

SATURN 2019

Design Leadership

Ruth Malan

Carnegie Mellon University
Software Engineering Institute

@ruthmalan

DESIGN LEADERSHIP

Design Excellence

- Leadership in the market

Design Leadership

- Leadership in the organization

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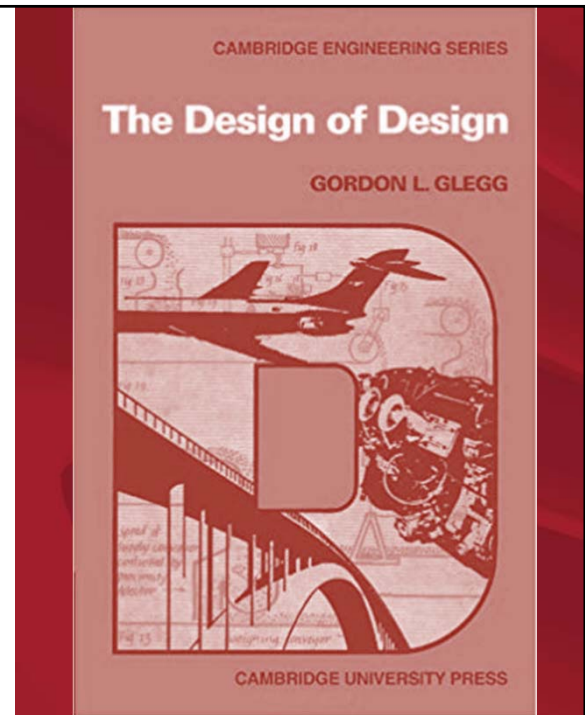
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DESIGN LEADERSHIP

The Design of the Problem

The Design of the Designer

The Design of Design



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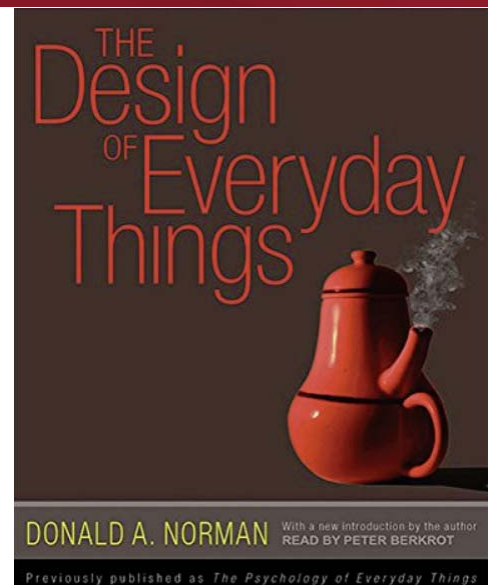
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Design Excellence is **NOT?**

To understand what something *is*, it helps to identify what it *is not*

Exercise (a):

What characterizes bad design?



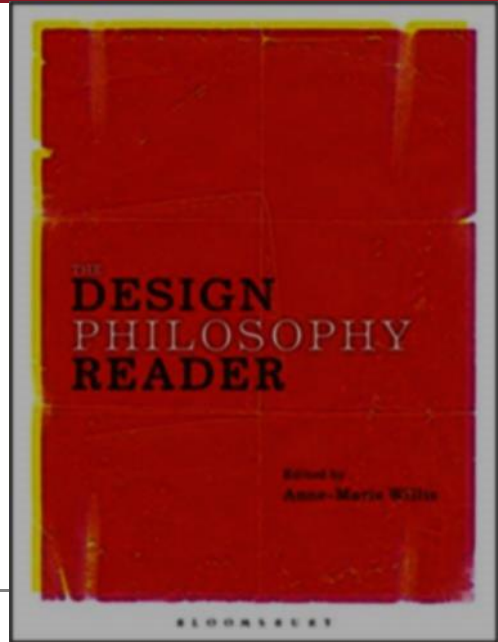
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Design Excellence *IS?*

Exercise (b):

What characterizes *great* design?



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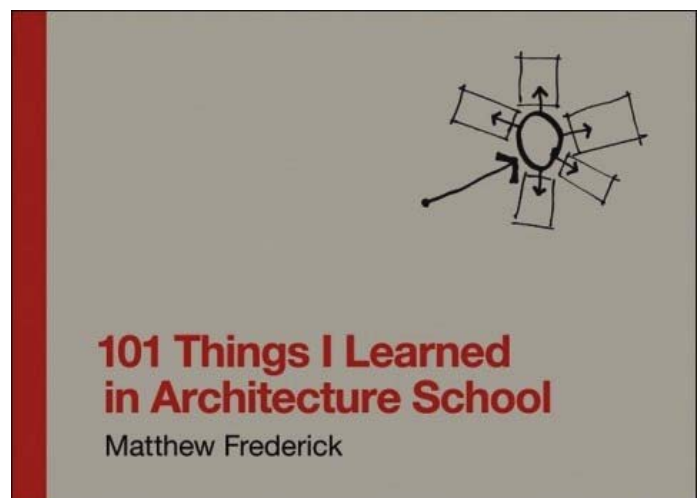
Design Excellence

Excellence is about FIT

- fit to context, and
- fit to purpose

“Always design a thing by considering it in its next larger context”

