Short Course on

User-Centered Product Definition for Creative Engineering Design

SSSA Pontedera
5 March – 16 April

Course objectives, approach

Objectives: Introduce participants to some Stanford Design Group/d.School and Silicon Valley design methods used in early stages of designing a new product.

Content: Mix of introduced ideas and techniques + hands-on sessions

Schedule: Tuesday/Thursday, with break during last week of March + Easter

Expectations: Modest “compiti” between classes, to gather information, build prototypes. Some tools, materials are provided for class. Student teams are expected to add to these on their own.

Biomimetics and Dextrous Manipulation Lab | Main » PisaShortCourse2013

http://bdml.stanford.edu/Main/PisaShortCourse2013

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User-Centered Product Definition for Creative Engineering Design

Instructor: MarkCutkosky (+39 328 771 4566, cutkosky@stanford.edu). You can often find me in the laboratory of Prof. Cesare Stefanini.

Dates: 5 March - 16 April 2013. Class times are Tuesday/Thursday at 14:30, with a couple of breaks during last week of March (Cutkosky at Washington DC) and for Pasqua.

- Detailed Schedule (PDF)

Location: Aula 1 + other rooms, as needed, at SSSA Pontedera

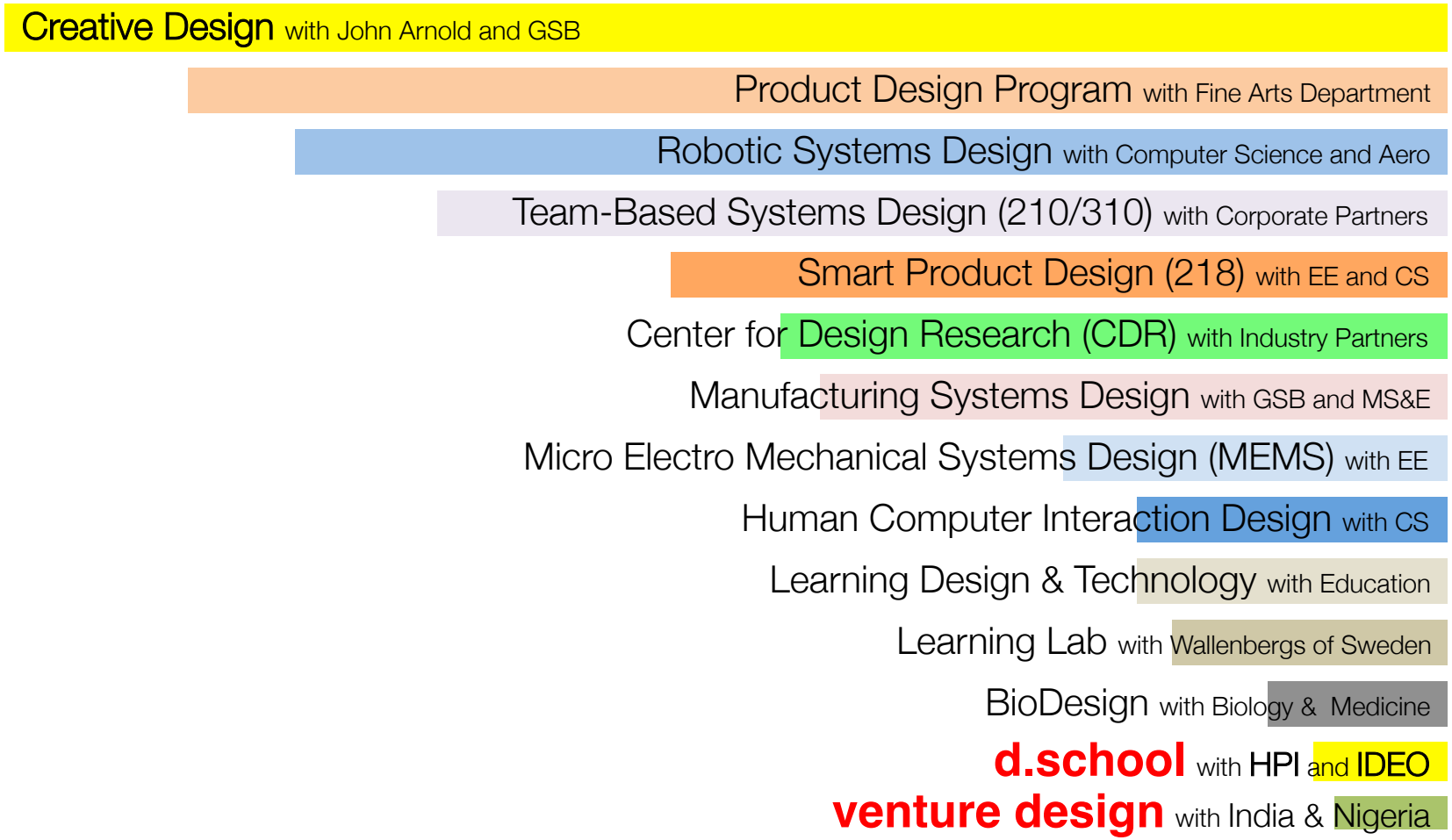
Description:
The objective of this short course is to give participants an introduction to some of the methods used in the Stanford M.E. Design Group, the d.School and design firms in "Silicon Valley," to promote user-centered design. The course content is taken in part from the first quarter of a graduate design sequence at Stanford, ME310abc, and focuses on the early stages of product development, when the main challenge is to determine *what to design*. In ME310, teams of graduate students at Stanford collaborate with partner teams at various universities around the world to address problem statements provided by corporate partners. Specific methods introduced in the first part of the course include: structured brainstorming and design definition, user and technology benchmarking, persona development and critical experience and critical function prototyping.

For the purposes of
by the instructor. At
product developme

http://bdml.stanford.edu/Main/PisaShortCourse2013

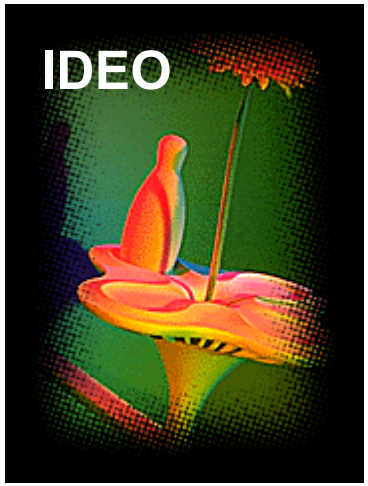
The course is recommended for graduate engineers interested in engineering design that addresses the (sometimes hidden) needs of users. Enrollment will be limited to 32 participants (8 teams of 4). Informally, it is also a prologue to the design course that Prof. Cesare Stefanini will be conducting this spring.

Context: 50 years of project-based design



Context: entrepreneurial design connections

ATLAS SNOW-SHOE COMPANY

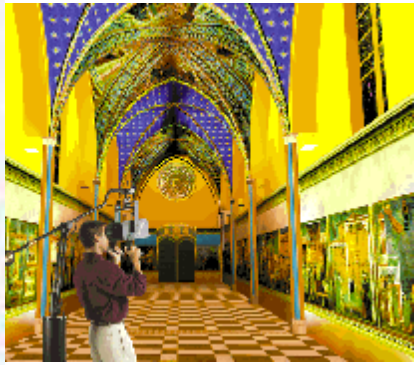


Gyration

big island

welcome to the island

Immersion Inc.



