

dancing with ambiguity

user centered product service innovation

larry leifer

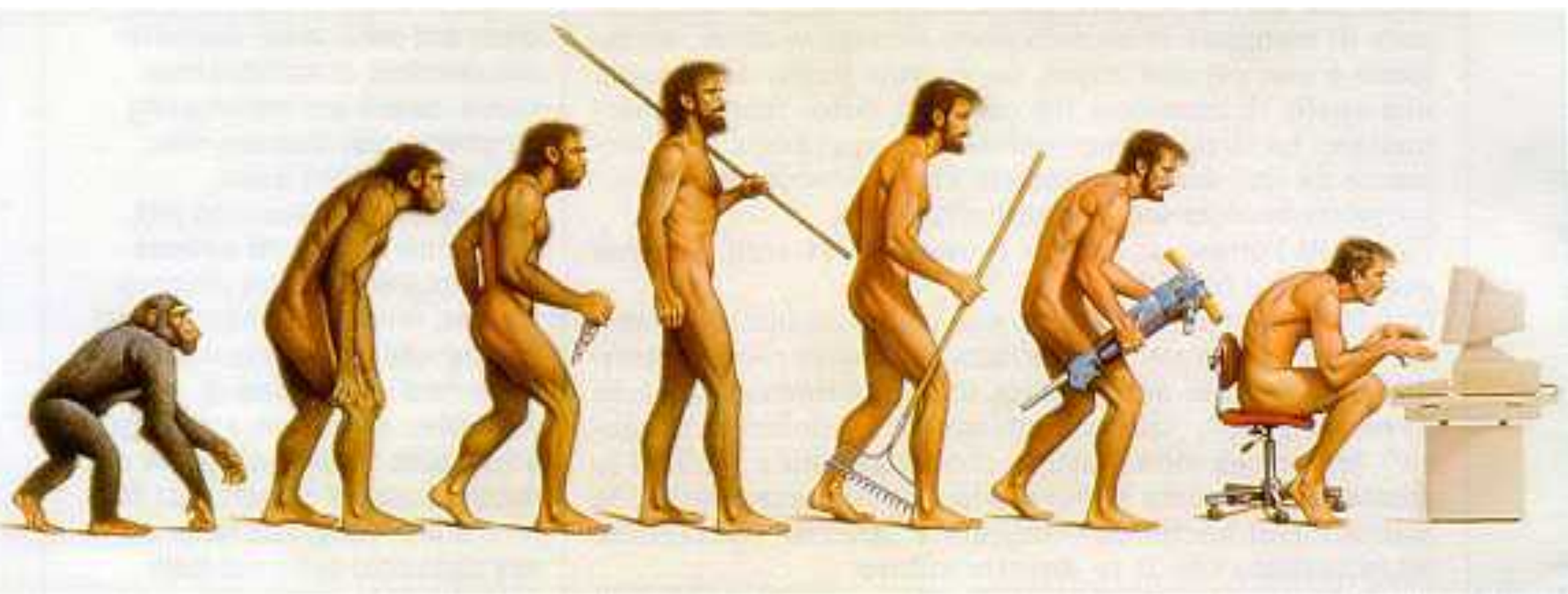
center for design research @ stanford university
international conference on service oriented computing
ICSOC'2010, San Francisco, 09 december 2010

letting

trans-disciplinary teams be creative

letting

service innovation happen



my journey



1,035,968 BCE

our journey

today we go **hunting** for the next
big idea in service oriented computing

and the road map
looks like this

OK

so what can we do

The McGraw-Hill Companies

BusinessWeek

MAY 17, 2004

www.businessweek.com

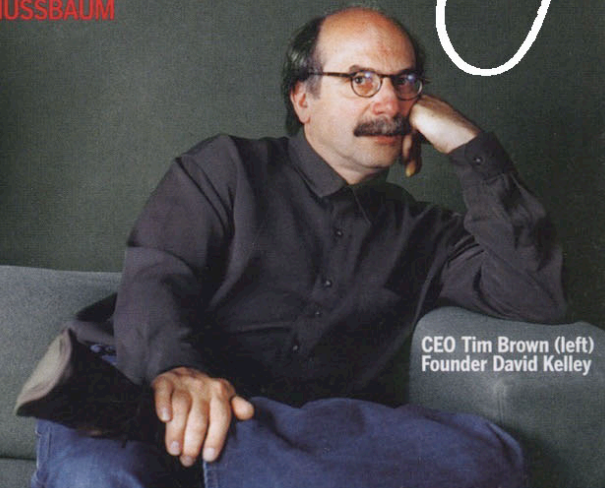
the
break
through

THE POWER OF DESIGN



Thinking
A firm called IDEO redefined good design by creating experiences, not just products. Now it's changing the way companies innovate.

BY BRUCE NUSSBAUM



CEO Tim Brown (left)
Founder David Kelley

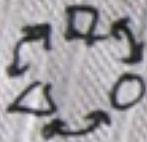
COVER PHOTOGRAPHY
BY TIMOTHY ARCHIBALD

the plan

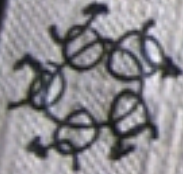
OUR INTENT: CREATE THE BEST
DESIGN SCHOOL. PERIOD.



prepare FUTURE INNOVATORS to be
breakthrough thinkers & doers



use DESIGN THINKING to
inspire multidisciplinary teams



foster RADICAL COLLABORATION
between students, faculty & industry

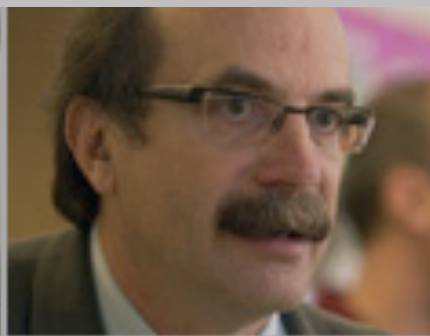


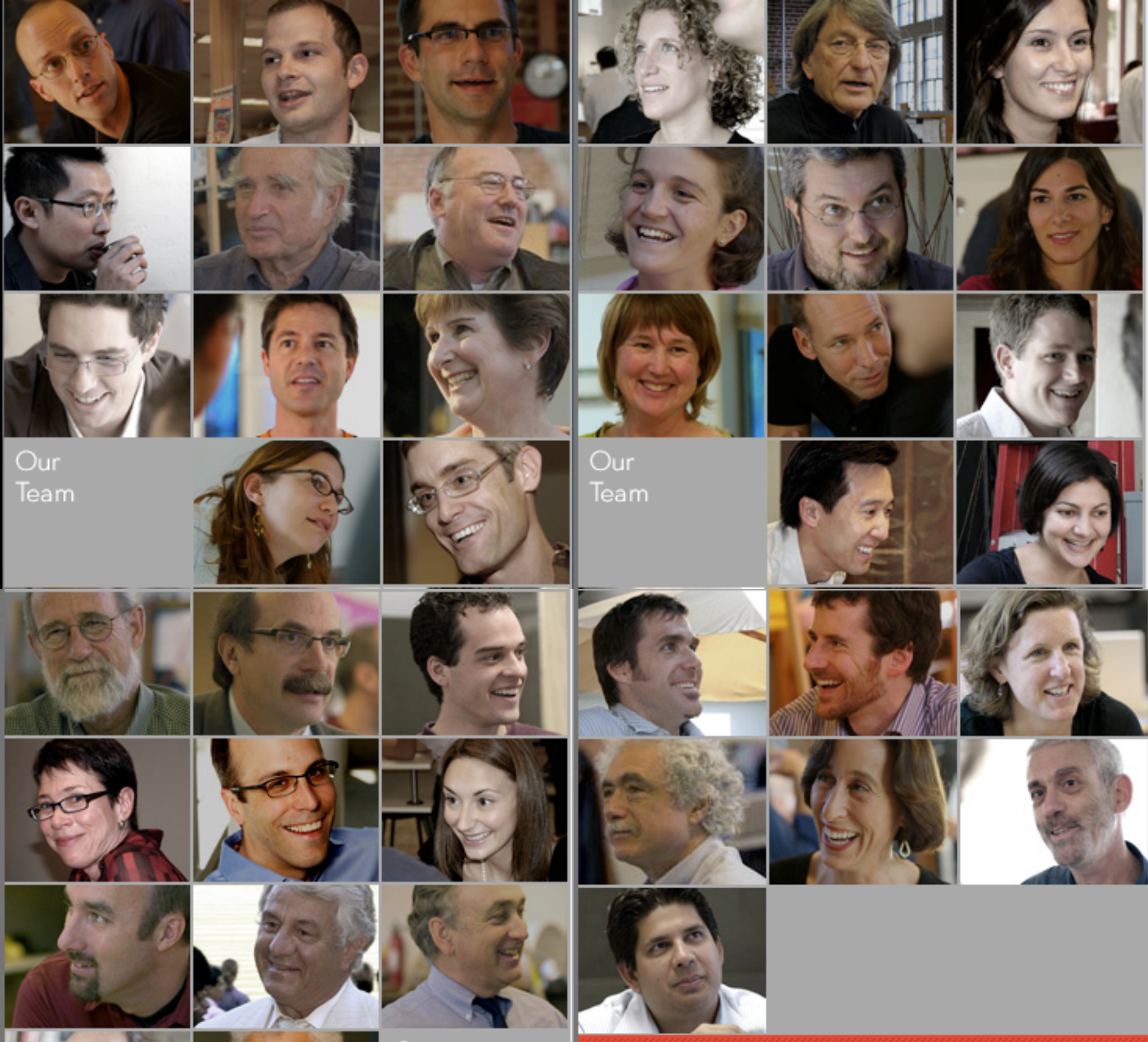
tackle BIG PROJECTS and use
prototyping to discover new solutions

