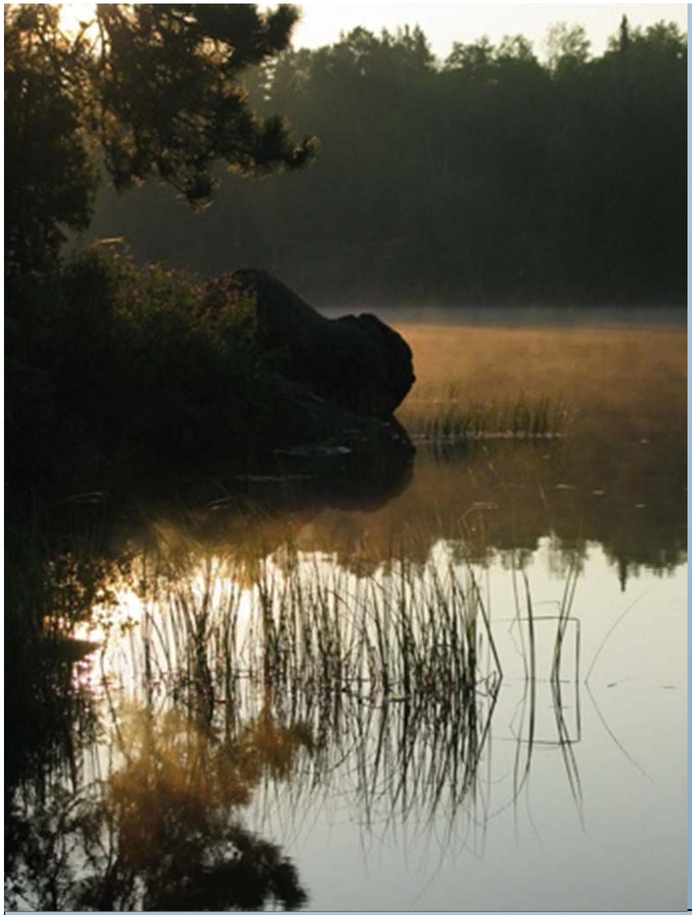


lean

software development

Design Thinking

First of All – Solve the Right Problem

mary@poppendieck.com

Mary Poppendieck

www.poppendieck.com

Does This Sound Familiar?

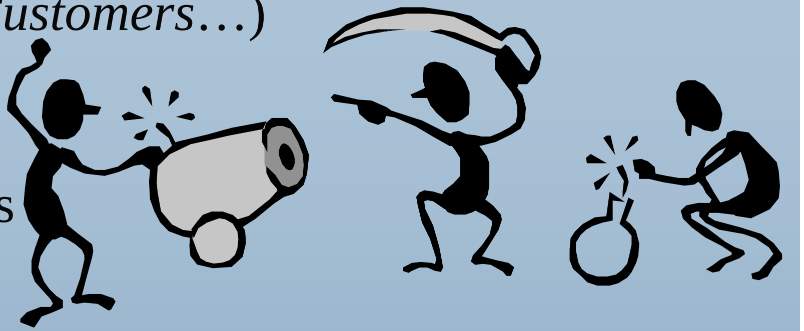
“*They**” aren’t doing their part.

(* *The Business, The Product Owner, The Customers…*)

✓ *They* won’t set priorities

✓ *They* aren’t getting the backlog ready

✓ *They* don’t have time for iteration reviews



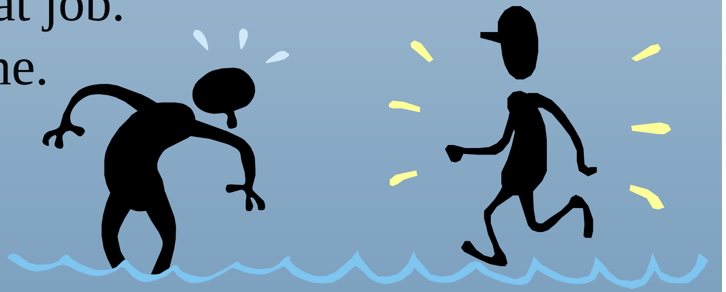
The Probable Cause:

✓ *They* have been assigned the most difficult part of the job.

✓ *They* don’t have the training or tools to do that job.

✓ *They* shouldn’t be expected to do the job alone.

✓ Why is this about *them* anyway?



The Cure – Recognize That:

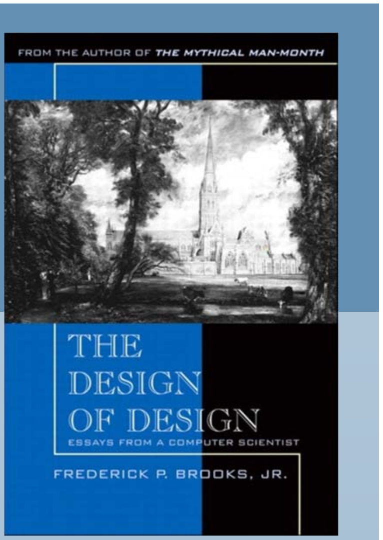
✓Design is an integral part of development.

✓Deciding what to design is the hardest part of the design task.

✓We have assigned the hard part to *them* – have *they* accepted it?

✓The only valid measure of *our* success is *their* success.

The Design Problem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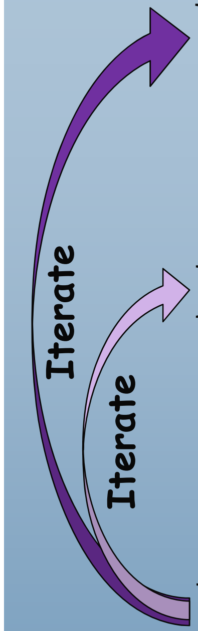


Understand the problem

"Deciding what to design is the hardest part of the design task. … A small team is much better [at this] than an individual."

Design a solution

"Design isn't just to satisfy requirements, but also to uncover requirements. … Design isn't simply selecting from alternatives, but also realizing their existence."

Implement the design

"One of the most striking 20th century developments in the design disciplines is the progressive divorce of the designer from both the implementer and the user. … [As a result] instances of disastrous, costly, or embarrassing miscommunication abound."

Who’s Responsible for Design?

Software

Hardware/Software

System of Systems

Commercial Product

Product Manager

Chief Engineer

What to do

User Interaction Designer

Industrial Designer

Systems Engineer

How to do it

Internal Process

Business Sponsor

Program Manager

What to do

Business Analyst

IT Architect

How to do it

Application

Enterprise System

The Product Owner Problem

Software | Hardware/Software | System of Systems

Commercial Product

Product Manager | ***Chief Engineer***

User Interaction Designer | Industrial Designer | Systems Engineer

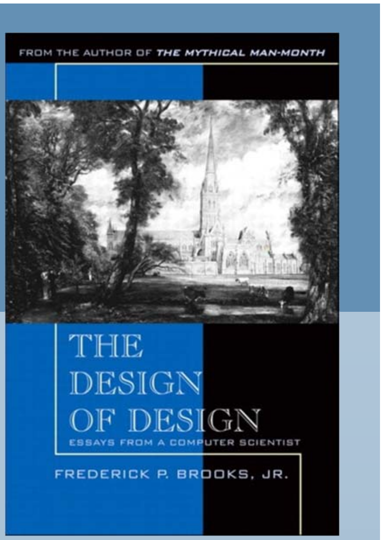
Internal Process

Business Sponsor | ***Program Manager***

Business Analyst | IT Architect

Application | Enterprise System

The Single Owner Problem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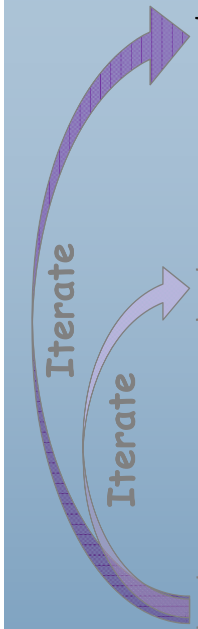

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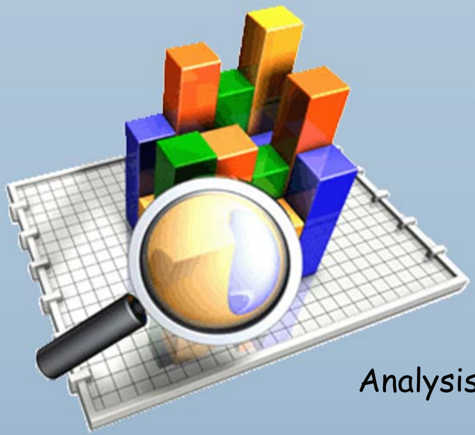
Three Approaches to Deciding what to Design