CROSS ROUTE
Enterprise Systems Integration
EXTENDING THE ENTERPRISE
SITE MAP

VIRTUAL TECHNOLOGIES

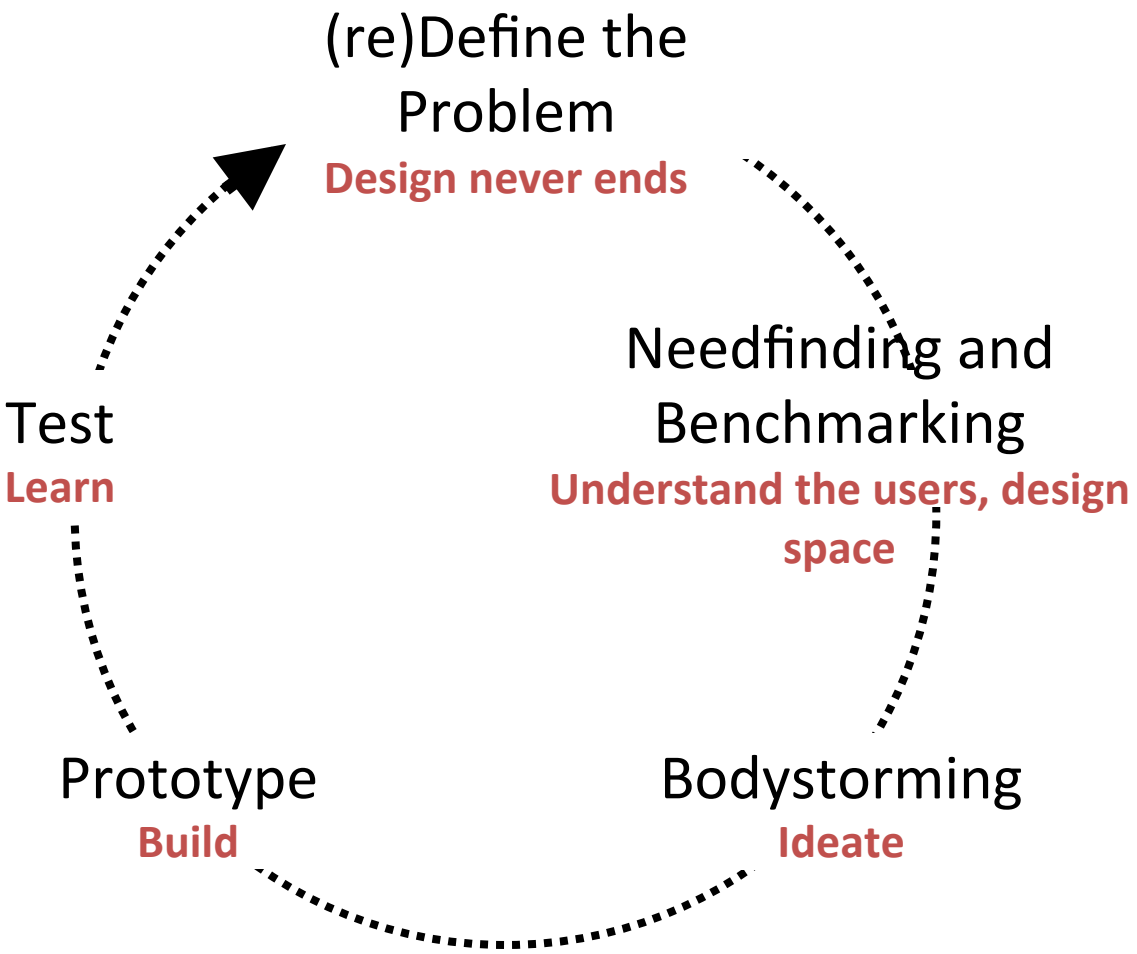
addressed by **IDEO** co-founder, Prof. David Kelley


tangible communication

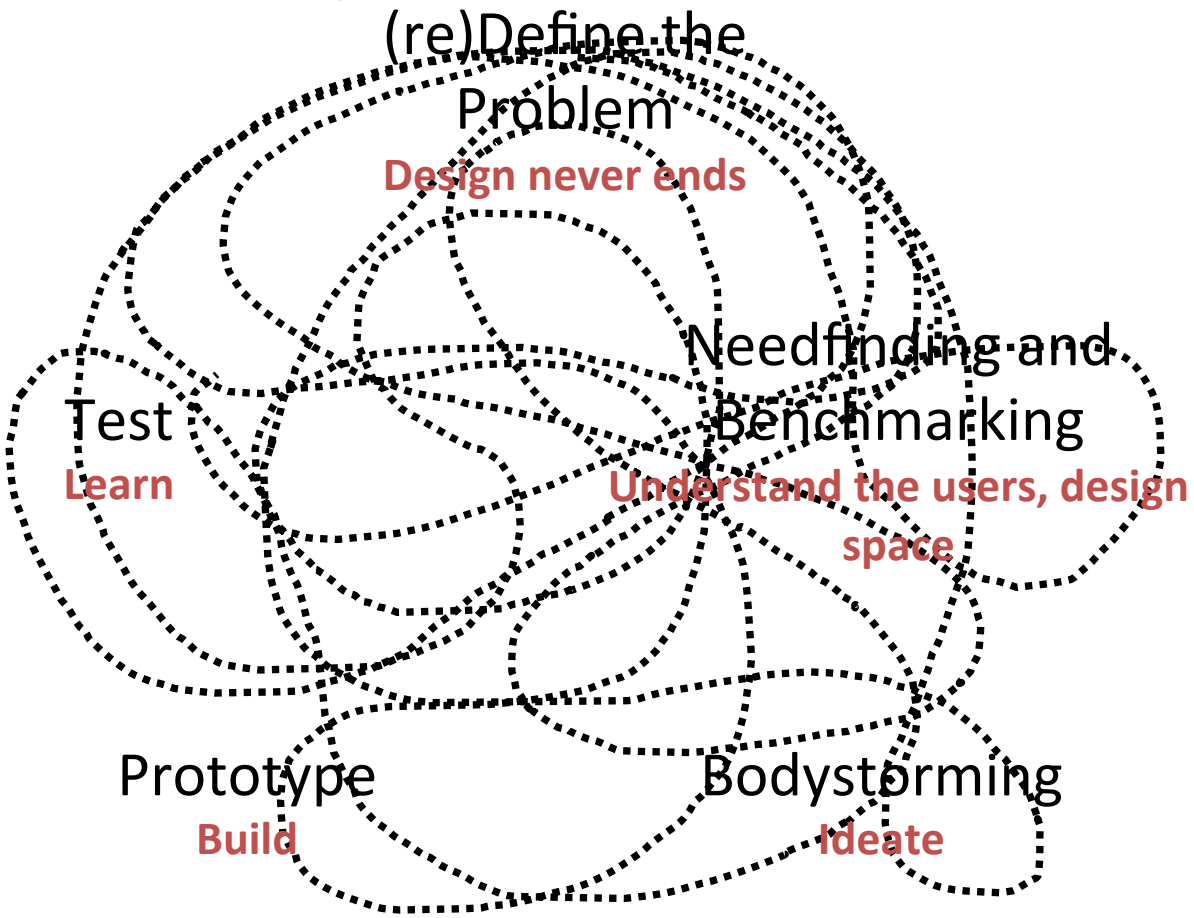

prototype storming


defying gravity

Stanford-IDEO
early **design process**



Stanford-IDEO like design process … in reality

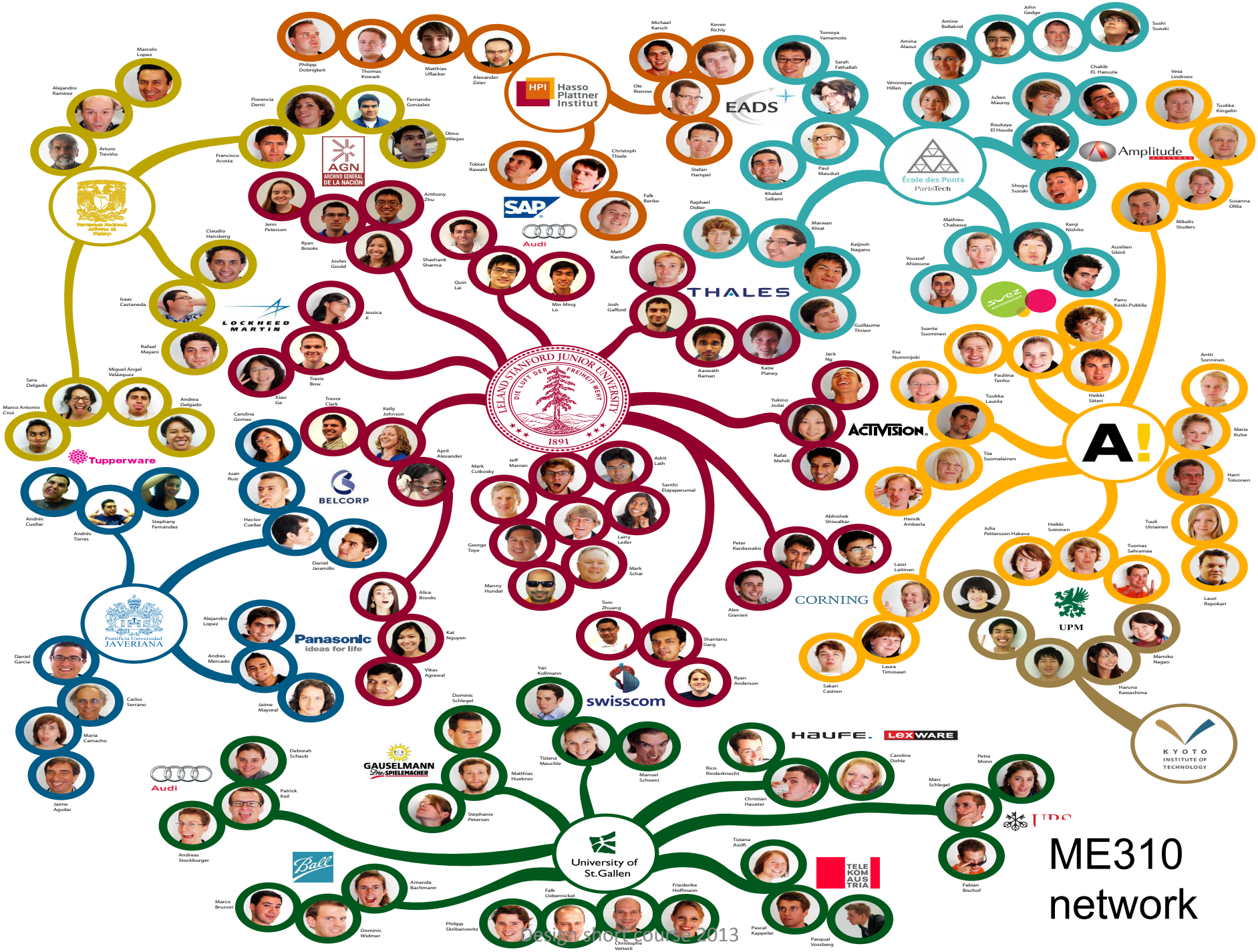


Background: Two kinds of project courses

- Projects specified by instructor
- Pedagogically inspired
- Everybody does same project
- Content introduced *Just in Time*
- Results:
  - Effective content injection
  - High enthusiasm
  - Potential for overload
  - Organized
  - Sometimes unclear if "real world"

