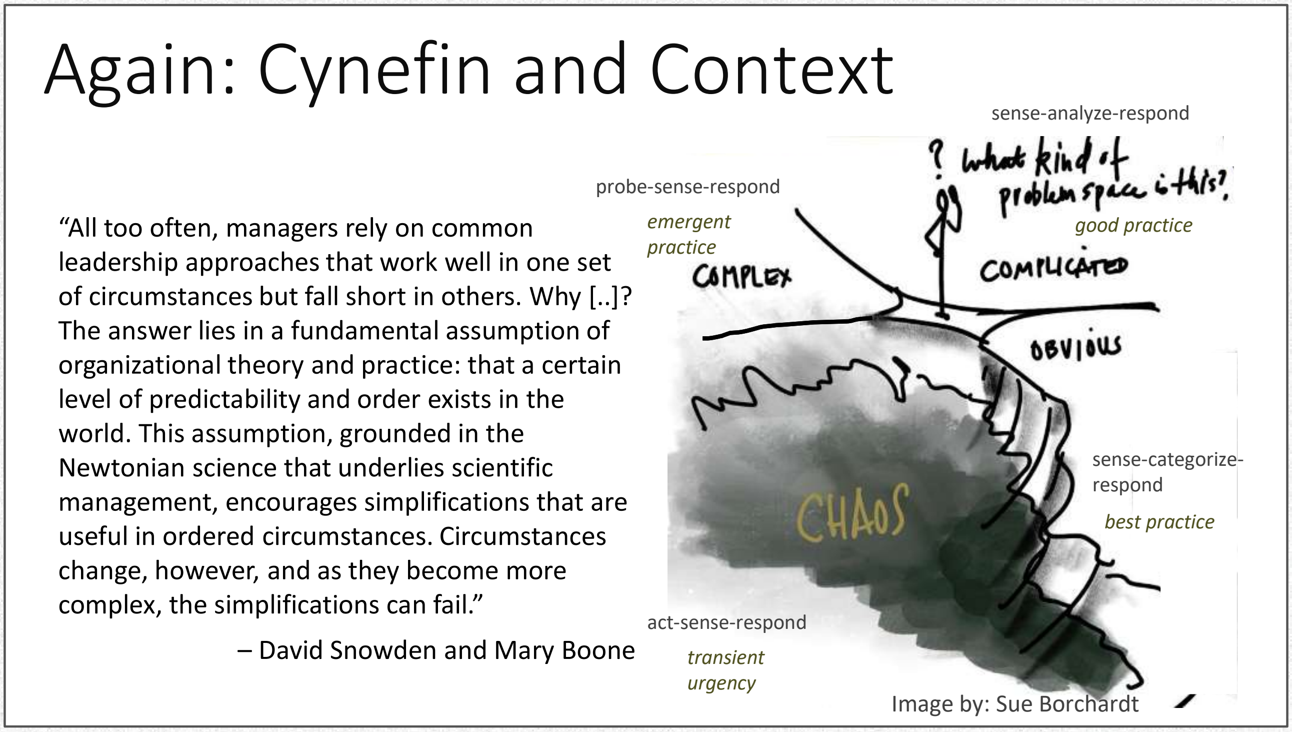
Engineers have a concept of a design envelope or design space that is created by constraints – outside the design envelope, the design is (technically) infeasible or (economically or socially) not viable.

The concept of a Pareto frontier is useful, not because we know (in general) where this frontier lies exactly (though we find out when we cross it), but because it reminds us we're working in a space of interacting decisions and constraints – some of which may only "bite" (factor crucially) at some point.

Pareto Frontier: "The Pareto frontier is the set of all Pareto efficient allocations, conventionally shown graphically. ... It is a statement of impossibility of improving one variable without harming other variables in the subject of multi-objective optimization (also termed Pareto optimization)." (Source: wikipedia)

*"Pareto efficiency* or Pareto optimality is a situation where no individual or preference criterion can be better off without making at least one individual or preference criterion worse off or without any loss thereof." (Source: wikipedia)

*Circumstances matter — is this ordered and routine, or novel and unpredictable?*



## Again: Cynefin and Context

"All too often, managers rely on common leadership approaches that work well in one set of circumstances but fall short in others. Why [..]? The answer lies in a fundamental assumption of organizational theory and practice: that a certain level of predictability and order exists in the world. This assumption, grounded in the Newtonian science that underlies scientific management, encourages simplifications that are useful in ordered circumstances. Circumstances change, however, and as they become more complex, the simplifications can fail."

– David Snowden and Mary Boone

sense-analyze-respond

*good practice*

probe-sense-respond

*emergent practice*

sense-categorize-respond

*best practice*

act-sense-respond

*transient urgency*

Image by: Sue Borchardt

## *Liz Keogh's Introduction to Cynefin*

Liz Keogh has a useful introduction to Dave Snowden's Cynefin framework (and the extracts below are from Liz Keogh's post). Cynefin introduces four domains – obvious, complicated, complex and chaotic:

### Obvious

Obvious problems are ones that either children can solve, or, if they do require expertise, the solution is obvious. In the obvious domain, there's normally one good way to solve the problem – a "best practice".

### Complicated

As things become more and more complicated, the solution requires more and more expertise. A watchmaker knows how to fix your watch. The outcome is still predictable, but now it takes an expert to know how to get there. Both the Obvious and Complicated domains are called ordered. Ordered problems have repeatable solutions; the same process applied to the same problem will always work.

### Complex

Complex problems are ones in which the solution, and the practices which lead to it, emerge. While it's possible to think of examples of what a solution might look like, attempting to create that solution usually creates unexpected side-effects; other problems or unintended consequences that might need to be solved. Cause and effect are only correlated in retrospect; you can see how you got there, but you couldn't possibly have predicted it. This is the domain of "wicked" problems that tend to resist being easily solved with expertise. In the complex domain, we have to probe the problem.

"A Quick Introduction to Cynefin ," by Liz Keogh

### Chaos

Chaos is a transient domain; it resolves itself quickly, and not necessarily in your favor. It's dominated by urgency and the need to act, and act fast.

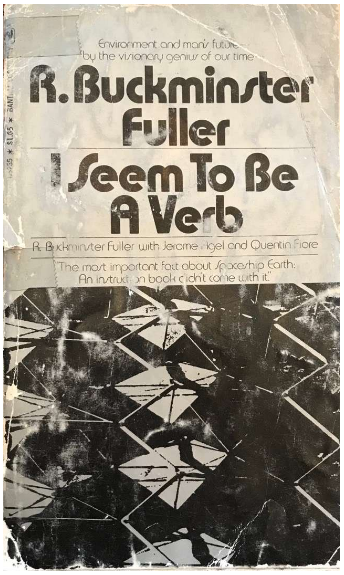
*"Cynefin, pronounced ku-nev-in, is a Welsh word that signifies the multiple factors in our environment and our experience that influence us in ways we can never understand"*

*— David Snowden and Mary Boone*

# The Leadership Moment

"I always say to myself, what is the most important thing we can think about at this extraordinary moment."

– Buckminster Fuller


Environment and man's future by the visionary genius of our time
R. Buckminster Fuller
I Seem To Be A Verb
R. Buckminster Fuller with Jerome Agel and Quentin Fiore
"The most important fact about Spaceship Earth: An instruction book didn't come with it."

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## *What at this Moment?*

It's a lot? Sure. We need to continually be asking ourselves the orienting question: "what at this extraordinary moment, is the most important thing for me, and for us, to be attending to?" The discipline is in the question. We still need to do mundane things, supporting things, etc. However, we're guiding our own attention, and, as a leader, potentially others'.

Leadership is associated with vision, or at least, we tend to attribute absence of leadership when clear, shared vision is lacking. Is vision what we need to be attending to? Is it threat, and inhibitors to success? Is it decisions and shared understanding of the outcomes and our chosen approach to reaching them?

## Who *at this Moment?*

We need to be aware of, think consciously about, who is involved. Diverse perspectives, born of different backgrounds and experience sets, are important to understanding the (various) contexts of use, development, and operations, surface ethical considerations, and understanding alternatives and impacts.

Asking who, is also about understanding that with too many involved, we can slow the process down (reaching agreement, decisions by committee, etc.). And we need to balance this with creating shared understanding and insight into the constraints and forces taken into account. We can get some of these benefits, involving others in reviews, etc.

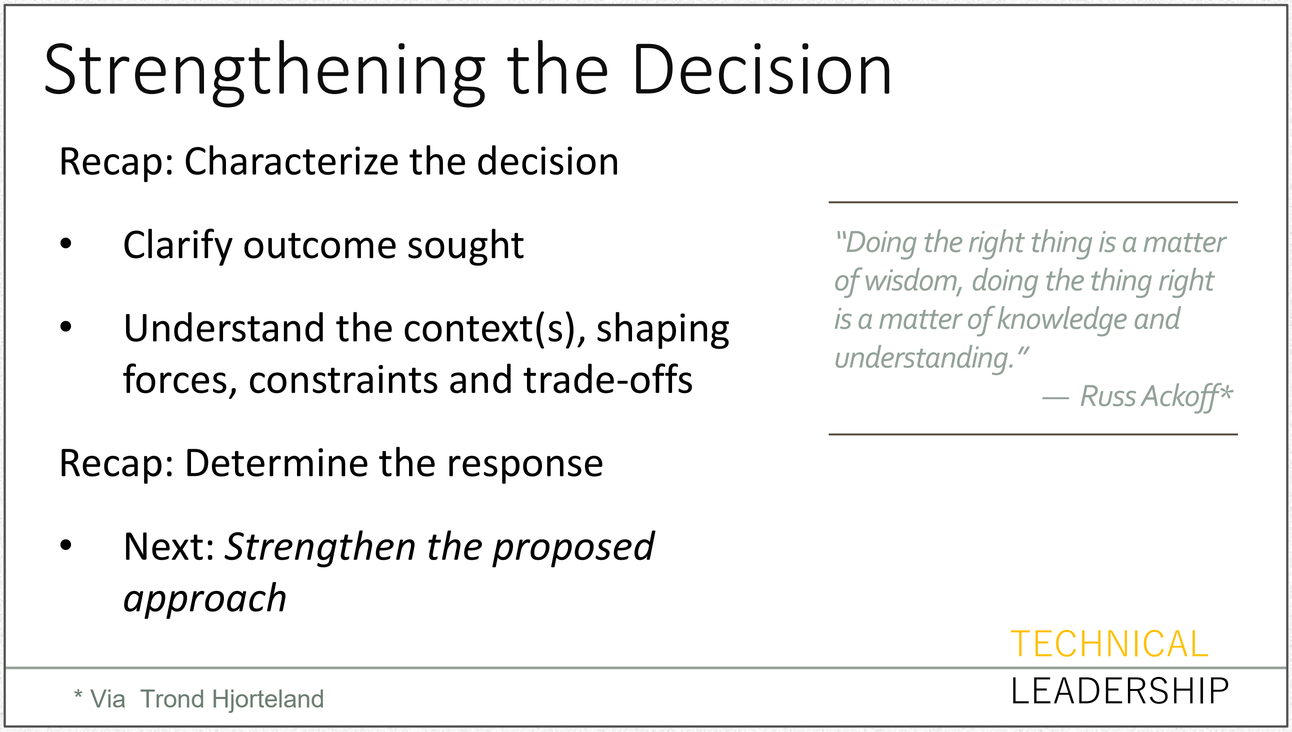
## *Minimalist Discipline*

Adopt a minimalist orientation:

Leaders work across; any decisions we make (or decisions we guide in the making), ought to be those that have substantive consequence and impact on system outcomes, and implications in different contexts.

Minimalist: does the decision need to be made by me? Scope? Timing? Impact? No? Then don't make it!

***If it's highly consequential, make it good, and then make it better***



# Strengthening the Decision

Recap: Characterize the decision

- Clarify outcome sought
- Understand the context(s), shaping forces, constraints and trade-offs

Recap: Determine the response

- Next: *Strengthen the proposed approach*

> *"Doing the right thing is a matter of wisdom, doing the thing right is a matter of knowledge and understanding."*
>
> *— Russ Ackoff**

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* Via Trond Hjorteland

## *Strengthening Our Decisions*

So far, we've been considering why we make decisions and what kinds of decisions we make more intentionally and when. And what goes into making technical decisions. Not prescriptively, for it's a judgement call, or rather, sets of judgment calls.

To inform the decision, we seek to understand the context or circumstances (Diana Montalion), and seek to identify the best possible approach, or solution, or resolution.

If the decisions we're making are make or break, it's worth considering how might we strengthen our reasoning underlying the decision. What do we need to learn, to increase confidence (our own, and stakeholders') in our approach? What constrains us? What are we not willing to compromise on? And yes, this can take time. We acknowledge uncertainty and incompleteness and seek to improve our understanding of impact and fit and options and opportunities.

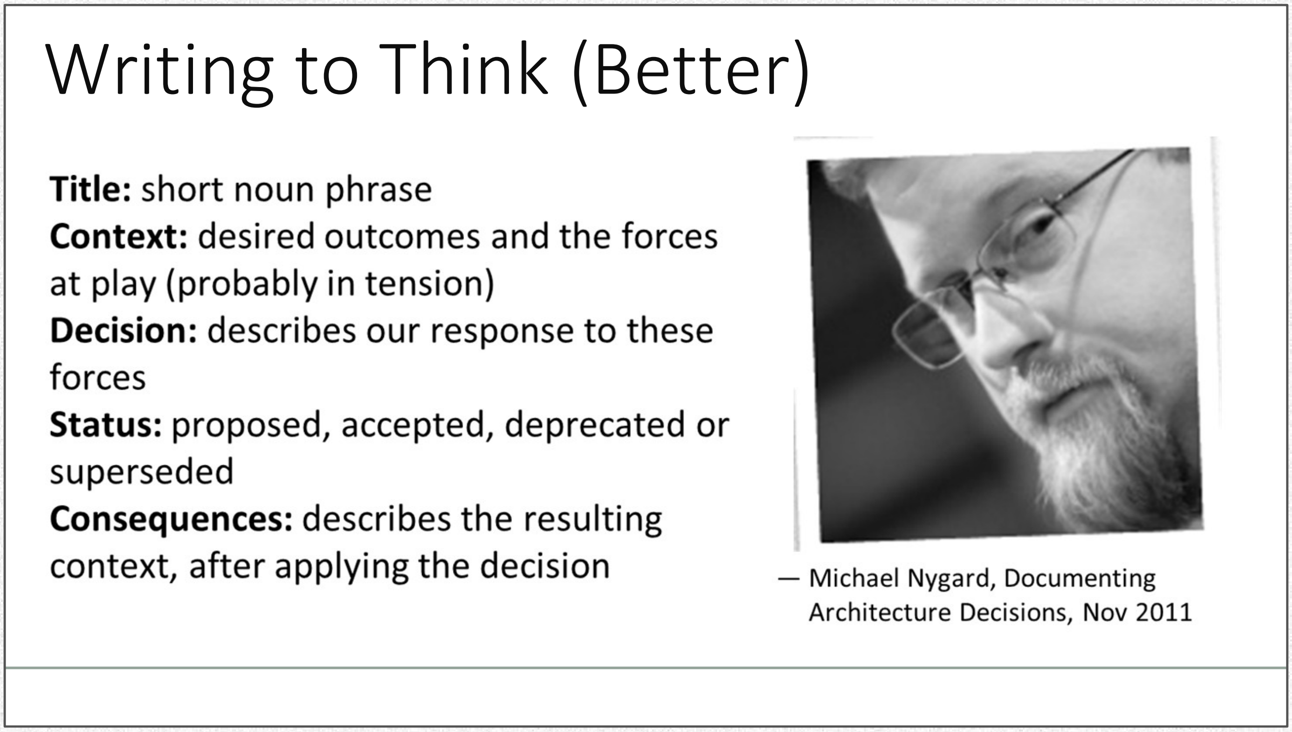
Not that we want bullets, but to play with the "no silver bullets" (Brooks in MMM) expression: we know that objectivity isn't a thing we reach, but in attempting it, we employ the practices of science and experiment, to try to get to sounder decisions. To discover. To adapt. Where it matters.

> *"My first round I tried appealing to rationality. Then I ran smack bang into bounded rationality."*
>
> *— Abdul Gani*

> *"There is a silver bullet — it's relationships of goodwill and a commitment to objectivity"*
>
> *— Dana Bredemeyer*

> *"look at reasons in terms of:*
>
> - *fact: is it so?*
> - *inference: does it follow?"*
> - *weight: does it matter?"*
>
> *— Diana Montalion*

***Writing it down helps clarify , communicate and record***



## Writing to Think (Better)

**Title:** short noun phrase
**Context:** desired outcomes and the forces at play (probably in tension)
**Decision:** describes our response to these forces
**Status:** proposed, accepted, deprecated or superseded
**Consequences:** describes the resulting context, after applying the decision

— Michael Nygard, Documenting Architecture Decisions, Nov 2011

> *"Here are [..] reasons that radiating intent is better than begging forgiveness:*
> *Radiating intent gives a chance for someone to stop you before you do a thing, in case it's truly harmful*
> *Radiating intent gives people who have information, or want to help, an opening to participate*
> *Radiating intent leaves better evidence of your good will"*
> *— Elizabeth Ayer*

Source:_https://medium.com/@ElizAyer/dont-ask-forgiveness-radiate-intent-d36fd22393a3n

### *Write It Down — No Really, Do It!*

Writing our thinking down helps us to see what we're thinking, so we can improve it – the thinking, or the way we're communicating it. It creates externalized reasoning and memory that others can access, understand, and help improve.

We've mentioned keeping a systems and decision journal as a way to be more reflective and intentional about learning from our system(s) and decisions, and what is shaping up in the context. Design pattern templates and ADRs (covered earlier) help direct our attention, so that in our conversations and in formulating and writing our reasoning down, we have a well-trod path to follow in the form of template structure.

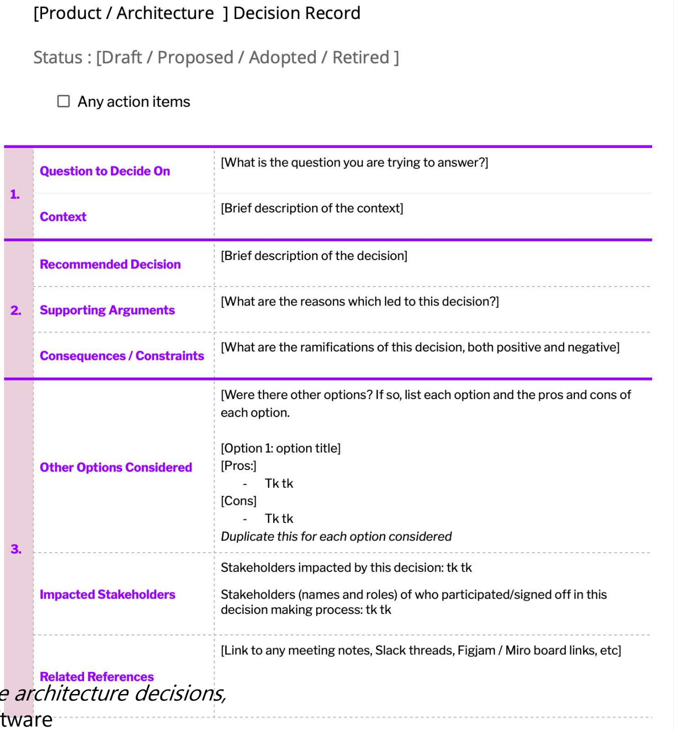
Various architecture decision templates have been published, including by Jeff Tyree and Art Akerman then at Capital One (in IEEE Software, so this template and discussion gained exposure and influence), and Olaf Zimmerman at IBM. But Michael Nygard's simplified (and well-described) Architecture Decision Record template caught on as a just enough version for documenting architecture decisions in an Agile context.

See Nat Pryce's ADR tools on Github:
https://github.com/npryce/adr-tools
See also Upmo and Wisen Tanasa's examples:
https://opensoftwaredesign.com/upmo/decisions/

***There are various templates for Architecture Decision Records; of note: Indu Alagarsamy's brevity-oriented template***

# Variations

Highlighting Impacted Stakeholders: stakeholders (those impacted by the decision) have different perspectives and orientations and concerns… and agendas… (and these unfold and evolve)… Noting who is impacted, reminds us who to involve.