STANFORD d school

start-up d.team

january 2006





d.team today

january 2008



Prof
computer
Science

Prof
business

Prof
Entre
preneur
ship

MBA
student

artist-
engineer
now our
man in
Paris

mechanical
engineer
student

the action is
peer-to-peer
service
learning

it is always about people



tangible communication



prototype storming



accelerated learning



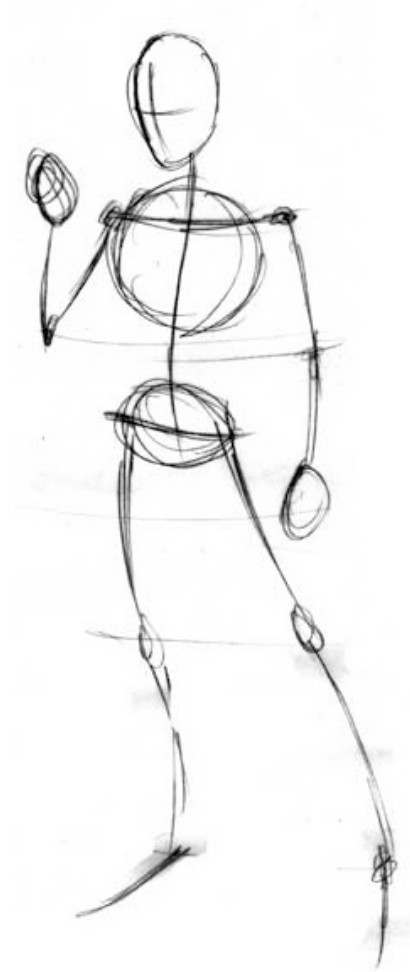
defying gravity



creating ambiguity

building “T” people

should **i** be
an



“**I**”

shaped

or

“**T**”