- Projects taken from outside (e.g. industry)
- Every project is different
- Process introduced *Just in Time.*

- Results:
  - Real world
  - Mixed enthusiasm
  - Potential for overload
  - Sometimes seen as "not organized"


Stanford University
1891
Hasso Plattner Institut
SAP
Audi
EADS
École des Ponts ParisTech
Amplitude
THALES
LOCKHEED MARTIN
ACTIVISION
A!
Tupperware
BELCORP
Panasonic
ideas for life
Pontificia Universidad JAVERIANA
CORNING
UPM
swisscom
GAUSELMANN
HAUFE.
LEXWARE
KYOTO INSTITUTE OF TECHNOLOGY
University of St.Gallen
TELEKOM AUSTRIA
Ball
AGN
ARCHIVO GENERAL DE LA NACIÓN
ME310
network
design short course 2013

ME310 Project-based learning

I hear and I forget.
I see and I remember.
I do and I understand.
Confucius

Me310 is about forming and running creative, productive, engineering design teams.

It is also about "the Design Division philosophy" of engineering design.

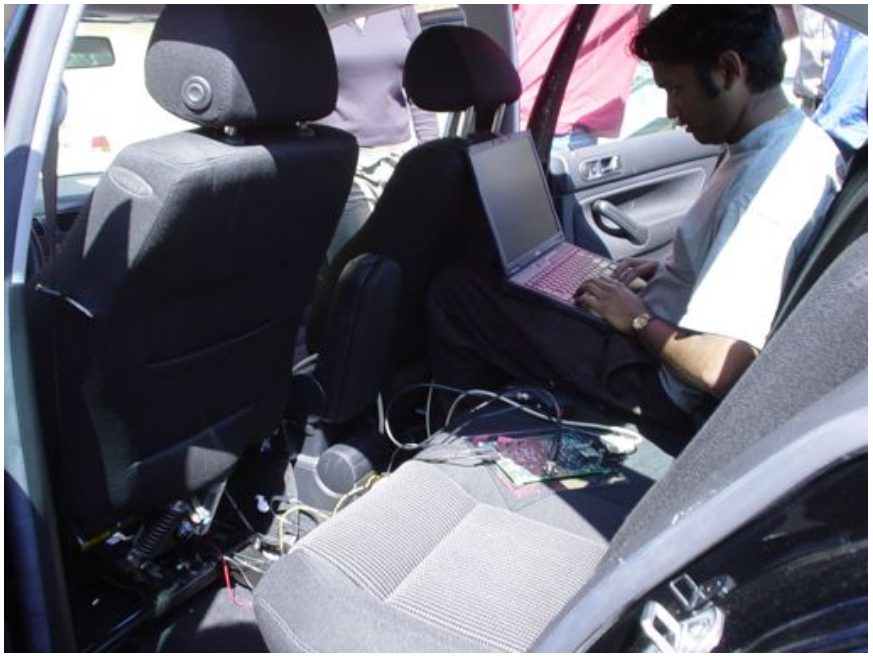
It is the quintessential project-based learning (PBL) course:

- see and hear
- do and experience
- reflect and introspect
- document for the future

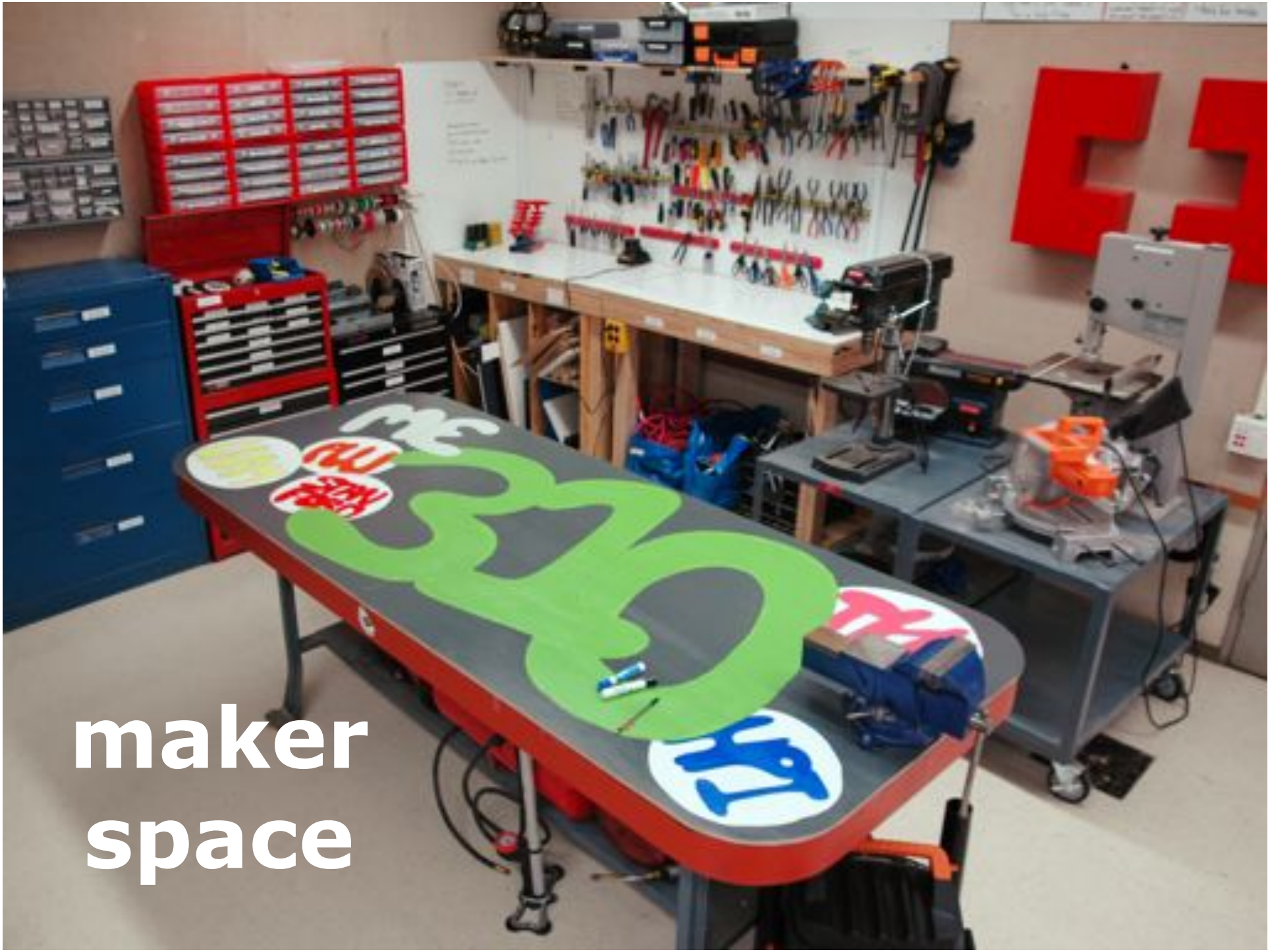

30 weeks
Autumn
Winter
Spring
Presentations &
Documentation
short course focus
Autumn
explore the
problem
space
Corporate
Projects Start
Paper Bike
Design
Exercise
Benchmarking
Prototypes
Critical
Function
Prototype
Winter
explore the
solution
space
Darkhorse
Prototype
Funky System
Prototype
Functional
System
Prototype
Spring
deliver a
functional
product
Whatever it takes to get it done
(testing, refinement, manufacturing)

Typical project development

Fall: **Make it up**
Winter: **Make it Real**
Spring: **Make it Happen**




tangible
access to each other


maker
space

Where does the project come from?

- **Traditional Engineering** -- *A **problem** looking for a **solution…***

  "We have this interesting problem and hope that you can design something that provides a solution to it."

Successful but limited innovation…

Where does the project come from?