[Product / Architecture ] Decision Record

Status : [Draft / Proposed / Adopted / Retired ]

☐ Any action items

| | | |
|---|---|---|
| 1. | **Question to Decide On** | [What is the question you are trying to answer?] |
| | **Context** | [Brief description of the context] |
| 2. | **Recommended Decision** | [Brief description of the decision] |
| | **Supporting Arguments** | [What are the reasons which led to this decision?] |
| | **Consequences / Constraints** | [What are the ramifications of this decision, both positive and negative] |
| 3. | **Other Options Considered** | [Were there other options? If so, list each option and the pros and cons of each option.<br>[Option 1: option title]<br>[Pros:]<br>- Tk tk<br>[Cons]<br>- Tk tk<br>*Duplicate this for each option considered* |
| | **Impacted Stakeholders** | Stakeholders impacted by this decision: tk tk<br>Stakeholders (names and roles) of who participated/signed off in this decision making process: tk tk |
| | **Related References** | [Link to any meeting notes, Slack threads, Figjam / Miro board links, etc] |

From: Indu Alagarsamy, *Document your product and software architecture decisions,* https://domainanalysis.io/p/document-your-product-and-software

## *Architecture Decision Records*

Joel Parker Henderson has collected various resources around Architecture Decision Records, from templates and guidance, to links to the ADRs of various organizations, on github.

https://github.com/joelparkerhenderson/architecture-decision-record

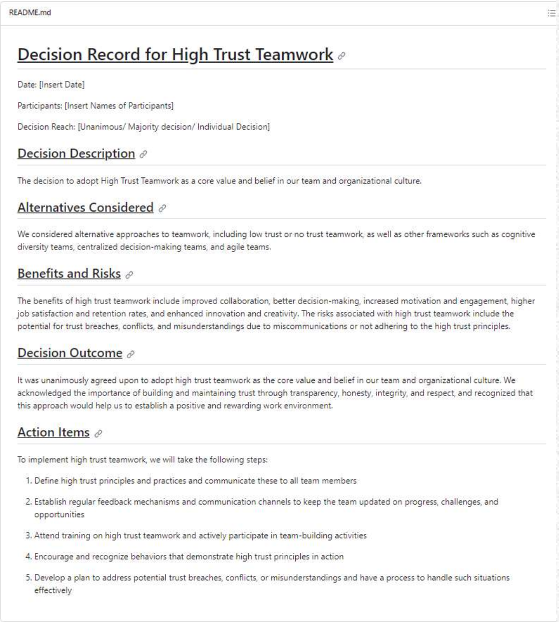
*Examples*: https://github.com/joelparkerhenderson/architecture-decision-record/tree/main/examples

The Application Logging ADR of the HHS/Head-Start-TTADP project might be contrasted with the Metrics, Monitors and Alerts ADR (as an exercise, noting that the team's context and judgment factors):

- Application Logging https://github.com/HHS/Head-Start-TTADP/blob/main/docs/adr/0004-application-logging.md
- Metrics, Monitors and Alerts https://github.com/joelparkerhenderson/architecture-decision-record/tree/main/examples/metrics-monitors-alerts#metrics-monitors-alerts

The ADR template is vital. Still, too much of a good thing sinks itself under its own weight, so there's the matter of which decisions to record and how much of the reasoning to persist.

Many, but not all, ADRs focus on technology choices.
Example of a team oriented decision: https://github.com/joelparkerhenderson/architecture-decision-record/tree/main/examples/high-trust-teamwork



README.md

# Decision Record for High Trust Teamwork

Date: [Insert Date]

Participants: [Insert Names of Participants]

Decision Reach: [Unanimous/ Majority decision/ Individual Decision]

## Decision Description

The decision to adopt High Trust Teamwork as a core value and belief in our team and organizational culture.

## Alternatives Considered

We considered alternative approaches to teamwork, including low trust or no trust teamwork, as well as other frameworks such as cognitive diversity teams, centralized decision-making teams, and agile teams.

## Benefits and Risks

The benefits of high trust teamwork include improved collaboration, better decision-making, increased motivation and engagement, higher job satisfaction and retention rates, and enhanced innovation and creativity. The risks associated with high trust teamwork include the potential for trust breaches, conflicts, and misunderstandings due to miscommunications or not adhering to the high trust principles.

## Decision Outcome

It was unanimously agreed upon to adopt high trust teamwork as the core value and belief in our team and organizational culture. We acknowledged the importance of building and maintaining trust through transparency, honesty, integrity, and respect, and recognized that this approach would help us to establish a positive and rewarding work environment.

## Action Items

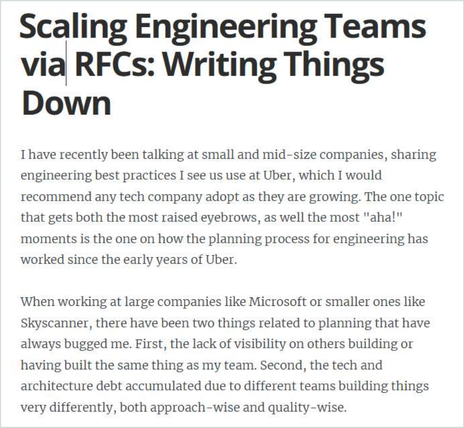
To implement high trust teamwork, we will take the following steps:

1. Define high trust principles and practices and communicate these to all team members
2. Establish regular feedback mechanisms and communication channels to keep the team updated on progress, challenges, and opportunities
3. Attend training on high trust teamwork and actively participate in team-building activities
4. Encourage and recognize behaviors that demonstrate high trust principles in action
5. Develop a plan to address potential trust breaches, conflicts, or misunderstandings and have a process to handle such situations effectively

# Power of Writing things Down

"Writing and sharing that writing with others creates accountability. It also almost always leads to more thorough decisions."

— Gergely Orosz



## Scaling Engineering Teams via RFCs: Writing Things Down

I have recently been talking at small and mid-size companies, sharing engineering best practices I see us use at Uber, which I would recommend any tech company adopt as they are growing. The one topic that gets both the most raised eyebrows, as well the most "aha!" moments is the one on how the planning process for engineering has worked since the early years of Uber.

When working at large companies like Microsoft or smaller ones like Skyscanner, there have been two things related to planning that have always bugged me. First, the lack of visibility on others building or having built the same thing as my team. Second, the tech and architecture debt accumulated due to different teams building things very differently, both approach-wise and quality-wise.

https://blog.pragmaticengineer.com/scaling-engineering-teams-via-writing-things-down-rfcs/

### *Writing Things Down*

"Usually, I see this being less straightforward. "This is not what I meant when we talked." or "What about this important edge case we forgot?" and "If we change this here, it could break this other part of the system" are things that often come up when writing the plan down. It's great to have these discussions before having the same realizations when the project is halfway done."

— Gergely Orosz, Scaling Engineering Teams via RFCs

"Understanding requires elaboration, so it's important for us to understand how we can elaborate better. Naturally, we could elaborate our findings by talking about them. Unfortunately in an oral presentation, we could get away with unfounded claims. A "you know what I mean", or a confident gestures may stop your peer from assessing what you have elaborated.

Instead of just using an oral communication, we should elaborate by writing too. There are many points in the process of writing where we would question and challenge the arguments that we have written when they don't work. If there are contradictions or gaps, our writing show that to us. Elaboration in writing also mean that we don't have to wait for anyone to be available to listen to us, we can do it at any time."

— Wisen Tanasa, "Elaborate in writing to test your understanding"

One thing I like to add, is that in addition to getting our own thinking clearer, a good discussion (in writing, illustrated well, as relevant, too) of strategically and architecturally significant decisions, is an important venue for sharing design insight and engineering experience!

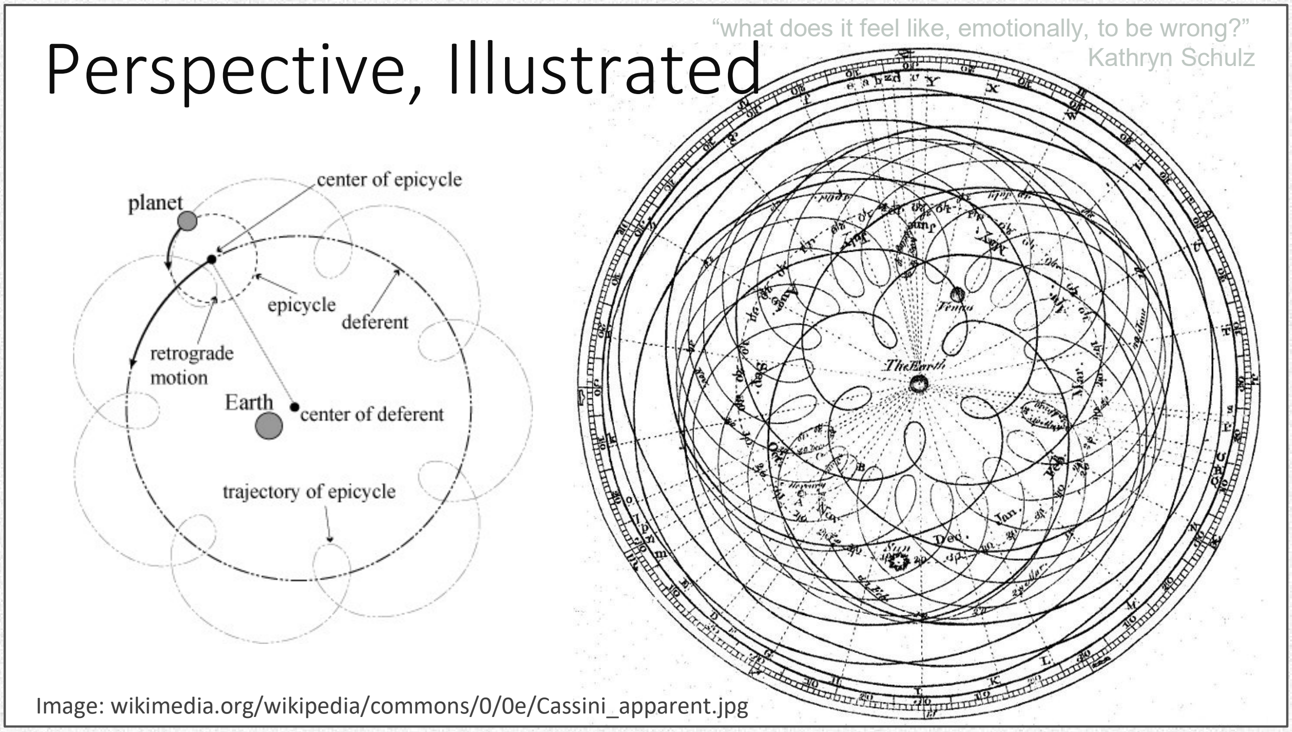
"Socialize. Pairing. Whiteboarding. Story-telling over lunch. We humans have used social methods for millennia to communicate our most sacred concepts."

— Kent Beck, "The Documentation Tradeoff"

This is so important! *And* we also use writing. To get clearer. To explore. To convey (to others, and across time). To convene conversation around.

And the conversations with our externalized thinking, *and with others*, is important. It creates further avenues to gaining access to different perspectives, to surface and probe our assumptions.

***Perspective influences our views, and our views  influence our perspectives***



## Perspective, Illustrated

"what does it feel like, emotionally, to be wrong?"
Kathryn Schulz

Image: wikimedia.org/wikipedia/commons/0/0e/Cassini_apparent.jpg

> *"Such assumptions appear so obvious that people do not know what they are assuming because no other way of putting things has ever occurred to them. With these assumptions a certain limited number of types of [..] systems are possible"*
>
> *— Susanne Langer, Philosophy in a New Key*

### *Perspective (Shifts)*

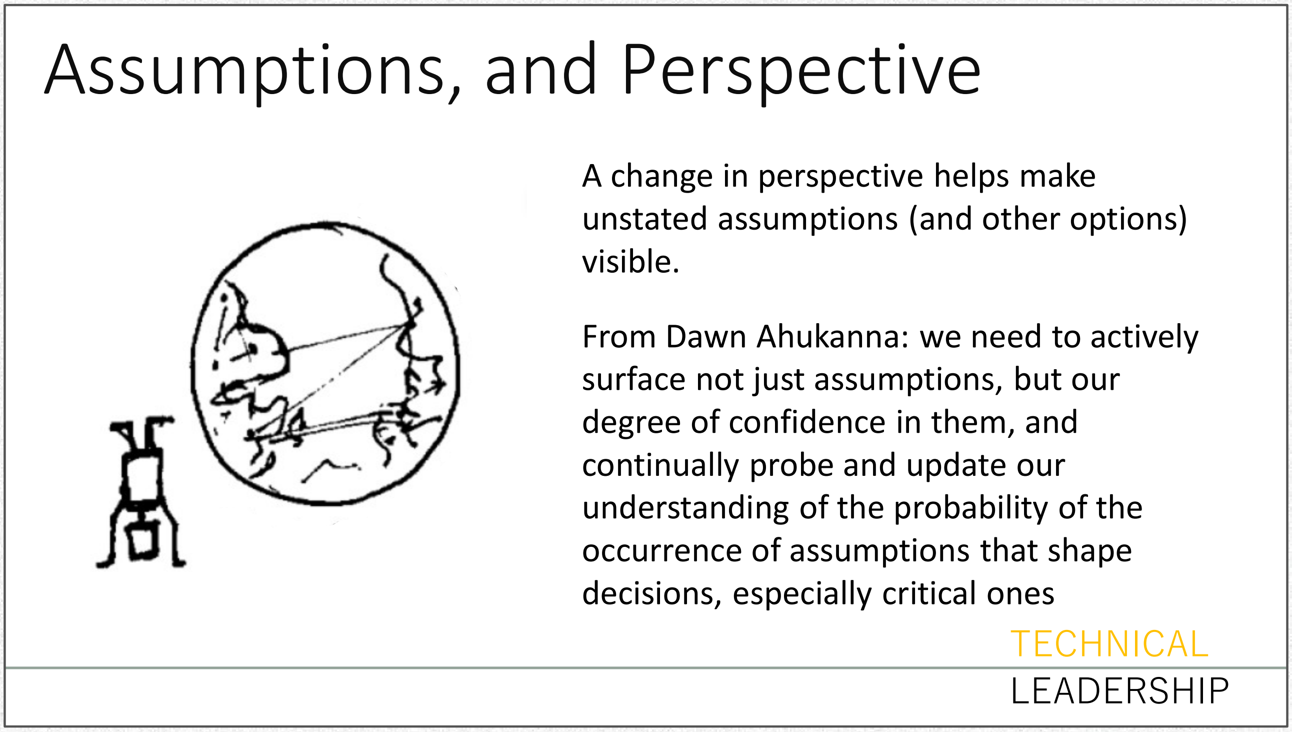
Christin Gorman used this example in a wonderful talk recently: Before Copernicus, the earth was generally assumed to be at the center of the universe (geocentricism), and observations about the planets' movements were explained by a model that worked – its predictions were consistent with observations.  Copernicus argued that the sun was at the center of the solar system, which resulted in a much simpler model, that explained and predicted the planets paths.

Christin uses this as an example of how we can be wrong. (And not know it. Until we know it.) Which brings in Kathryn Schulz's TED Talk: *On being wrong*.  It is wonderful, and highly recommended, but here is an important (and funny, when she does it) take-away:  When asked "what does it feel like, emotionally, to be wrong?" we answer things like "embarrassed," "awkward," (and if we're self-aware?) "defensive," … Kathryn points out:  "That is answering a different question – namely, "what does it feel like to find out we're wrong?" She recalls how, when running off a cliff, Wile Coyote continues running -- on thin air, and only falls when he realizes there's only air beneath him. And she points out that *being wrong feels exactly the same as being right*.  Sure, there's the old quip: "The first principle is that you must not fool yourself – and you are the easiest person to fool." But notice, that was talking about *you*. I'm kidding, but also not. It's key to Kathryn's talk.

*Christin Gorman: Our architecture is a mess! Are you sure?, DevCon 2019*

*Kathryn Schulz: https://www.ted.com/talks/kathryn_schulz_on_being_wrong*

*Compensate for blindspots, taking a different point of view*



# Assumptions, and Perspective

A change in perspective helps make unstated assumptions (and other options) visible.

From Dawn Ahukanna: we need to actively surface not just assumptions, but our degree of confidence in them, and continually probe and update our understanding of the probability of the occurrence of assumptions that shape decisions, especially critical ones

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*'But the critical ones are what Jeff Bezos calls "irreversible" and therefore load bearing. If they are built on assumptions (with probability o) "Things fall apart; the center does not hold" (Yeats, quoted by Chinua Achebe in Things Fall Apart.)'*

*— Dawn Ahukanna*

## *Repairing Blindspots*

"A change of perspective " ··· Alan Kay reminds us to take a different vantage point, to see from a different perspective, use the lens of various views. We need to notice what is hard to notice from inside the tunnel of our own vision — where what we're paying attention to, shapes what we perceive and pay attention to. Another way to get a change of perspective, is to get another person's perspective. Our team can miss the gorilla*, so to speak, when our attention is focused on the design issues of the moment. Fresh perspective, and even just naive questions about what the design means, can nudge an assumption or weakness into view. And merely telling the story, unfolding the narrative arc of the architecture to fit this person or audience, then that, gets us to adopt more their point of reference, across more perspectives — in anticipation, and when we listen, really listen, to their response and questions.

We need to adopt the discipline of not just accepting our initial understanding, but rather seeking different understandings. This illuminates options, and gives us other things to try. These are the significant decisions, decisions about the important stuff, after all.

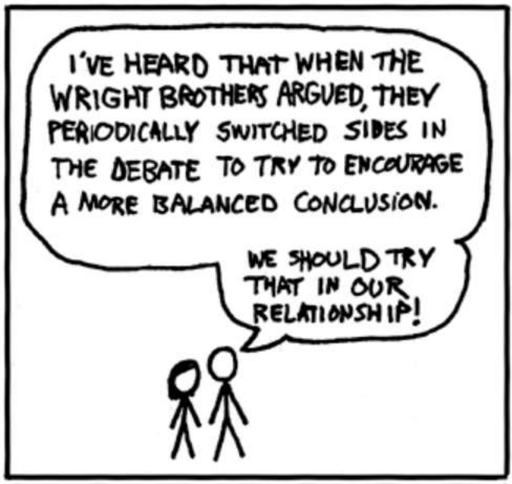
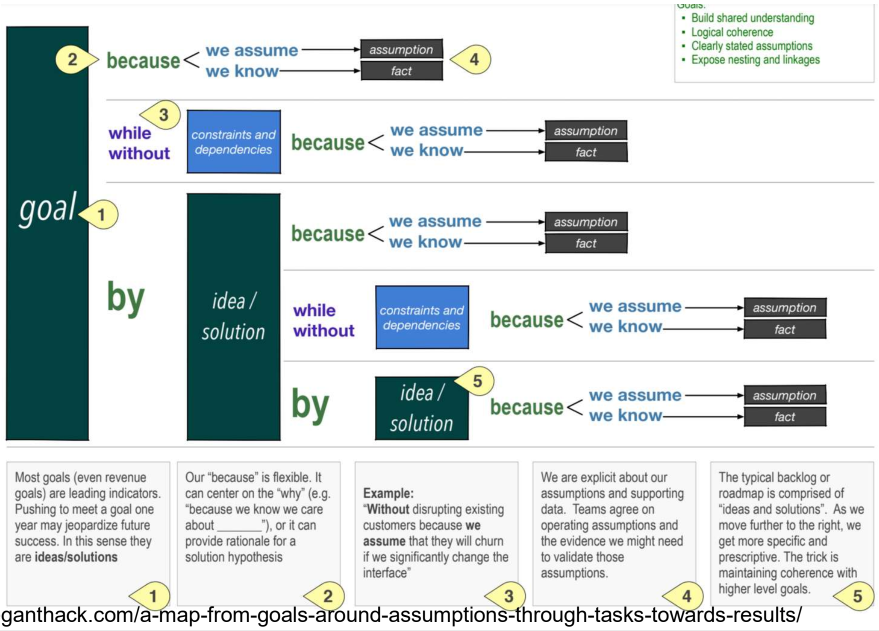

I'VE HEARD THAT WHEN THE WRIGHT BROTHERS ARGUED, THEY PERIODICALLY SWITCHED SIDES IN THE DEBATE TO TRY TO ENCOURAGE A MORE BALANCED CONCLUSION.
WE SHOULD TRY THAT IN OUR RELATIONSHIP!

Image xkcd.com/106/

** referencing the Simons and Chabris Selective Attention Experiment.*

## Assumption and Constraint Mapping



Most goals (even revenue goals) are leading indicators. Pushing to meet a goal one year may jeopardize future success. In this sense they are **ideas/solutions** 1

Our "because" is flexible. It can center on the "why" (e.g. "because we know we care about ________"), or it can provide rationale for a solution hypothesis 2

**Example:**
"**Without** disrupting existing customers because **we assume** that they will churn if we significantly change the interface" 3

We are explicit about our assumptions and supporting data. Teams agree on operating assumptions and the evidence we might need to validate those assumptions. 4

The typical backlog or roadmap is comprised of "ideas and solutions". As we move further to the right, we get more specific and prescriptive. The trick is maintaining coherence with higher level goals. 5

Source: John Cutler, https://eleganthack.com/a-map-from-goals-around-assumptions-through-tasks-towards-results/

### *Goals as Fields and Enabling Constraints*

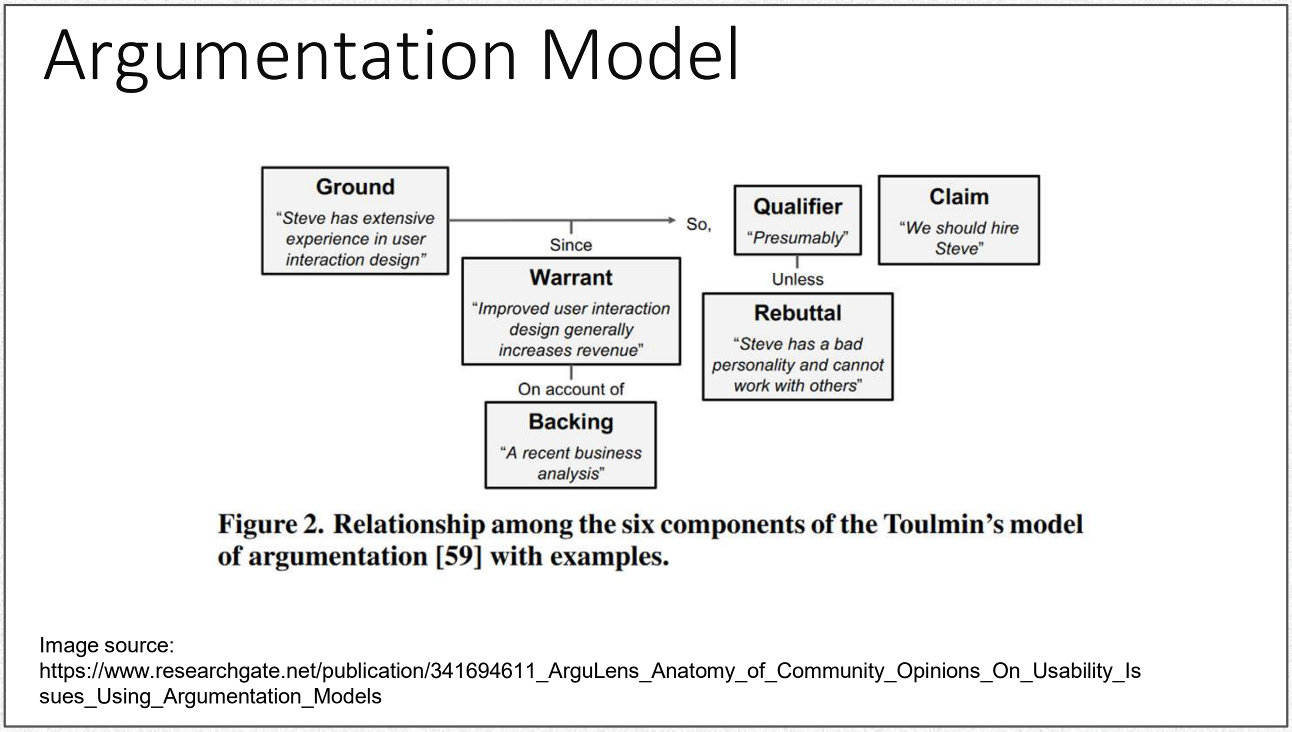
So we have explored dynamics using influence maps and causal loop diagrams. Now, with the Technical Debt Exercise in mind, identify challenges we need to address. Pick a challenge. What is the goal that makes this challenge one we need to address? Explore how we might achieve the goal, using the template – see template on the slide (from John Cutler), and description on John Cutler's site at:

https://eleganthack.com/a-map-from-goals-around-assumptions-through-tasks-towards-results/

> *"I try actively to question myself and my certainties"*
>
> *— Jérémie Zimmerman*

> *"A lot of work is the work of noticing what work needs doing."*
>
> *— Elizabeth Zagroba*

> *"Design involves assumptions about the future of the object designed, and the more that future resembles the past the more accurate the assumptions are likely to be. But designed objects themselves change the future into which they will age."*
>
> *— Petroski, To Engineer is Human*



Argumentation Model

Ground
"Steve has extensive experience in user interaction design"

Since

Warrant
"Improved user interaction design generally increases revenue"

On account of

Backing
"A recent business analysis"

So,

Qualifier
"Presumably"

Unless

Rebuttal
"Steve has a bad personality and cannot work with others"

Claim
"We should hire Steve"

**Figure 2. Relationship among the six components of the Toulmin's model of argumentation [59] with examples.**

Image source: https://www.researchgate.net/publication/341694611_ArguLens_Anatomy_of_Community_Opinions_On_Usability_Issues_Using_Argumentation_Models

## *Decision-based Evidence Making (Finding)*

From Cameron Tonkinwise (on LinkedIn):

"The lead example in the article is [..] the Aeron Chair for which initial market research evidenced distaste. With this example, the article is defending how things other than positivist evidence often inform a decision, things like expert pattern detection. If an external context demands 'evidence' to backup those 'intuitions,' then it is justifiable, the article argues, to do 'evidence making' - though a better phrase is 'evidence finding' to get some distance from 'evidence fabricating.'