shaped

person

today



“|”
shaped



Design Thinking Behavior

in-depth knowledge

**“T”
shaped**

why is it so hard



Design Thinking Behavior

in-depth knowledge

to be a “T” person

FORESIGHT
thinking & doing

DESIGN
thinking & doing

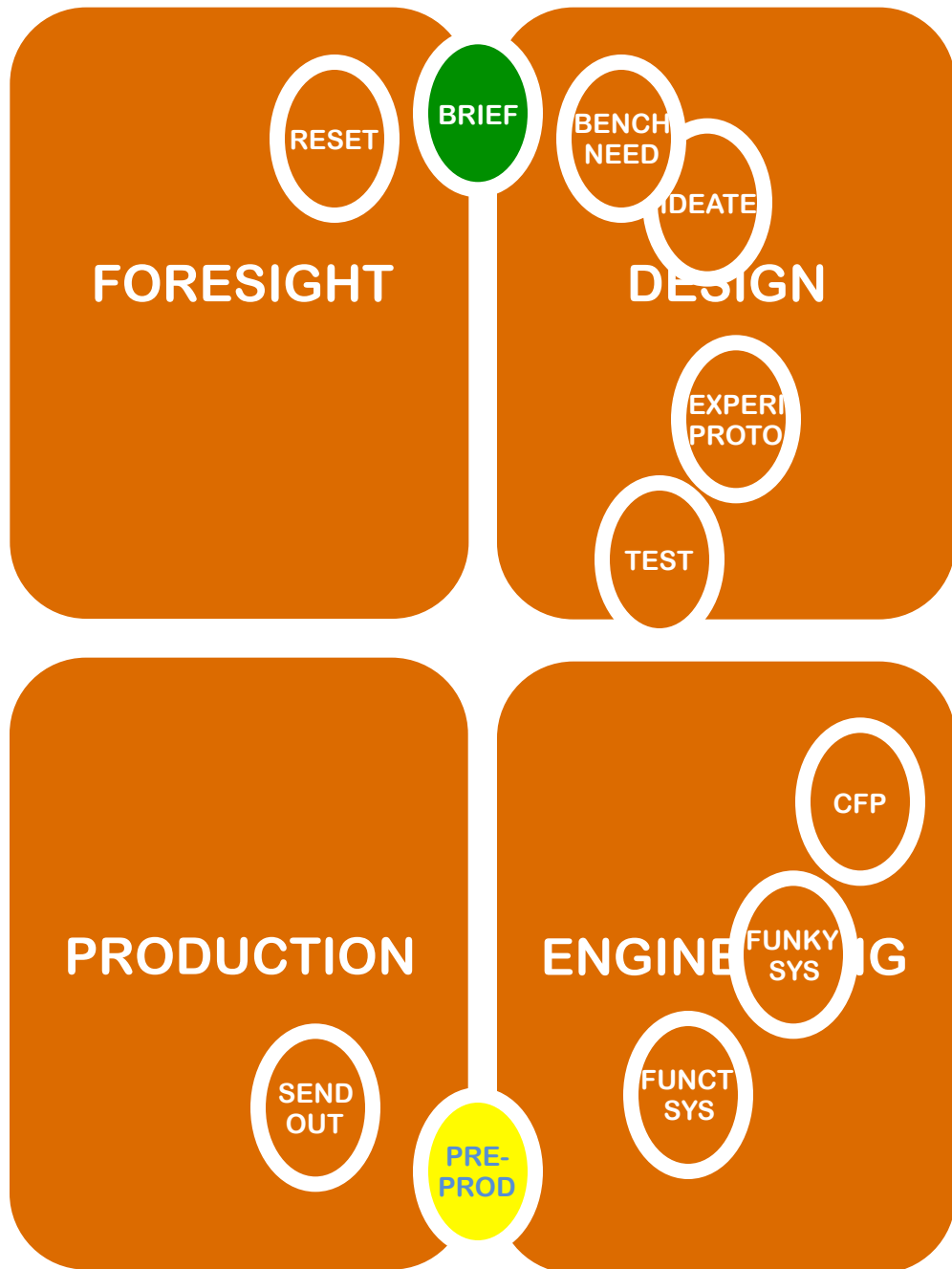
people

have different
ways of thinking,
working, and
learning

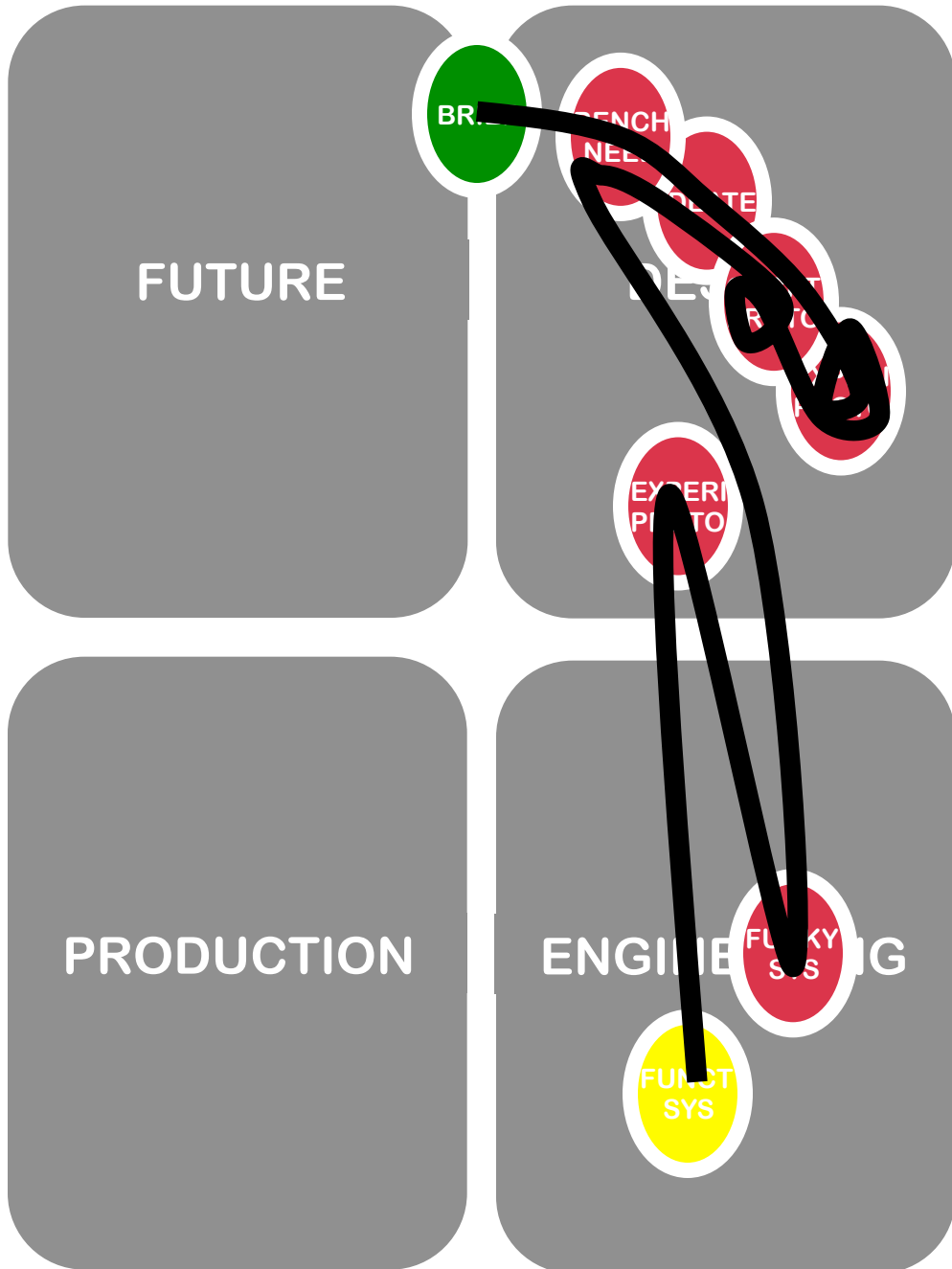
(Lande 2009)

PRODUCTION
thinking & doing

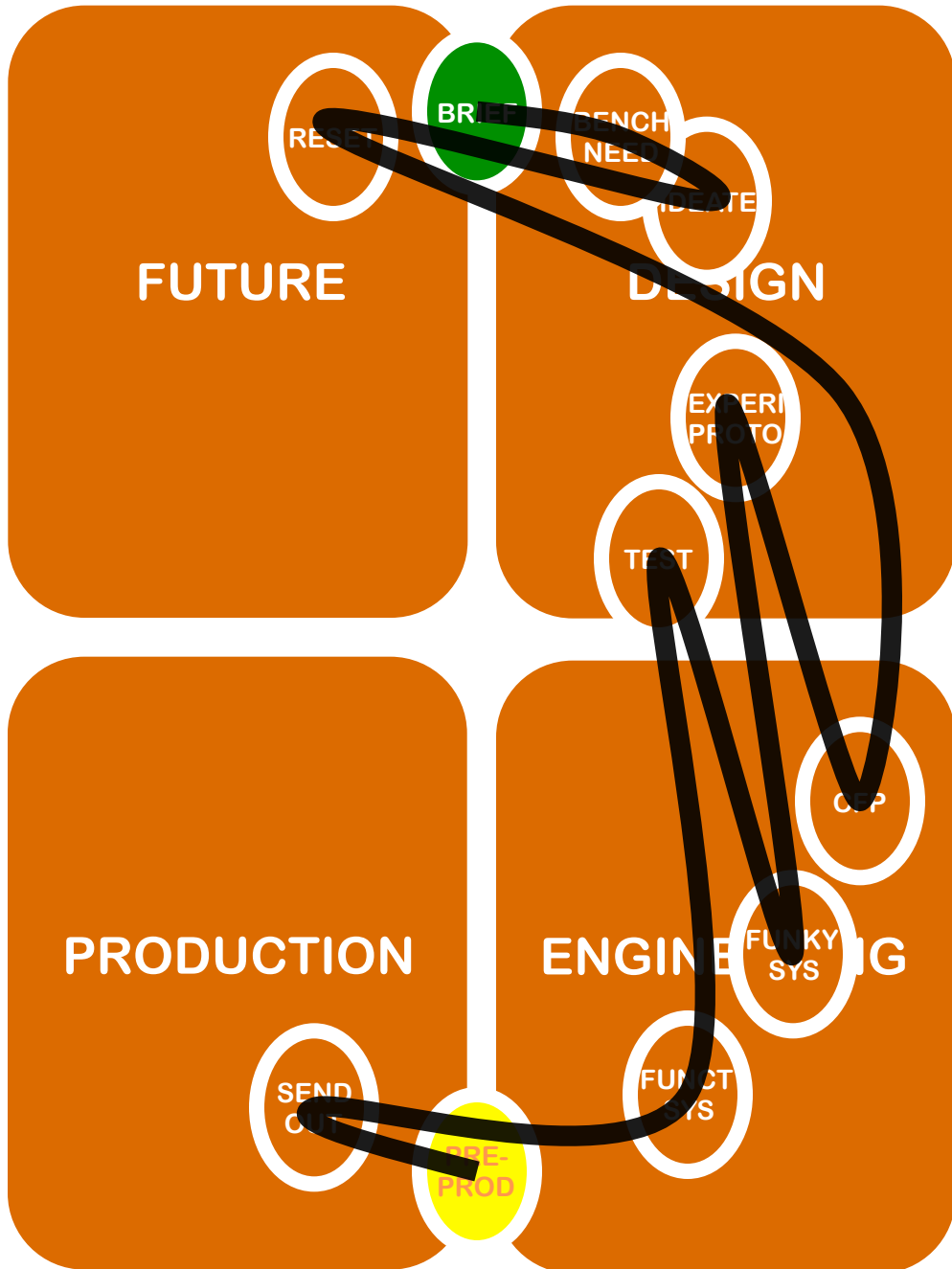
ENGINEERING
thinking & doing



way points
along the
passage from
a concept to
the functional
proof-of-concept
prototype



team-B's
8 month
passage
through the
thinking and
doing space



team-A's
8 month
passage
through the
thinking and
doing space

A earned a **WOW**

B earned a thank you

who is on the team

global graduate design innovation teams



global mixed-discipline teaching teams



global professional design team coaches



Project Coach



Munich Team



Stanford Team



Project Coach



Teaching Team



Teaching Team



international culture coaches



Project Coach



Project Coach



Munich Team



Stanford Team



Culture Coach



Culture Coach



Teaching Team



Teaching Team



real corporate projects



Project Coach



Project Coach



Class Coach



Munich
Team



Stanford
Team



Class Coach



Teaching Team



Teaching Team



Thomas Kowark
 Matthias Uflacker
 Simon Blake
 Mathias Domschke
 Alexander Zeiler