— Eliel Saarinen



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DESIGN LEADERSHIP

Design Excellence

System Design Matters

Systems

- Emergence
- Properties
- Coherence

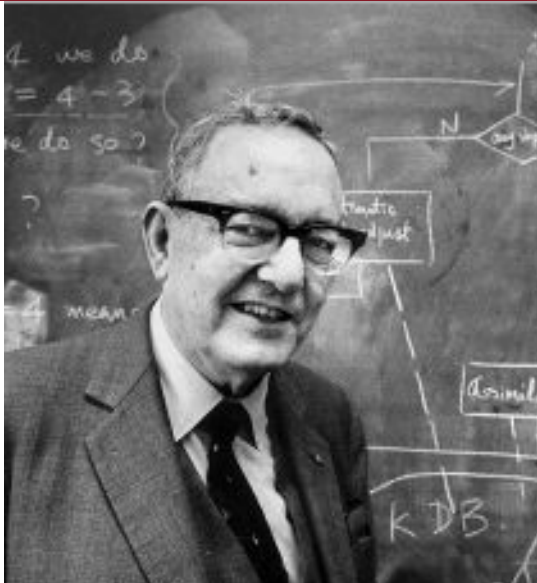
Decisions

- Constraints
- Tradeoffs
- Context

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What is Design?



“The engineer, and more generally 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

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What is a System?

“The defining properties of any system, are properties of the whole, which none of the parts have. If you take the system apart, it loses its essential properties”

— Russell Ackoff



If Russ Ackoff had given a TED Talk...

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What is a System?



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

-- Donella Meadows

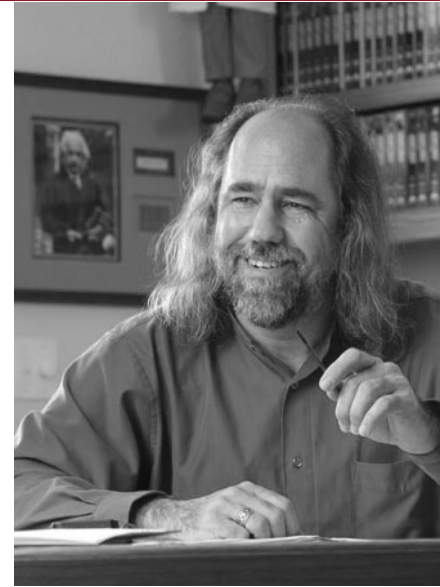
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What is System Design?

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

— Grady Booch



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@grady_booch

Architecture Decisions

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

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@mtnygard

Decisions Constrain

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

— Alicia Juarrero



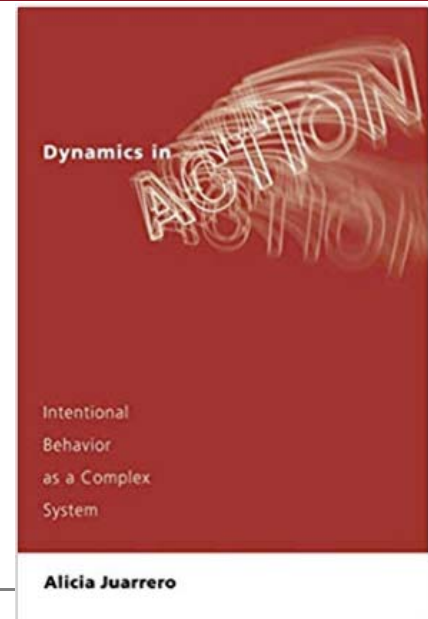
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Photo by Will Evans, LeanUX 2015

Constraints Enable

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



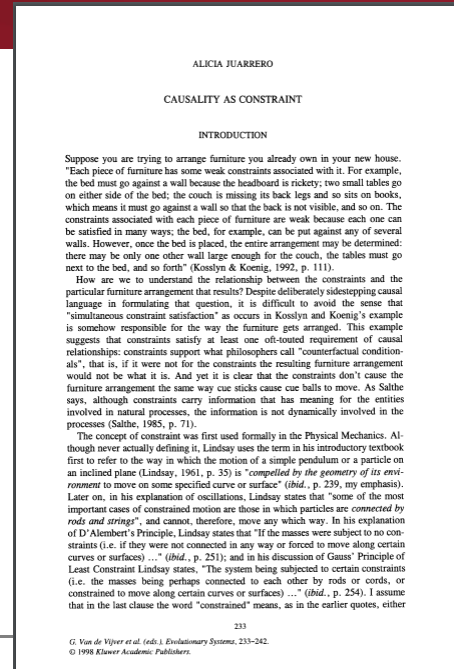
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Constraints Enable

“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 Constraint”

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Decisions in Context



Diana Montalion

@dianamontalion Follows you

"The value of every **decision** we make depends on the **context** in which we make it. In The Lord of the Rings, Frodo's journey to destroy the ring is meaningful inside the context of Middle Earth. Otherwise, he's a short, hairy guy with apocalyptic hallucinations."

— Diana Montalion

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Decisions Entail Tradeoffs

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



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@sarahmei

Decisions Entail Tradeoffs

“Microservices: **gain** scalability and fault tolerance **at the price of** additional complexity in managing a distributed system”

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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, Quora

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Mattias Petter Johansson, Quora

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Decisions in Context

“Design quality is not a property of the code. It's a joint property of the code and the **context** in which it exists.”