The Military Approach

Critical Thinking



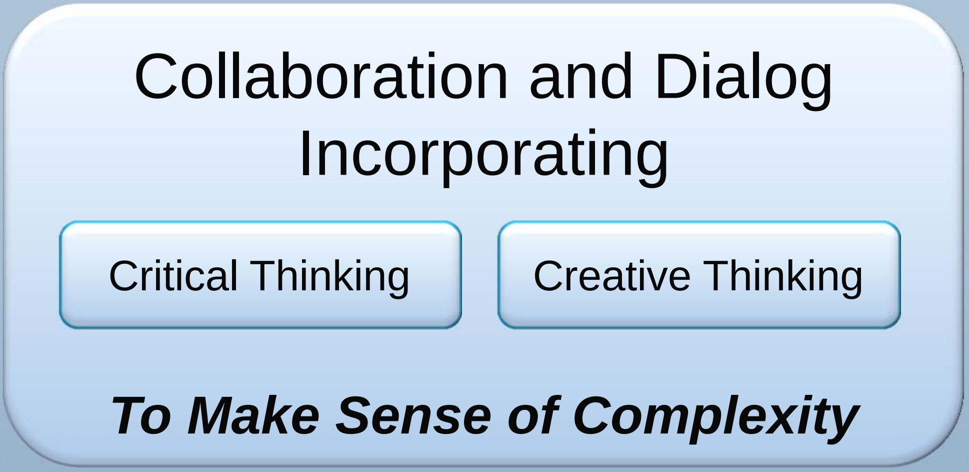
Analysis

The Data-Based Approach

The Ethnography Approach

Go and See

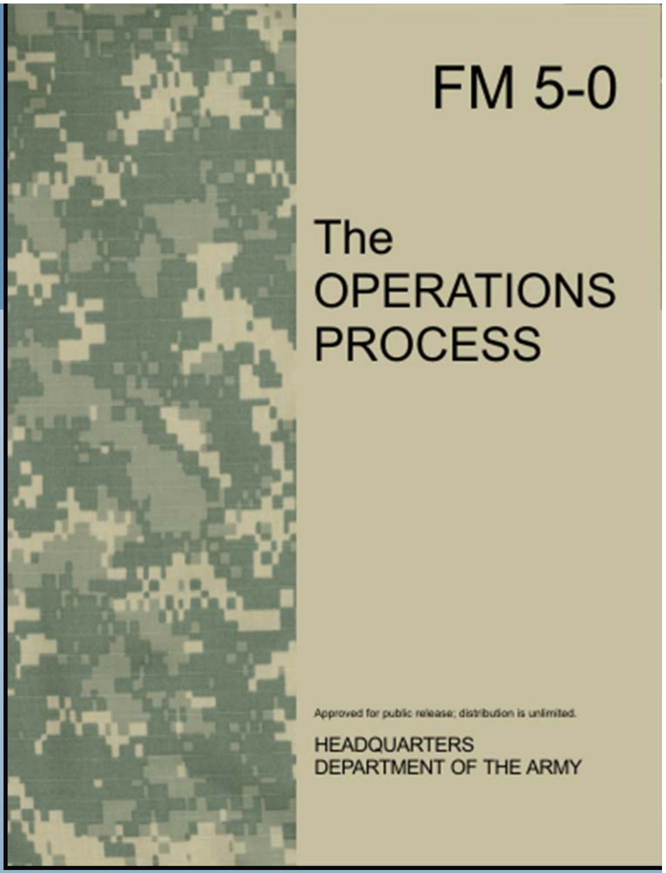
The Military View of Design


Collaboration and Dialog Incorporating

Critical Thinking

Creative Thinking

To Make Sense of Complexity


FM 5-0

The OPERATIONS PROCESS

Approved for public release; distribution is unlimited.

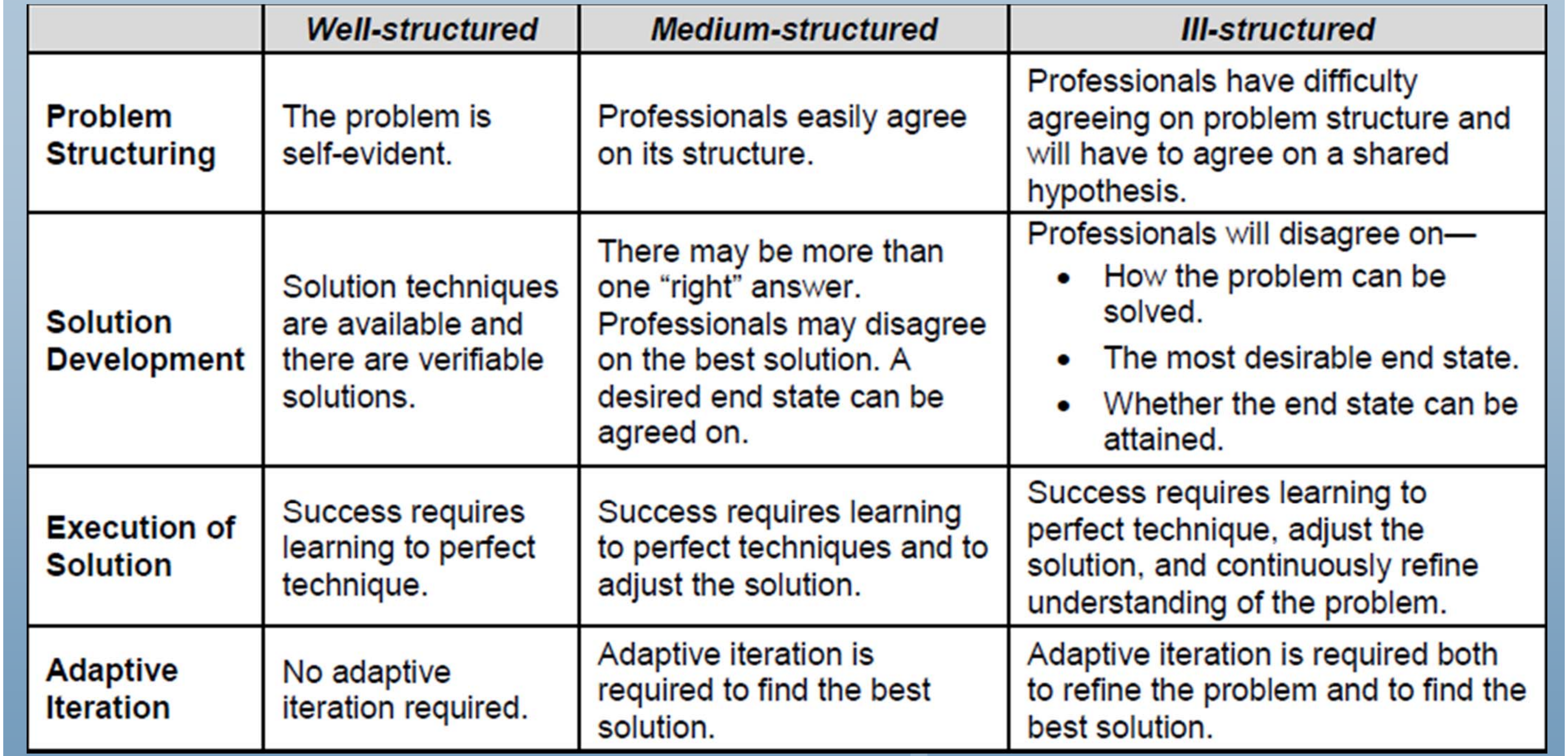
HEADQUARTERS
DEPARTMENT OF THE ARMY

March, 2010

"When situations do not conform to established frames of reference – when the hardest part of the problem is figuring out what the problem is – ...design is essential."