Alexander Lange
 Andreas Borchardt
 Michaela Blaimer
 Andreas Meyer

Anders Häggman
 Juho Huotari
 Chongbei Song
 Suvi Numminen
 Tuuli Utraiinen
 Gregory Kress

Wataru Mito
 Riku Nagasaki
 Antti Sonninen
 Eero Miettinen
 Anni Harju

HPI Hasso Plattner Institut
 Sven Wagner-Boysen

Ralf Gehr
 Stephan Richter

SAP
 Benjamin Emde

SAP
 Hiroshi Yamaguchi

Ji Lee

Gregory Kress

Sascha Gysel

Anja Staud

University of St. Gallen

Carlos Serrano

Pontificia Universidad JAVERIANA

Jorge

Dirk Schatzel

Audi
 Kent Frankovich

Jonathan Chiu
 Jenny Ouk

Simon Plucinski

Tiffany Tseng

Jeffrey Manian

Nina Bhatti

Jacobi Grillo

Chris Stivers

Martin Carvajal

Luis Ochoa

GENERAL METALICA S.A.

Juha Forsblom
 Ville Sundberg

Autodesk
 Pyry Taanila

YLE
 Harri Toivonen

Hongbin Li

John Shinozaki

Pioneer
 Carolyn Fu

Andy Huibers

Lindsey Sunden

Arda Kara

Alejandro Ramirez

Alan Viverette

Shrey Gupta

Lauri Repokari

Jani Kalasniemi

THALES

Virginie Dupré

Thibault Scoarnec

Amine Bellakrid

Virginia Cruz

Victor Castro

Francisco Pulido

Victor Gonzalez

MEIO

Andreas Lamprecht

Anders Häggman

Suvi Numminen

Tuuli Utraiinen

Lauri Repokari

Seiki Ishii

Dirk Schatzel

Juha Forsblom

Markku Koskela

Lauri Repokari

Vi Van

Eero Miettinen

Aaron Engel-Hall

Uri Geva

Pyry Taanila

Richard Salin

Anni Harju

Kalevi Aaltonen

Rohan Bhoobe

Luyi Yang

Harri Toivonen

Sara De Moitié

Elena Seppälä

Mari Mäkelä

Nan Bai

Bob Smith

Ville Taajamaa

Ville Taajamaa

Sari Alén

Julien Braun

David Mesri

Scott Lathrope

Jamie Nesbitt

Mark Bianco

Reimi Dupeuble

Nicolas Fernandez