Even 'evidence finding' risks confirmation bias. Then again, any well-designed scientific experiment is structured around a lamp-post-lost-key hypothesis that it seeks, hopefully, to disconfirm.

This article had me thinking about Stephen Toulmin's approach to argument analysis. This points to the importance of being able to identify not just the claim and the evidence for the claim, but the warrant. This nice old word means something like 'the philosophical assumption behind why that kind of evidence is evidence of the claim' (hence police need a basis on which to search for evidence) [..]

All of this is a core problem in design: you can do research into a context and perhaps discover what problems people have, but that won't tell you how to best solve that problem, something that requires an abductive leap.

The thing to do is focus on the 'decision' side not the 'evidence' side. Make error-friendly, reversible decisions. 'Safe-to-learn' is a social context that privileging evidence avoids taking responsibility for."

*"CONVERSATION, n. [..] each exhibitor being too intent upon the arrangement of his own wares to observe those of his neighbor.*

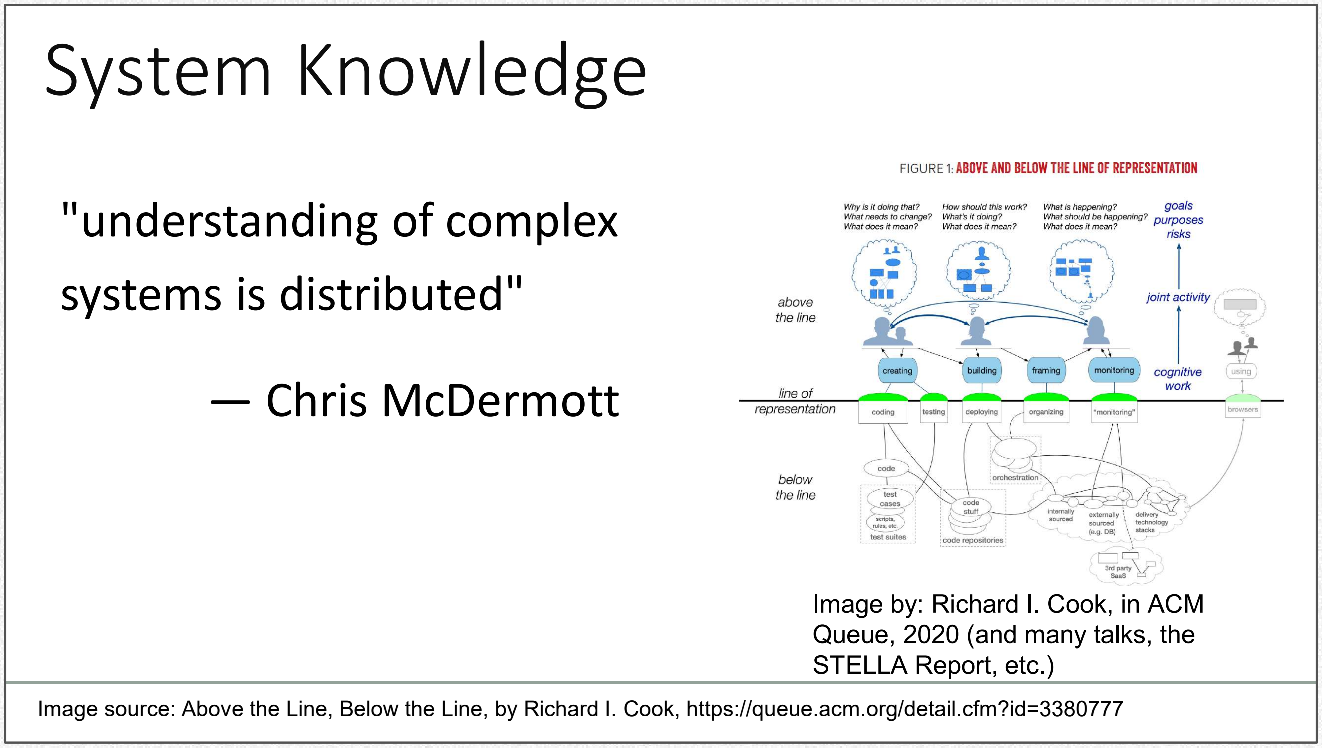
*DECIDE, v.i. To succumb to the preponderance of one set of influences over another set.*

*DELIBERATION, n. The act of examining one's bread to determine which side it is buttered on.*

*RATIONAL, adj. Devoid of all delusions save those of observation, experience and reflection.*

*REASON, v.i. To weigh probabilities in the scales of desire."*

*— Ambrose Bierce, The Devil's Dictionary*



## System Knowledge

"understanding of complex systems is distributed"

— Chris McDermott

FIGURE 1: ABOVE AND BELOW THE LINE OF REPRESENTATION

Image by: Richard I. Cook, in ACM Queue, 2020 (and many talks, the STELLA Report, etc.)

Image source: Above the Line, Below the Line, by Richard I. Cook, https://queue.acm.org/detail.cfm?id=3380777

## *Imperfect and Incomplete*

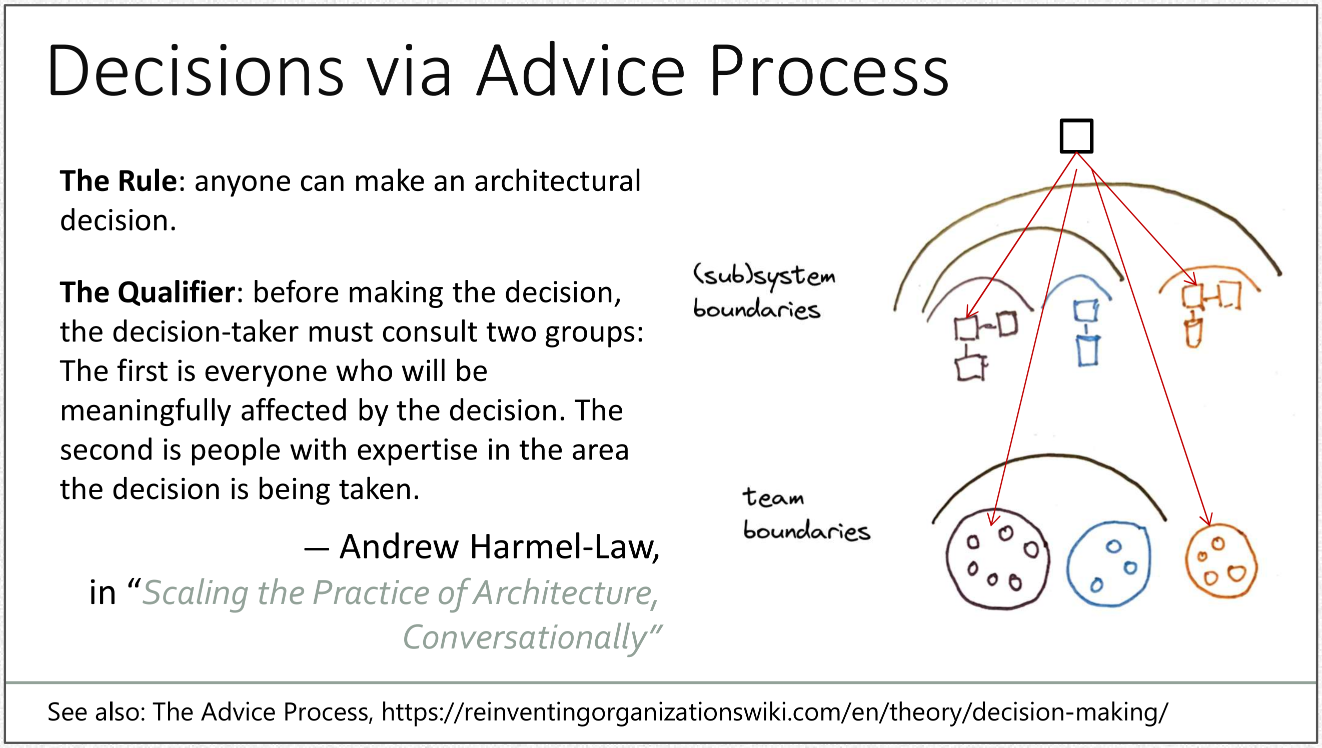
Indeed, when it comes to complex systems, as Chris McDermott observed in a talk last week: "understanding of the system is distributed." None of us understand it all, in breadth and depth, and even if we did or could, circumstances are ever changing, the environment is changing, the system is changing. And so is understanding.  David Woods observed (and it is known as Woods' Theorem): "As the complexity of a system increases, the accuracy of any single agent's own model of that system decreases rapidly." (STELLA Report)

"The people engaged in observing, inferring, anticipating, planning, troubleshooting, diagnosing, correcting, modifying and reacting to what is happening are shown with their individual mental representations. These representations allow the people to do their work -- work that is undertaken in pursuit of particular goals. To understand the implications of their actions requires an understanding of the cognitive tasks they are performing and, in turn, an understanding of what purposes those cognitive tasks serve.

The green line is the line of representation. It is composed of terminal display screens, keyboards, mice, trackpads, and other interfaces. The software and hardware (collectively, the technical artifacts) running below the line cannot be seen or controlled directly. Instead, every interaction crossing the line is mediated by a representation. This is true as well for people in the using world who interact via representations on their computer screens and send keystrokes and mouse movements.

A somewhat startling consequence of this is that what is below the line is inferred from people's mental models of The System.

This is not to say that what is below the line is imaginary. But the artifacts there cannot be perceived or manipulated directly. Instead, people use mental models of what, although hidden, they infer must be there to interpret what they see on the screens and to predict what the effect of typing a character or clicking a mouse will be." from The STELLA report, https://snafucatchers.github.io/



## Decisions via Advice Process

**The Rule**: anyone can make an architectural decision.

**The Qualifier**: before making the decision, the decision-taker must consult two groups: The first is everyone who will be meaningfully affected by the decision. The second is people with expertise in the area the decision is being taken.

— Andrew Harmel-Law,
in "*Scaling the Practice of Architecture, Conversationally*"

See also: The Advice Process, https://reinventingorganizationswiki.com/en/theory/decision-making/

## *Conversations and Learning*

So we have talked about Architecture Decision Records as a device for leading our thinking – directing us to consider contexts, impact and consequences. That is, implicitly drawing on and refining our Theory of the Problem, Theory of the Solution, and Match between.

We (as an industry) have also seen something of a return to the RFC (request for comment), as a mechanism to involve more people in architecture decision making. This may take the form of an ADR adding a space for comments (and in-flight status). One of the ways to build expertise, is to draw on expertise, perspectives, alternative points of view and experience.

Andrew Harmel-Law has pushed this practice further, working as an architect with Thoughtworks clients and in an article he wrote, hosted on Martin Fowler's site. In what he calls the Advice Process, anyone can make an architectural decision, but they must get advice from 1. those affected or impacted by the decision, and 2. those who have expertise relevant to the decision.

This is a process to make better decisions, and foster and build system understanding and design expertise.

Architecture decisions impact across boundaries.

In Andrew's words: "while decision-takers are in no way obliged to agree with the advice the folks in these two consulted groups give them, they must seek it out, and they must listen to and record it. We are not looking for consensus here, but we are looking for a broad range of inputs and voices."

And later, "It will come as no surprise to learn that consequently, a series of ADRs, and their surrounding conversations provide an excellent learning ground for people wanting to begin to take on the task of decision-taking; everything is out in the open, including the dissent and compromise-making. Less experienced practitioners of architecture can peruse the history of what went before them quickly and easily, see good (and quite likely less-good) examples, and see decisions being taken (and perhaps also being revoked when circumstances change / the team learned more). They are almost a thinking and decision lore for a set of software, written in the hand of those who contributed most to it."

— Andrew Harmel-Law, Scaling the Practice of Architecture, Conversationally, 2011

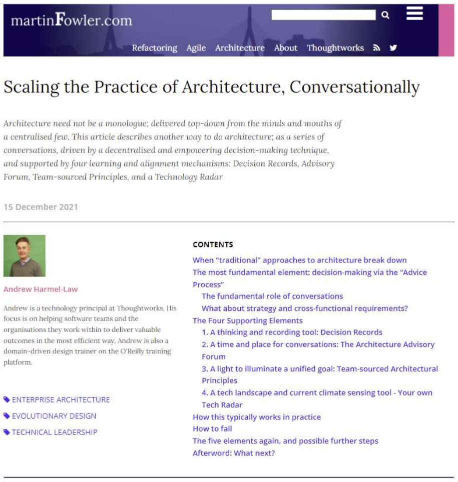
Note: Where we say architecture, we could also add in other strategically significant decisions; that is, decisions that impact identity and value.

***Through the Advice Process, we create a forum for developing system understanding,***

# Architecture Advisory Forum

"the invitees to the AAF are those typically affected / possessing relevant expertise."

– Andrew Harmel-Law



Scaling the Practice of Architecture, Conversationally

*Architecture need not be a monologue; delivered top-down from the minds and mouths of a centralised few. This article describes another way to do architecture; as a series of conversations, driven by a decentralised and empowering decision-making technique, and supported by four learning and alignment mechanisms: Decision Records, Advisory Forum, Team-sourced Principles, and a Technology Radar*

15 December 2021

Andrew Harmel-Law

Andrew is a technology principal at Thoughtworks. His focus is on helping software teams and the organisations they work within to deliver valuable outcomes in the most efficient way. Andrew is also a domain-driven design trainer on the O'Reilly training platform.

ENTERPRISE ARCHITECTURE
EVOLUTIONARY DESIGN
TECHNICAL LEADERSHIP

CONTENTS

When "traditional" approaches to architecture break down
The most fundamental element: decision-making via the "Advice Process"
  The fundamental role of conversations
  What about strategy and cross-functional requirements?
The Four Supporting Elements
  1. A thinking and recording tool: Decision Records
  2. A time and place for conversations: The Architecture Advisory Forum
  3. A light to illuminate a unified goal: Team-sourced Architectural Principles
  4. A tech landscape and current climate sensing tool - Your own Tech Radar
How this typically works in practice
How to fail
The five elements again, and possible further steps
Afterword: What next?

From: Andrew Harmel-Law, Scaling the Practice of Architecture, Conversationally, 2021

## *Structured Conversations and Learning: Architecture Advice Forum*

"The second supporting element in this alternative approach exists to make all the conversations supporting this advice-seeking easier: a weekly, hour-long Architecture Advisory Forum ("AAF").

Fundamentally, this is a regular and recurring place and time for conversations. Your ideal attendees are delegates from each team as well as your key representatives from your Advice Process checklist. However, the invite should remain completely open to encourage transparency and openness. The timeliness and quality of the conversations which take place is a key indicator of success, but equally important is the breadth and diversity of views shared, and the same goes for the contributors. If architecture is being "done" here, and lessons shared and learned, then you're winning."

"Firstly, the Advice Process reigns. Decisions taken to the AAF are still owned and made by the originators. The only thing other attendees can do is offer advice, or suggest additional people to seek advice from. Hence the name.

This brings us to the second key difference. Given the Advice Process qualifiers, the invitees to the AAF are those typically affected / possessing relevant expertise. This means those typically present include representatives from each feature team (and not just the lead; BAs/POs and QAs are frequently present), people from other programmes of work, UX, Product, Operations, and occasionally senior execs."

— Andrew Harmel-Law

*Leadership is very much about ensuring that conversations that need to be happening are happening — not always initiating them, nor always helping to focus or navigate them, but ensuring they do happen and guiding when needed*

*Of note: in this model, architects also use the advice process*

***Bring more voices and experience to the decision process, through advice gathering***

# Architecture Advisory Forum

"When [the conversations] take place in an AAF there is an audience, so many people can listen and everyone can learn. The amount of organisational, domain, legacy, and experiential information and architectural skill-deployment shared at these sessions is unlike anything I have ever seen"

— Andrew Harmel-Law

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## *Conversations with "the System in the Room"*

The Architecture Advisory Forum convenes conversations about key system decisions with "the system in the room" – if not the full system, folk who bring in the perspective of relevant, or impacted parts of the system. (User research will go beyond this, too.)

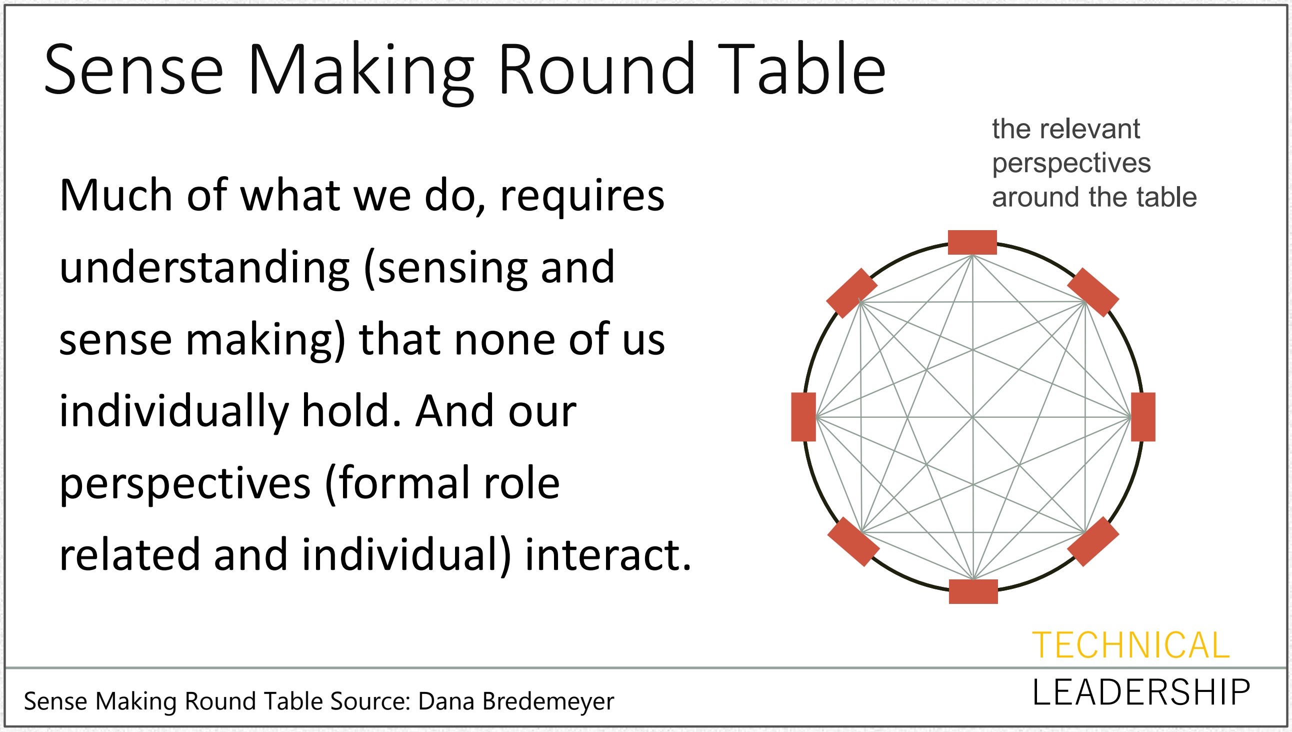
Over time, these conversations increase the repertoire of, or at least exposure to, a variety of system design elements and approaches, and develop and nuance each person's system understanding, as various people grapple with the interaction between their perspectives, assumptions, concerns and understandings, and those of others across the various sociotechnical system spaces involved.