Source: United States Army Combined Arms Center

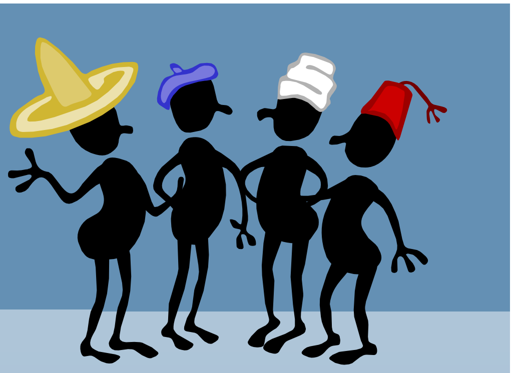
Types of Problems



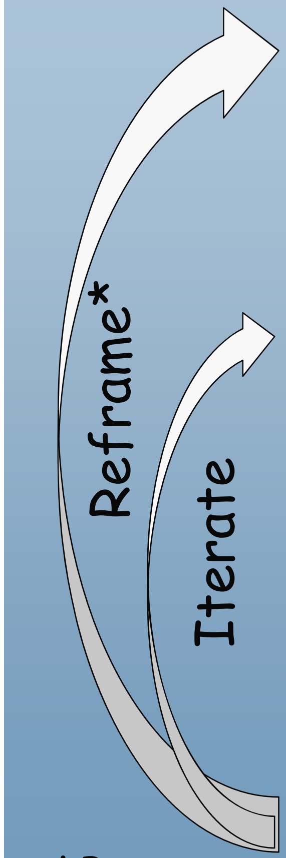
	Well-structured	*Medium-structured*	*Ill-structured*
Problem Structuring	The problem is self-evident.	Professionals easily agree on its structure.	Professionals have difficulty agreeing on problem structure and will have to agree on a shared hypothesis.
Solution Development	Solution techniques are available and there are verifiable solutions.	There may be more than one "right" answer. Professionals may disagree on the best solution. A desired end state can be agreed on.	Professionals will disagree on— • How the problem can be solved. • The most desirable end state. • Whether the end state can be attained.
Execution of Solution	Success requires learning to perfect technique.	Success requires learning to perfect techniques and to adjust the solution.	Success requires learning to perfect technique, adjust the solution, and continuously refine understanding of the problem.
Adaptive Iteration	No adaptive iteration required.	Adaptive iteration is required to find the best solution.	Adaptive iteration is required both to refine the problem and to find the best solution.

Source: United States Army Combined Arms Center

Solve the Right Problem



Assemble a Diverse Team to:

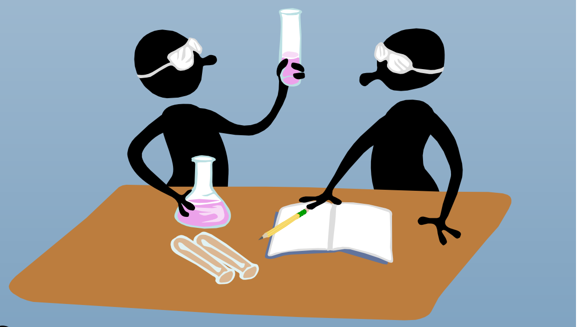


Frame

- ✓ Carefully Observe the Situation
- ✓ Conceptualize the Problem

Experiment

- ✓ Visualize/Prototype Ideas
- ✓ Try Tentative Solutions



Make Sense of the Situation

- ✓ Reflect Critically/Creatively
- ✓ Refine Mental Models

*Pivot

United States Army Combined Arms Center

What Customers Value

IBM
PC*jr*

Consider the IBM PCjr.

One day after it was announced in 1984, newspapers called it a failure. They were right.

Why didn't IBM know those criteria ahead of time?

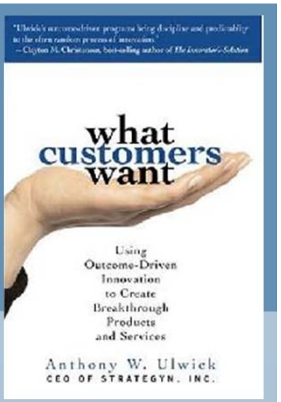
Consider the Lexus

LEXUS

The first year it ranked first in every criteria "Car and Driver" used to rank luxury cars.

This was precisely the design criteria set by the chief engineer: rank top in every rated category.

Discovering What Customers Value


"Ulwick's outcome-driven programs bring discipline and predictability to the often random process of innovation."
– Clayton M. Christensen, best-selling author of The Innovator's Solution
what customers want
Using Outcome-Driven Innovation to Create Breakthrough Products and Services
Anthony W. Ulwick
CEO OF STRATEGYN, INC.

Discover Outcomes: Functional criteria people have for a job

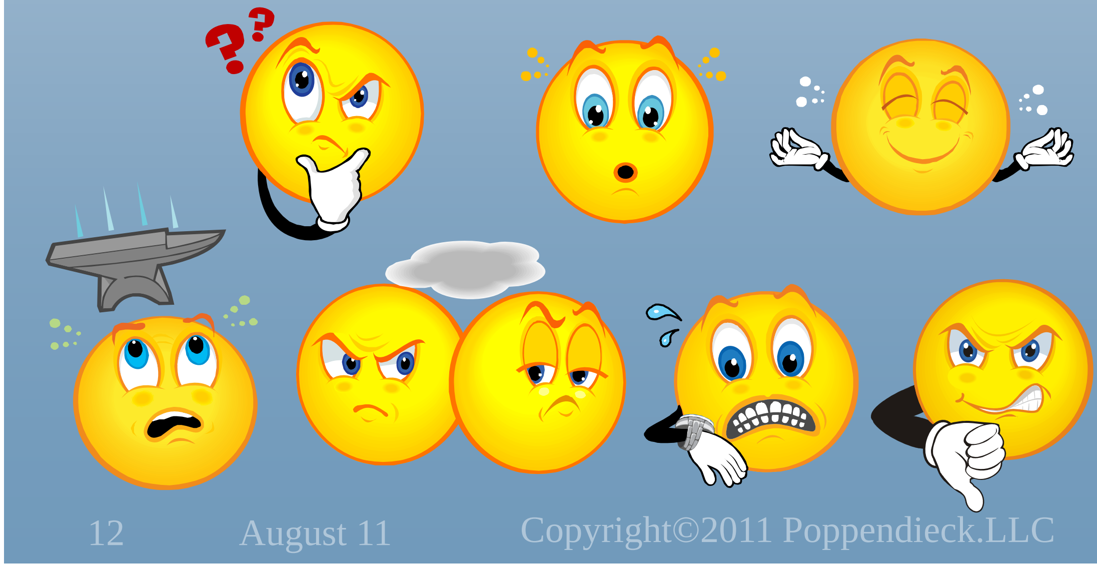
What annoys people when doing the job?

What causes stress – even unnoticed?

When do things go exceptionally well?

What should be: Minimized? Increased?

Analysis



Rate each Outcome:

Importance (1-5)

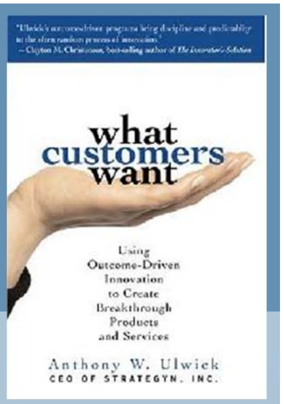
Satisfaction (1-5)

Calculate Opportunity:

Importance + Agony

Agony = min[Importance-Satisfaction,0]