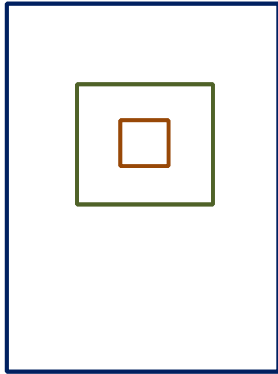
– Sarah Mei



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@sarahmei

Decisions in Context



To make a decision, we need to have a (good enough) conception of

- Desired outcome(s)
- Forces and constraints

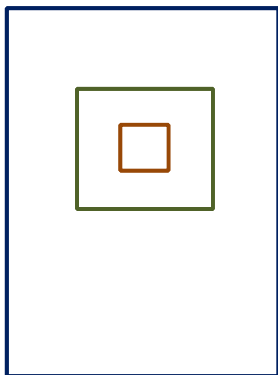
Arising in context of

- development
- operations
- use
- value network

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Decisions in Context

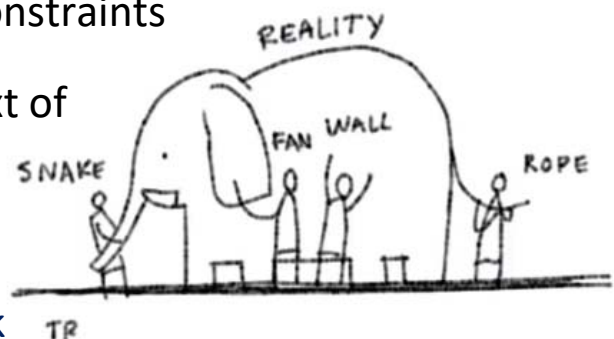


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Arising in context of

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Image by Dave Gray in "Liminal thinking: The pyramid of belief"

Architecture Decisions

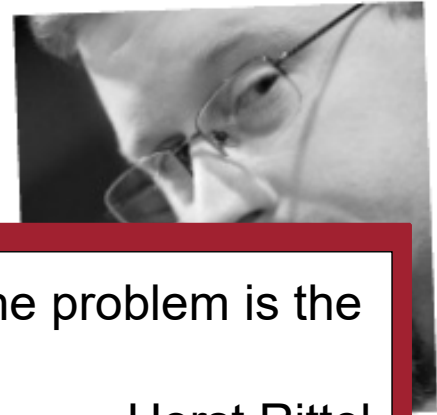
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“formulating the problem is the problem”

– Horst Rittel

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Formulating the Problem

Dancing with Systems

1. Get the beat
Before you disturb the system in any way, watch how it behaves.
2. Listen to the wisdom of the system
Aid and encourage the forces and structures that help the system run itself.

– Donella Meadows



Image: donellameadows.org

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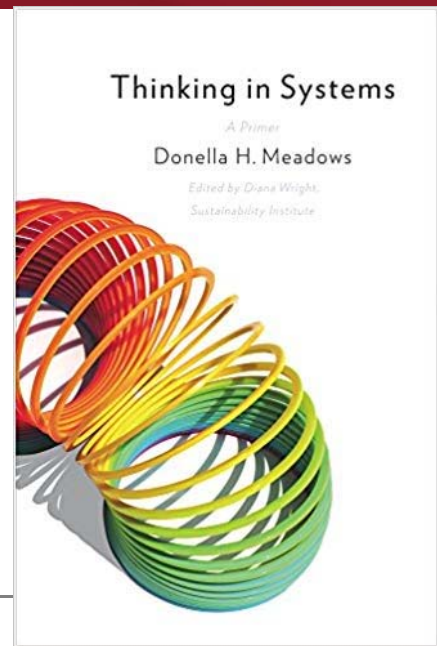
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Dancing With Systems

The Dance

3. Expose your mental models to the open air
4. Stay humble. Stay a learner
- ..
9. Go for the good of the whole
10. Expand time horizons
11. Expand thought horizons
12. Expand the boundary of caring

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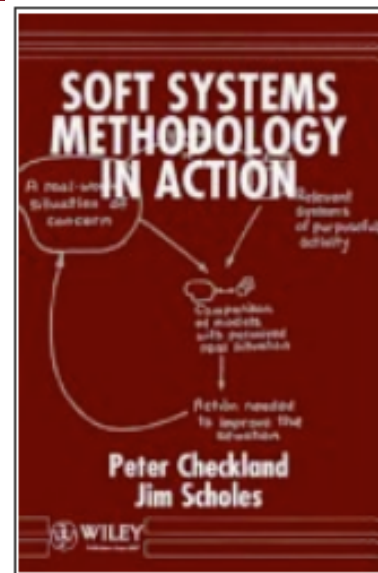
Rich Pictures

Sketch to see the system

“sketchprototype” the system in context

- who’s involved: individuals and organizations
- what happens: value flows and transformations
- concerns

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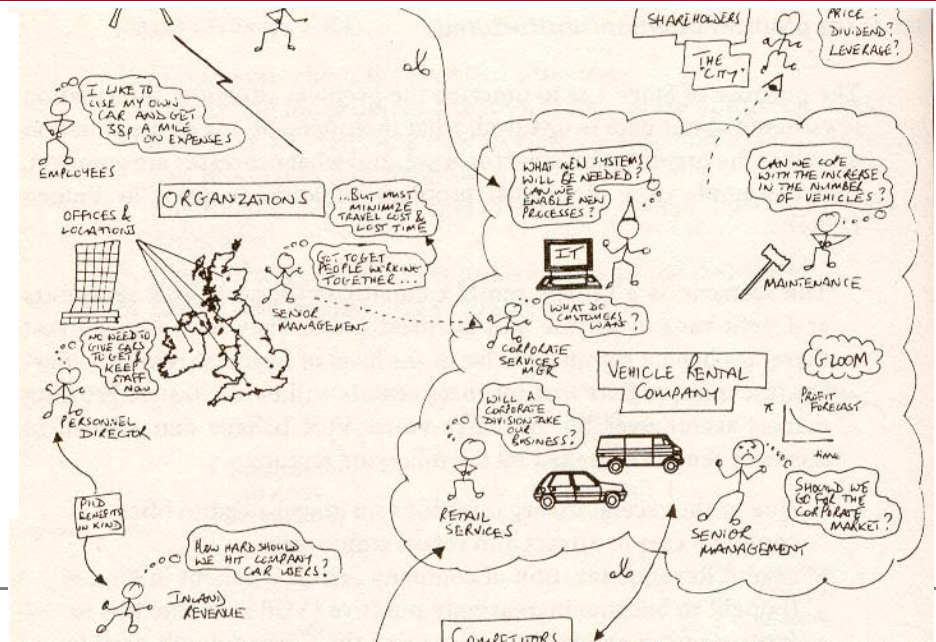
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Rich Pictures

No rules!