I again want to point out that I am referring to Andrew Harmel-Law's work (which is specifically in the architecture context) here, but we might consider extending advice gathering to other strategically important areas (such as strategic aspects of product design, or SRE and platform engineering, usability, etc.).

Now, I want to return to André Henry's point (in the quote alongside). Some of our decisions have impacts and consequences and implications outside our of our extended team's collective experience (even as we strive to be more inclusive). For decisions of consequence to the people and ecosystems that our system impacts, we need to extend our consequence scanning and advice gathering, so that we are drawing on broader demographic and geographic, experience and can anticipate adverse impacts. Further,

"you also have to get to market and this is where the experience comes in" — André Henry

> *"So much of this comes from experience, and seeing the consequences of decisions and learning from others."*
>
> *— André Henry*



## Sense Making Round Table

Much of what we do, requires understanding (sensing and sense making) that none of us individually hold. And our perspectives (formal role related and individual) interact.

the relevant perspectives around the table

TECHNICAL LEADERSHIP

Sense Making Round Table Source: Dana Bredemeyer

> *"information is a flow of messages, while knowledge is created and organized by the very flow of information, anchored on the commitment and beliefs of its holder. This understanding emphasizes an essential aspect of knowledge that relates to human action." — Ikujiro Nonaka**

> *"Access to information and limiting access to information is a very old strategy for trying to push forward one political agenda or one agenda or another"*
>
> *— John Green*

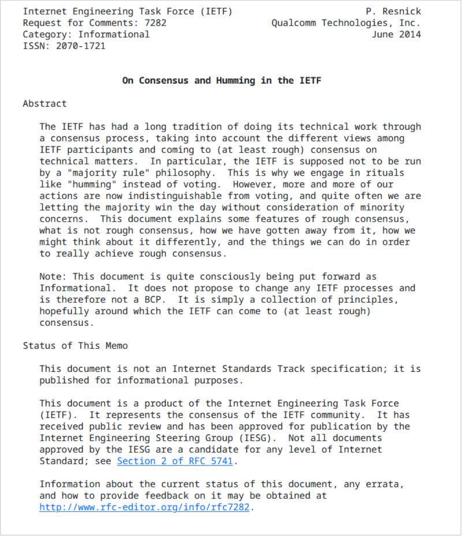
### *Understanding, Diagnosing and Acting as Joint Activity*

Complexity (in our work, our organizations, and the various contexts we're impacting with the systems we're evolving) means we're seeking to act in contexts that are mixes of stable and shifting, even dramatically. Where knowledge applies, but is distributed – among different people, and in relevance. Yet we need to act, and bring about requisite coherence (in our organization, and systems, and systems in contexts). One way to do that, is to bring those who have relevant experience and perspective together to jointly make sense of the situation, and response. So "leadership is about creating contexts" is about fostering contexts for joint (situation) understanding or sense making, and in so doing fostering understanding that informs decisions and gives collaborative impetus to action.

* Ikujiro Nonaka, *Dynamic Theory of Organizational Knowledge Creation*

# Consensus?

“Engineering always involves a set of tradeoffs. Its almost certain that any time engineering choices need to be made, there’ll be options that appeal to some people, but [not] others. In determining consensus, the key is to separate choices that are simply unappealing from those that are truly problematic. If at the end of the discussion some people have not gotten the choice they prefer, but they have become convinced that the chosen solution is acceptable[..]they have still come to consensus.” — P Resnick



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Internet Engineering Task Force (IETF)                        P. Resnick
Request for Comments: 7282                    Qualcomm Technologies, Inc.
Category: Informational                                        June 2014
ISSN: 2070-1721


                  On Consensus and Humming in the IETF

Abstract

   The IETF has had a long tradition of doing its technical work through
   a consensus process, taking into account the different views among
   IETF participants and coming to (at least rough) consensus on
   technical matters.  In particular, the IETF is supposed not to be run
   by a "majority rule" philosophy.  This is why we engage in rituals
   like "humming" instead of voting.  However, more and more of our
   actions are now indistinguishable from voting, and quite often we are
   letting the majority win the day without consideration of minority
   concerns.  This document explains some features of rough consensus,
   what is not rough consensus, how we have gotten away from it, how we
   might think about it differently, and the things we can do in order
   to really achieve rough consensus.

   Note: This document is quite consciously being put forward as
   Informational.  It does not propose to change any IETF processes and
   is therefore not a BCP.  It is simply a collection of principles,
   hopefully around which the IETF can come to (at least rough)
   consensus.

Status of This Memo

   This document is not an Internet Standards Track specification; it is
   published for informational purposes.