Determining the Best Opportunities



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what customers want

Using
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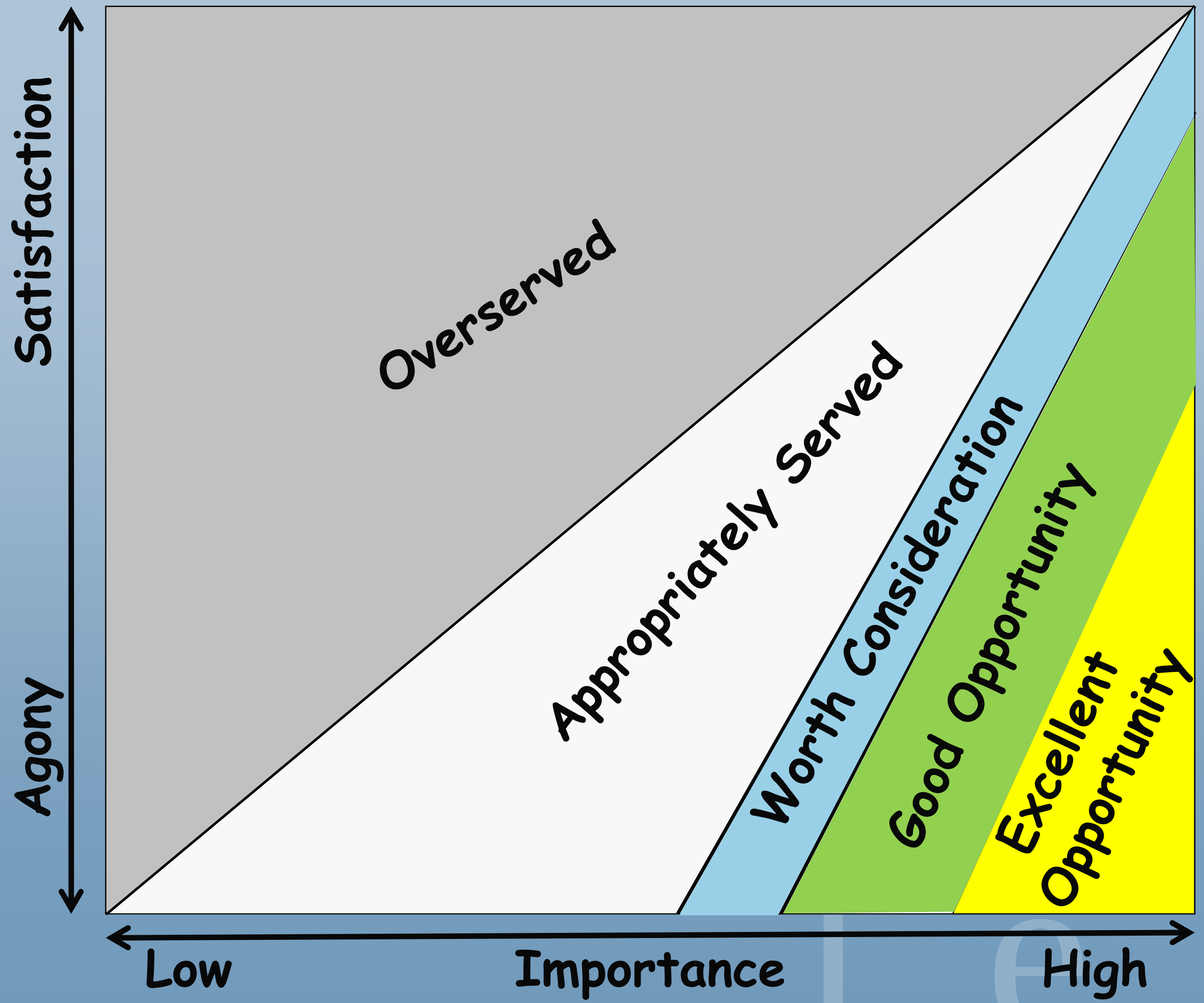


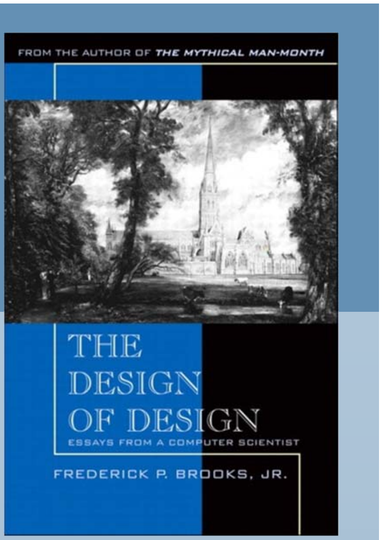
Design Thinking

How Might We Improve the Shopping Experience?

- ✓Multiple Perspectives
- ✓Time Constraints
- ✓Go and See
- ✓Brainstorm
- ✓Prototypes
- ✓Convergence
- ✓Build to Learn
- ✓Critical Evaluation

http://**www.youtube.com/watch?v=M66ZU2PCIcM**

The Imagination Problem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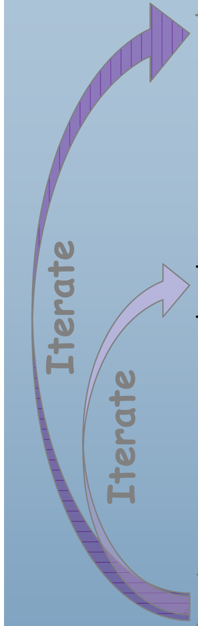

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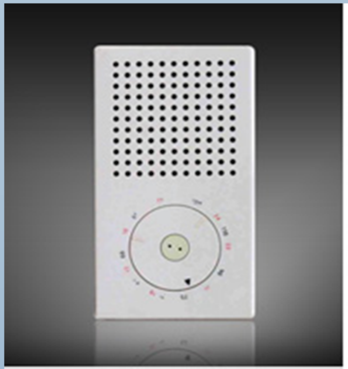
Industrial Design

Dieter Rams:

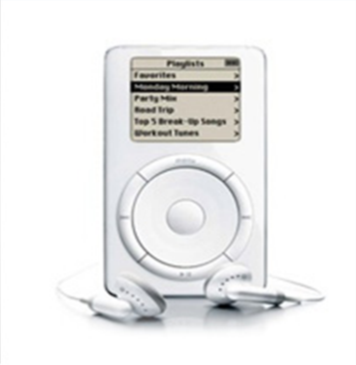
Ten Principles of Good Design

Good design:

1. Is innovative
2. Makes a product useful
3. Is aesthetic
4. Makes a product understandable
5. Is unobtrusive
6. Is honest
7. Is long-lasting
8. Is thorough down to the last detail
9. Is environmentally friendly
10. Is as little design as possible