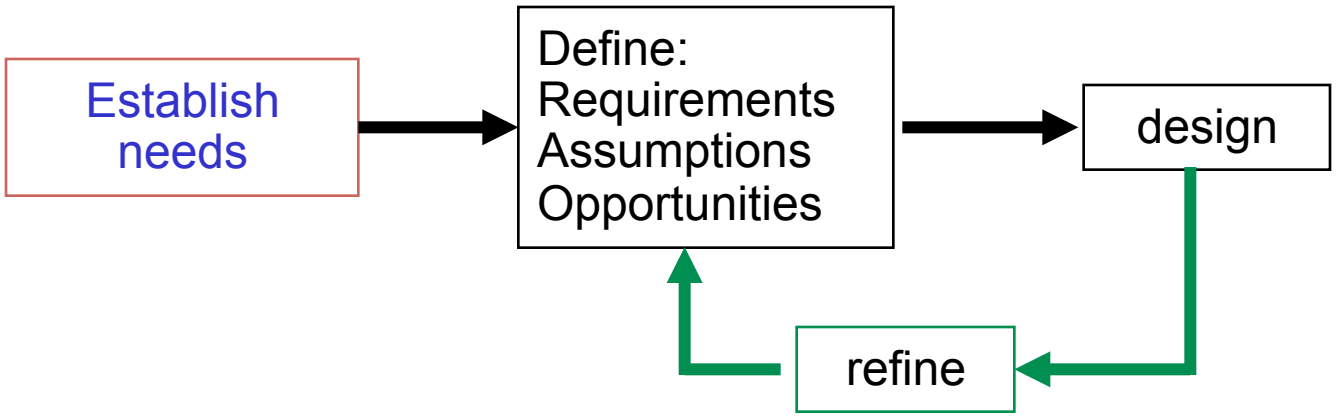
- **Technology Push** -- *A **solution** looking for a **problem**…*

  "We have this interesting new sensor (or actuator, or material, or display, or…) technology and we hope that you can design something that will make use of it and help create a market for it."

Innovative, but limited success…

Where does the project come from?

- **Needs Pull**: "*We think there may be an opportunity to design something that improves the experience of…*"



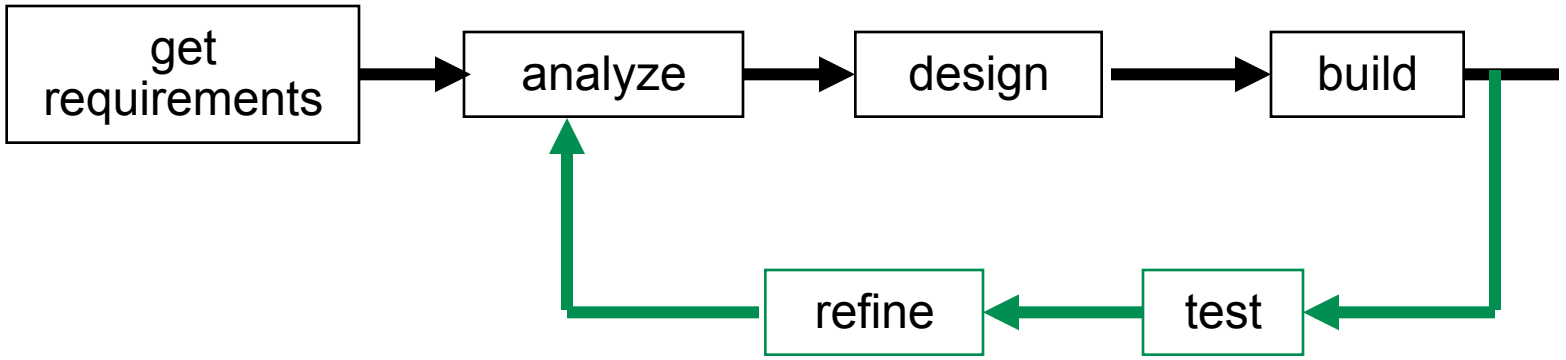
Successful and innovative!

Symbiosis

Driving better all the time...

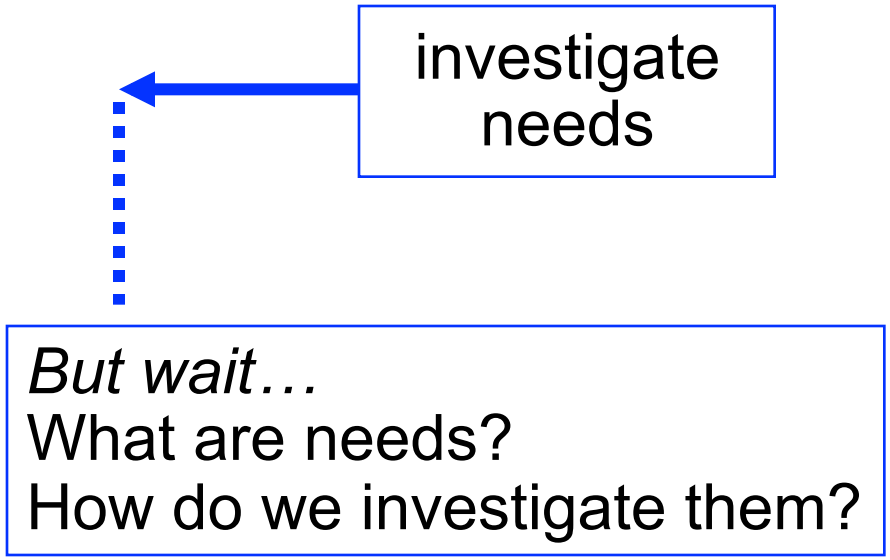
- The car adapts, so that from the driver's perspective it is *better* after one year than when he bought it.
- The car helps the driver to drive *better*, with greater safety, skill and enjoyment.
- Like a prized horse and rider, they are a symbiotic team, *driving better all the time.*

Traditional Engineering Design Process



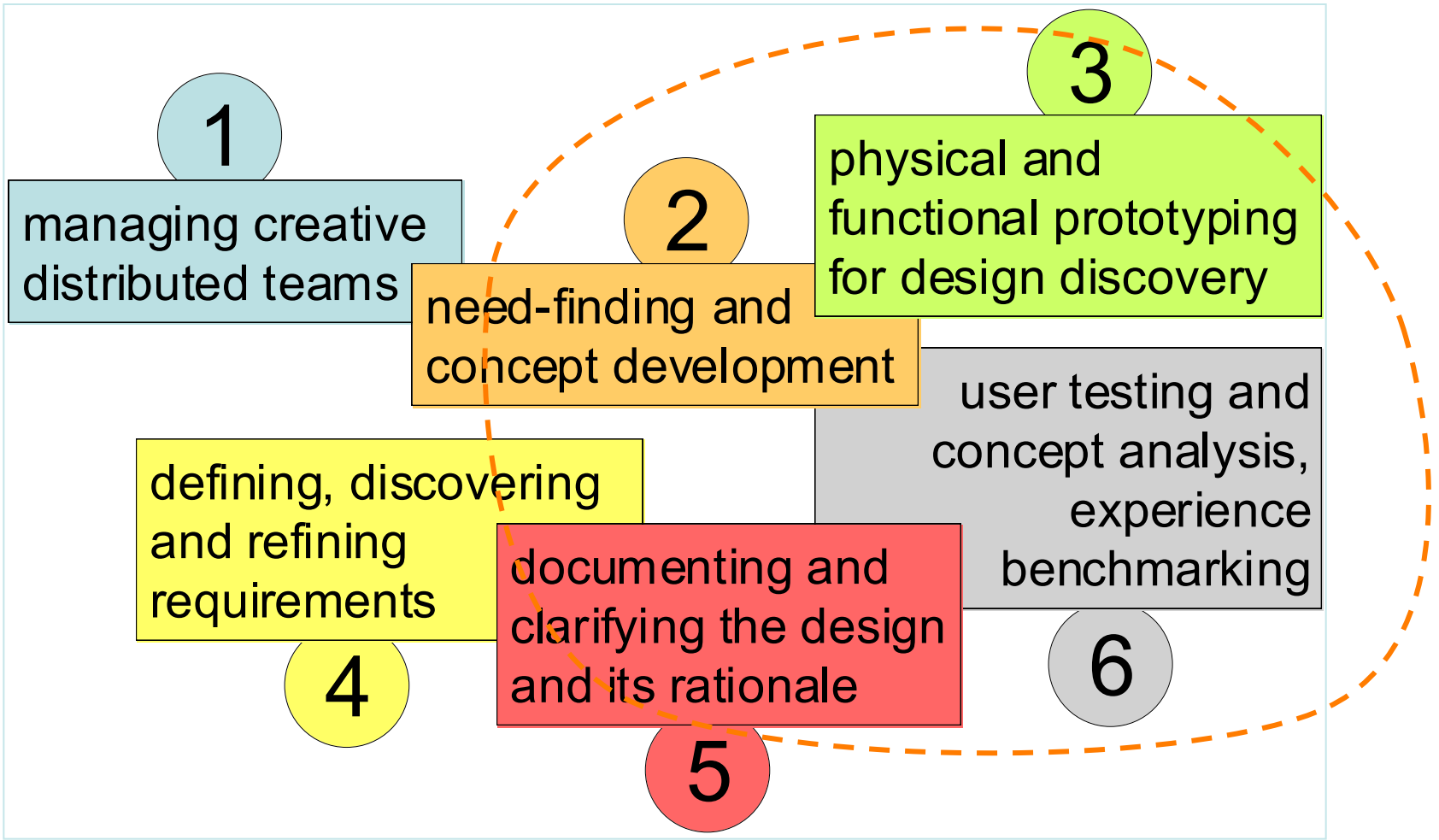
Needs-based Design
requires a new design process