   This document is a product of the Internet Engineering Task Force
   (IETF).  It represents the consensus of the IETF community.  It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG).  Not all documents
   approved by the IESG are a candidate for any level of Internet
   Standard; see Section 2 of RFC 5741.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc7282.
```

https://datatracker.ietf.org/doc/html/rfc7282

## *Consensus*

“Having full consensus, or unanimity, would be ideal, but we don't require it: Requiring full consensus allows a single intransigent person who simply keeps saying "No!" to stop the process cold.”

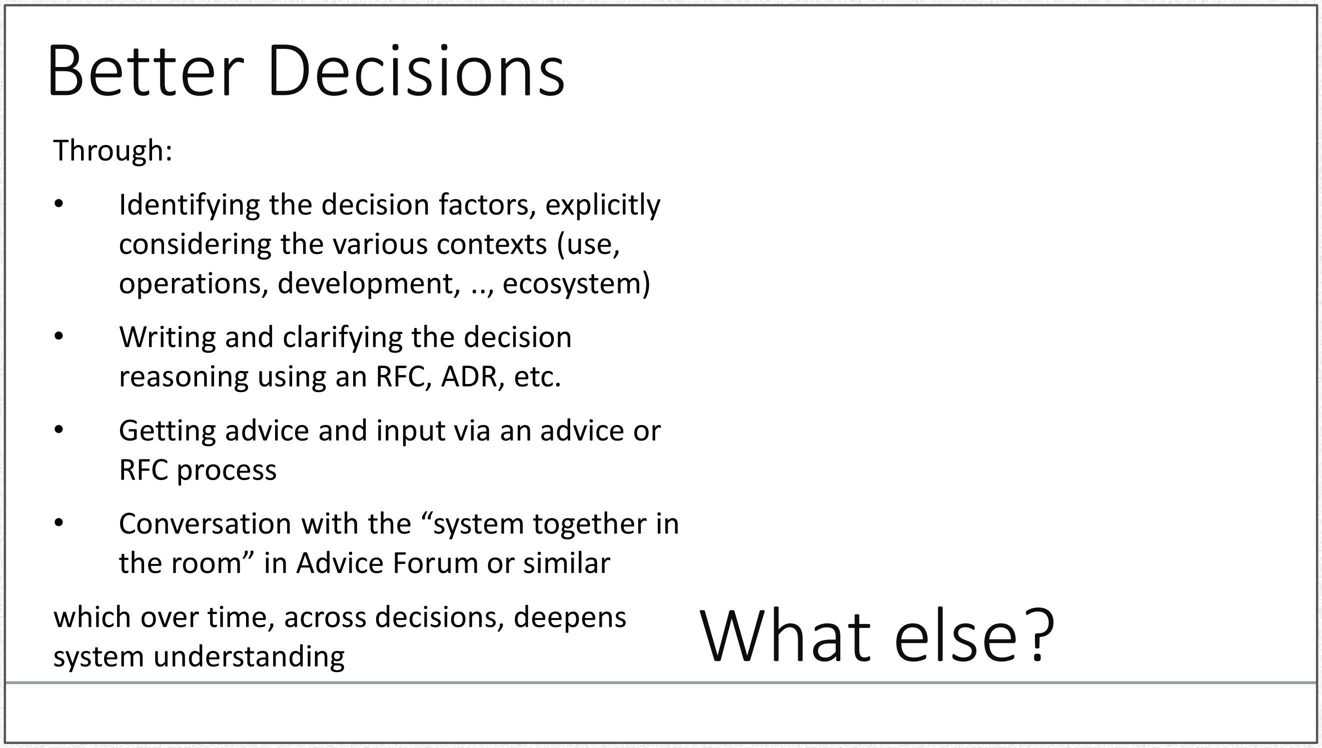
“Lack of disagreement is more important than agreement”

“But _determining_ consensus and _coming to_ consensus are different things than _having_ consensus.”

“the group must have honestly considered the objection and evaluated that other issues weighed sufficiently against it.  Failure to do that reasoning and evaluating means that there is no true consensus.”

Source: https://datatracker.ietf.org/doc/html/rfc7282

Another great read: Feminist Perspectives on Argumentation by Catherine E. Hundleby https://plato.stanford.edu/entries/feminism-argumentation/



## Better Decisions

Through:

- Identifying the decision factors, explicitly considering the various contexts (use, operations, development, .., ecosystem)
- Writing and clarifying the decision reasoning using an RFC, ADR, etc.
- Getting advice and input via an advice or RFC process
- Conversation with the “system together in the room” in Advice Forum or similar

which over time, across decisions, deepens system understanding

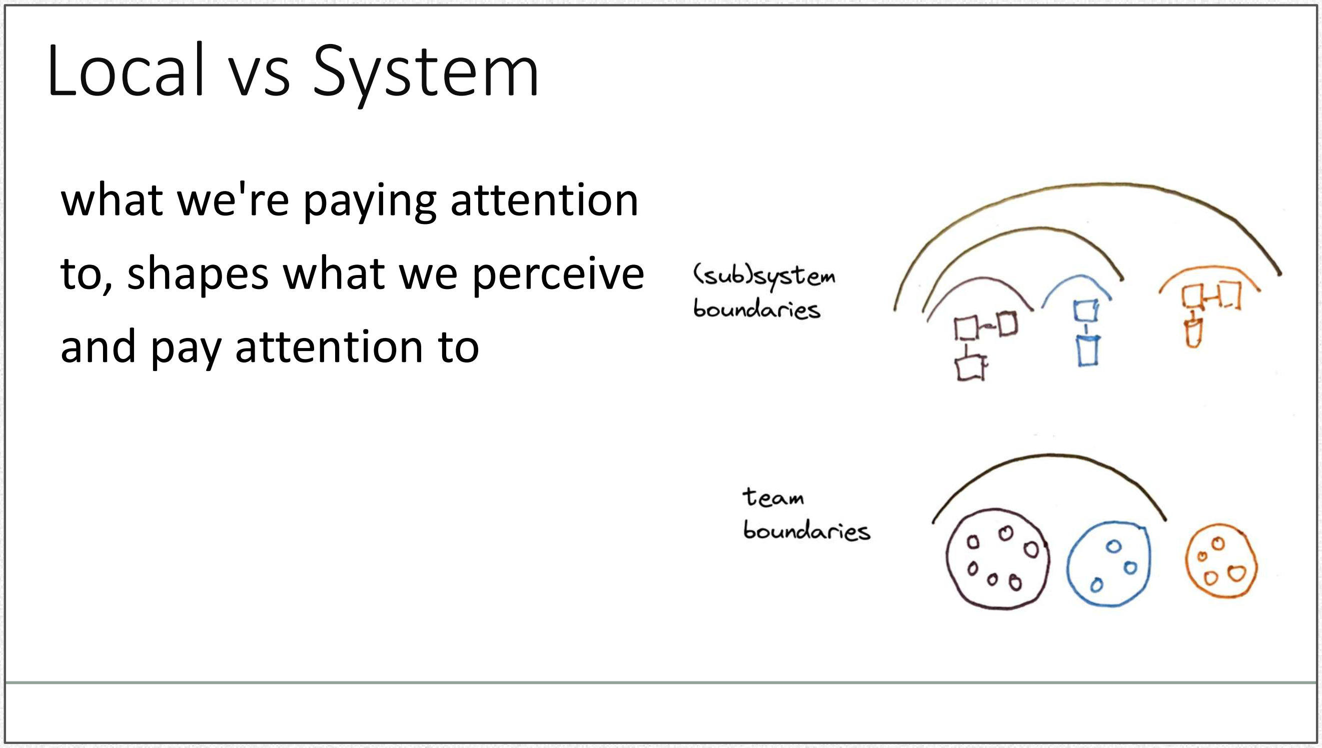
What else?

### *So Far*

To recap and reinforce, we have looked at better decisions through the frames of decision “anatomy,” directing our attention at what we’re taking into account, and in particular reminding us that forces are not just forces in the technical context, shaping developer experience and technical outcomes.  We need to look outwards to effects and side-effects, to forces and desired outcomes, arising in the user space and other partnering parts of the organization, and beyond.

Documenting decisions with some version of an ADR shares this reasoning, and an RFC or advice process encourages input and advice. The better the decision process – where it gathers input, what it seeks to understand in terms of impact and consequences, the options created and deliberated, and so forth – the more the decision record itself serves to teach design reasoning and increase the design repertoire of decision makers and decision readers and implementers.

An Advice Forum, or similar, brings “the system” (representative parts of it) together in conversation, and over time builds and deepens understanding.



## Local vs System

what we're paying attention to, shapes what we perceive and pay attention to

### *Local Concerns and Autonomy*

So, this is good. Conversations are happening. And people are being brought into the decision informing, decision shaping, decision understanding process. Better decisions. Better socialization of the decisions, as now more people are part of the various conversations considering the decision, its approach, alternatives, tradeoffs and ramifications.

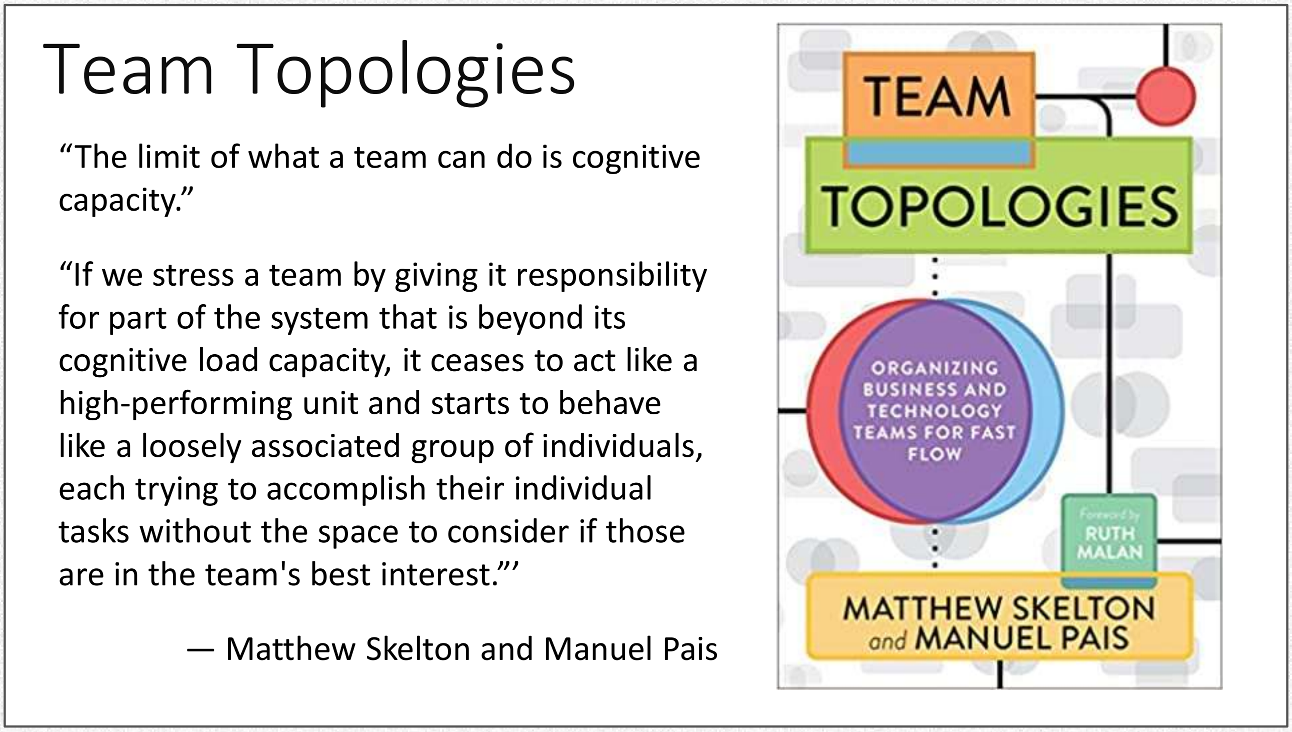
However. Focus builds focus. What we are paying attention to, shapes what we perceive and pay attention to.

At any rate, with focus and autonomy, we need to pay attention to, put work into, the system as a system, where decisions that impact what the system is and is becoming, are made with the system in mind.

Where "the" system is not quite so simple as "a" system. It's not just that it's a sociotechnical system, or a system of systems. We're creating systems for users (impacting their sociotechnical systems) within systems (the economic and sociotechnical systems of our design-development and operations). This brings into view the various boundaries that technical leadership and system design is spanning. Within our organization, and the various teams involved. As well as of our system and what capabilities it takes on, and shares, with users and how that impacts their value flows.

And working across these boundaries mean that we, as leaders in tech, are spanning organizational gaps – that would otherwise be gaps in perception and anticipation. We notice the need for, and create the context for, (participative ensemble) work that needs to be done at the system level.

> *"Don't ever stop talking about the system."*
>
> *— Eb Rechtin*



## Team Topologies

“The limit of what a team can do is cognitive capacity.”

“If we stress a team by giving it responsibility for part of the system that is beyond its cognitive load capacity, it ceases to act like a high-performing unit and starts to behave like a loosely associated group of individuals, each trying to accomplish their individual tasks without the space to consider if those are in the team's best interest.”’

— Matthew Skelton and Manuel Pais

### *Cognitive Load*

“When we talk about cognitive load, it's easy to understand that any one person has a limit on how much information they can hold in their brains at any given moment. The same happens for any one team by simply adding up all the team members' cognitive capacities.”

“When cognitive load isn’t considered, teams are spread thin trying to cover an excessive amount of responsibilities and domains. Such a team lacks bandwidth to pursue mastery of their trade and struggles with the costs of switching contexts.”

— Matthew Skelton and Manuel Pais

Jessica Kerr: “When a team's cognitive load is too high, coherence dissolves. You get a group of individuals instead”

*‘Cognitive load was characterized in 1988 by psychologist John Sweller as “the total amount of mental effort being used in the working memory.”’*

*— Matthew Skelton and Manuel Pais*

### *Coordination Costs*

If there is interaction between (microservices, modules, ..) components (and hence an interface), work has gone into enabling that interaction. It may be communication and coordination between the teams involved, or may be interface design work that’s been done, and that the teams agree to adhere to.  It may be that the components publish and subscribe to events, but those are designed. Somewhere, that coordination cost is born as design attention and design communication (which may be code).  If born by only one side of the interface, the other side bears the cost of accommodating to its constraints.

Coupling enables interactions to build capabilities, but comes with co-ordination costs. Communicating across contexts means understanding the needs and trade-offs across those boundaries, and the synthesis and emergence sought.  This may mean context switching away from the focus of the team’s work on the component(s) they are responsible for, increasing cognitive load which we seek to reduce.

# Put Work into Common Ground

"requires continuing effort to sustain, extend, and repair common ground."

— Richard Cook

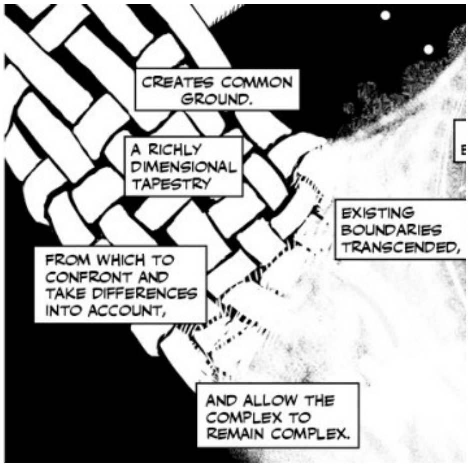

CREATES COMMON GROUND.
A RICHLY DIMENSIONAL TAPESTRY
EXISTING BOUNDARIES TRANSCENDED,
FROM WHICH TO CONFRONT AND TAKE DIFFERENCES INTO ACCOUNT,
AND ALLOW THE COMPLEX TO REMAIN COMPLEX.

Image from: *Unflattening,* by Nick Sousanis

## Common Ground Takes Effort

"Joint activity assumes a basic compact, which is an agreement (often tacit) to facilitate coordination and prevent its breakdown." — Gary Klein et al.

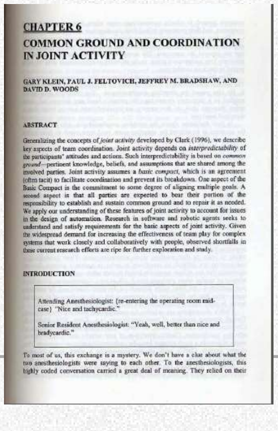
Gary Klein and collaborators, working on joint activity (and systems development and evolution is joint activity), indicate that joint activity depends on interpredicatability, and interpredictability depends on a "common ground" of shared knowledge, beliefs and assumptions. And Richard Cook (quote on slide), who you might recognize from the classic "How systems fail," is reminding us that common ground takes effort – effort to build, effort to sustain and extend, and effort to repair.

## Byte-Size Architecture Sessions

Andrea Magnorsky created a practice area around something many of us maybe sorta do, but should do more, and more consciously. Those whiteboard (or Miro board) discussions we pull others into, to noodle on some part of the system? Those Architecture Community of Practice meetings? Extend/modify that idea to intentionally and regularly get folk talking about and modeling "the system" and architecture. Building understanding of this system, together. Addressing issues, together. And doing so at a regular cadence (like an hour a week) with just enough structure, to build shared understanding, to investigate and learn together, to explore options, and more. Make it an ongoing practice.

https://bytesizearchitecturesessions.com/

> *"Collective responsibility is not a matter of adding but of interweaving, a matter of the reciprocal modification brought about by the interweaving. It is not a matter of aggregation but of integration."*
>
> *— Mary Parker Follett*



CHAPTER 6

**COMMON GROUND AND COORDINATION IN JOINT ACTIVITY**

**GARY KLEIN, PAUL J. FELTOVICH, JEFFREY M. BRADSHAW, AND DAVID D. WOODS**

**ABSTRACT**

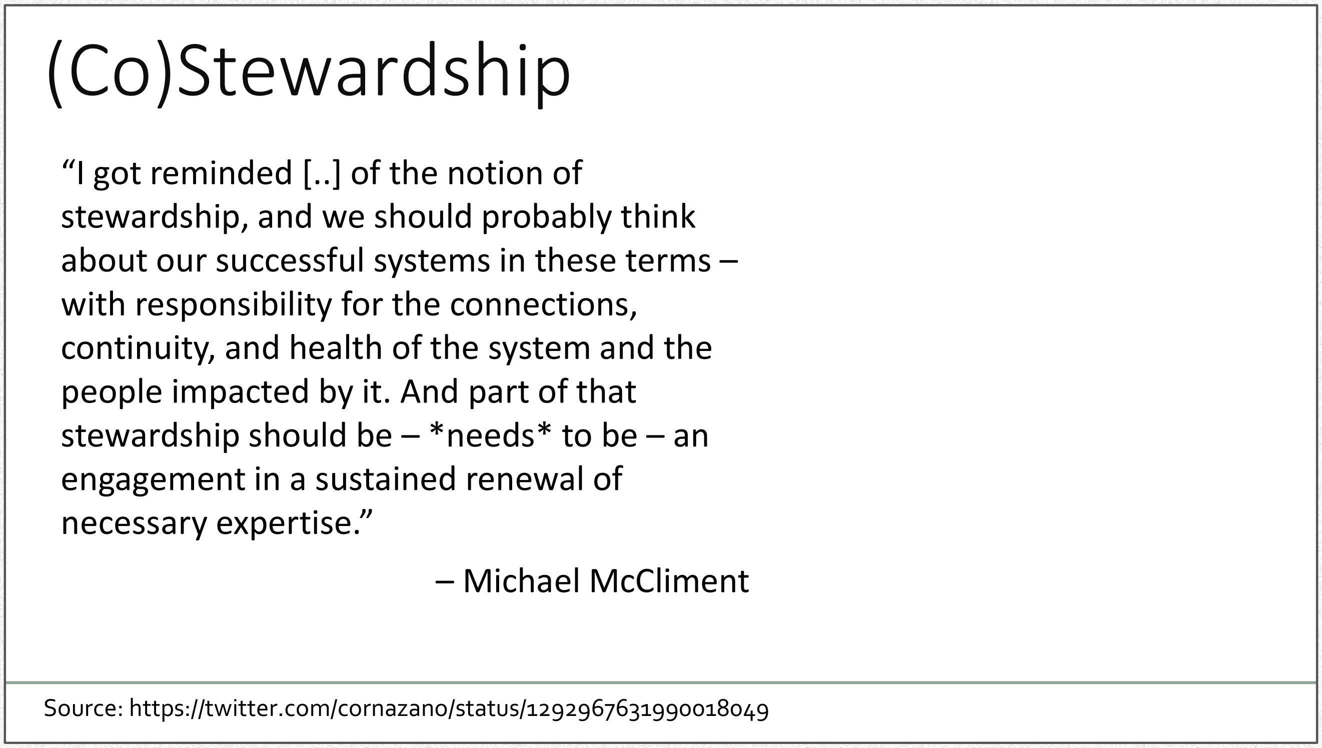
Generalizing the concepts of *joint activity* developed by Clark (1996), we describe key aspects of team coordination. Joint activity depends on *interpredictability* of the participants' attitudes and actions. Such interpredictability is based on *common ground*—pertinent knowledge, beliefs, and assumptions that are shared among the involved parties. Joint activity assumes a *basic compact*, which is an agreement (often tacit) to facilitate coordination and prevent its breakdown. One aspect of the Basic Compact is the commitment to some degree of aligning multiple goals. A second aspect is that all parties are expected to bear their portion of the responsibility to establish and sustain common ground and to repair it as needed. We apply our understanding of these features of joint activity to account for issues in the design of automation. Research in software and robotic agents seeks to understand and satisfy requirements for the basic aspects of joint activity. Given the widespread demand for increasing the effectiveness of team play for complex systems that work closely and collaboratively with people, observed shortfalls in these current research efforts are ripe for further exploration and study.

**INTRODUCTION**

Attending Anesthesiologist: (re-entering the operating room mid-case) "Nice and tachycardic."

Senior Resident Anesthesiologist: "Yeah, well, better than nice and bradycardic."

To most of us, this exchange is a mystery. We don't have a clue about what the two anesthesiologists were saying to each other. To the anesthesiologists, this highly coded conversation carried a great deal of meaning. They relied on their



## (Co)Stewardship

> “I got reminded [..] of the notion of stewardship, and we should probably think about our successful systems in these terms – with responsibility for the connections, continuity, and health of the system and the people impacted by it. And part of that stewardship should be – *needs* to be – an engagement in a sustained renewal of necessary expertise.”
>
> – Michael McCliment

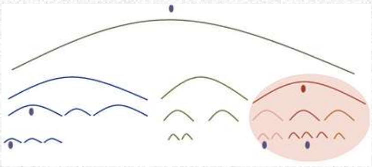
Source: https://twitter.com/cornazano/status/1292967631990018049

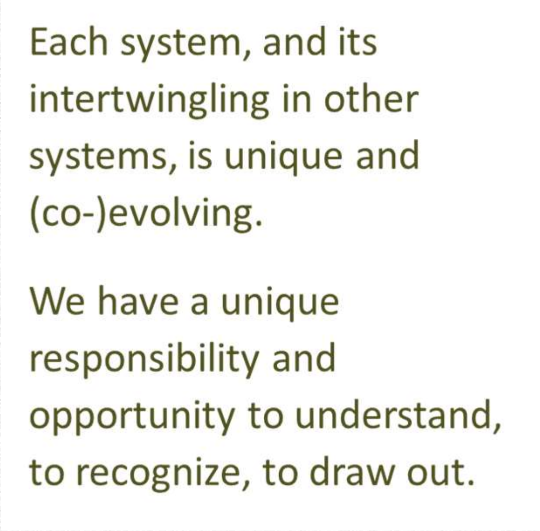
### *Stewardship*

This brings to mind the notion of stewardship and the sustained building and renewal of the expertise it takes to be good stewards of the system – stewards who are convening conversations and growing expertise and contextualizing work so that we’re bending the arc of our system more towards (structural, conceptual, design, organizational) integrity, and sustainability in technical, economic, social and environmental terms.