Show:

- structures (people organizations, systems, etc)
- concerns, goals, frustrations
- flows, interactions, transformations

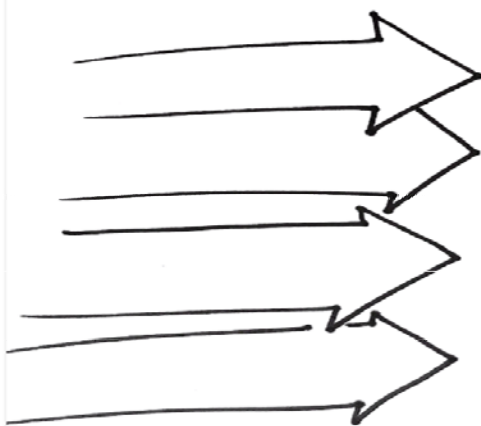


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Force Field Analysis

pros or forces for

cons or forces against



decision or
solution
approach

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Source: Gamestorming.com, by Dave Gray

Design Exercise

Exercise (20 minutes)

- Rich picture
- Force field analysis
- Situation: help people recover, following a disaster

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DESIGN LEADERSHIP

Design Excellence

System Design Matters

Systems

- Emergence
- Properties
- Coherence

Integrity

- Structural
- Design
- Organizational

Decisions

- Constraints
- Tradeoffs
- Context

Sustainability

- Technical
- Social
- Economic
- Environmental

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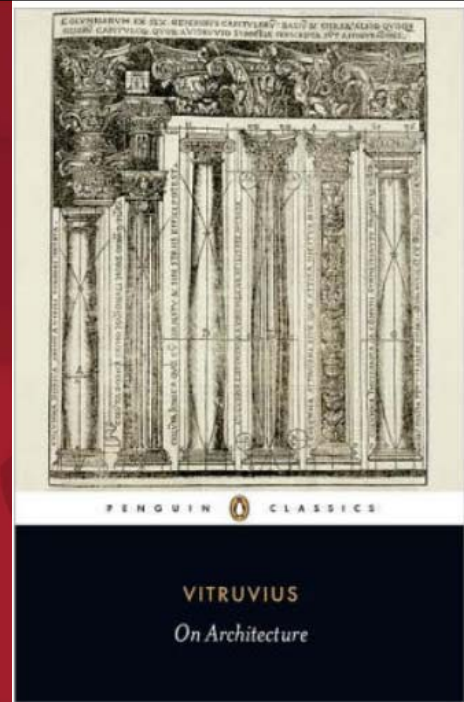
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The fundamental principles of architecture:

- *firmitatis*: durability
- *utilitatis*: utility
- *venustatis*: beauty

— Vitruvius



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Durability and Failures

How Complex Systems Fail

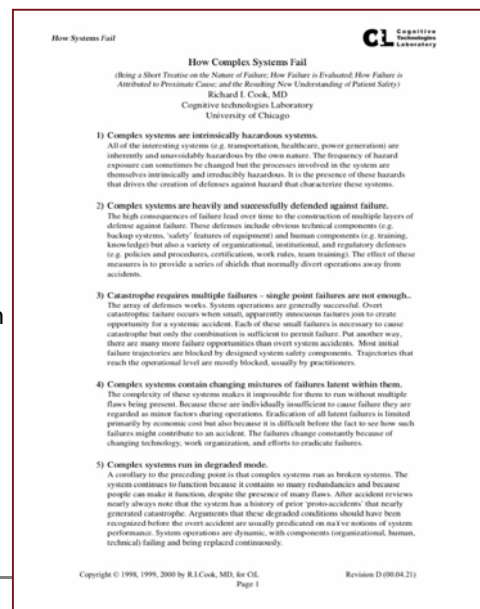
1. Complex systems are intrinsically hazardous systems

2. Complex systems are heavily and successfully defended against failure

The high consequences of failure lead over time to the construction of multiple layers of defense against failure.

3. Catastrophe requires multiple failures – single point failures are not enough

The array of defenses works. [...] Overt catastrophic failure occurs when small, apparently innocuous failures join to create opportunity for a systemic accident.



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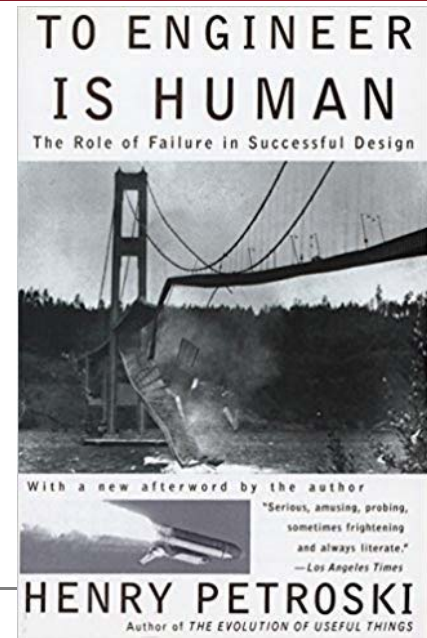
— Richard I. Cook

Forces and Failures

“Successful engineering is all about understanding how things break or fail.”