Needs-Based Engineering Design



Stanford ME310 - Fall quarter topics

(topics especially useful in the early stages of design projects)



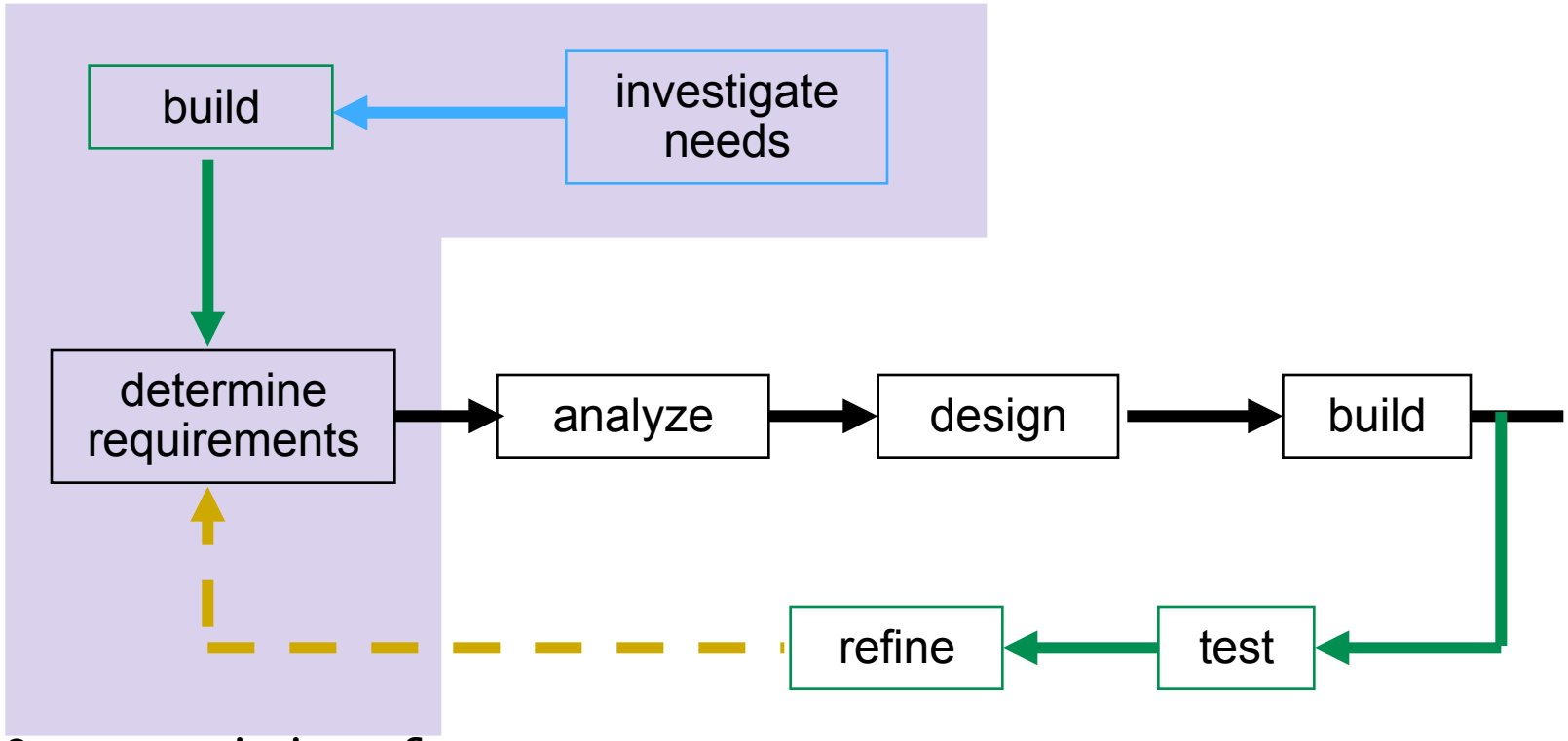
“Deep Dive” Video

IDEO design process

Look for:

- identifying **needs/opportunities**
- benchmarking, researching
- brainstorming
- building early prototypes to help define **requirements**

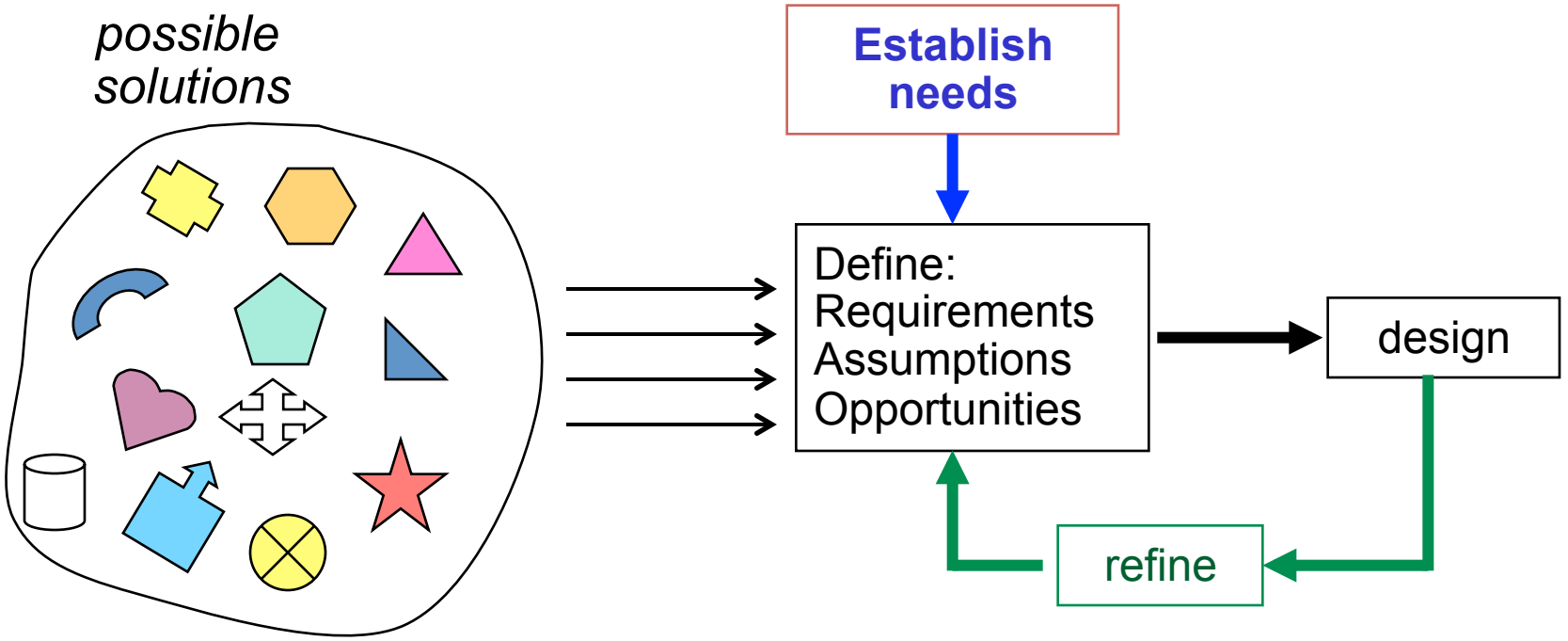
Needs-Based Engineering Design



Opportunities for Market Discovery and Creation

But companies have solutions and they want to create markets and products for markets…