Austin Gispanski

John Shinozaki

John Shinozaki

Pierre Valade

Thomas France

Laurent Calvalido

Kevin Reynolds

Andy Huibers

Erin Liman

Coralie Frick

Amina Alaoui

Sushi Suzuki

Denise Curti

Lindsey Sunden

Erin Liman

Nicolas Gaudron

Marc de Saily

Cecile Fonquernie

Bernice Marshall

Paul Doersch

Shrey Gupta

Arturo Trevino

Luis Equihua

Bernardo Nuñez

John Feland

Nipun Dave

Alejandro Ramirez

Vincente Borja

Victor Gonzalez

Rolando Fuentes

Carlos Lian

Jay Borenstein

Shrey Gupta

Arturo Trevino

Luis Equihua

Bernardo Nuñez

where is the team working









DO NOT



what is the
STANFORD.IDEO
design process

Stanford-IDEO

like **design process**

(re)Define the
Problem

Design never ends

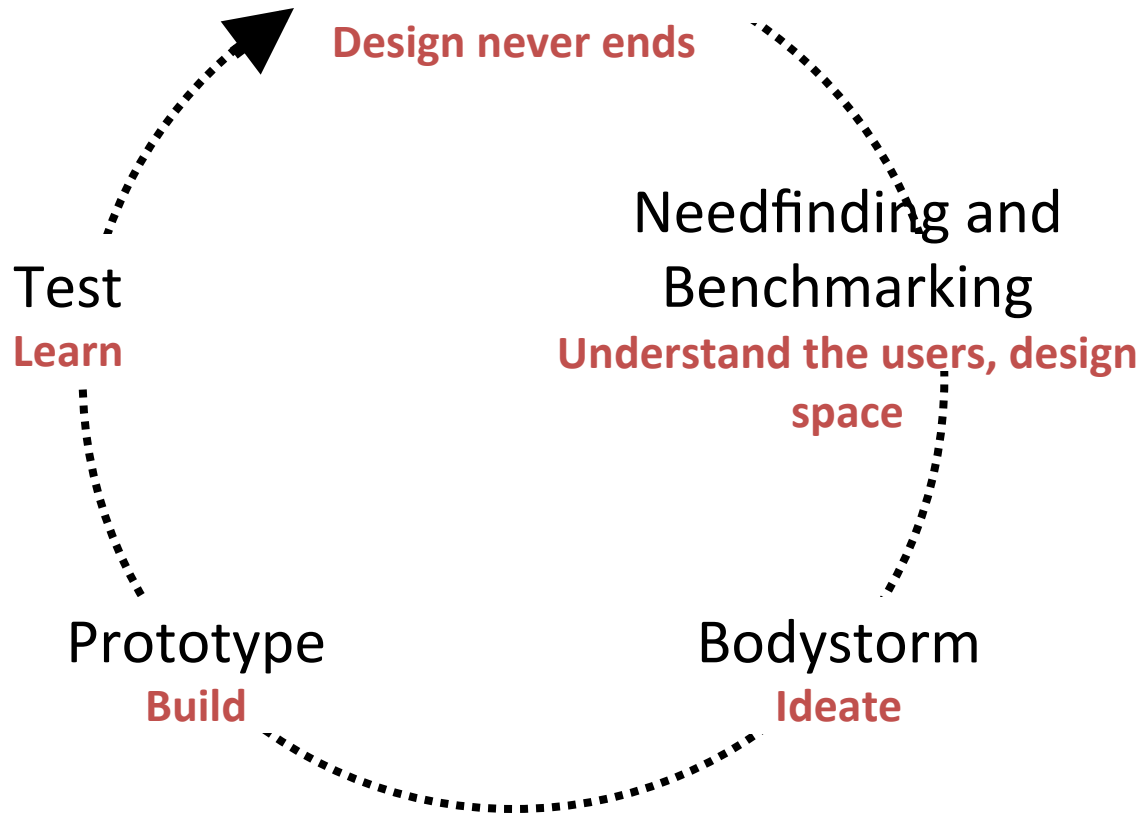
Needfinding and
Benchmarking

**Understand the users, design
space**

Test
Learn

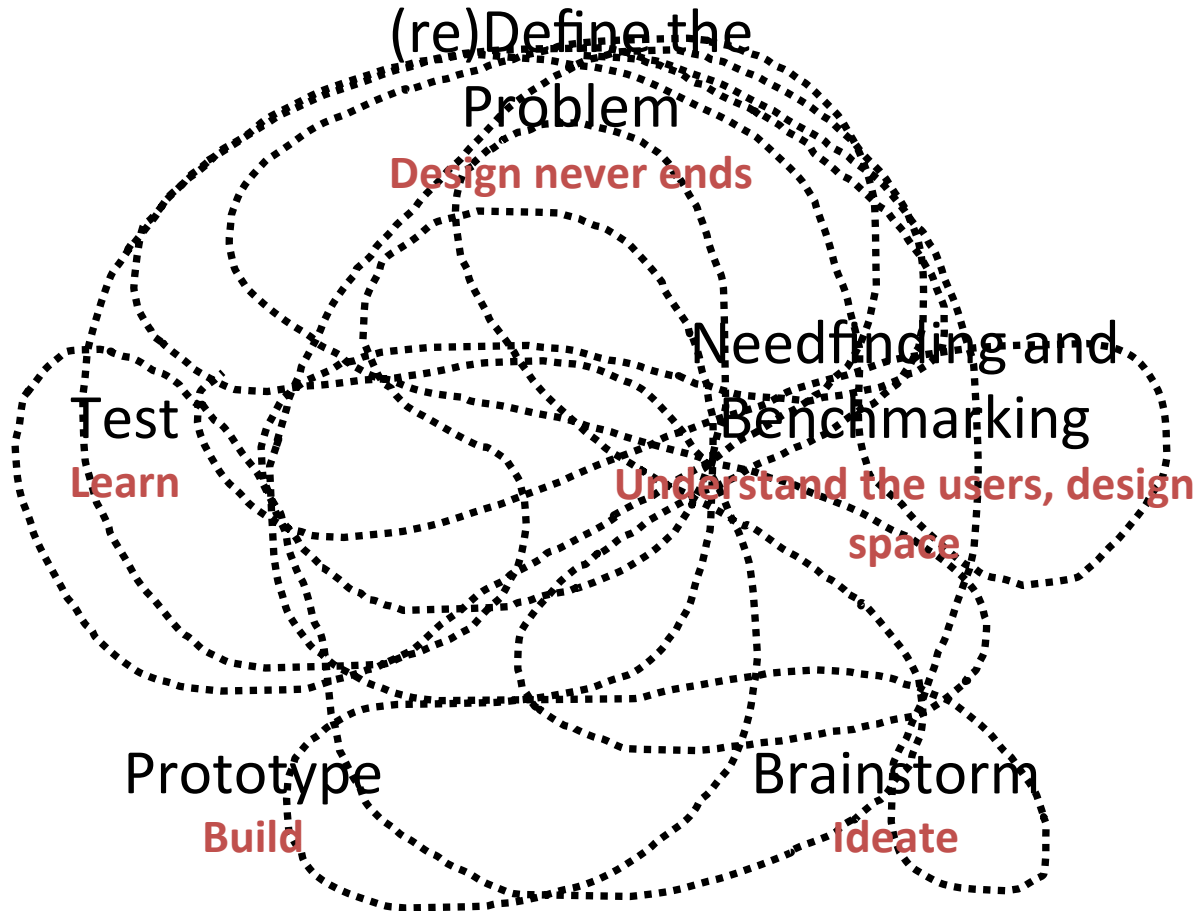
Prototype
Build

Bodystorm
Ideate



Stanford-IDEO

like design process ... in
reality



re-designing

**products
processes
education
science**

and the human service experience

example

me310 experiment

need-find, conceive, build-test

Autodesk Bloom'09



BLOOM

TEAM AUTODESK

ME 310

FINAL PRESENTATION

3 JUNE 2010

BROKEN ELECTRONIC DEVICES?



CONTEXT

VISION

SOLUTION: RE

SOLUTION: UX

CONCLUSION

THE PROBLEM



CONTEXT

VISION

SOLUTION: RE

SOLUTION: UX

CONCLUSION



USE
[CONSUMER]



END OF LIFE
[RECYCLER]



CONTEXT

VISION

SOLUTION: RE

SOLUTION: UX

CONCLUSION

BLOOM





10 STEPS, NO TOOLS



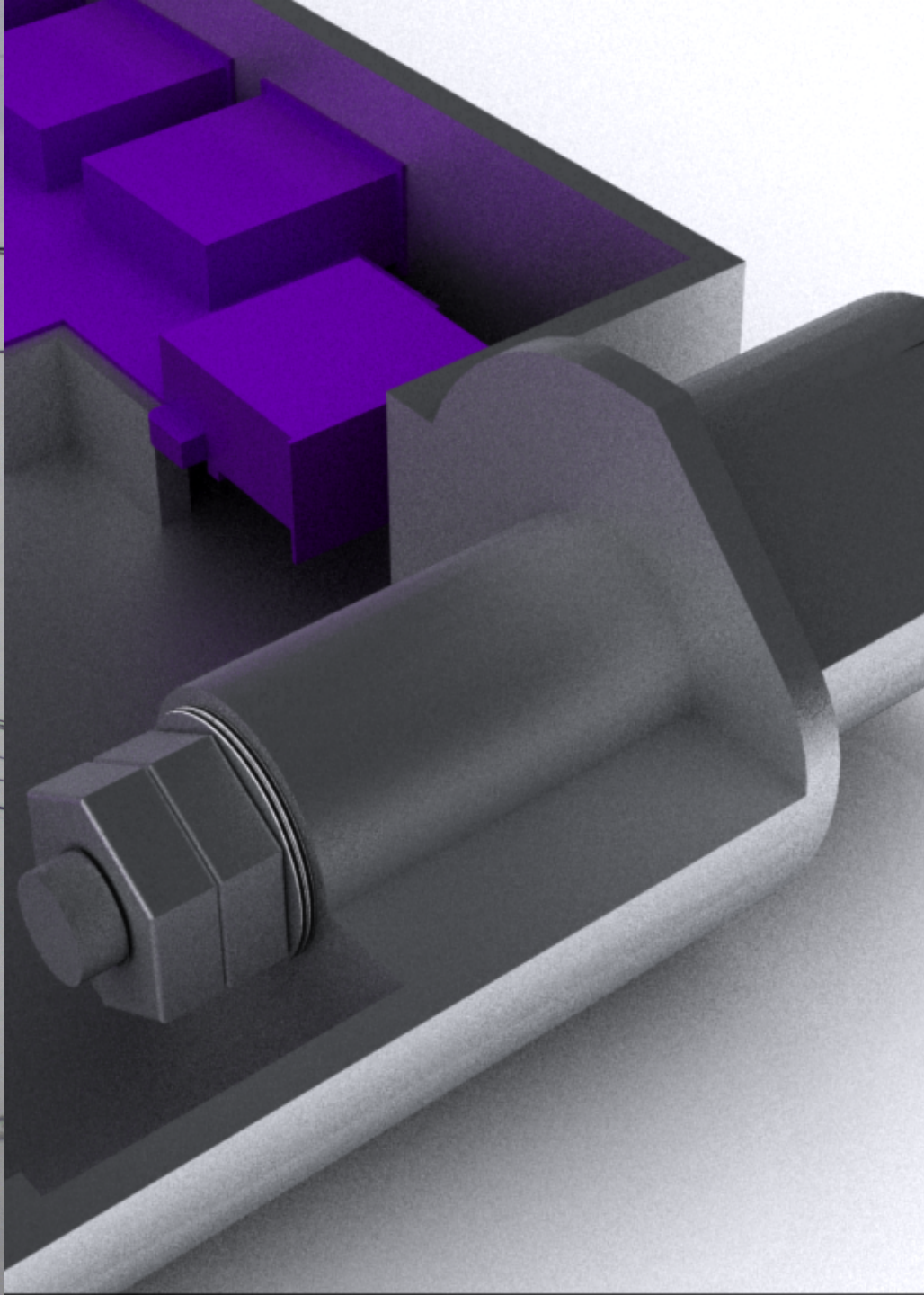
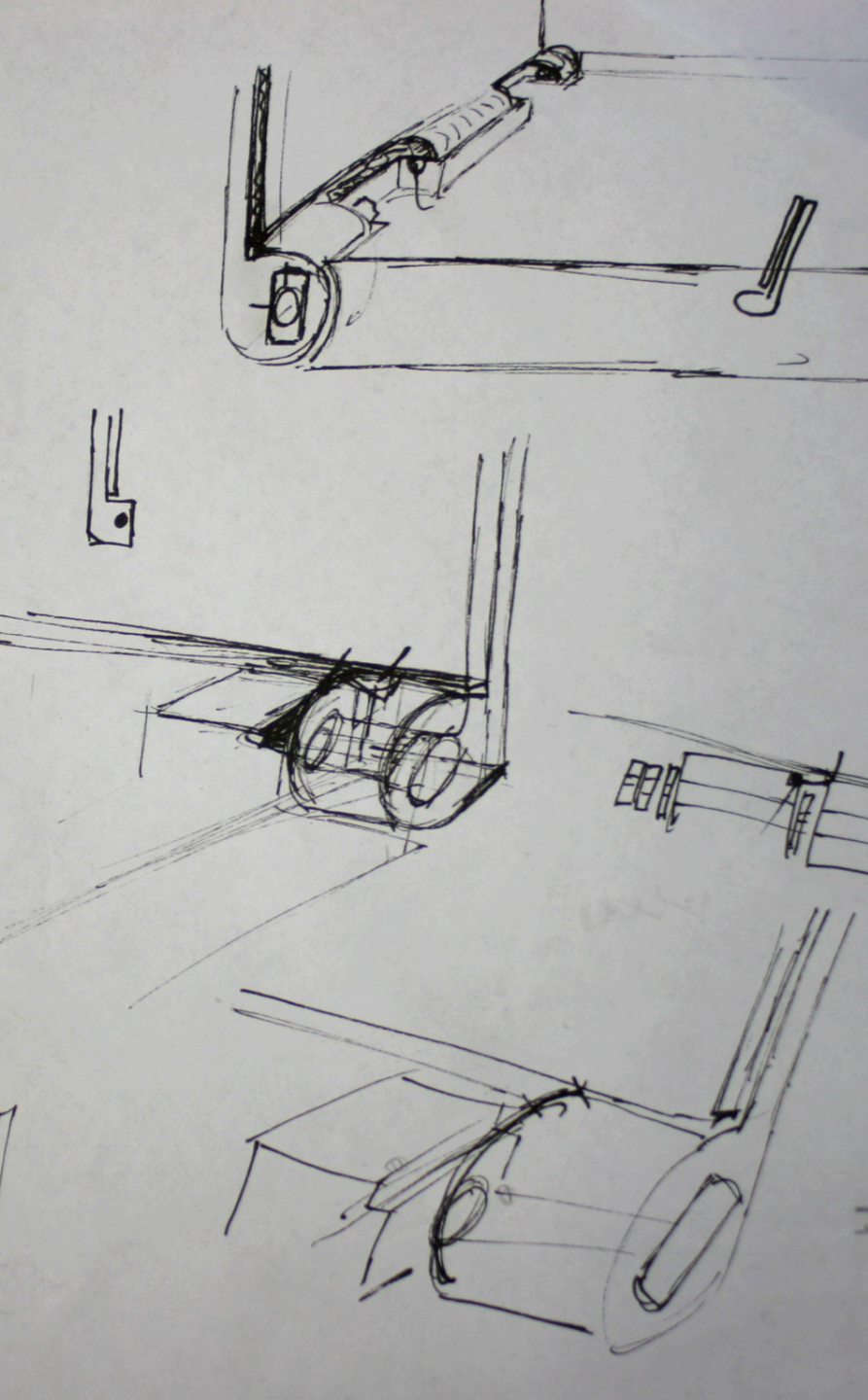
CONTEXT