Dieter Rams – Braun
1958

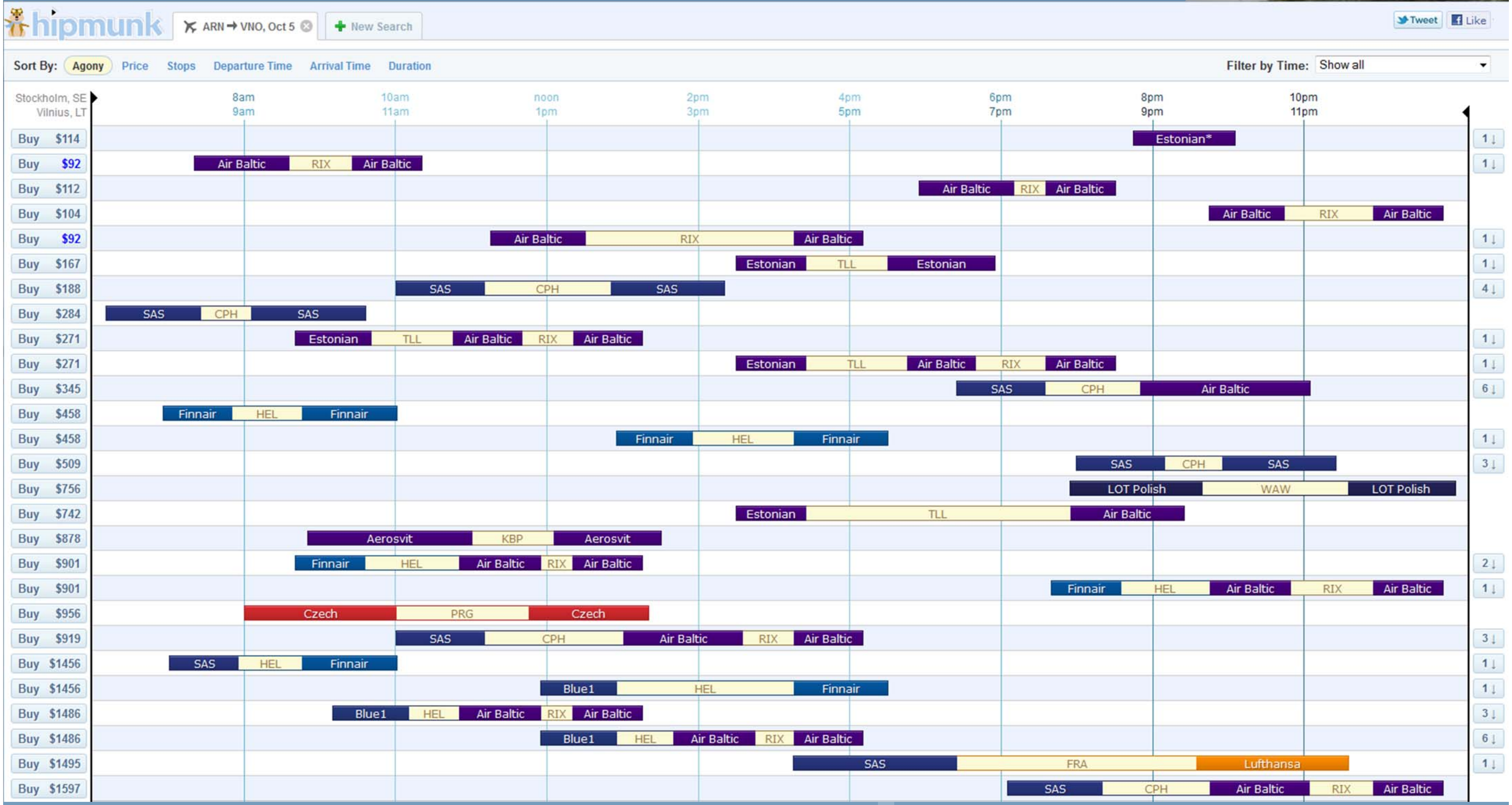


Jonathan Ive – Apple
2001

Don Chadwick
& Bill Stumpf
Herman Miller
1994

Oxo
Universal
Design

User Interaction Design



Buy	$114	Estonian*	1↓
Buy	$92	Air Baltic RIX Air Baltic	1↓
Buy	$112	Air Baltic RIX Air Baltic	
Buy	$104	Air Baltic RIX Air Baltic	
Buy	$92	Air Baltic RIX Air Baltic	1↓
Buy	$167	Estonian TLL Estonian	1↓
Buy	$188	SAS CPH SAS	4↓
Buy	$284	SAS CPH SAS	
Buy	$271	Estonian TLL Air Baltic RIX Air Baltic	1↓
Buy	$271	Estonian TLL Air Baltic RIX Air Baltic	1↓
Buy	$345	SAS CPH Air Baltic	6↓
Buy	$458	Finnair HEL Finnair	
Buy	$458	Finnair HEL Finnair	1↓
Buy	$509	SAS CPH SAS	3↓
Buy	$756	LOT Polish WAW LOT Polish	
Buy	$742	Estonian TLL Air Baltic	
Buy	$878	Aerosvit KBP Aerosvit	
Buy	$901	Finnair HEL Air Baltic RIX Air Baltic	2↓
Buy	$901	Finnair HEL Air Baltic RIX Air Baltic	1↓
Buy	$956	Czech PRG Czech	
Buy	$919	SAS CPH Air Baltic RIX Air Baltic	3↓
Buy	$1456	SAS HEL Finnair	1↓
Buy	$1456	Blue1 HEL Finnair	1↓
Buy	$1486	Blue1 HEL Air Baltic RIX Air Baltic	3↓
Buy	$1486	Blue1 HEL Air Baltic RIX Air Baltic	6↓
Buy	$1495	SAS FRA Lufthansa	1↓
Buy	$1597	SAS CPH Air Baltic RIX Air Baltic	

Simulates the Flying Experience – Not the Buying Experience

Disruptive Design

GE Healthcare

Kjell Kristoffersen
Chief Engineer

The Vscan: $8000 Ultrasound unit the size of a mobile phone. Based on designs originating in China, it is revolutionizing global healthcare.

“We realized that the biggest impediment was that we were selling what we were making [rather than] making what the customers here needed.”*

*V. Raja, president and CEO of GE Healthcare-South Asia.

“Our engineering and marketing teams now interact closely with the customers here [in India] to understand their requirements. We look at their work flow, their environmental limitations, their profitability issues and other factors and we then price, design and manufacture the products accordingly”**

**Ashish Shah, General Manager, GE Healthcare Technology - India

The MAC-i: ~$500 – EKG’s for Rs 9

Designing an Ecosystem

Greg Joswiak: Product Manager – iPod & iPhone

I manage product marketing and product management -- I don't actually own the engineering. But we work very closely with them on the features we create and what the product's going to be about. … I believe in creating great products.

We do our best to try to understand what customers are going to want down the road. I'm fond of the Wayne Gretzky quote -- you skate to where the puck is going to be. We try to understand as we develop our product road map, what's going to be exciting in the future. And that's one of the advantages we have over our competitors. Our competitors tend to put the cross hairs on where we are now, and by the time they come up with a product that tries to match where we are now, we're beyond them. We're one or two generations beyond, moving faster than they are.

Apple is in a pretty unique position because we're a world-class hardware designer and a world-class software designer. It's rare enough to be on one of those lists, and we're the only company I can think of that's on both of those lists. So whenever we design a product, we try to take advantage of that capability that we have, to engineer the hardware and the software together so we can take full advantage of each.

From Article by Jon Fortt November 25, 2007, CNN Money

Evolutionary Design

Value-Driven Development Principles and Values – Agility is the Tool, Not the Master

by Tom Gilb

1. Control projects by quantified critical-few results: 1 page!

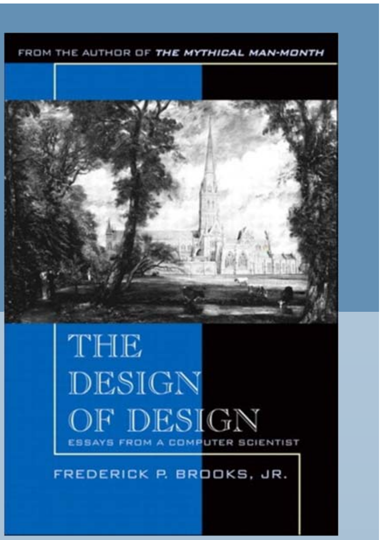
   Most of our so-called functional requirements are not actually requirements. They are designs to meet unarticulated, higher-level, and critical requirements.
2. Make sure those results are business results, not technical.

   People do not do development projects to get function, features and stories. These are never the primary drivers for the investment in a development project.
3. Give developers the freedom to discover *how* to deliver those results.

   The worst scenario I can imagine is when we allow real customers, users, and our own salespeople to dictate 'functions and features' to the developers, carefully disguised as 'customer requirements'. Maybe conveyed by our product owners. If you go slightly below the surface of these false 'requirements' you will find that they are not really requirements. They are really bad amateur design for the 'real' requirements.
4. Estimate the impacts of designs on the quantified goals.

   Let developers engineer technical solutions to meet the quantified requirements. This gets the right job (design) done by the right people (developers) towards the right requirements (higher level views of the qualities of the application). … A designer should be able to estimate the many impacts of a suggested design on requirements.
5. Select designs with the best value impacts for their costs, do them first.
6. Decompose the workflow into weekly (or 2% of budget) time boxes.

The Divorce Problem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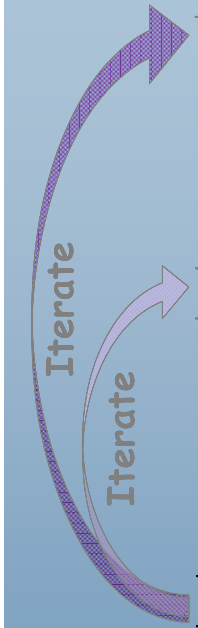

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“Deciding what to design is the hardest part of the design task. … A small team is much better [at this] than an individual.”

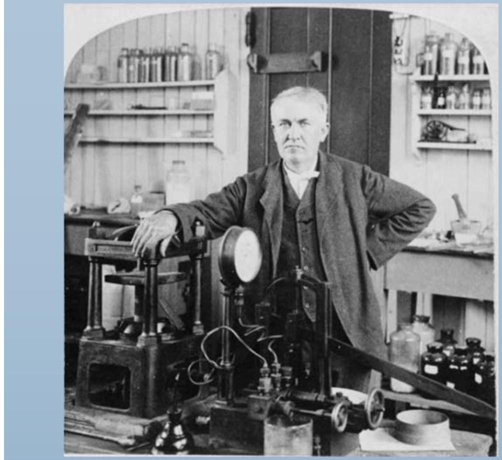
Design a solution

“Design isn’t just to satisfy requirements, but also to uncover requirements. … Design isn’t simply selecting from alternatives, but also realizing their existence.”

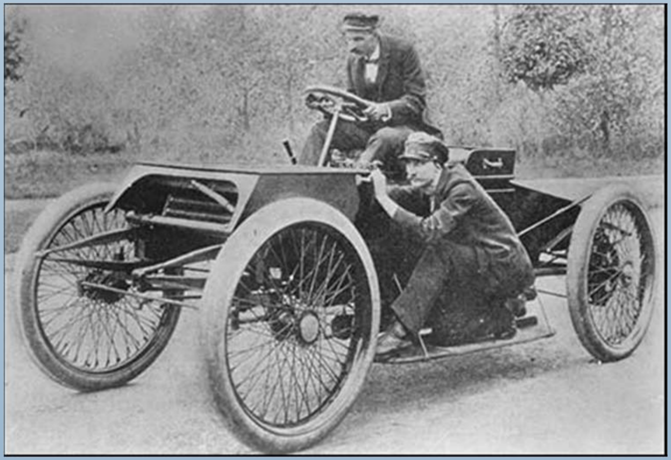
Implement the design

“One of the most striking 20th century developments in the design disciplines is the progressive divorce of the designer from both the implementer and the user. … [As a result] instances of disastrous, costly, or embarrassing miscommunication abound.”