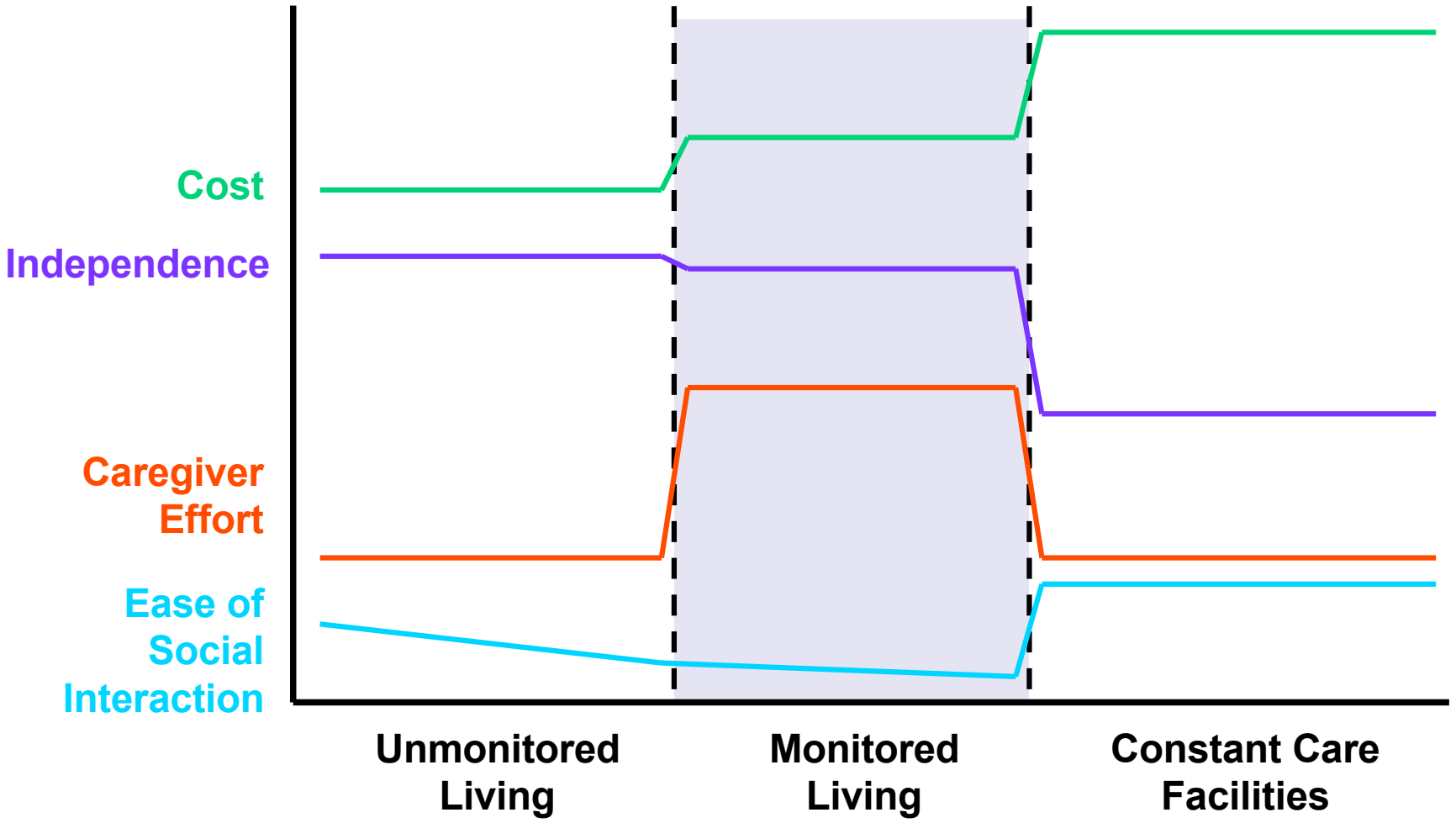
So how does it really work?



Example #1: Intel **Intel**liCare

- Intel Corp. has microprocessor solutions for wireless applications.
- What groups of people have needs that might create market opportunities for such devices?
- What products and markets might develop around these needs?
- What designs could help define a market?

Phases of Aging – iCare Focus



IntelliCare: persona development

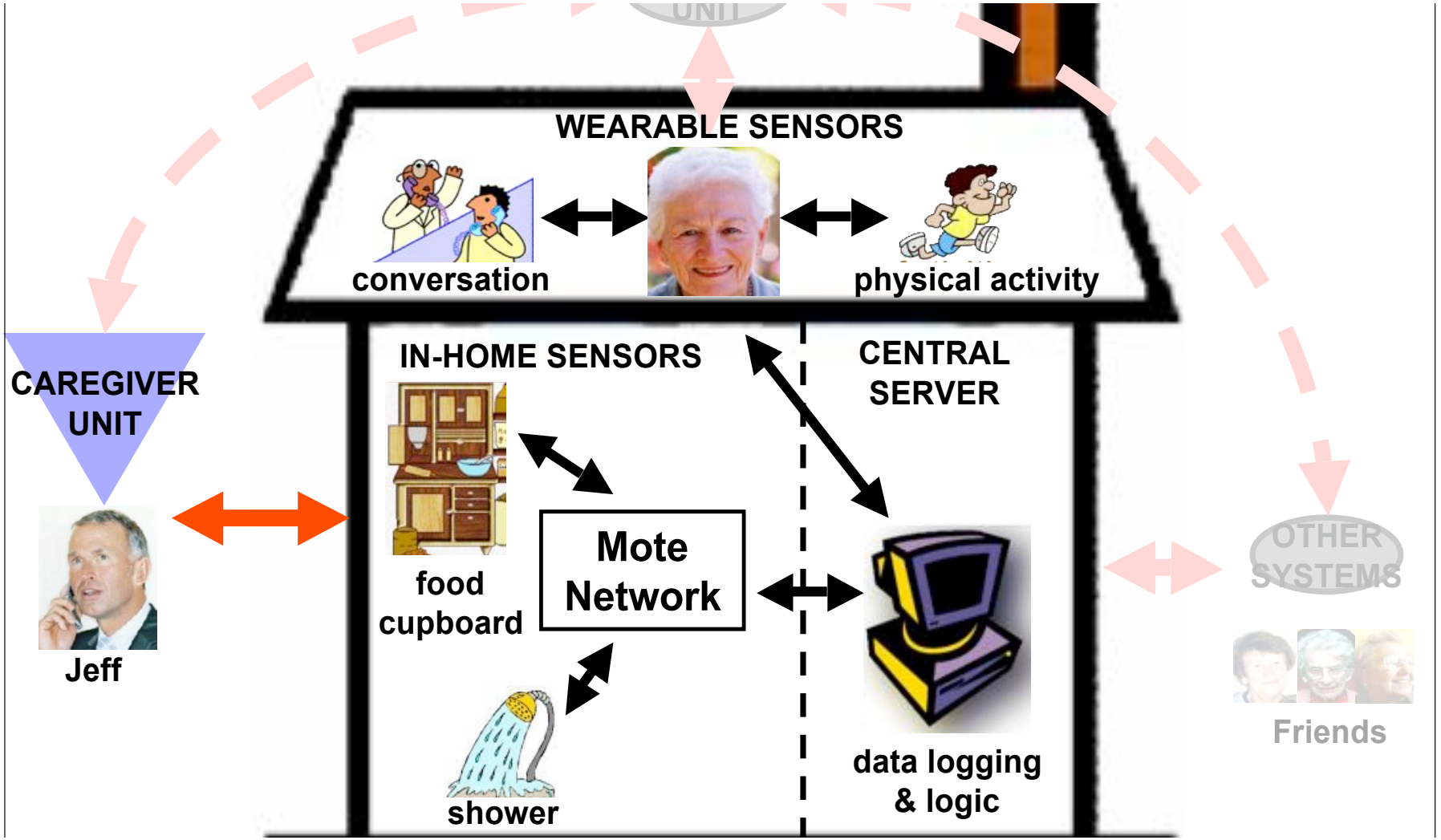
How: Based on user interviews, benchmarking (literature + social services, etc.)
Why: promotes attention to detail that makes a design truly meet users' needs

Figure 11: Mary and her son Jeff

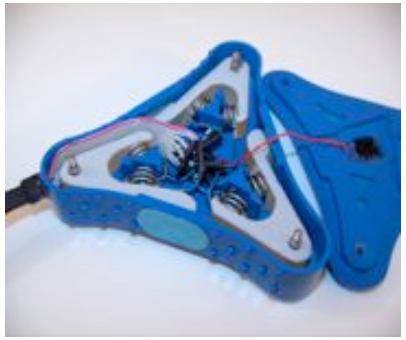
This scenario was developed by the members of team INTELiCare. It serves as a situation that the team used to design around. The situation is intentionally designed to be simple, so the initial system design may be straightforward and less prone to complication.

Meet Mary and Jeff. Mary is an 88-year old widow who lives independently at her home. She is in good physical health, but is becoming more forgetful as her age increases. Additionally, she has become more isolated, resulting in decreased physical and social activity levels. Mary's son Jeff becomes increasingly concerned as he notices decline in her activity levels and mental sharpness. When the need arises, Jeff will act as Mary's primary caregiver, since he is her

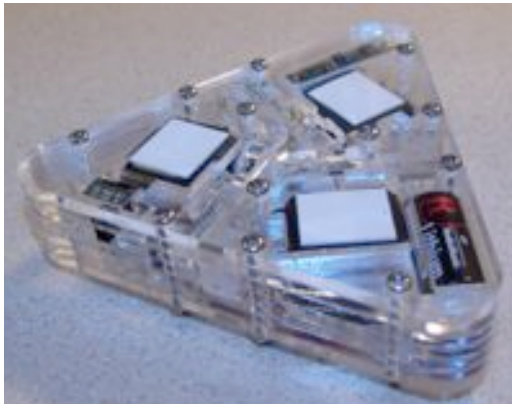
IntelliCare: context framing, benchmarking



Various prototypes from Stanford and Sweden (KTH)



prototypes of caregiver ambient display (shape change & vibration)



prototype of elder unit (pendant)

Example #2: Panasonic

Develop innovative “hands free” solutions for interacting with personal devices (smartphones, MP3, bluetooth headset, etc.)