VISION

SOLUTION: RE

SOLUTION: UX

FUTURE

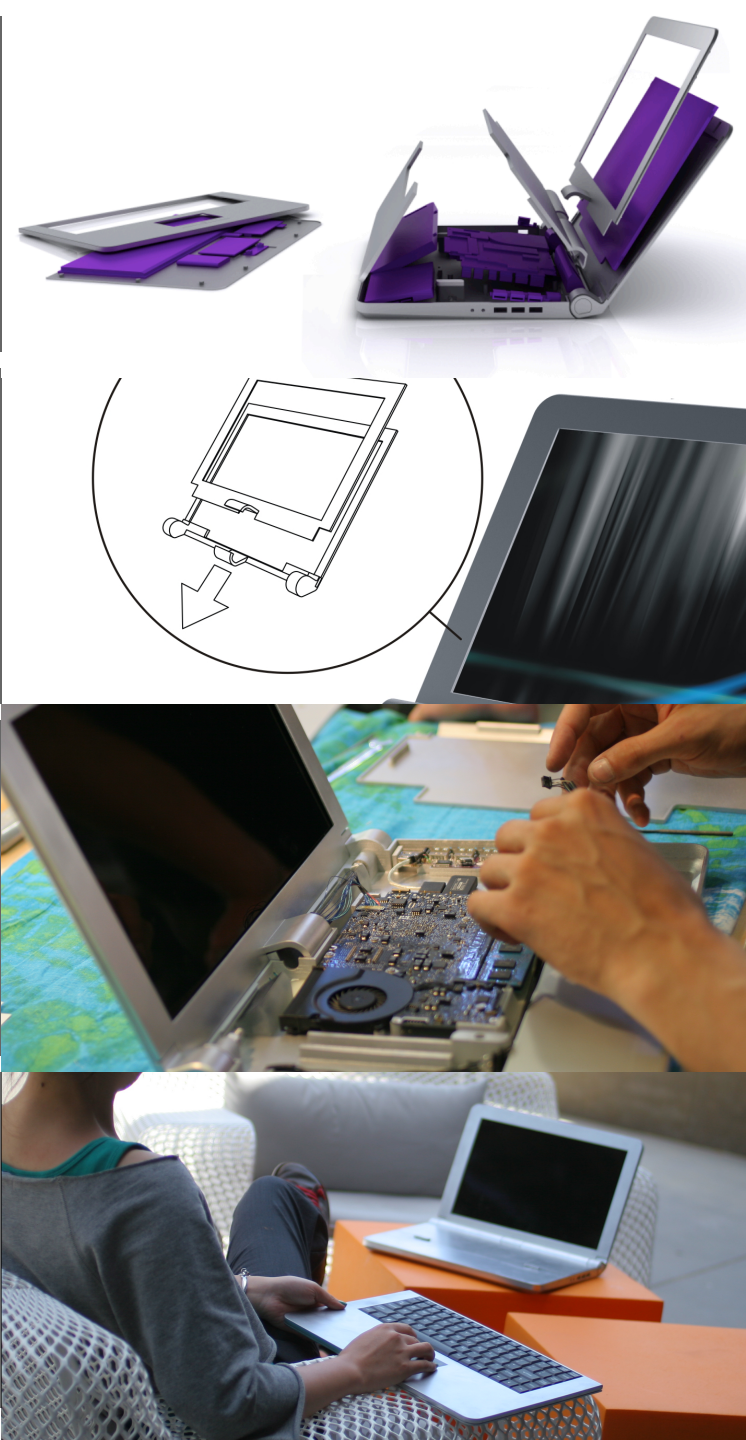


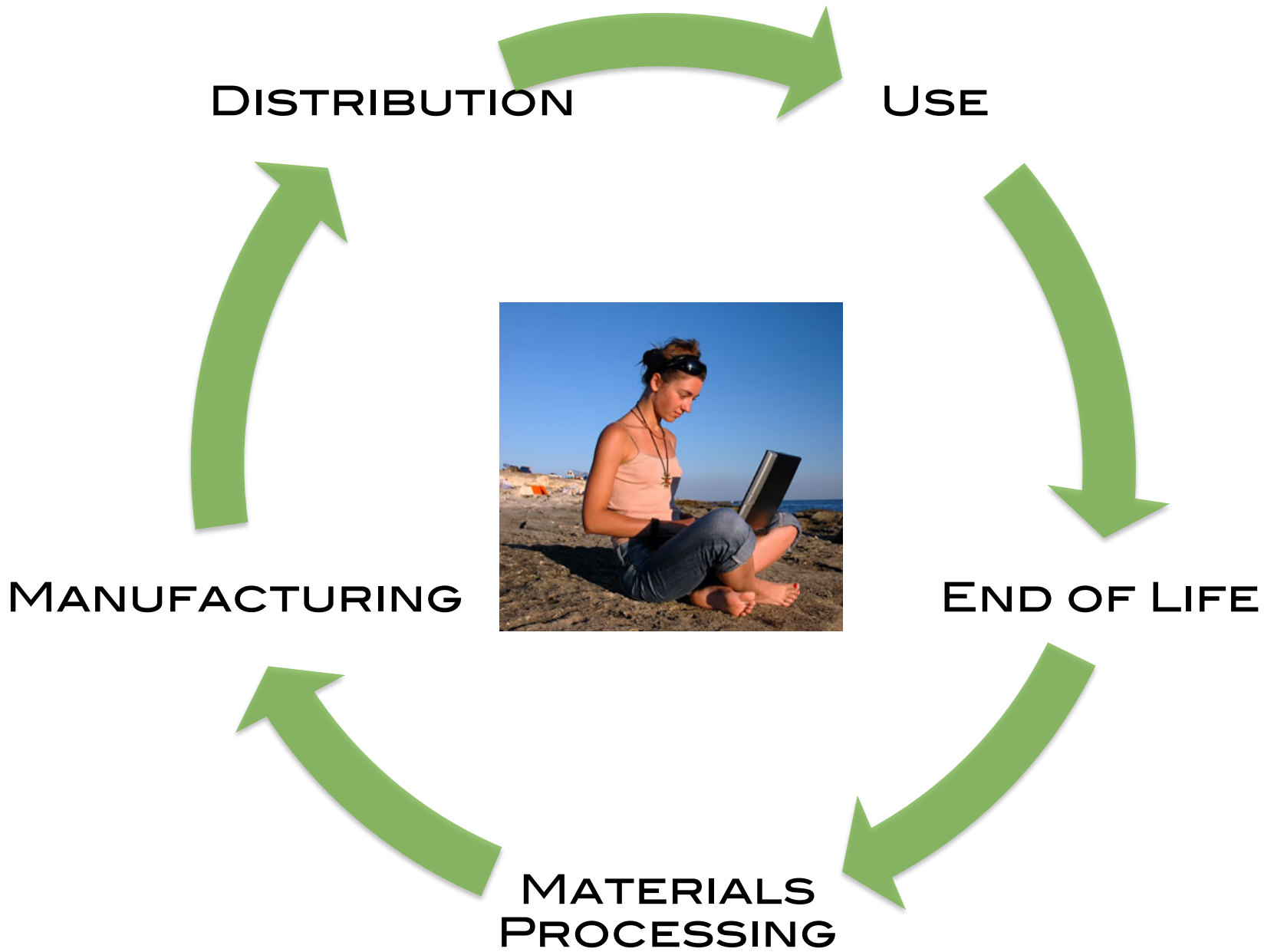
USER-FRIENDLY
DISASSEMBLY

INTUITIVE INSTRUCTIONS

QUICK REPAIR / UPGRADE

REMOVABLE KEYBOARD





example

me310 experiment

need-find, conceive, build-test

serve good wind in the convertible

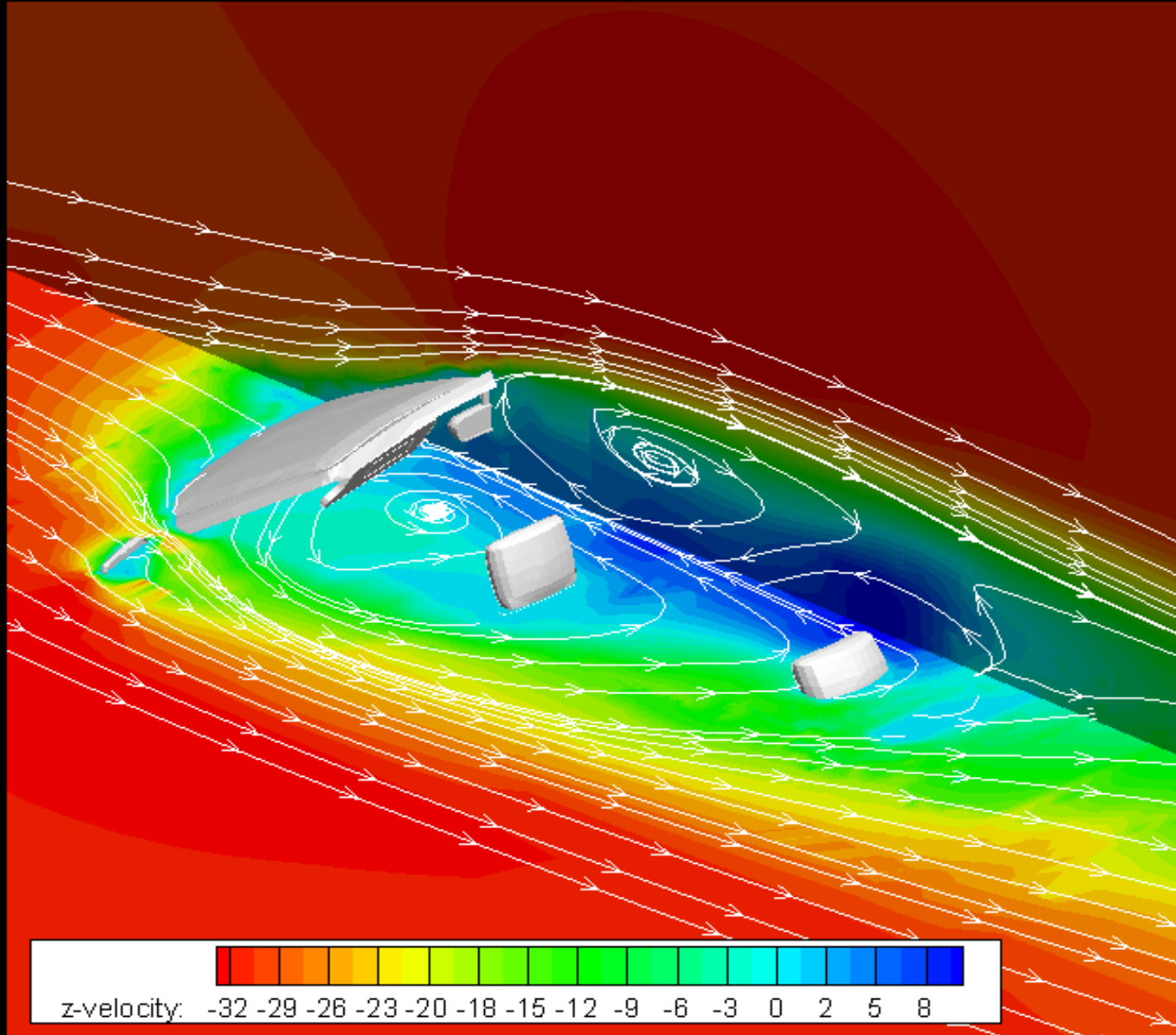
BMW 2005

project challenge
improve the open air experience



**critical function
prototype**

modeling what we know @ TUM