Don’t Divorce Designers from Implementers or Users

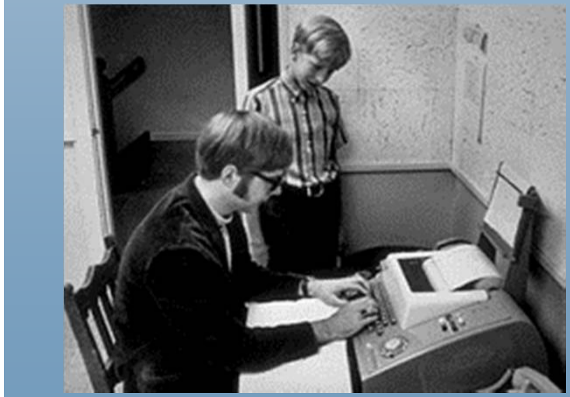


Thomas Edison



Henry Ford

Wright Brothers



Bill Gates & Paul Allen

Steve Jobs & Steve Wozniak

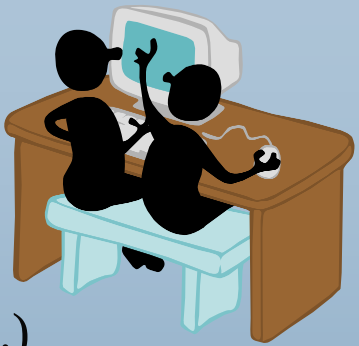
Larry Page & Sergey Brin

*Remedies for Divorce**

Use-Scenario Experience

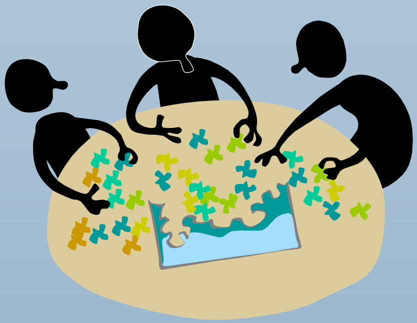
Designers actually do the job they are automating.

(Eg: Canadian Air Traffic Control System.)



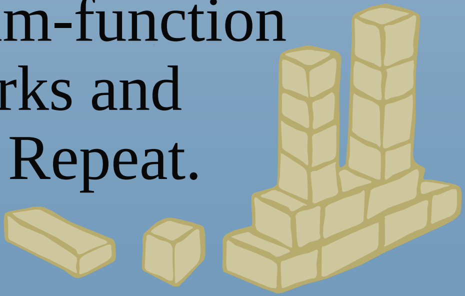
Concurrent Engineering

Implementers are intimately involved in the design process.



Incremental Development and Iterative Delivery

Build a minimum-function version that works and give it to users. Repeat. Frequently.



Cross-Functional Teams

The team includes people from every function necessary for success, and has *direct contact with users from the onset.*

* First 3 from Fred Brooks: The Design of Design

The Team Size Problem

What is the ideal agile development team size?

- Typically recommended: 7 +/– 3
- Typically limited to developers and testers

But cross-functional teams include many disciplines:

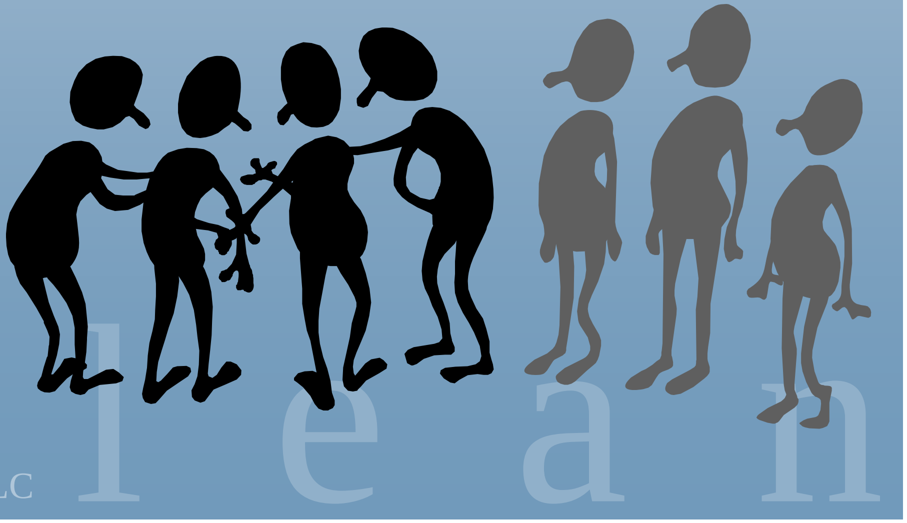
Designers	Testers	Support	Marketing
SME’s	Developers	Operations	Other Specialists

When an effort requires more than ~10 people, should you:

a) Split into multiple teams?
- How do the teams communicate?

b) Increase team size?
- How do people communicate?

c) Some combination of the two?
- What does it look like?



Team Size Examples

Dunbar's Magic Number: 150

Gore & Associates (Splits business units at ~150 people)

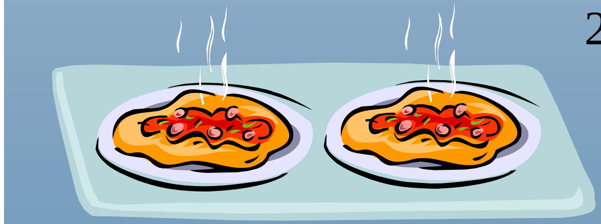
"The pressure that comes to bear if we are not efficient … the peer pressure is unbelievable. This is what you get when you have small teams, where everybody knows everybody. Peer pressure is much more effective than a concept of a boss. Many, many times more powerful."

Tandberg (now part of Cisco)

"We have found that the ideal team size is 30-70"*

* (The number of engineers needed to develop a new software-intensive high end video display product)

Amazon.com



2000 – Hit the wall: Classic architecture would not scale

2001 – 2009 Transition to services

- ✓ Each Service is Owned by a Two-Pizza Team
  - × Complete Team: Design, Implementation, Operations, Support
  - × If the service is too big, split the service
- ✓ Perfected the Cloud to make small cross-functional teams possible

Conway's Law: "Organizations which design systems are constrained to produce designs which are copies of the communication structures of these organizations."

Managing a Large Project

Tandberg* Codec C90

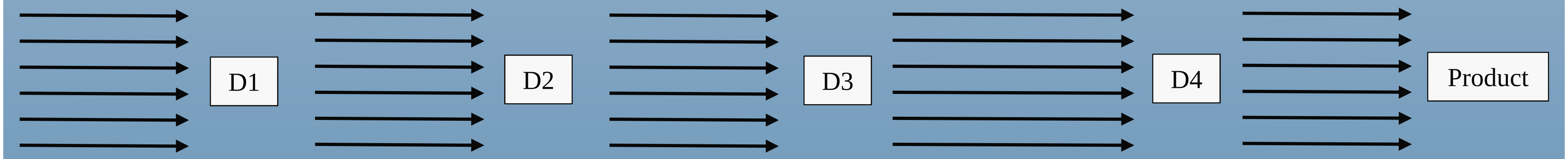
20 months from Idea to Production

Started spring 2007
1st HW prototype mid 2008
Released late 2008
Years ahead of competitors
55-65 people involved

2-3 people mechanics/design
4-5 people electronics/hardware
40-50 people software dev
5-6 people FPGA development
4 people test developers
1 person approvals

The Project Manager's Story

- ✓ *I managed mini-projects approximately three months long. Each one ended in a prototype: the D1 prototype used existing hardware and some new chips. The D2 prototype had several prototype hardware parts and quite a bit of software. At the D3 prototype review, we decided to delay the D4 prototype by 2 months so we could use a new chip that was newly available. That decision made this the most advanced Codec on the market; we were years ahead of our competitors.*