- *Team identified problem:* unobtrusive control of devices, calls, etc.
- *Team identified solution:* use “teeth click” and head tilt as control inputs

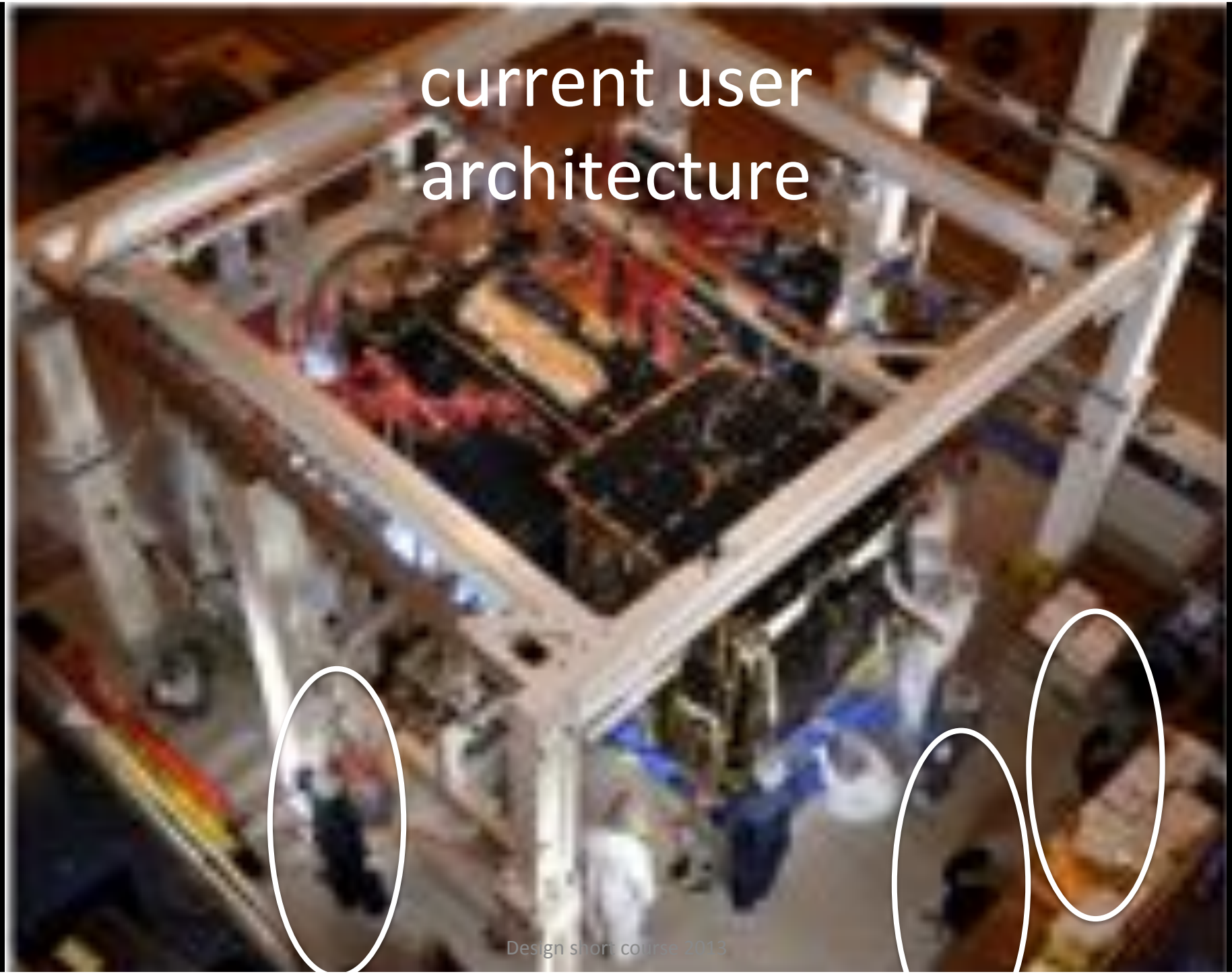
example #3: Satellite Manufacturing

Need-find, conceive, build-test
re-invent the physical architecture of communication satellites