— Henry Petroski

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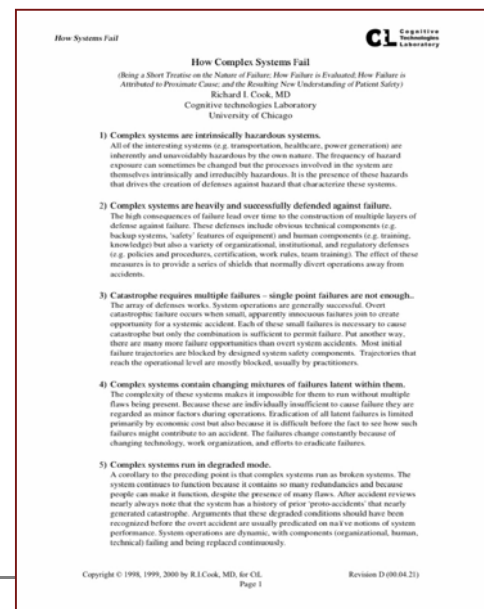
Resilience and Integrity

How Complex Systems Fail

16. Safety is an emergent property of systems
17. People continuously create safety
18. Failure free operations require experience with failure

— Richard I. Cook

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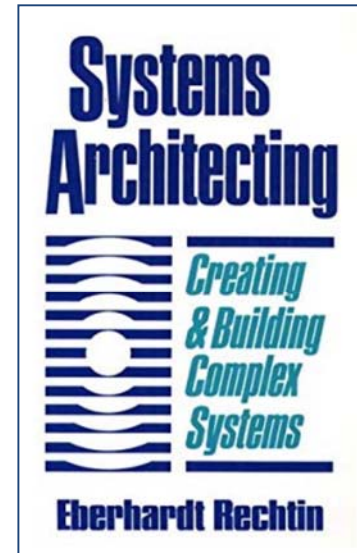
Ambiguity

A high tolerance for ambiguity

..

Willingness to backtrack, to seek multiple solutions

— Eberhardt Rechtin



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DESIGN LEADERSHIP

Design Excellence

Leadership Matters

Personal

- experience
- self-awareness

Technical

- do design, make or influence decisions

Strategic

- Why? Where to?

Organizational

- making others successful

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DESIGN LEADERSHIP

The Design of the Problem

The Design of the Designer

- The inventive
- The artistic
- The rational

The Design of Design



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DESIGN LEADERSHIP

The Design of the Designer

The Design of Design

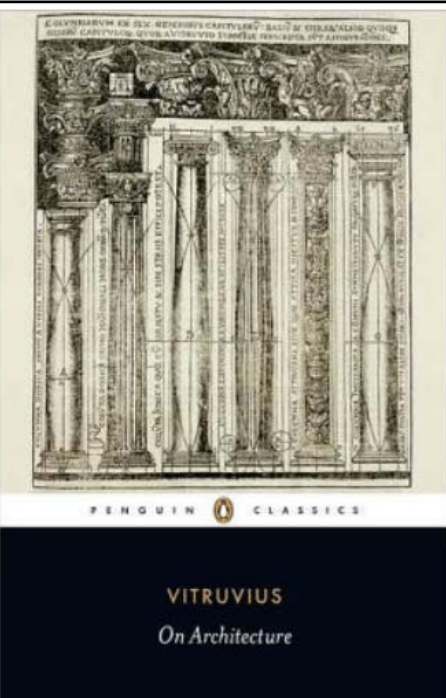
The Design of the Problem

VITRUVIUS

BOOK I

PREFACE

- THE EDUCATION OF THE ARCHITECT
- THE FUNDAMENTAL PRINCIPLES OF ARCHITECTURE
- THE DEPARTMENTS OF ARCHITECTURE
- THE SITE OF A CITY
- THE CITY WALLS
- THE DIRECTIONS OF THE STREETS; WITH REMARKS ON THE WINDS
- THE SITES FOR PUBLIC BUILDINGS



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Design with many designers

“Great teams make great people, not the other way around”

— Jessica Kerr



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@jessitron

Effectiveness

What characterizes great designers?

What characterizes effective leaders?