Roles that have “across” organizational unit (teams, teams of teams; managers, architects, managers of managers, senior SREs and principal engineers, CTOs, etc.) focus, each have a unique responsibility field, with a unique relationship and perceptual field, putting them in a position to develop understandings of the system (and interacting systems) at this scope. From this unique across-boundaries vantage point, we scan for and discern what needs to be understood and responded to, to sustain the system. Anticipatory awareness means paying ongoing attention to understanding the various contexts (use, development, operations, business, technology,⋯), the system, and the implications of changes and shifts. This is work. Collaborative work. Integrative work. Still, work. As is co-shaping and responding to shifts.

Anticipatory awareness and intentional design, both as ongoing processes as the system and its contexts co-evolve, mean doing hard things that have outcomes and consequences. And stewardship also means building the organizational will and wherewithal to confront, understand, cope with, and co-create and co-evolve towards better. Even as we seek to understand and shape what we mean by “better.”

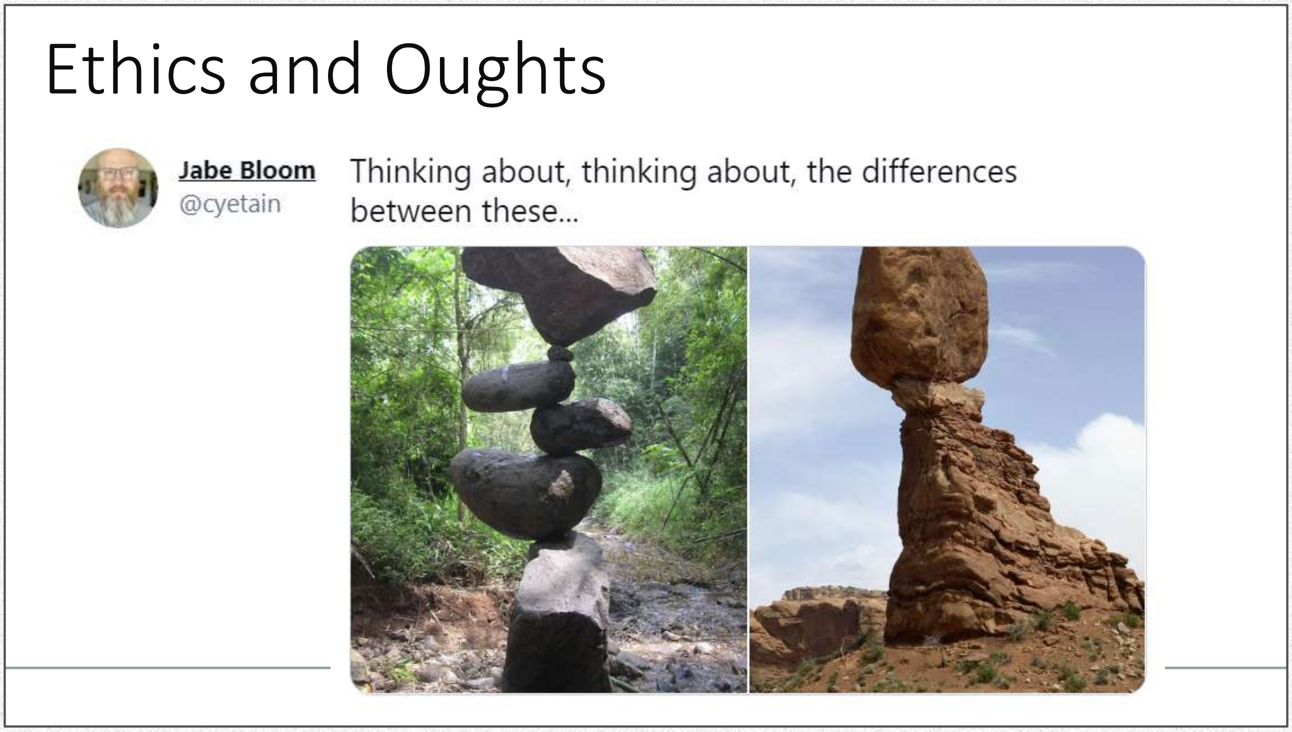




Each system, and its intertwingling in other systems, is unique and (co-)evolving.

We have a unique responsibility and opportunity to understand, to recognize, to draw out.

***Design expresses intention. Once we have intention, we have judgment. Consequences. Tradeoffs. Oughts. Ethics.***



# Ethics and Oughts

**Jabe Bloom**
@cyetain

Thinking about, thinking about, the differences between these...

*"the designer, is concerned with how things ought to be - how they ought to be in order to attain goals, and to function."*
*— Herbert Simon*

*We lead to enable things to be more the way they ought to be.*

## *Intention, and Oughts*

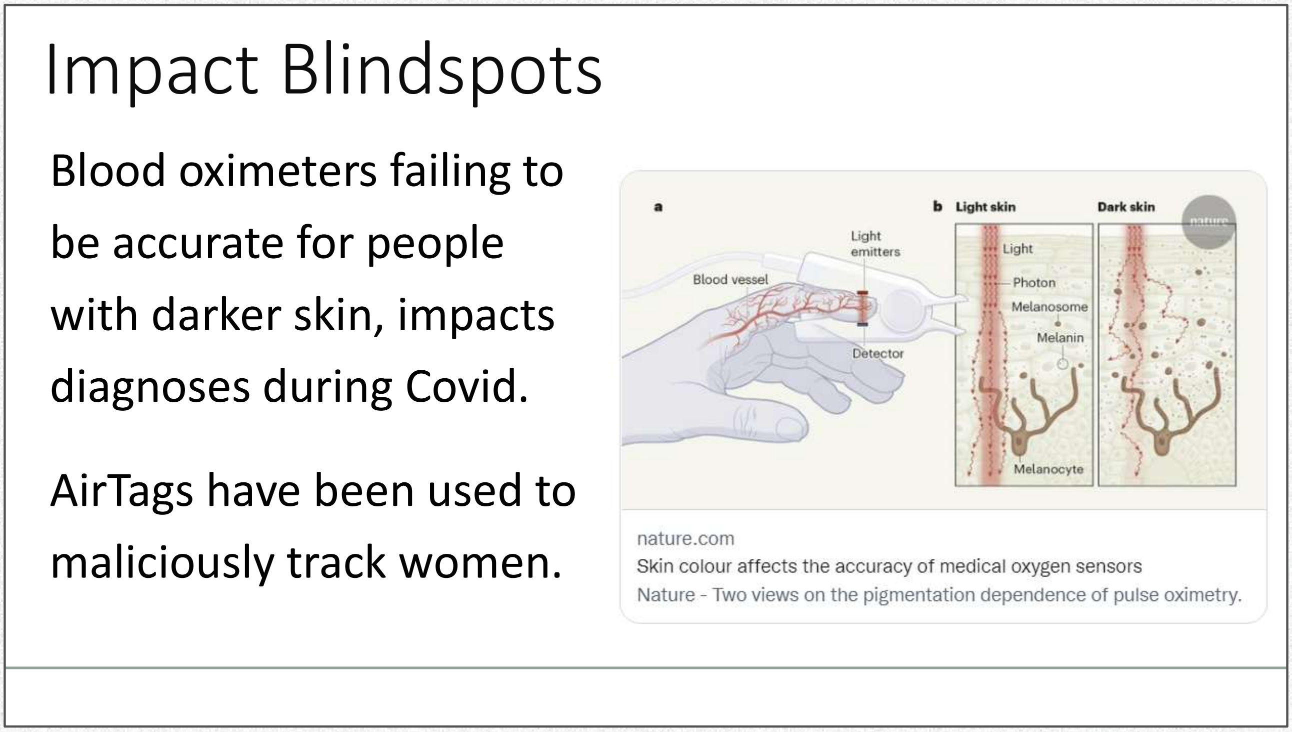
"The rocks on the right where (presumably) assembled by "objective" means, no human intervened, physical explanations should be able to capture how it "got like that. " [T]he rocks on the left... OTOH... can't VIOLATE physical laws... but their assembly includes a good deal of human judgment" — Jabe Bloom (@cyetain)

Just because we can, doesn't mean we should. But there is a lot to discern, and forces and pressures.

Consider rock stacking in river beds. "Rock stacking can be detrimental to the sensitive ecosystems of rivers and streams. Moving rocks from the river displaces important ecosystem structure for fish and aquatic invertebrates. Many of our Ausable River fish species lay eggs in crevices between rocks, and moving them can result in altered flows, which could wash away the eggs or expose the fry to predators. Salamanders and crayfish also make their homes under rocks, and rock moving can destroy their homes, and even lead to direct mortality of these creatures." (Ausable River Association website)

The point? Is that our impact adds up. How much should and could we think about? More than we have, typically? Yes, technology disrupts. Has positive and negative effects. Still, considerate design would have us think in terms of impacts.

***Diversity on the team is important, as is doing the work to understand impact***



# Impact Blindspots

Blood oximeters failing to be accurate for people with darker skin, impacts diagnoses during Covid.

AirTags have been used to maliciously track women.

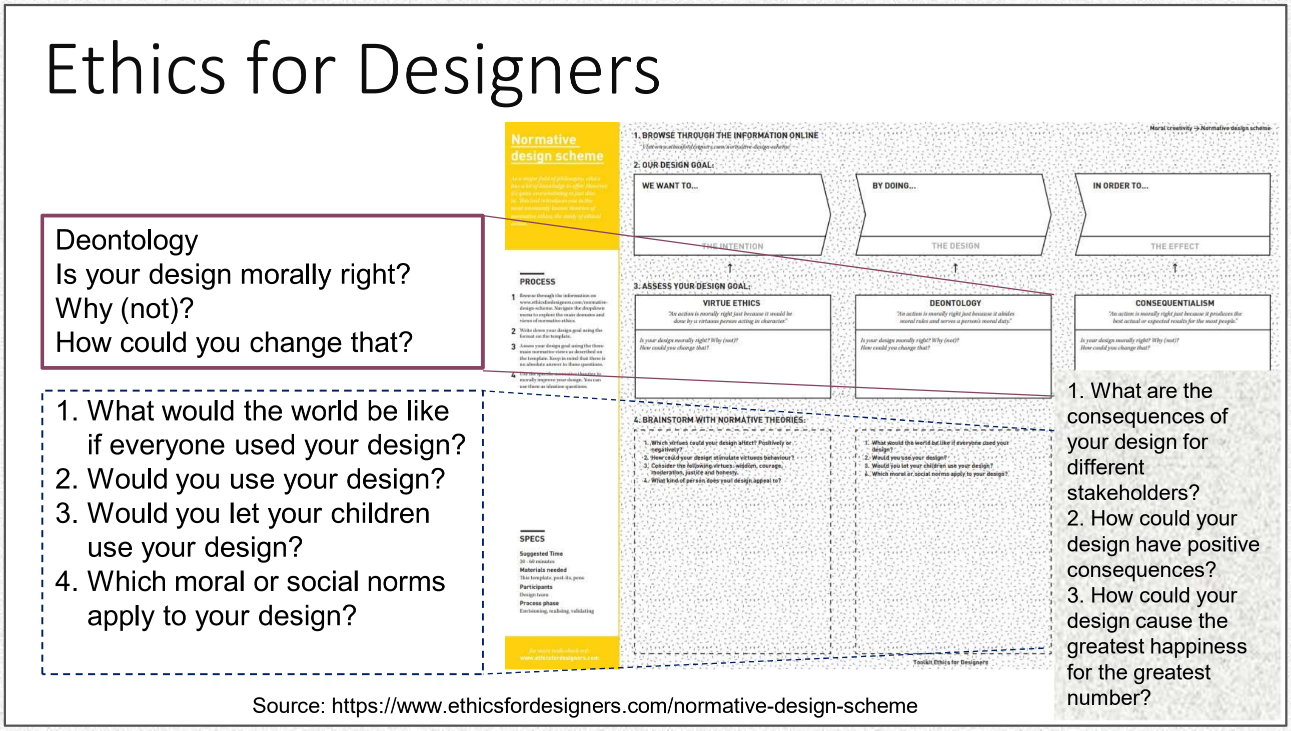
nature.com
Skin colour affects the accuracy of medical oxygen sensors
Nature - Two views on the pigmentation dependence of pulse oximetry.

## *Responsibilities and Outcomes*

Lore has it that “The ancient Romans had a tradition: whenever one of their engineers constructed an arch, as the capstone was hoisted into place, the engineer assumed accountability for his work in the most profound way possible: he stood under the arch.” (Michael Armstrong). Being around as a legacy system ages, is another way that we in software get to experience the impact of decisions made years, and even just days, ago… But our responsibilities aren’t just to our future selves, in development and operations. They are to users, and communities, and other creatures and ecosystems. And it can be hard to anticipate. This is not a get out of responsibility free card. We need to foster diverse teams and partner with others to research options and impacts (to anticipate, and as we build out the system, to probe and test impacts and outcomes). It’s work and part of this work is to explore for what our team and organization is set up to be blind to (e.g., strive to see from different points of view, and partner with impacted groups).

“Those of us developing software don’t need to be told what a big impact it’s had on humanity this century. I’ve long maintained that this places a serious responsibility on our profession. Whether asked to or not, we have a duty to ensure our systems don’t degrade our society.” — Martin Fowler, in the introduction to a post on Thoughtworks’ “Responsible Tech Playbook” at https://martinfowler.com/articles/2021-responsible-tech-playbook.html

> *"Given any design team organization, there is a class of design alternatives which cannot be effectively pursued by such an organization because the necessary communication paths do not exist."*
>
> *— Mel Conway*



## Ethics for Designers

Deontology
Is your design morally right?
Why (not)?
How could you change that?

1. What would the world be like if everyone used your design?
2. Would you use your design?
3. Would you let your children use your design?
4. Which moral or social norms apply to your design?

1. What are the consequences of your design for different stakeholders?
2. How could your design have positive consequences?
3. How could your design cause the greatest happiness for the greatest number?

Normative design scheme
Moral creativity → Normative design scheme
1. BROWSE THROUGH THE INFORMATION ONLINE
2. OUR DESIGN GOAL:
WE WANT TO...
BY DOING...
IN ORDER TO...
THE INTENTION
THE DESIGN
THE EFFECT
3. ASSESS YOUR DESIGN GOAL:
VIRTUE ETHICS
"An action is morally right just because it would be done by a virtuous person acting in character."
DEONTOLOGY
"An action is morally right just because it abides moral rules and serves a person's moral duty."
CONSEQUENTIALISM
"An action is morally right just because it produces the best actual or expected results for the most people."
Is your design morally right? Why (not)? How could you change that?
4. BRAINSTORM WITH NORMATIVE THEORIES:
1. Which virtues could your design affect? Positively or negatively?
2. How could your design stimulate virtuous behaviour?
3. Consider the following virtues: wisdom, courage, moderation, justice and honesty.
4. What kind of person does your design appeal to?
1. What would the world be like if everyone used your design?
2. Would you use your design?
3. Would you let your children use your design?
4. Which moral or social norms apply to your design?
PROCESS
SPECS
Suggested Time
30 - 60 minutes
Materials needed
This template, post-its, pens
Participants
Design team
Process phase
Envisioning, realising, validating
www.ethicsfordesigners.com
Toolkit Ethics for Designers

Source: https://www.ethicsfordesigners.com/normative-design-scheme

## *How Design Designs Us: Part 3 | The Ethics of Design*

Leyla Acaroglu writes:

"With all this rapid post-industrial revolution growth and technological advancement, we are beginning to see the fall-out of the avoidance of a singular question: how does what we design, design us?"

"Nearly everyone I interviewed had, at some point, learnt about the systemic implications of rapid innovation and how to make better decisions; yet, most of them still passed off the responsibility of 'right' decision making to someone else. It was the boss's, client's, manufacturer's, government's, or consumer's choice that would solve the problem that their production would participate in. When everyone within a system plays this hands-off, 'that's not my problem' game, the system is very quickly riddled with externalities… and a shit load of problems! This appears to be the case with the complex debate around the ethics of design and technology."

> *"Who is taking responsibility for the outcomes, externalities, and downright damaging impacts of our hyper-consumer, ever-changing landscape of new gadgets and virtual arenas that are coming on board at a lighting speed pace?"*
>
> *— Leyla Acaroglu*

Source: Leyla Acaroglu, How Design Designs Us: Part 3 | The Ethics of Design https://medium.com/disruptive-design/how-design-designs-us-part-3-the-ethics-of-design-ca40e33f5842#.5ur28he4l

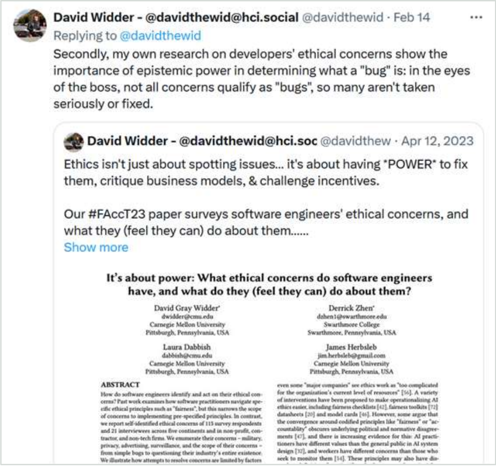
Some folk I value following, to learn more at the intersection of ethics and design: Abeba Birhane (@abebab); Alba Villamil (@albanvillamil)

*Not deciding and not acting, just means other things are (implicitly) being decided and acted on …*

# Where Not to Act is to Act

"In the end, there are no perfect solutions to leadership and management problems [..] But because the essence of leadership is action and responsibility, one cannot *not* act."

— Peter Vaill



David Widder - @davidthewid@hci.social @davidthewid · Feb 14

Replying to @davidthewid

Secondly, my own research on developers' ethical concerns show the importance of epistemic power in determining what a "bug" is: in the eyes of the boss, not all concerns qualify as "bugs", so many aren't taken seriously or fixed.

David Widder - @davidthewid@hci.soc @davidthew · Apr 12, 2023

Ethics isn't just about spotting issues... it's about having *POWER* to fix them, critique business models, & challenge incentives.

Our #FAccT23 paper surveys software engineers' ethical concerns, and what they (feel they can) do about them......

Show more

**It's about power: What ethical concerns do software engineers have, and what do they (feel they can) do about them?**

David Gray Widder*
dwidder@cmu.edu
Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

Derrick Zhen*
dzhen1@swarthmore.edu
Swarthmore College
Swarthmore, Pennsylvania, USA

Laura Dabbish
dabbish@cmu.edu
Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

James Herbsleb
jim.herbsleb@gmail.com
Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

**ABSTRACT**

How do software engineers identify and act on their ethical concerns? Past work examines how software practitioners navigate specific ethical principles such as "fairness", but this narrows the scope of concerns to implementing pre-specified principles. In contrast, we report self-identified ethical concerns of 115 survey respondents and 21 interviewees across five continents and in non-profit, contractor, and non-tech firms. We enumerate their concerns – military, privacy, advertising, surveillance, and the scope of their concerns – from simple bugs to questioning their industry's entire existence. We illustrate how attempts to resolve concerns are limited by factors

even some "major companies" see ethics work as "too complicated for the organization's current level of resources" [56]. A variety of interventions have been proposed to make operationalizing AI ethics easier, including fairness checklists [42], fairness toolkits [72] datasheets [20] and model cards [46]. However, some argue that the convergence around codified principles like "fairness" or "accountability" obscures underlying political and normative disagreements [47], and there is increasing evidence for this: AI practitioners have different values than the general public in AI system design [32], and workers have different concerns than those who seek to monitor them [34]. These principles may also have dis-

TECHNICAL
LEADERSHIP

## *Hard Things Are Still Hard*

Ethical matters often contain clear choices. And not so clear choices. And hard choices. A technology that takes away jobs in one area, may open up jobs or create solutions to a societal concern (treatments, etc.) in another. Not considering ethical choices, and their conflicts, doesn't make them go away (like some object permanence game).

Agnotology is culturally cultivated ignorance. Nescience is a term for constructed ignorance. Daniel R. DeNicola identified "five forms of nescience, distinguished by factors motivating a decision to barricade the boundary of knowledge: rational ignorance, strategic ignorance, willful ignorance, privacy and secrecy, forbidden knowledge." (PropCazhPM)

It can be useful to distinguish rational ignorance from strategic ignorance:

'This habit of feigning incompetence at a task, so as to make it someone else's responsibility, is called "weaponized incompetence," and can show up at work in a number of different ways.' (strategic ignorance)