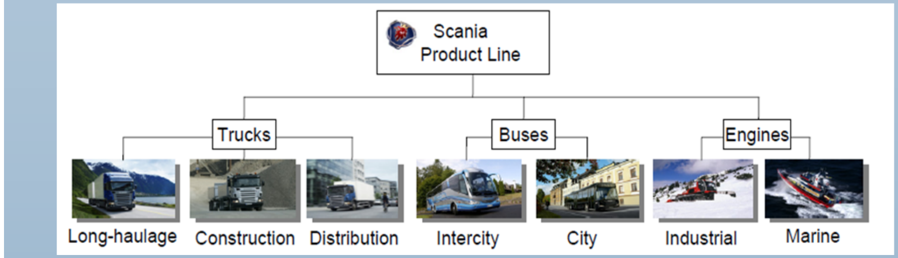


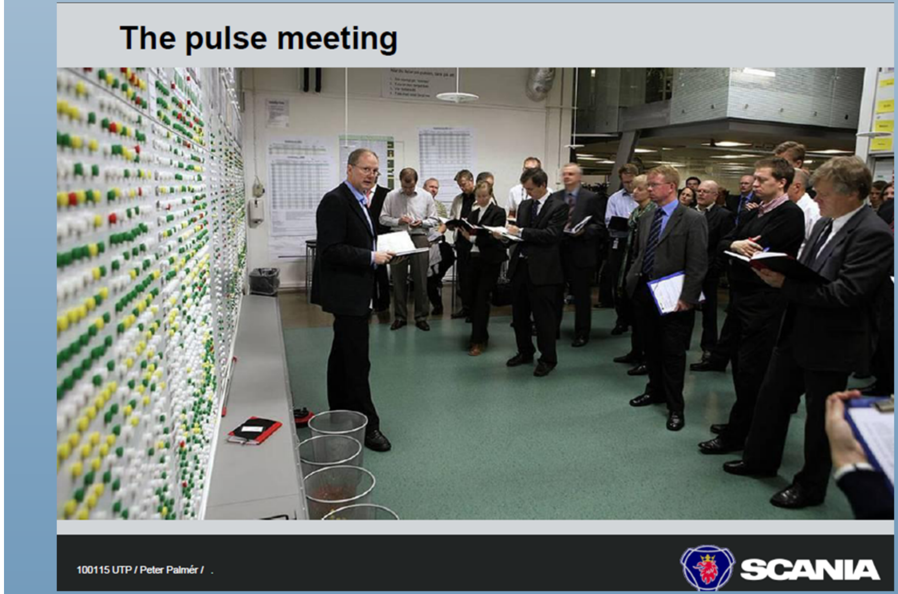
- ✓ *My role was to make sure all of the teams were communicating and had everything they needed to meet the prototype deadlines.* [This role is similar to that of a Release Manager.]

*now part of Cisco

Visualization

Scania



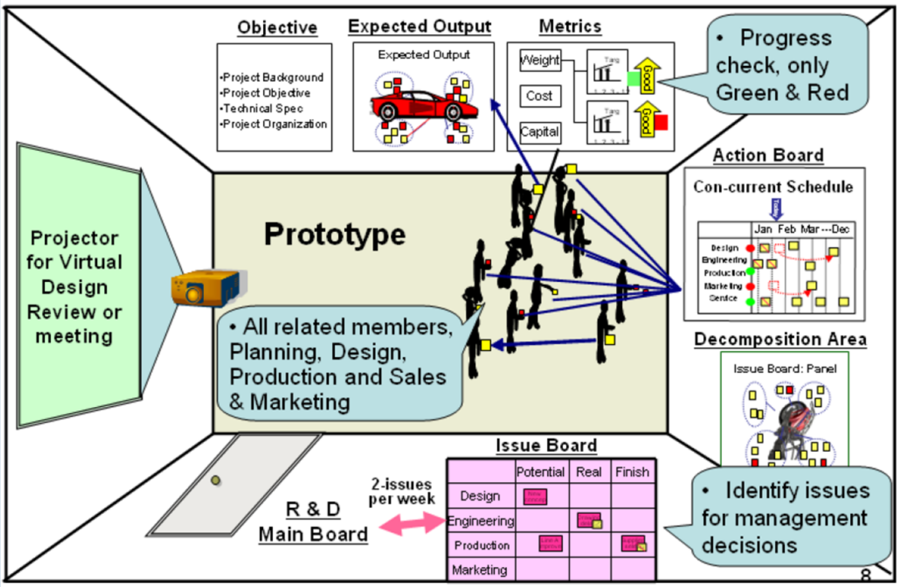


The pulse meeting

100115 UTP / Peter Palmér / .

Toyota

'Obeya' (Big Room)



- Progress check, only Green & Red

- All related members, Planning, Design, Production and Sales & Marketing

- Identify issues for management decisions

	Potential	Real	Finish
Design			
Engineering			
Production			
Marketing			

Cross-Functional Team works with Chief Engineer to make decisions in real time, based on visual information.

Large Scale Integration

Alan Mulally: Changing the Culture at Ford

Restructure the Business:

- ✓One Ford – Global Vehicles
  - × Two Brands, 12 Platforms
- ✓Matrix Organization:
  - × Product Teams (eg. Ford Focus)
  - × Skill Teams (eg. Stamping-and-Body)

Work Together as One Team:

- ✓Information Center (Big Room)
  - × Walls lined with charts and graphs)
- ✓Weekly Meetings (Executive Team)
  - × Anticipate/address problems as a team
- ✓System focused, long term decisions

Accelerate Development:

- ✓Build vehicles that people want & need
- ✓Simplify and streamline development
  - × One team per nameplate
  - × 85% common parts

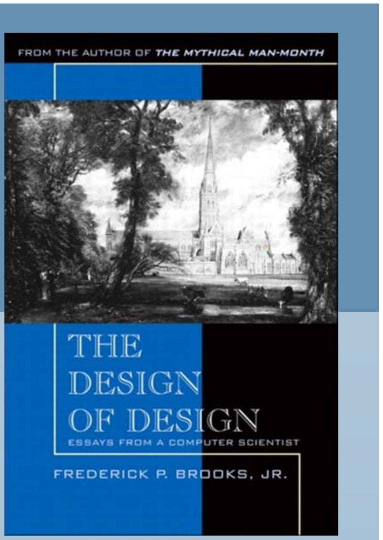
Ford's Biggest Cheerleader

Mulally understands that people crave coming to work at a company they can believe in. He has given Ford's employees a reason to feel good about themselves and proud of the company… by defining a simple, but powerful mission: build higher quality, more fuel efficient, safer cars.

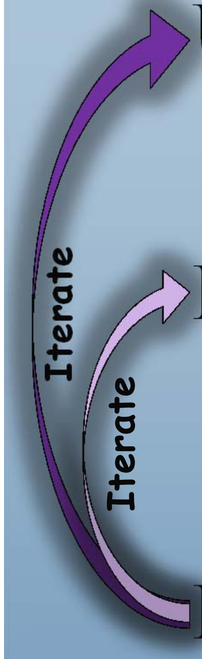
"The more each of us knows what we're really contributing to, the more motivated and excited and inspired we are." (Mulally) — *Tony Schwartz, Harvard Business Review Blog*

Chief Executive Magazine named
Alan Mulally 2011 CEO of the Year

The Linear Thinking Problem


FROM THE AUTHOR OF THE MYTHICAL MAN-MONTH
THE DESIGN OF DESIGN
ESSAYS FROM A COMPUTER SCIENTIST
FREDERICK P. BROOKS, JR.

The Design of Design



Understand the problem

"Deciding what to design is the hardest part of the design task. … A small team is much better [at this] than an individual."

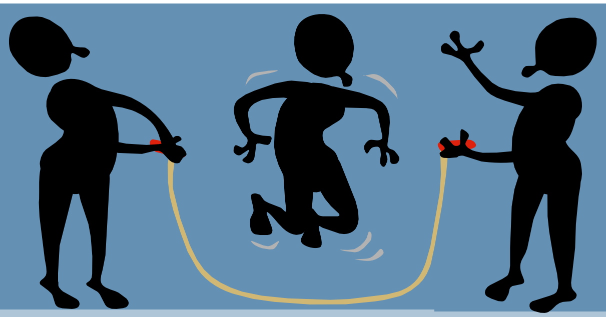
Design a solution

"Design isn't just to satisfy requirements, but also to uncover requirements. … Design isn't simply selecting from alternatives, but also realizing their existence."

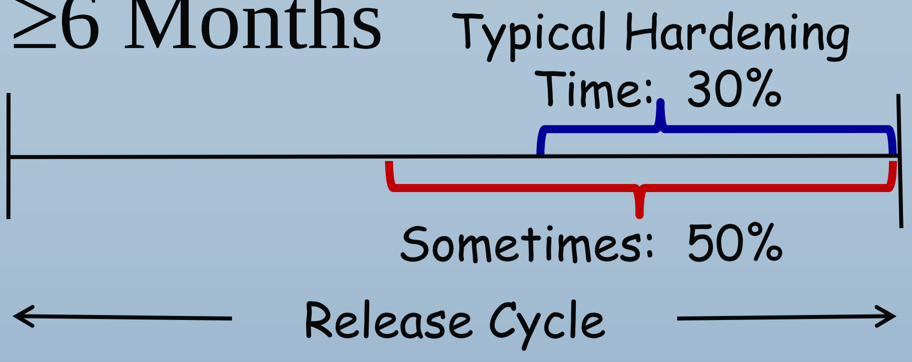
Implement the design

"One of the most striking 20th century developments in the design disciplines is the progressive divorce of the designer from both the implementer and the user. … [As a result] instances of disastrous, costly, or embarrassing miscommunication abound."