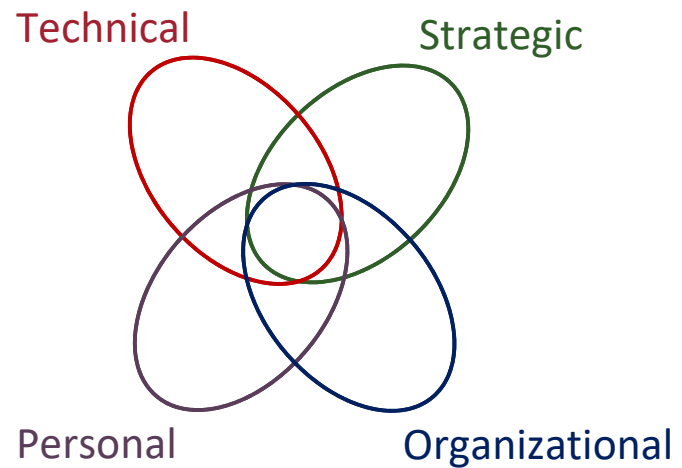


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Design Leadership

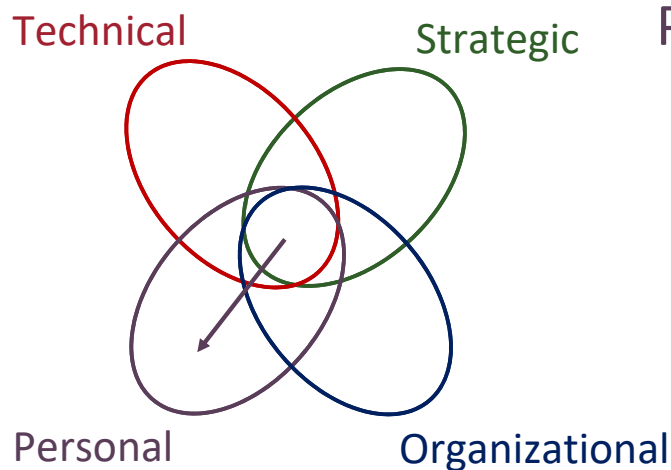
Know
Do
Be



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Design Leadership



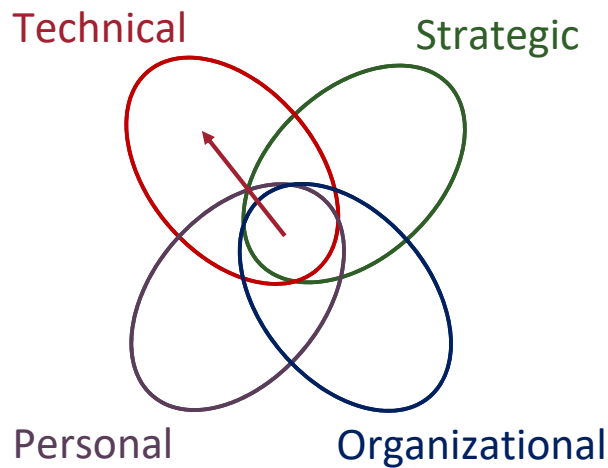
Personal Effectiveness

- Self awareness
- Empathy
- Creativity and imagination
- 4Es (embodied, embedded, extended, enactive) cognition
- Cognitive amplifiers, fallibilities and biases
- Perception and meaning making

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Design Leadership



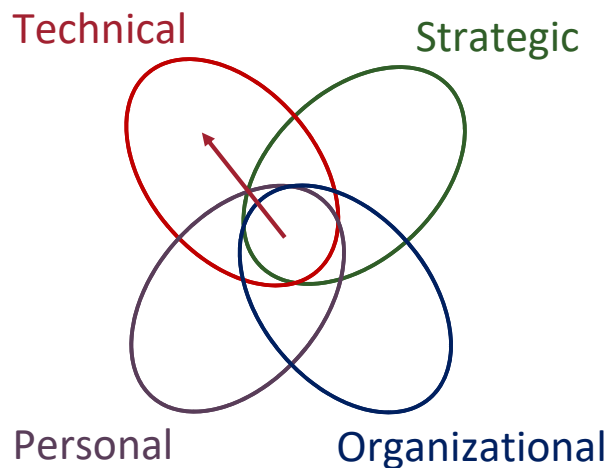
Technical Effectiveness

- Techniques in system design: modeling, prototyping, visualization; components, responsibilities, interactions and mechanisms; designing boundaries, interfaces and promises; abstraction and reification, observability, ..
- System qualities (scalability, reliability, availability, ...) and characterizing the design envelope
- Constraints and forces: role of; identifying; ... tradeoffs
- Affordances and design for fit to context and to purpose
- Heuristics, principles, patterns, ..
- Complexity, Uncertainty, and Related strategies (e.g., reversibility)
- Agility and flexibility, System Integrity, Technical debt, Failures, Reliability Engineering, and Resilience
- Sustainability, evolution and architecture transitions, feedback loops

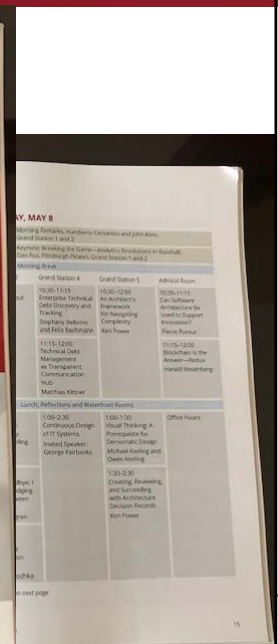
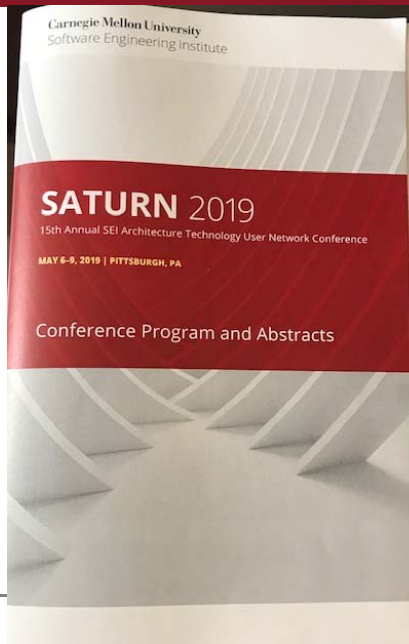
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Technical Effectiveness



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Technical Effectiveness

Study your predecessors' works intently, to see how they solved problems

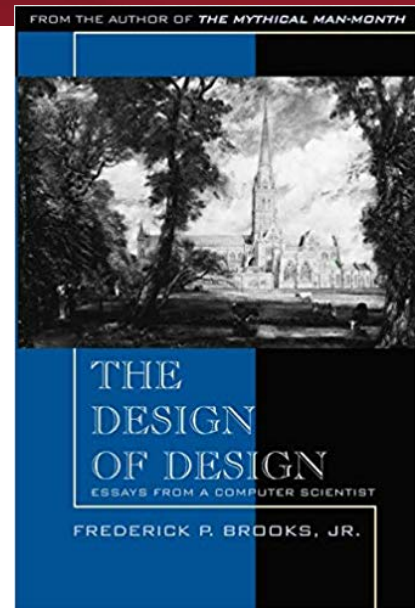
Try to figure out why they made the design choices they did

Keep a "sketch book" in which you put ideas, designs, and pieces of designs

When starting a design, write down your assumptions about the users and the uses

Design, design, design!