'"rational ignorance" [is] ignorance we CHOOSE to retain. We make a decision that something isn't worth knowing, or the benefits of learning X would not outweigh the investment of learning X.'

— @PropCazhPM (on twitter)

*"the ability to hold two opposing ideas in mind at the same time and still retain the ability to function. One should, for example, be able to see that things are hopeless yet be determined to make them otherwise."*
*— F. Scott Fitzgerald*

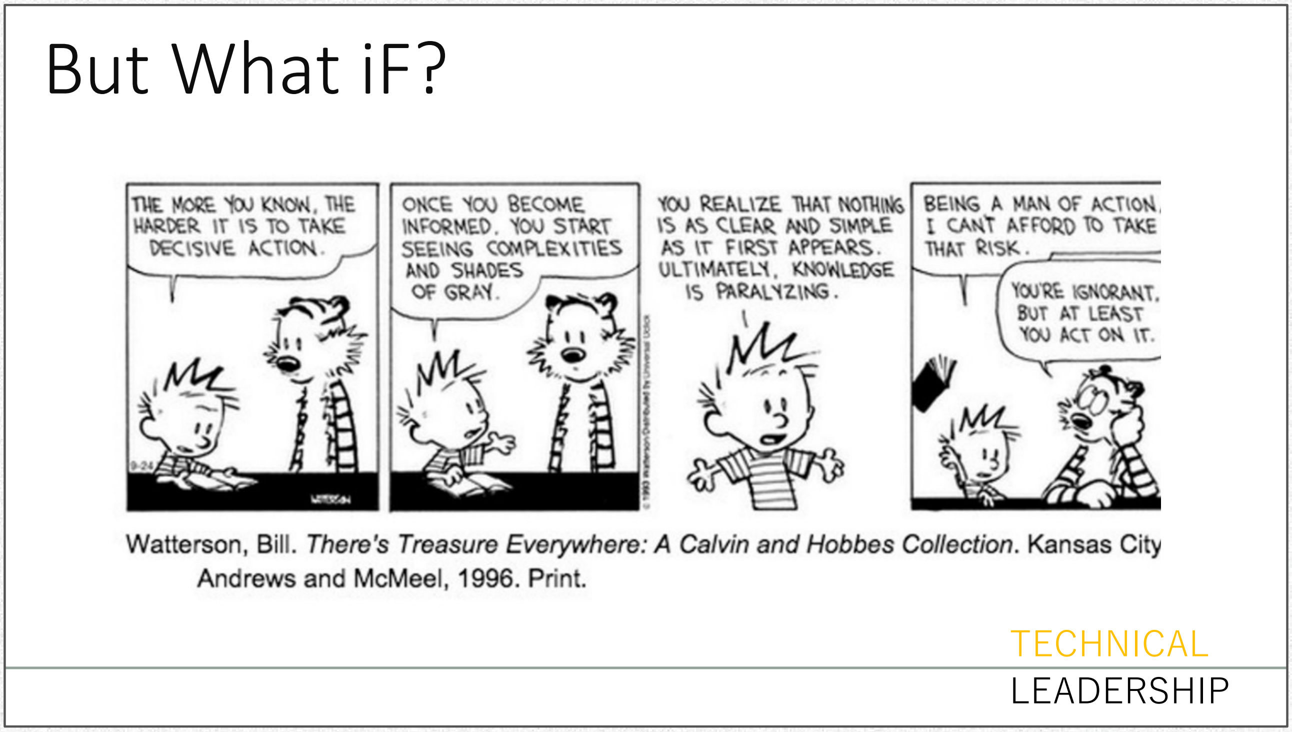
Recommended:

Daniel R. DeNicola, *Understanding Ignorance*

Philosophytube (Abigail Thorn) episode on *Ignorance and Censorship*

*Shannon Mattern, Modeling Doubt, https://www.youtube.com/watch?v=b6ogLgWnpes&t=891s*

*Not deciding and not acting, just means other things are being decided and acted on …*



# But What iF?

THE MORE YOU KNOW, THE HARDER IT IS TO TAKE DECISIVE ACTION.
ONCE YOU BECOME INFORMED, YOU START SEEING COMPLEXITIES AND SHADES OF GRAY.
YOU REALIZE THAT NOTHING IS AS CLEAR AND SIMPLE AS IT FIRST APPEARS. ULTIMATELY, KNOWLEDGE IS PARALYZING.
BEING A MAN OF ACTION, I CAN'T AFFORD TO TAKE THAT RISK.
YOU'RE IGNORANT. BUT AT LEAST YOU ACT ON IT.

Watterson, Bill. *There's Treasure Everywhere: A Calvin and Hobbes Collection*. Kansas City Andrews and McMeel, 1996. Print.

TECHNICAL
LEADERSHIP

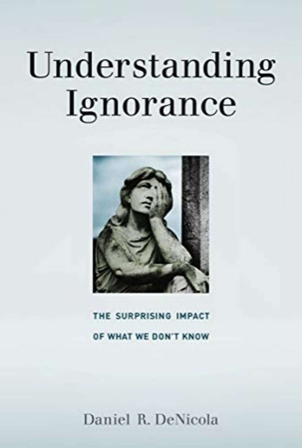
## *Hard Things Are Still Hard*

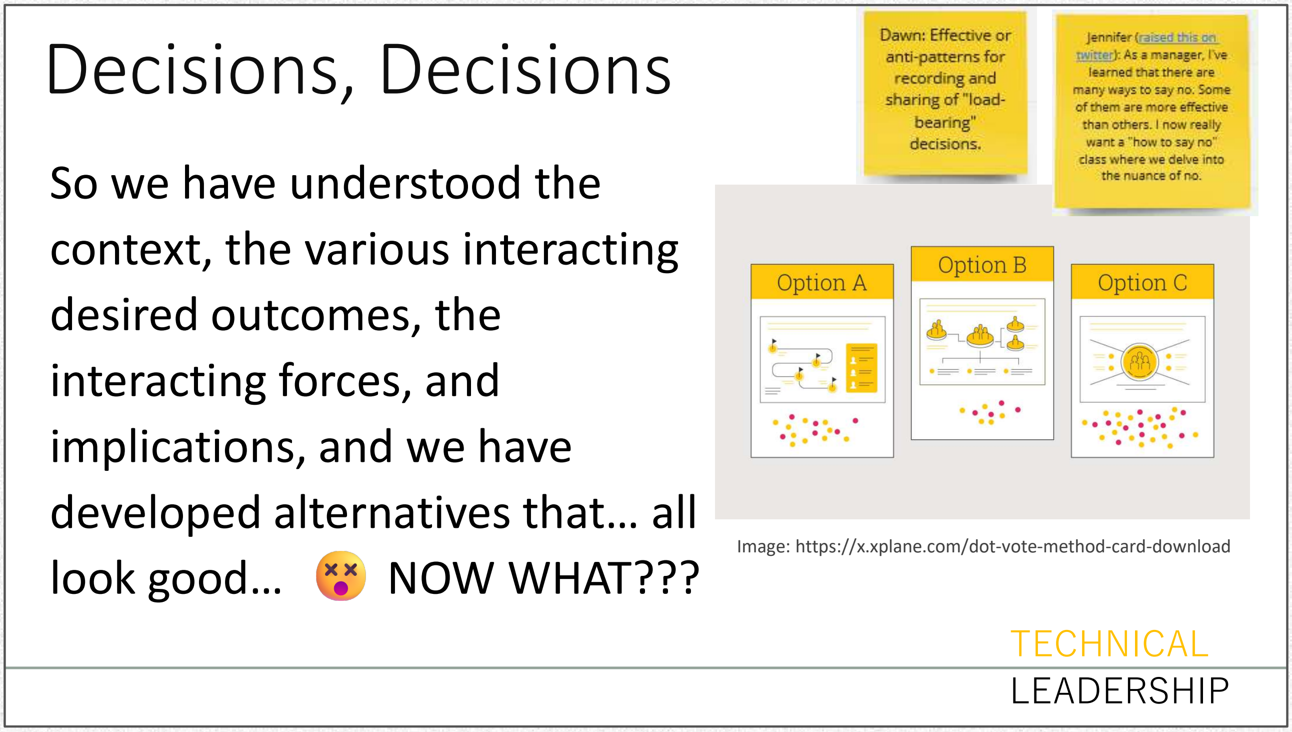
"Any adequate theory of knowledge or philosophy of education must incorporate an understanding of ignorance. Ignorance is neither a pure or a simple concept... In its house are many mansions. It is both an accusation and a defense..” [..]

"Ignorance is a scourge, but it also may be a refuge, a valve, even an accompaniment to virtue.. Ignorance is a many-splendored thing..."

— Daniel R. DeNicola, *Understanding Ignorance: The Surprising Impact of What We Don't Know*

*"Now I believe I can hear the philosophers protesting that it can only be misery to live in folly, illusion, deception and ignorance, but it isn't — it's human."*
*— Desiderius Erasmus*





## Decisions, Decisions

So we have understood the context, the various interacting desired outcomes, the interacting forces, and implications, and we have developed alternatives that… all look good… 😵 NOW WHAT???

Dawn: Effective or anti-patterns for recording and sharing of "load-bearing" decisions.

Jennifer (raised this on twitter): As a manager, I've learned that there are many ways to say no. Some of them are more effective than others. I now really want a "how to say no" class where we delve into the nuance of no.

Image: https://x.xplane.com/dot-vote-method-card-download

TECHNICAL
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### *Decisions Are About Choices*

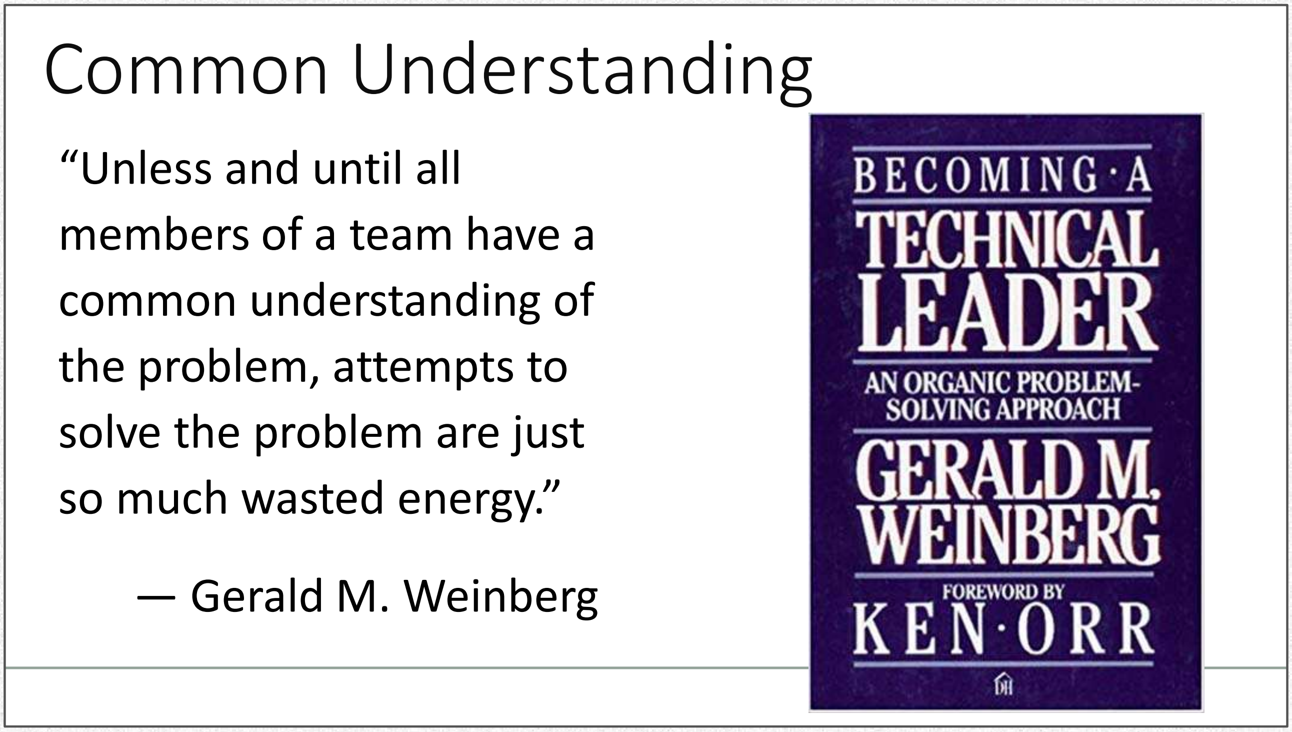
Sometimes we'll do this work, and the choice is clear. Or we pick the most intuitive path based on our experience and best sense of what to do with limited time, and attention and resources.  Other times, it's hard — the choice may not be clear, or those involved may be split on what alternative is preferred. It is all the more difficult (and potentially fractious), if it's a crucial decision that much depends on.

Some ways to winnow the choice set: dot voting and attempts to converge; play "vote off the island," voting the least preferred out of the consideration set (and then considering factors like minimization of regret). A powerful approach, is to go back to the notion of reversibility, and consider how to make the decision testable in a short timeframe, before too much depends on it and while it is still reversible.

For those who disagree, we can ask: what would it take, to make this approach work for you? Or: if you partially agree, is this sufficient to try out, and what should we explore first to address your concerns?

### *Hard Choices*

When we're working across the system, strategically and structurally significant decisions need to be made from a system — not local (to a part) — perspective.  So not only do they impact different people — stakeholders (the ones with stakes, to quote Tom Graves) — but they are things people care about, and have strong, but different, opinions about. They are seen from different vantage points where there are different pressure points, by different teams and their people, responsible for different pieces of the system. We work across the system. And across the turfs and charters of teams, and individuals, and functions. Well. All this means that people will see things differently. Care about them differently. And as leaders we need to make decisions to meet broader system or organizational goals. Decisions that will sometimes look suboptimal from the perspective of local goals.  These decisions need to be communicated effectively, so that progress can be made even if there isn't uniform agreement.



## Common Understanding

"Unless and until all members of a team have a common understanding of the problem, attempts to solve the problem are just so much wasted energy."

— Gerald M. Weinberg

BECOMING·A
TECHNICAL
LEADER
AN ORGANIC PROBLEM-SOLVING APPROACH
GERALD M.
WEINBERG
FOREWORD BY
KEN·ORR

## Some Ways to Develop Common Understanding

We orient to working together, especially in ways that draw out assumptions and ideas, so that we can ask questions and probe (work them out, as well as instrument, to better assess) and respond to them together. Working together (ensemble design as well as ensemble programming) is a rich way to build common ground and shared understanding.  But when teams (of teams) get too large for this to be particularly effective, we start to rely on a more fractal approach, with smaller teams. As much as we can, we involve team members to work collaboratively on addressing concerns that cut across teams. Still, proactive system identity and integrity defining work, needs perspective and leadership across boundaries. There's also the matter of building organizational will to do bigger things that impact various teams. At any rate, even where everyone can't be involved, drawing in some of those who'll be impacted, helps to bring ideas and concerns into the decision making, and builds understanding among those who can share it in their teams. In other words, working organically, through participation, broadens the set of those who can tell the story of the system, its architecture and key decisions. We still need to write significant decisions down (and describe architectural models and their implications) and talk about them.

"[The basic compact of joint activity] includes an expectation that the parties will repair faulty knowledge, beliefs, and assumptions when these are detected. Common ground is not a state of having the same knowledge, data, and goals. Rather, common ground refers to a process of communicating, testing, updating, tailoring, and repairing mutual understandings"

— Klein et al, Common Ground and Coordination in Joint Activity

*If you are a good leader,*
*Who talks little,*
*They will say,*
*When your work is done,*
*And your aim fulfilled,*
*"We did it ourselves."*
*— Lao Tse*

*"He who establishes his argument by noise and command shows that his reason is weak."*
*– Michel de Montaigne*

***Communicate to increase shared understanding and underscore priorities***

## Communicate, Communicate

"The longer I'm a leader, the more I realize that communicating something once is the equivalent of not communicating it at all. Communicate the [th/b]ring repeatedly until they literally ask you to stop."

— Nivia Henry

Image source: Nivia Henry (@lanooba) with permission

TECHNICAL
LEADERSHIP

### *Go Ahead, Repeat Yourself*

I really have to remind myself that I not only get to repeat myself, but I MUST repeat myself -- for the benefit of others. Contrast this (apocryphal??) interchange:

> "Simplify, simplify" — H. D. Thoreau
>
> 'One "simplify" would have sufficed' — Ralph Waldo Emerson

with Eberhardt Rechtin's:

> "Simplify, simplify, Simplify"

And recall he also said:

> "Communicate, Communicate, Communicate"

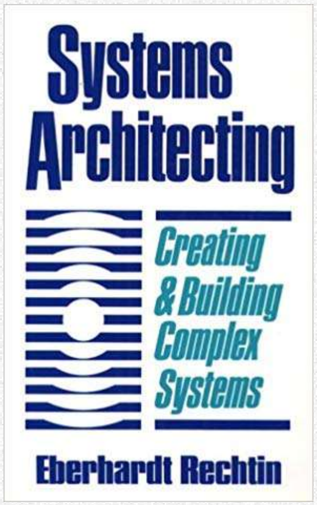
So much competes for attention, we miss things. And there are things we don't understand at first, and need to hear again, perhaps another way. Communicating helps increase awareness – of the decision and its ramifications, and implications we may not have been aware of. Conversations move understanding around. We need to keep having them, and drawing attention to what is important, or subtle or overlooked. We're helping to build shared understanding of critical shaping decisions, whether its architecture, product direction, strategy, or other matters of importance to system integrity and business outcomes.

"bring" was a typo (for thing), but I liked it — communicating what we're doing, why it matters and how that's important for the system (us/stakeholders/..).

In addition to our words, there's what is communicated by our actions.

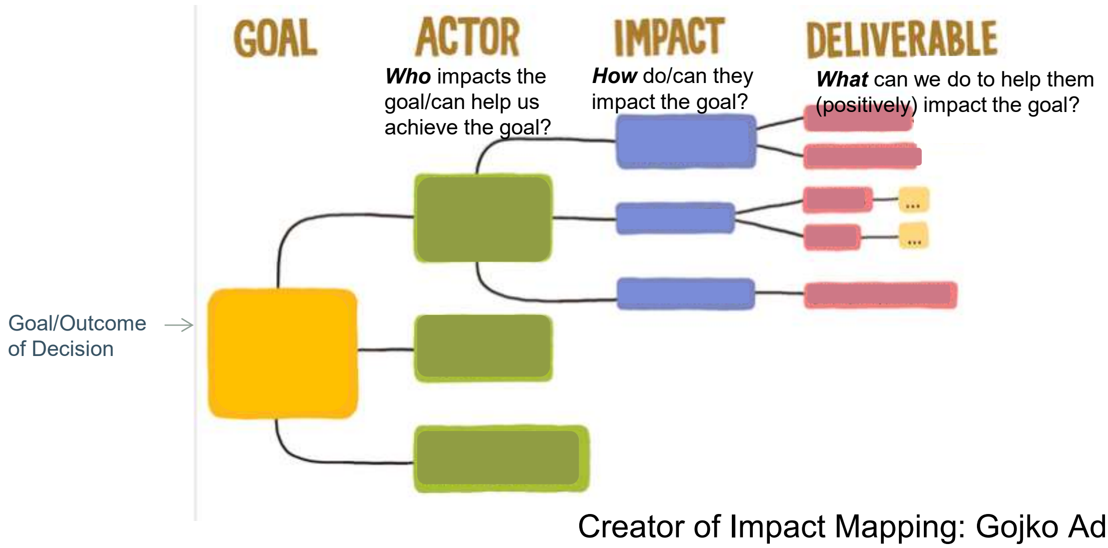
*"Don't ever stop talking about the system"*

*— Eb Rechtin*



*Explore the decision in terms of who needs to be enabled and how*

# Impact Mapping and Enablement



GOAL

ACTOR

***Who*** impacts the goal/can help us achieve the goal?

IMPACT

***How*** do/can they impact the goal?

DELIVERABLE

***What*** can we do to help them (positively) impact the goal?

Goal/Outcome of Decision

Creator of Impact Mapping: Gojko Adzic

Image adapted from: https://www.impactmapping.org/example.html

## *Impact Mapping*

We can use impact mapping to explore how to make the decision successful, organizationally. What information do teams need, in what format? What capabilities do they need to build and how can we help?

### *Impact Mapping Template*

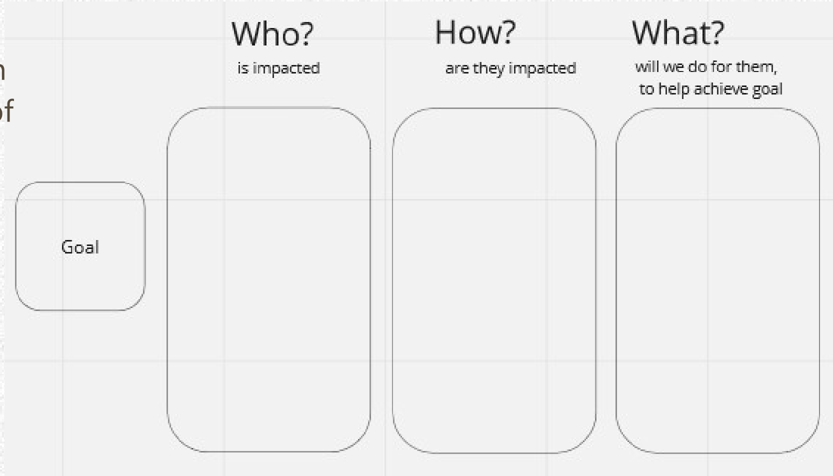
"*Goal*: The centre of an impact map answers the most important question: Why are we doing this? This is the goal we are trying to achieve.

*Actors* : The first branch of an impact map provides answers to the following questions: Who can produce the desired effect? Who can obstruct it? Who are the consumers or users of [our decision]? Who will be impacted by it? These are the actors who can influence the outcome.

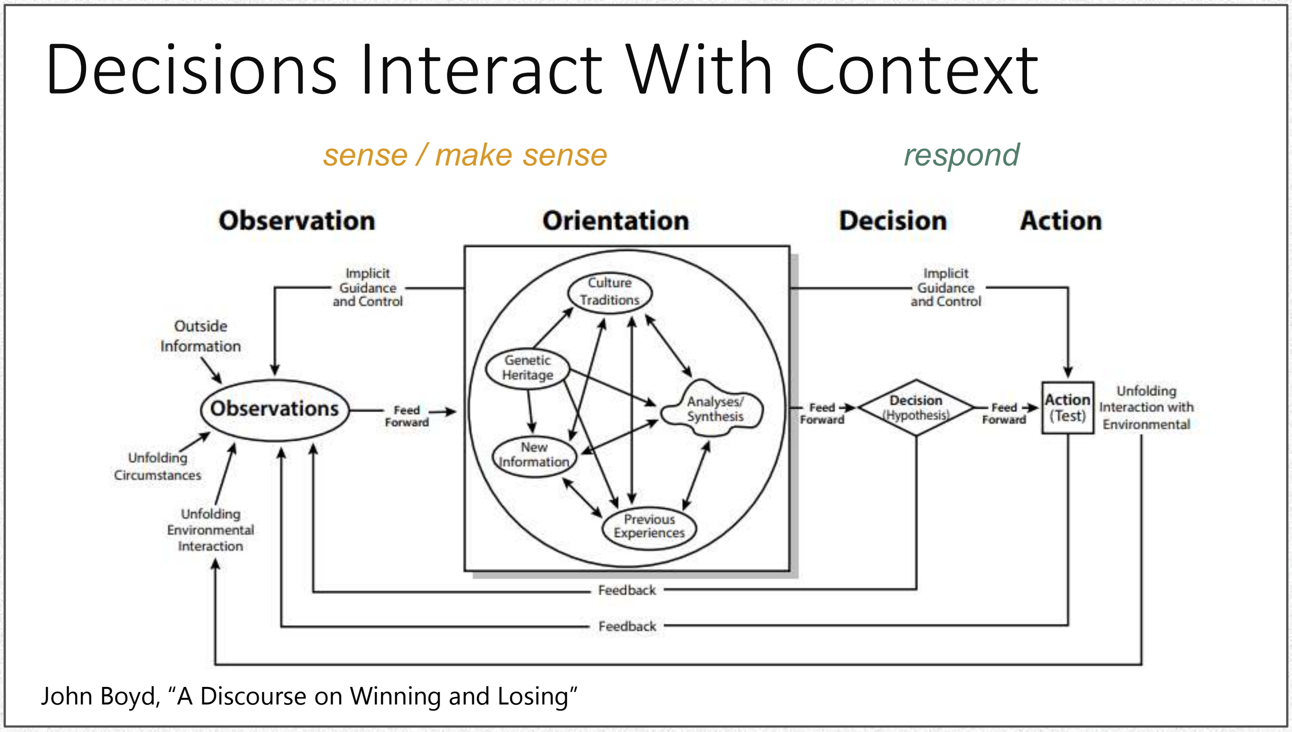
*Impacts*: Next, we answer the following questions: How would our actors' behaviour need to change? How can they help us to achieve the goal? How can they obstruct or prevent us from succeeding? These are the impacts that we're trying to create.

*Deliverables*: Once we have the first three questions answered, we can talk about scope. The third branch level of an impact map answers the following question: What can we do, to support the required impacts?"

Source: https://www.impactmapping.org/drawing.html



## *Boyd's Observe Orient Decide Act (OODA) Loop of loops*



# Decisions Interact With Context

John Boyd, "A Discourse on Winning and Losing"

## *Decisions Orient; Decisions Interact with Context; It's Loopy!*

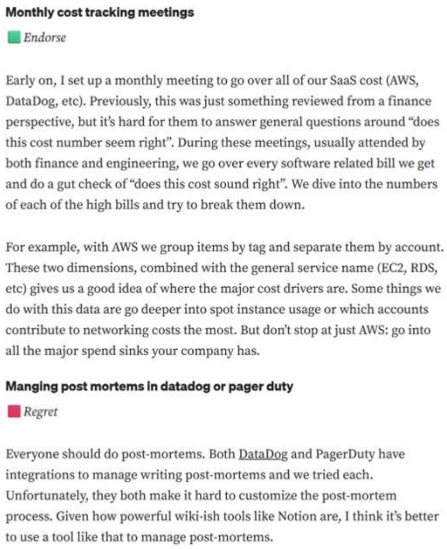
The OODA loop is a simplification, for all its depiction of feedback loops. While we're making decisions, we need information and re-enter observe/orient or sense/make sense stances and activities. Our evolving understanding changes our perception of the context. Our decisions change actions, potentially already underway. Actions change the context. And so forth.

***Review decisions on some established cadence, and sooner if needed***

# Shift Happens; Revisit Decisions

"(Almost) Every infrastructure decision I endorse or regret after 4 years running infrastructure at a startup" by Jack Lindamood

https://medium.com/@cep21/almost-every-infrastructure-decision-i-endorse-or-regret-after-4-years-running-infrastructure-at-d2aeba3b6a45



**Monthly cost tracking meetings**

🟩 *Endorse*

Early on, I set up a monthly meeting to go over all of our SaaS cost (AWS, DataDog, etc). Previously, this was just something reviewed from a finance perspective, but it's hard for them to answer general questions around "does this cost number seem right". During these meetings, usually attended by both finance and engineering, we go over every software related bill we get and do a gut check of "does this cost sound right". We dive into the numbers of each of the high bills and try to break them down.