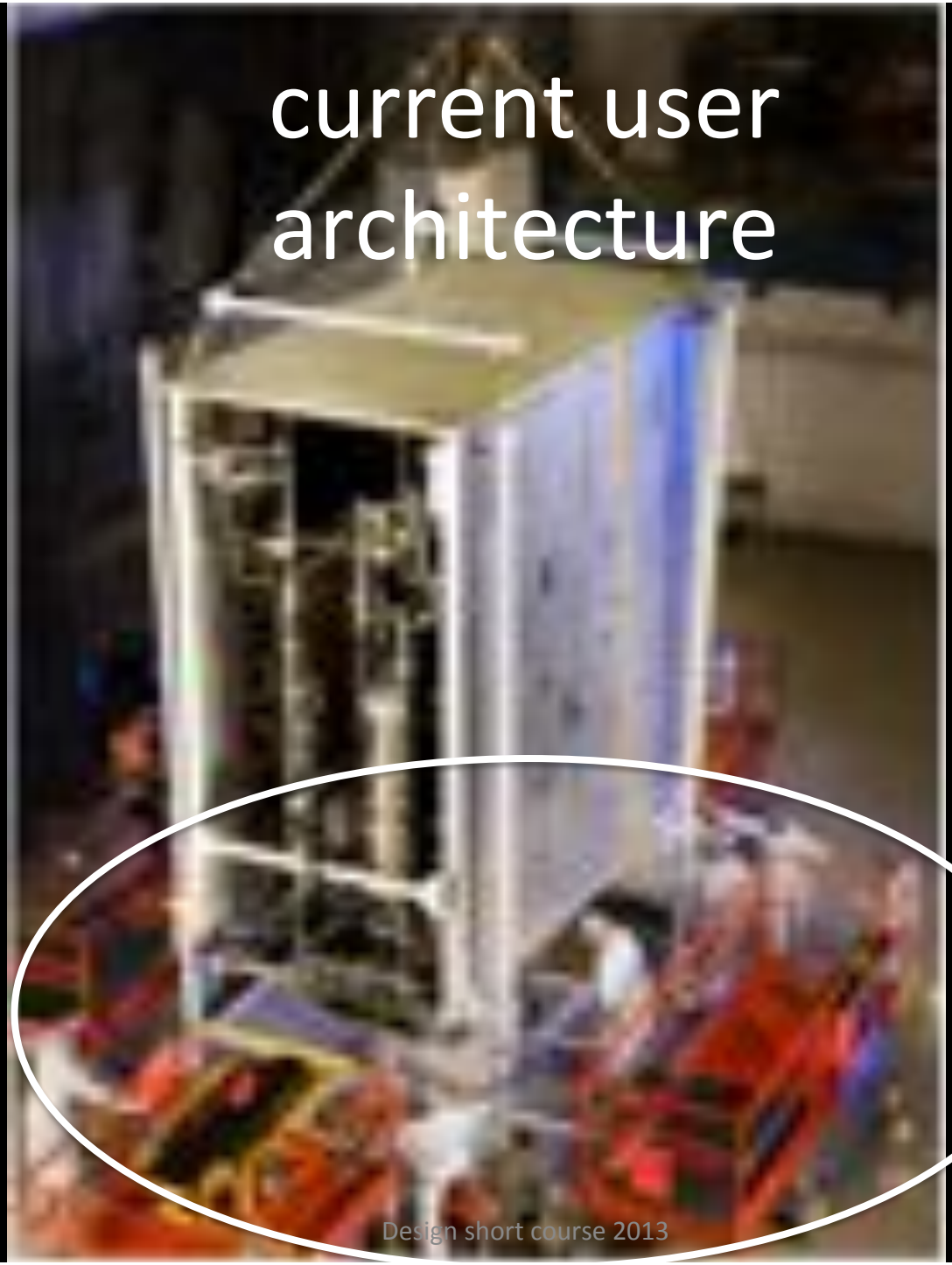
for Lockheed Martin

with Cali Columbia in 2011-12

current user architecture



current user architecture



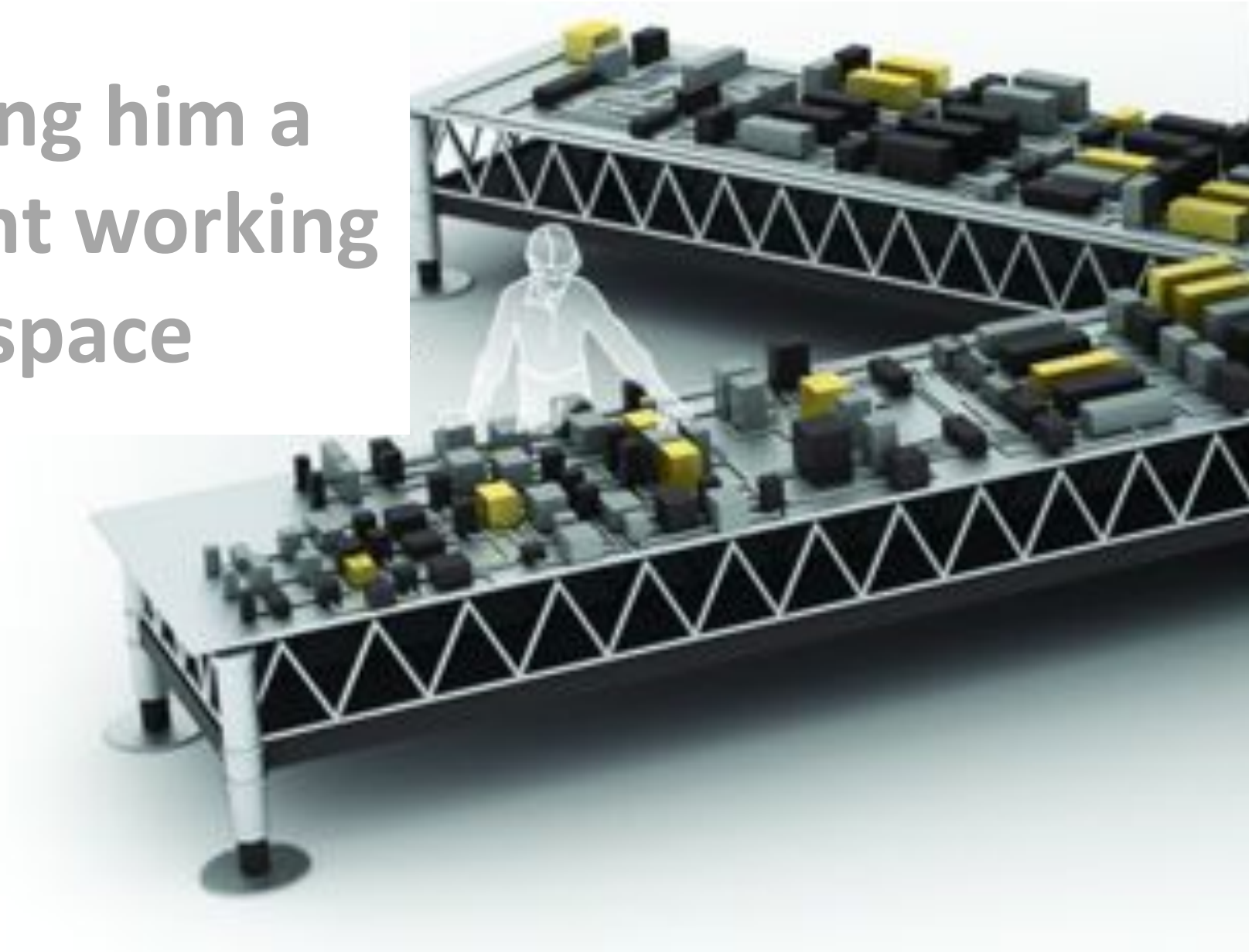
meet Kevin

Creating ***personas*** helps to ensure that user needs and desires are addressed

Based on interviews at Lockheed and Loral:
Enthusiastic, active.
Likes space domain.
Detail oriented, neat.
Doesn't like documentation
Doesn't like disassembly and rework…

keeping the user in perspective

giving him a decent working space



me310 example #4

need-find, conceive, build-test

re-invent the nursing home experience

for Swedish Welfare Agency with Lülea SE 2006

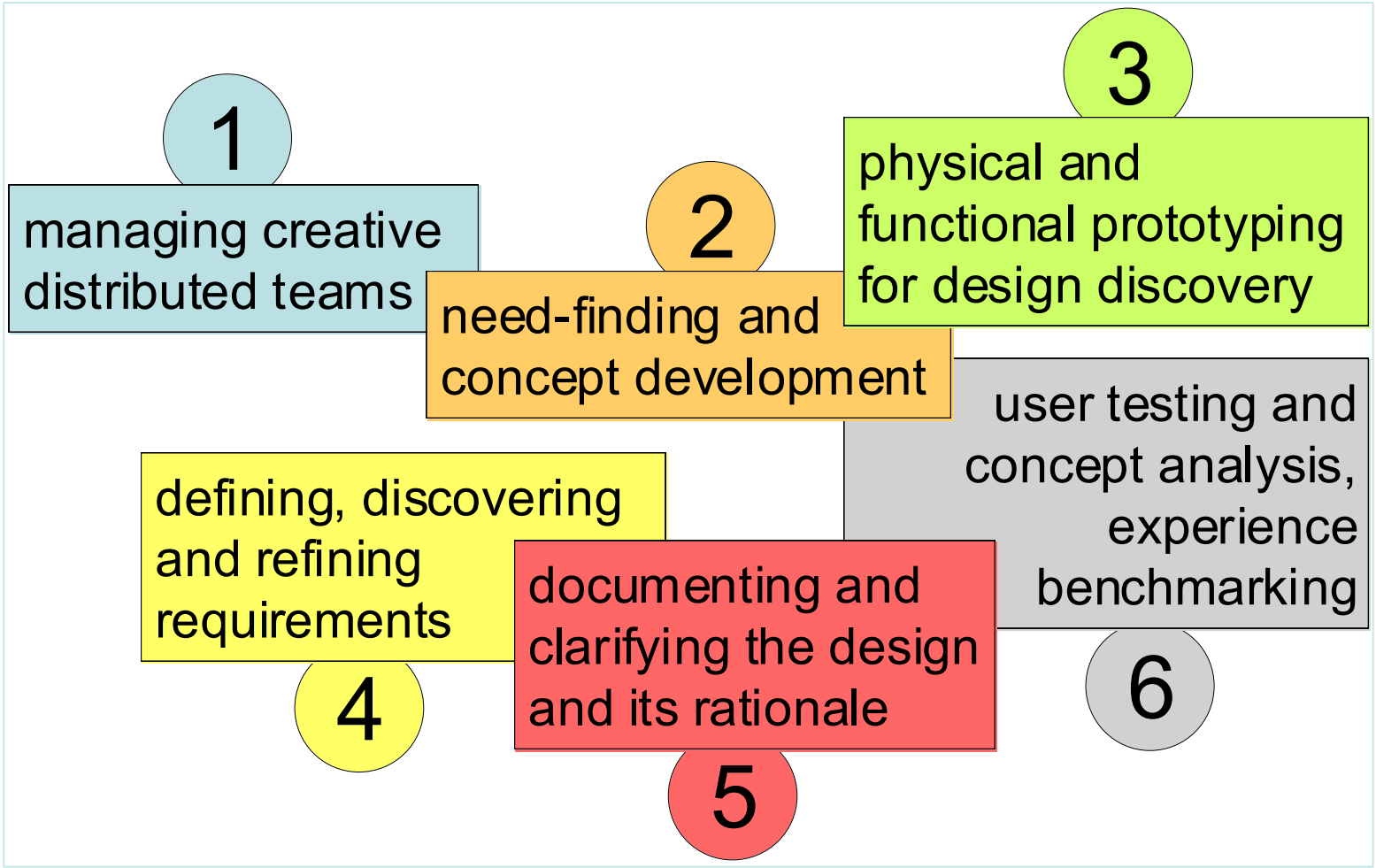

California


Sweden

benchmarking

Revisiting those "tools for early stage design"

(What have we seen examples of?)




design is all about people

Team Analysis (Wilde*/Jung/Myers-Briggs)

At any moment a person can be

Perceiving ⟷ Judging

Perception can be through

Sensing ⟷ Intuition

Judging can be based on

Feeling ⟷ Thinking

Any of these modes can be used in two ways:

Extroverted ⟷ Introverted

<Cutkosky,Richter,Dorn,Scheinman>

*Wilde, D.J., *Teamology: The Construction and Organization of Effective Teams*, Springer-Verlag (2009)

When faced with a design challenge my first preference is to…

take some time to think about the problem, perhaps sketching ideas, or making notes.
My best ideas often come to me when I'm in this reflective mode.

talk to people, look things up, go places, and get as much input as I can. I find that my best ideas are often triggered by external interactions.

Example #5: Getting closer to the inspiration of this short course…

Design something that will represent a new potential market for **Gorilla Glass**

- *Corning*
  - Materials Manufacturer
    - Pyrex® - heat resistant glass (beakers, test tubes, etc.)
    - Corning Ware® - kitchen-grade glass ceramics (baking trays, etc.)
    - Low Loss Optical Fibers
    - Gorilla® Glass - fusion process, ion-exchange, strength, no scratching
  - Products in many markets
    - Display technology, Telecom, Environmental
    - Specialty Materials (Gorilla®)
  - Fundamental Research (Materials and Processes)

- *Gorilla® Glass*
  - 2X strength at 1/2 the thickness
  - Scratch and abrasion resistant
    - 30x more than plastic
    - 5x more than conventional glass
  - Thin and strong
    - 0.5mm to 2.0mm thick
    - Flexible
  - Order of magnitude more expensive than ordinary soda-lime window glass