— Fred Brooks



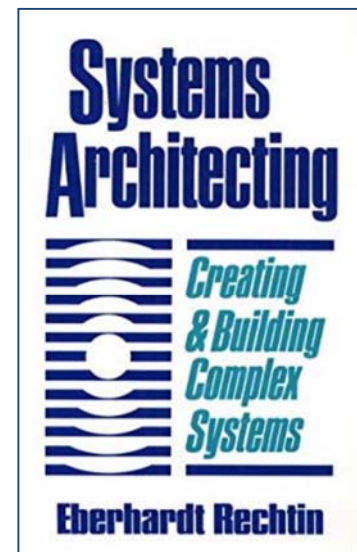
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Heuristics

Engineering heuristics, or rules of thumb, are "statements of common, or contextual, sense that aid in concept development, problem solving, decision making, or judgment"

— Eb Rechtin



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Heuristics

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



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@rebeccawb

Technical Effectiveness

Context: Designing Boundaries and Interfaces

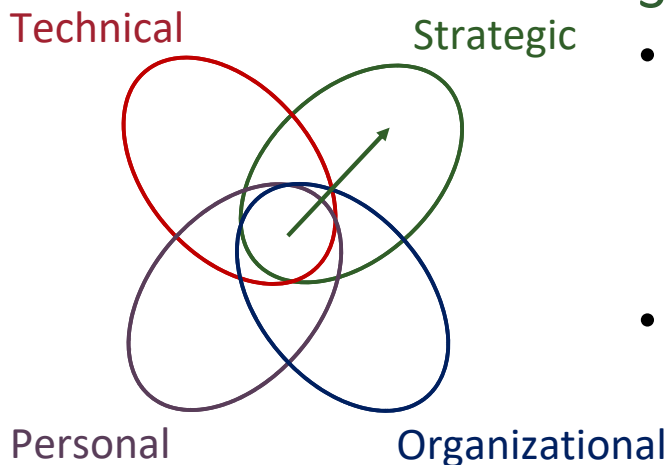
Heuristics:

- Don't partition by slicing through regions where high rates of information exchange are required. (Rechtin, 1991)
- Design things to make their performance as insensitive to the unknown or uncontrollable external influence as practical. (Rechtin, 1991)
- Postel's Law: be conservative in what you do, be liberal in what you accept from others (John Postel)

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Design Leadership



Strategic Effectiveness

- Context understanding
 - Mapping, ecosystems, value networks and differentiation
 - Technology radars, capability evolution and trends
- Operating models
 - How we create value
 - How we make money(/survive)

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Strategic Effectiveness

Context: Setting direction and scope

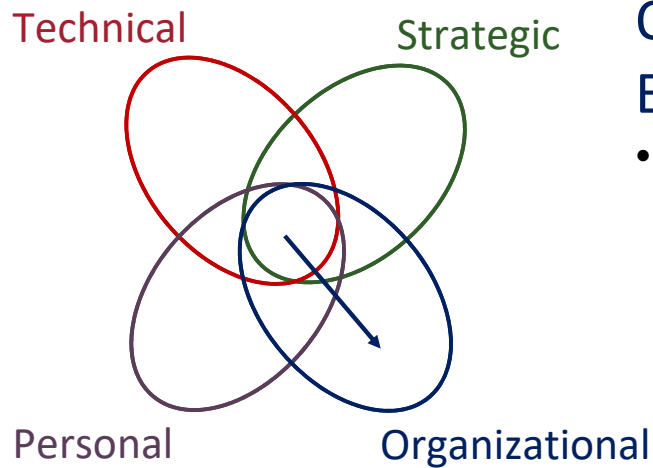
Heuristics:

- No complex system can be optimum to all parties concerned (Rechtin, 1991)
- 'focusing is saying "No"' — Steve Jobs
- "Some decisions are consequential and irreversible or nearly irreversible – one-way doors – and these decisions must be made methodically, carefully, slowly, with great deliberation and consultation." — Jeff Bezos

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Organizational Effectiveness

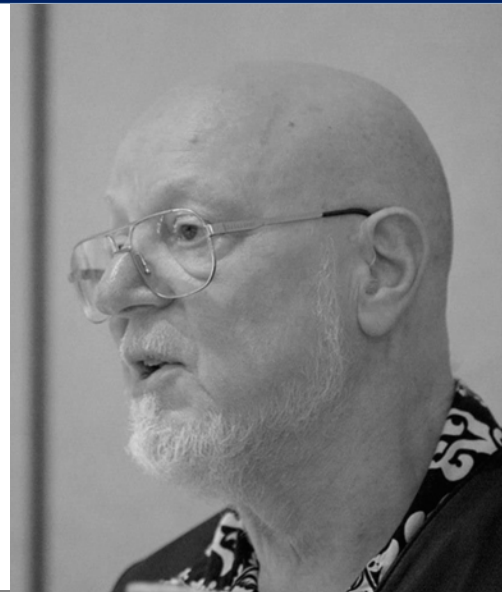
- Leadership and social dynamics
 - Building relationships, trust, teams
 - Working across the organization
 - Persuasion and influence; negotiation, disagreement
 - Decision making, judgment, effects of groups

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Organizational Effectiveness

Jerry Weinberg's Second Law of Consulting:
"No matter how it looks at first, it's always a people problem."