Release Cadence



≥6 Months



Typical Hardening Time: 30%

Sometimes: 50%

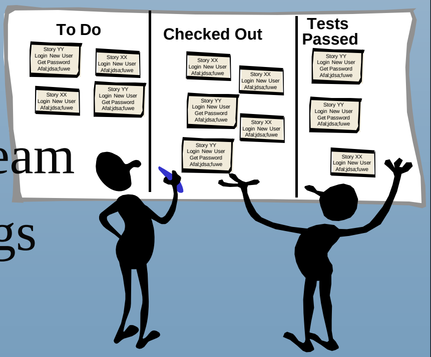
Release Cycle

- ✓ Very low ratio: value time / cycle time

Quarterly

- ✓ Automated integration testing
  - × Gojko Adzic, Specification by Example
- ✓ 2-4 week iterations that produce integration-testable code
- ✓ Business issues: Re-think public release sales & support policies

Monthly

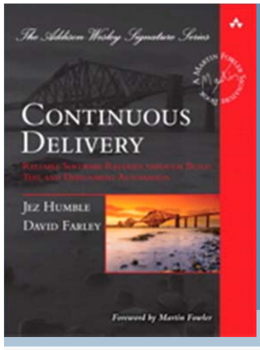


- ✓ Cross Functional Team
- ✓ Short Daily Meetings
- ✓ Visualization
- ✓ Business Issues: Software as a Service (SOS) works best at this cadence.

Weekly/Daily

- ✓ Iterations become irrelevant
- ✓ Estimating is largely unnecessary
- ✓ Kanban works well here
- ✓ Business Issues: Usually limited to SOS or internal releases

Thanks to Kent Beck for these ideas.


The Addison Wesley Signature Series
Continuous Delivery
Jez Humble
David Farley
Foreword by Martin Fowler

Continuous Deployment Requires Continuous Design

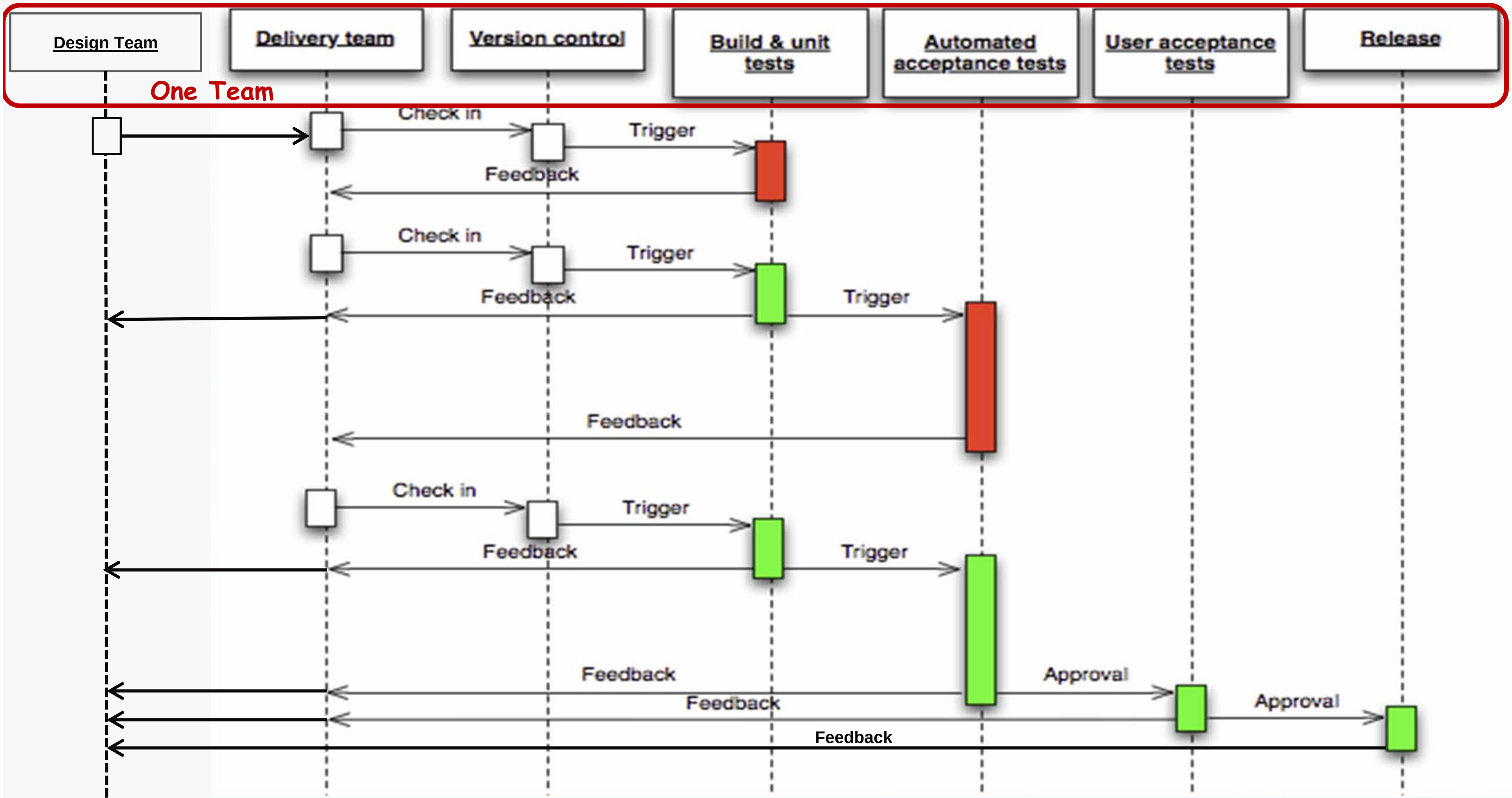


Diagram from Continuous Delivery by Jez Humble & David Farley

Don't Miss

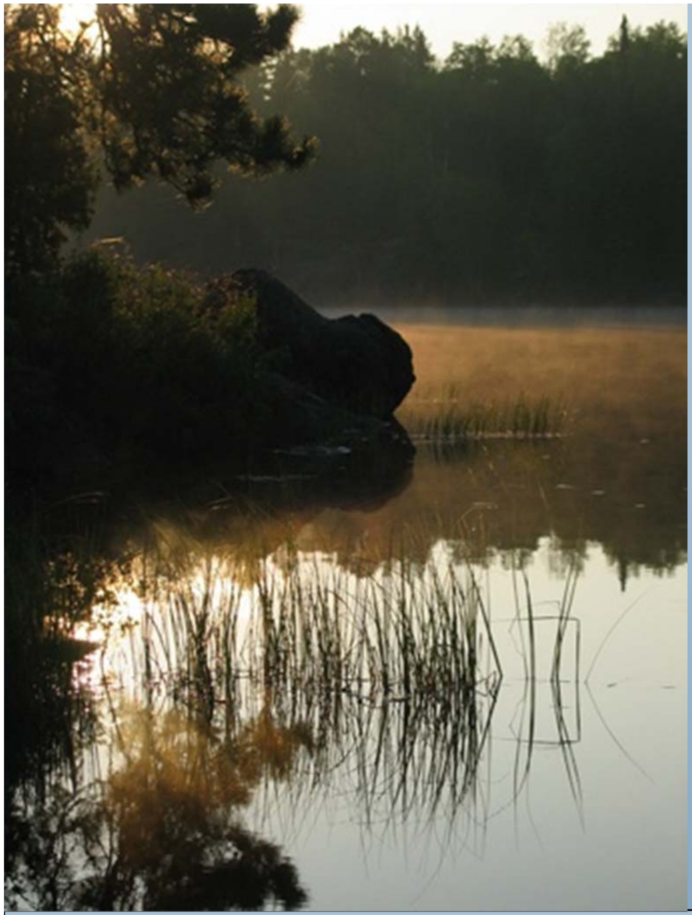
Satoshi Kuroiwa

Former Toyota IT Manager

Designed systems for the NUMI plant in California

Speaking at 1:30 today in this room.

"Basic Principle of TPS
and its Practical Ideas for Agile Software Process"



lean

software development

Thank You!

More Information: www.poppendieck.com