For example, with AWS we group items by tag and separate them by account. These two dimensions, combined with the general service name (EC2, RDS, etc) gives us a good idea of where the major cost drivers are. Some things we do with this data are go deeper into spot instance usage or which accounts contribute to networking costs the most. But don't stop at just AWS: go into all the major spend sinks your company has.

**Manging post mortems in datadog or pager duty**

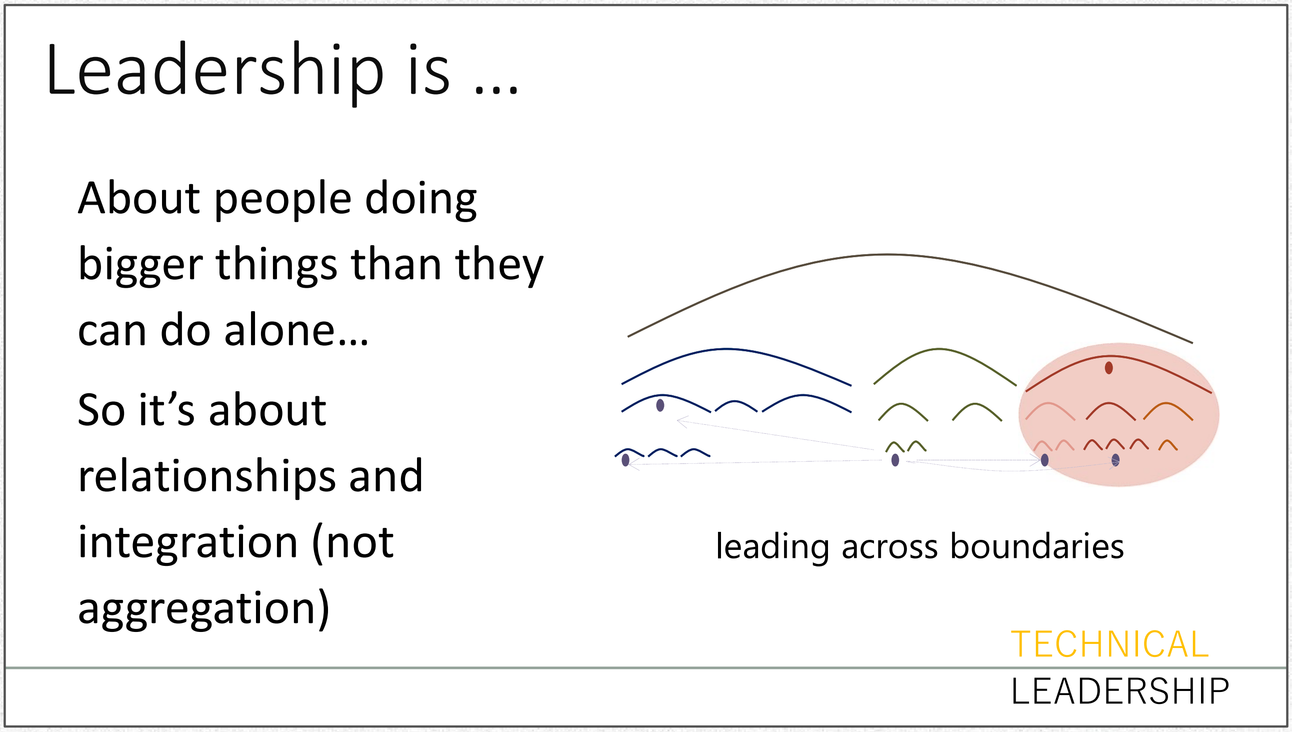
🟥 *Regret*

Everyone should do post-mortems. Both DataDog and PagerDuty have integrations to manage writing post-mortems and we tried each. Unfortunately, they both make it hard to customize the post-mortem process. Given how powerful wiki-ish tools like Notion are, I think it's better to use a tool like that to manage post-mortems.

## *Review Decisions*

Contexts shift. Afterall, the very technology and systems we're creating, are inducing shifts, and others are too. And we're learning. And by reviewing decisions for how they're holding up under the stresses and strains of evolution, operation, and use, we give ourselves the opportunity to learn, to revise, and to share the learning.

Jack Lindamood's review of technology choices they made, is a great example of such a reflection. Read it. You may not share the experiences; the whole point is that situations differ, and decisions or choices need to be with respect to the concerns and forces and constraints of the situation.



Leadership is …

About people doing bigger things than they can do alone…

So it's about relationships and integration (not aggregation)

leading across boundaries

TECHNICAL
LEADERSHIP

## *Unique Perspective*

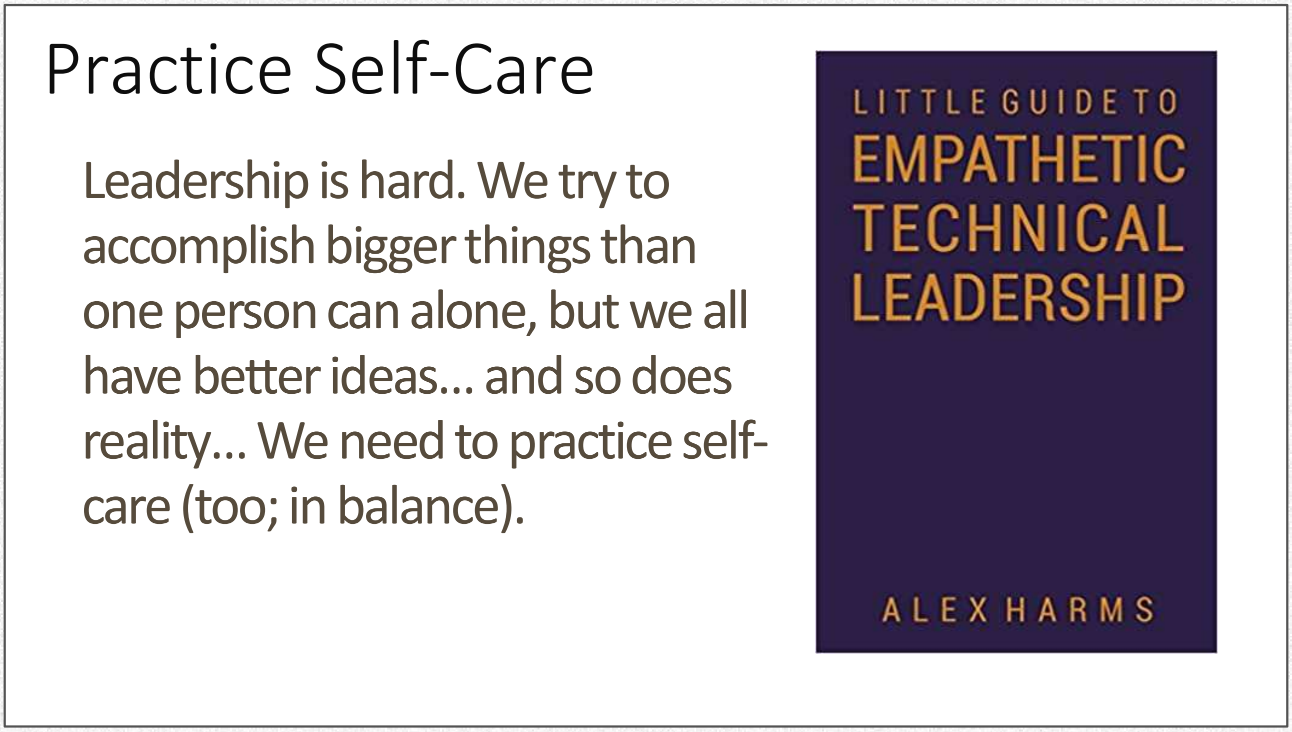
Leading, whether informal/ad hoc or a demand of a role, happens across – across responsibilities and organizational space. And for whatever scope we're leading across, we have commitments that relate to the systems, subsystems, or initiatives we're responsible for and to, at the scope. This may be formally associated with our role, or informal, if it's an initiative we see a need for, and have stepped up to lead on. Those commitments are to outcomes, and to those we lead.

To re-iterate for emphasis: we design, and we lead, to make things more the way they ought to be. We lead, to make it more a matter of *we*. And to discover, together, how things are, and ought to be. Still, we have a unique vantage point. Unique because of what we bring, but also because the organization gives us, or we take on, a unique *across* perspective.

This uniqueness of commitment and perspective means that we have a unique opportunity, and need, to develop our expertise in the very unique systems space we have taken on leadership responsibility for. It's not often that I write "unique" three times in a sentence, but I want to explain why this "observe" section is so important. We're noticing, to respond skillfully. And we're perceiving and building a point of view and expertise that no-one else is in a position to build.

> *"Reality is sedimented out of the process of making the world intelligible through certain practices and not others. Therefore, we are not only responsible for the knowledge that we seek but, in part, for what exists."*
>
> *— Karen Barad*

> *"Listen to the wisdom of the system."*
>
> *— Donella Meadows*



## Practice Self-Care

Leadership is hard. We try to accomplish bigger things than one person can alone, but we all have better ideas… and so does reality… We need to practice self-care (too; in balance).

LITTLE GUIDE TO EMPATHETIC TECHNICAL LEADERSHIP

ALEX HARMS

### *Leading is Hard; It's Work*

Leadership is hard. And even if we, as an organization and as individuals, embrace failures as key to learning and being responsive in changing, even volatile, contexts and situations, it takes a toll. We strive to get things more right, more the way they ought to be, and it's a load; there are cognitive, relational and emotional pressures, forces, currents, alignments and misalignments, ⋯ and it's a lot. A lot!

I've made points along these lines already, but it bears repeating:

> "Does your role involve being an "integrator" across teams?
>
> Supporting. Connecting. Cohering. Resolving. Balancing. Listening. Translating. Absorbing.
>
> If so, there is a good chance you have a view of your organization that no one has (not even the CEO).
> — John Cutler

This is important too:

> "You are taking on an emotional burden that most people don't take on. And you are shouldering an emotional burden that often goes unrecognized and unappreciated…and unpaid."
> — John Cutler

**Be kind.** Also to yourself.

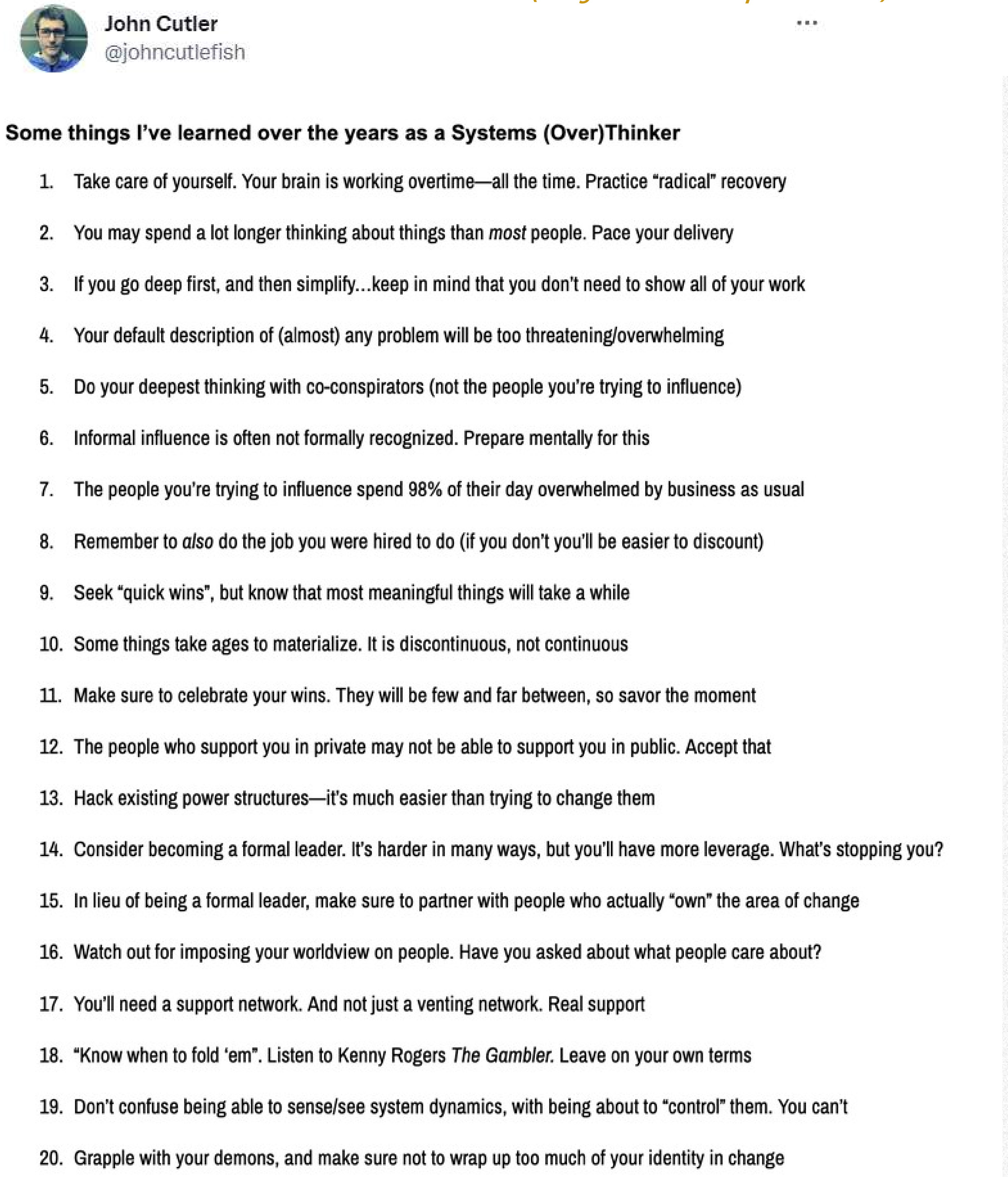
*"When is the right time to talk about the crushing pressures middle managers face?*

*We're trapped between top down leadership w/ varying levels of competence & ambition; and frustrated lower level employees who think we hold infinite power & are the barriers to their happiness."*

*— Nivia Henry*

Source: John Cutler, https://cutlefish.substack.com/p/tmb-4252-the-integrator-burden

***It's still hard, so practice self-empathy as well as self-awareness (being aware of our impact on others)***



John Cutler
@johncutlefish

**Some things I've learned over the years as a Systems (Over)Thinker**

1. Take care of yourself. Your brain is working overtime—all the time. Practice "radical" recovery
2. You may spend a lot longer thinking about things than *most* people. Pace your delivery
3. If you go deep first, and then simplify...keep in mind that you don't need to show all of your work
4. Your default description of (almost) any problem will be too threatening/overwhelming
5. Do your deepest thinking with co-conspirators (not the people you're trying to influence)
6. Informal influence is often not formally recognized. Prepare mentally for this
7. The people you're trying to influence spend 98% of their day overwhelmed by business as usual
8. Remember to *also* do the job you were hired to do (if you don't you'll be easier to discount)
9. Seek "quick wins", but know that most meaningful things will take a while
10. Some things take ages to materialize. It is discontinuous, not continuous
11. Make sure to celebrate your wins. They will be few and far between, so savor the moment
12. The people who support you in private may not be able to support you in public. Accept that
13. Hack existing power structures—it's much easier than trying to change them
14. Consider becoming a formal leader. It's harder in many ways, but you'll have more leverage. What's stopping you?
15. In lieu of being a formal leader, make sure to partner with people who actually "own" the area of change
16. Watch out for imposing your worldview on people. Have you asked about what people care about?
17. You'll need a support network. And not just a venting network. Real support
18. "Know when to fold 'em". Listen to Kenny Rogers *The Gambler.* Leave on your own terms
19. Don't confuse being able to sense/see system dynamics, with being about to "control" them. You can't
20. Grapple with your demons, and make sure not to wrap up too much of your identity in change

Source: John Cutler, https://twitter.com/johncutlefish/status/1518361842342453248

# (Not) an Ending

"You are your own stories."
— Toni Morrison

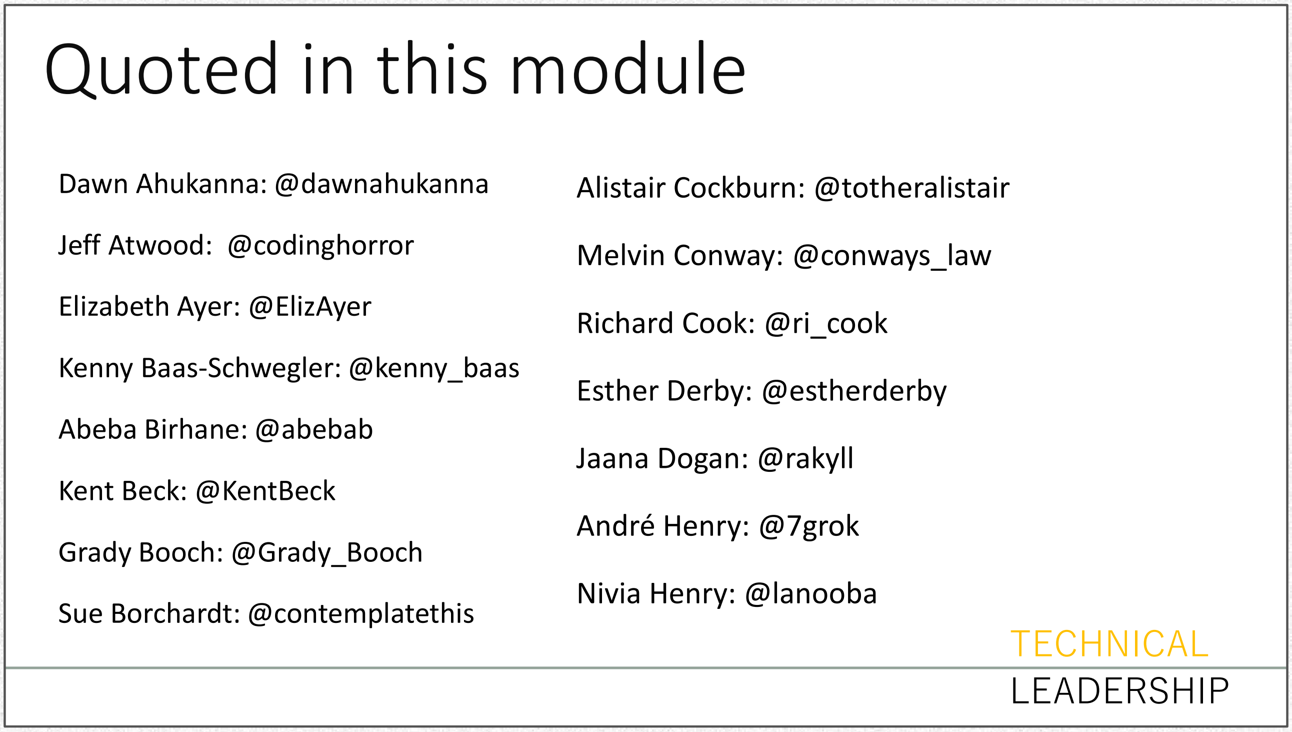
## *The Conversation Continues*

I quoted Nivia Henry a couple of pages back. It was a tweet from October 2021, that started several conversations (not just in replies, but other tweets and blog posts), exploring manager-of-managers and other "integrator" roles. And so it goes. Conversations. Experiments. Pushing different areas of our understanding, scaffolding and enabling what we are able to do, and do together. Leadership is messy; it's not governed by some rules of physics, though to cope we chunk, and scope, and focus, and synthesize and are demanding and are kind and are emphatically confidently assertive and nuanced and humble and more.

So the learning is punctuated here and there, but it's also an ongoing journey.  And we have company along some parts of the path. On Twitter, Mastodon, Bluesky or Linkedin and Discord.  See you there.

Source: Toni Morrison's Commencement Address to the Wellesley College Class of 2004 https://www.wellesley.edu/events/commencement/archives/2004commencement/commencementaddress

*"Of course, you're general, but you're also specific. A citizen and a person, and the person you are is like nobody else on the planet. Nobody has the exact memory that you have. What is now known is not all what you are capable of knowing. You are your own stories and therefore free to imagine and experience what it means to be human without wealth. What it feels like to be human without domination over others, without reckless arrogance, without fear of others unlike you, without rotating, rehearsing and reinventing the hatreds you learned in the sandbox. And although you don't have complete control over the narrative (no author does, I can tell you), you could nevertheless create it." —Toni Morrison*



# Quoted in this module

Dawn Ahukanna: @dawnahukanna

Jeff Atwood:  @codinghorror

Elizabeth Ayer: @ElizAyer

Kenny Baas-Schwegler: @kenny_baas

Abeba Birhane: @abebab

Kent Beck: @KentBeck

Grady Booch: @Grady_Booch

Sue Borchardt: @contemplatethis

Alistair Cockburn: @totheralistair

Melvin Conway: @conways_law

Richard Cook: @ri_cook

Esther Derby: @estherderby

Jaana Dogan: @rakyll

André Henry: @7grok

Nivia Henry: @lanooba

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> *"There is a Zulu phrase, 'Umuntu ngumuntu ngabantu', which means 'A person is a person through other persons.'*
>
> *— Abeba Birhane*

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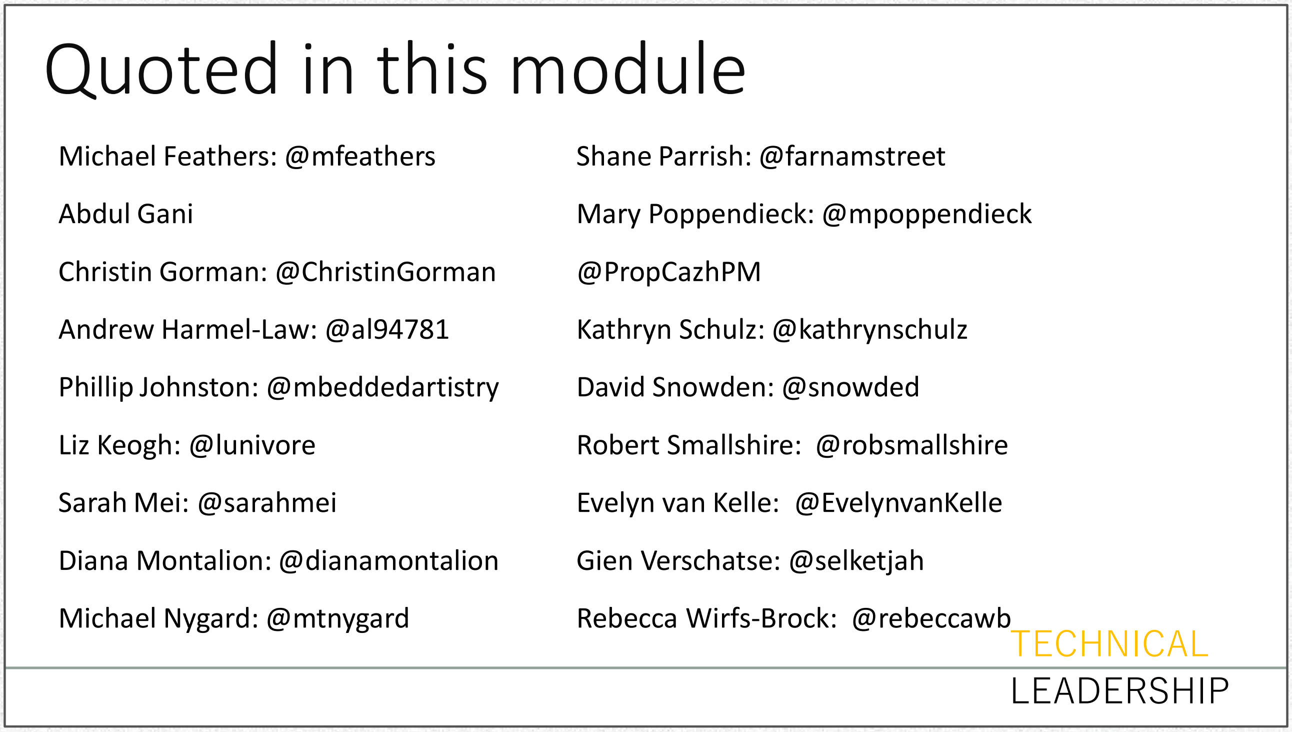

# Quoted in this module

Michael Feathers: @mfeathers

Abdul Gani

Christin Gorman: @ChristinGorman

Andrew Harmel-Law: @al94781

Phillip Johnston: @mbeddedartistry

Liz Keogh: @lunivore

Sarah Mei: @sarahmei

Diana Montalion: @dianamontalion

Michael Nygard: @mtnygard

Shane Parrish: @farnamstreet

Mary Poppendieck: @mpoppendieck

@PropCazhPM

Kathryn Schulz: @kathrynschulz

David Snowden: @snowded

Robert Smallshire: @robsmallshire

Evelyn van Kelle: @EvelynvanKelle

Gien Verschatse: @selketjah

Rebecca Wirfs-Brock: @rebeccawb

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> "We know from everyday experience that a person is partly forged in the crucible of community."
>
> —Abeba Birhane

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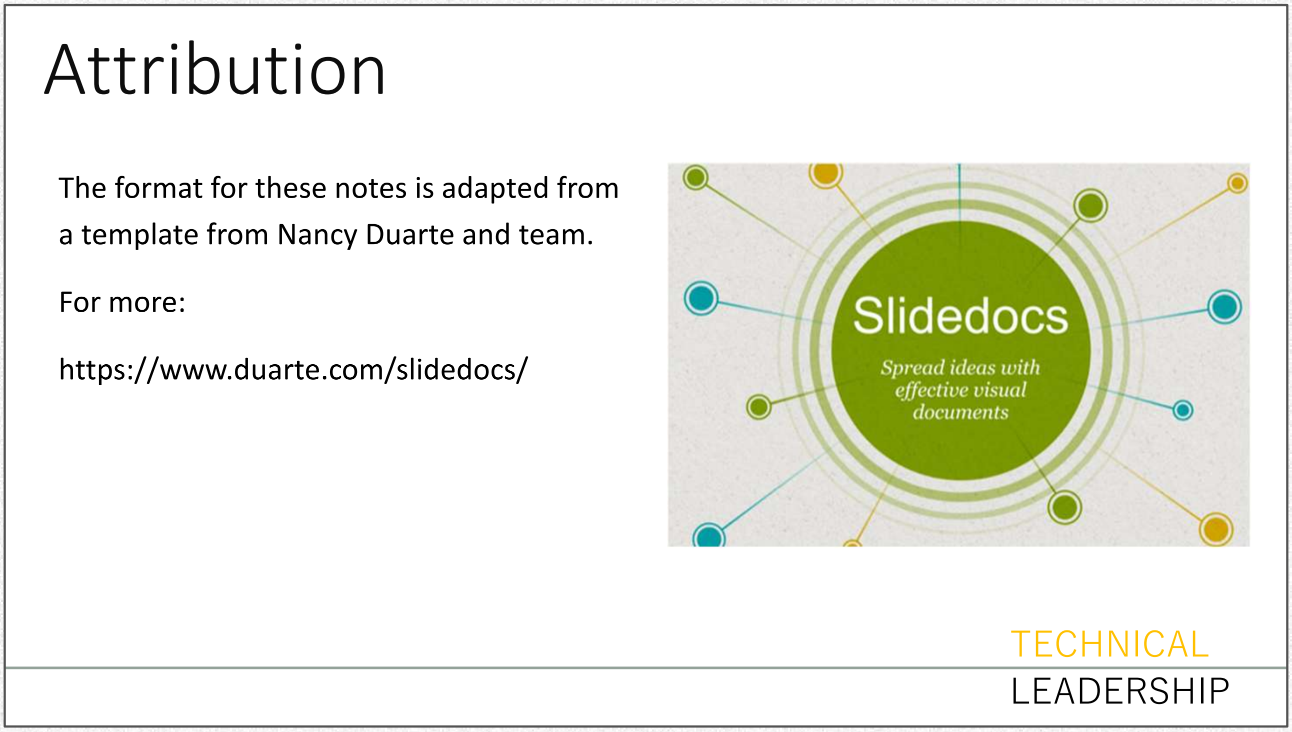

# Attribution

The format for these notes is adapted from a template from Nancy Duarte and team.

For more:

https://www.duarte.com/slidedocs/

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## *Duarte Slidedocs®*

We recommend the Duarte material on slidedocs® in addition to the template; much that is valuable there.

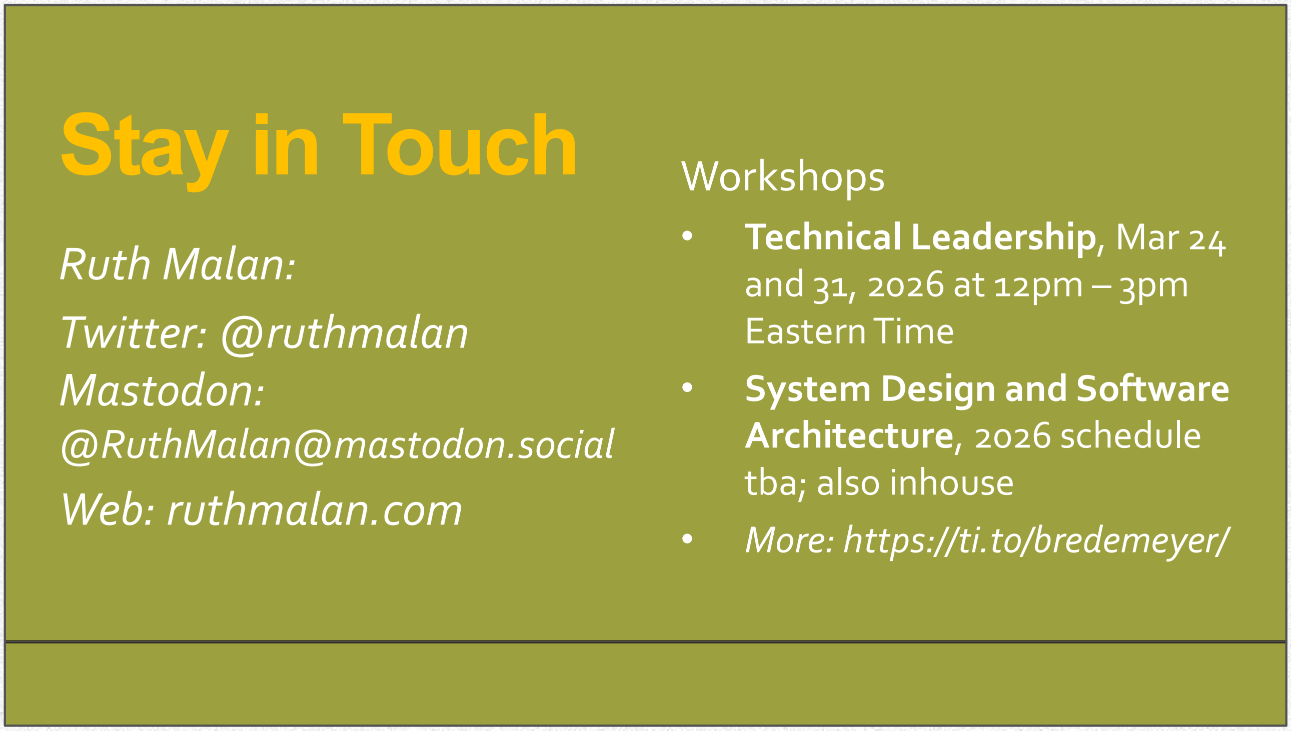
## *Quotes and Photos*

We have consciously brought various pioneers and contemporaries visibly into our materials for two reasons:

i. to acknowledge and celebrate the extent to which we are because of others (Abeba Birhane). It is a small way to bring into the room, so to speak, with us people whose insights and work has influenced us, and integrated with our experiences, other reading and conversations, and more, to build what we understand and can share.

ii. to recommend to you wonderful work you may want follow up on, and also to draw in our contemporaries who are sharing insights that you too may find useful, and want to follow them on twitter, etc.

> *"Act always so as to increase the number of choices.'*
> *— Heinz von Foerster*



## Stay in Touch

*Ruth Malan:*

*Twitter: @ruthmalan*
*Mastodon: @RuthMalan@mastodon.social*

*Web: ruthmalan.com*

Workshops

- **Technical Leadership**, Mar 24 and 31, 2026 at 12pm – 3pm Eastern Time
- **System Design and Software Architecture**, 2026 schedule tba; also inhouse
- *More: https://ti.to/bredemeyer/*

> *"What we care about is the productive life, and the first test of the productive power of the collective life is its nourishment of the individual. The second test is whether the contributions of individuals can be fruitfully united"*
> *— Mary Parker Follett*