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Organizational Effectiveness

Context: Communicating and persuading

Heuristics:

- Don't ever stop talking about the system (Rechtin, 1991)
- Participation persuades

Heuristics about context:

- tell a story about a situation the heuristics help with (Rebecca Wirfs-Brock)
- identify the activity that the heuristics help with (Eb Rechtin)

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Organizational Effectiveness

“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 bring repeatedly until they literally ask you to stop.”
— Nivia Henry



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@lanooba

Organizational Effectiveness

Responsibilities (Do):

- listen, communicate
- build relationships
- lead by example
- lead up

Qualities (Be):

- comfortable with ambiguity
- empathetic

Organizational Effectiveness

Responsibilities (Do)

Qualities (Be)

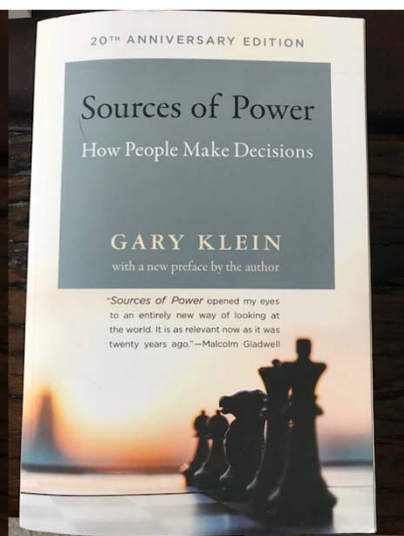
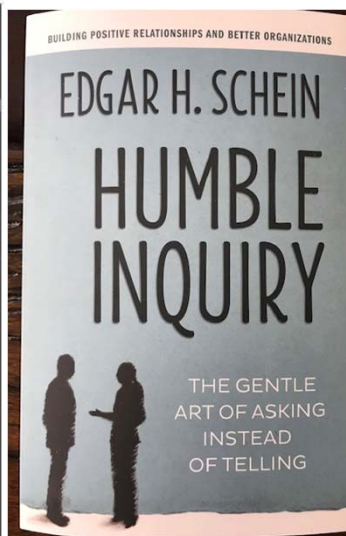
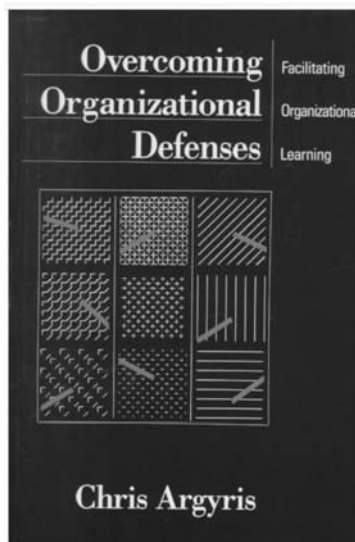
Resources (Know)

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Organizational Effectiveness

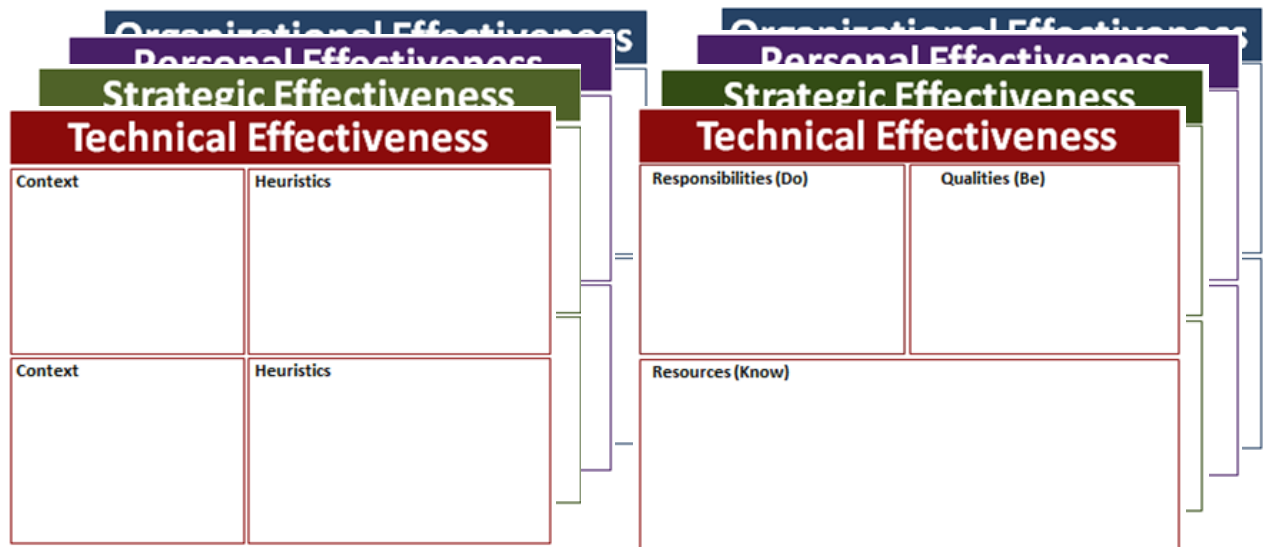
Know:



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Exercise



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Design Leadership

“Architecture is a way of thinking that is inescapably concerned with everything”
— Dana Bredemeyer



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@danabredemeyer

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