modeling what we don't know @ Stanford



airflow revisited



airflow revisited again



& again



... one more try



full scale prototyping



dark horse prototype

airflow
re-invented

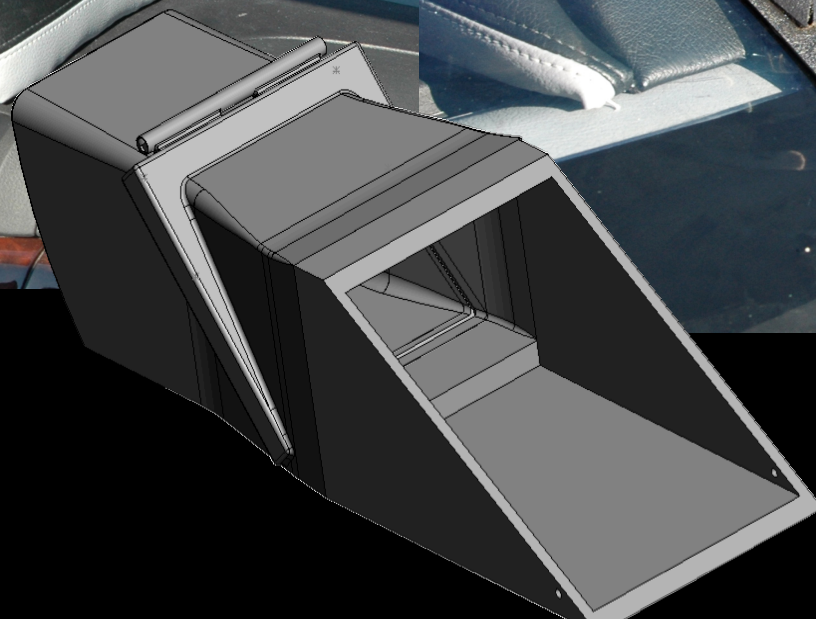
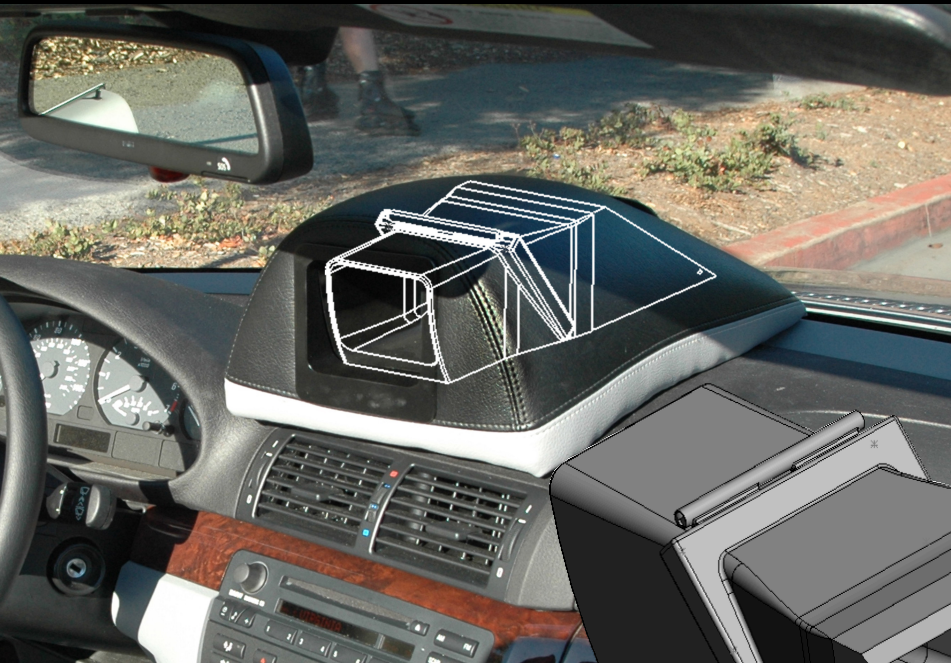


now we are getting very real

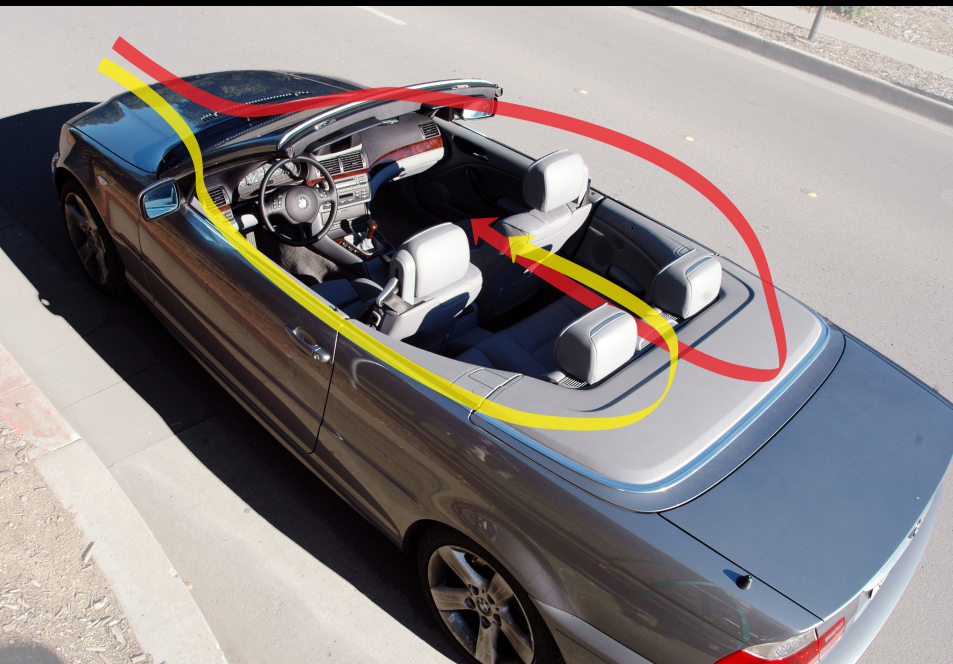


getting real on the open road

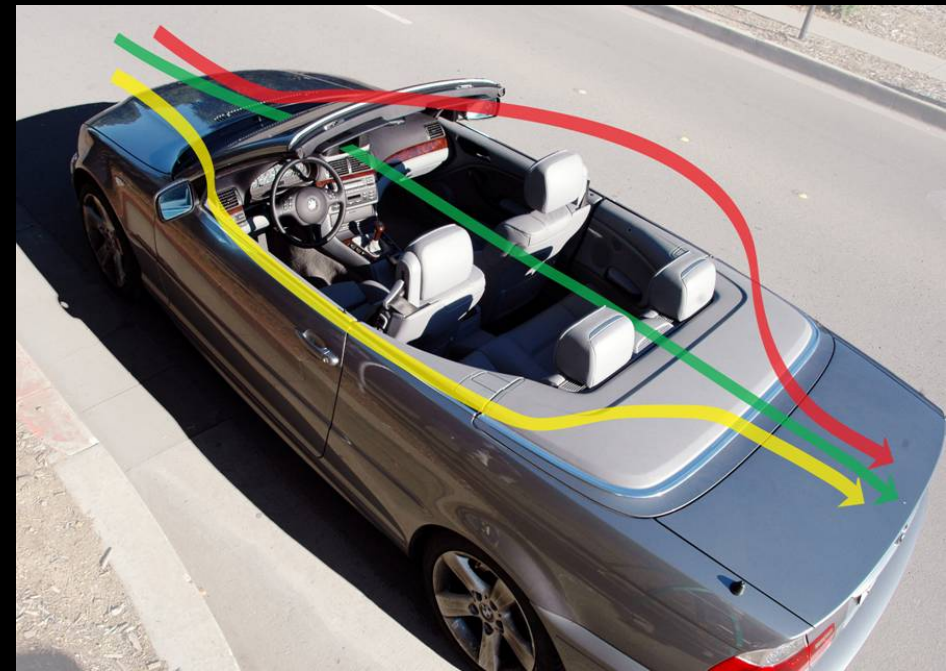
from concept to reality



fluid dynamics re-visited

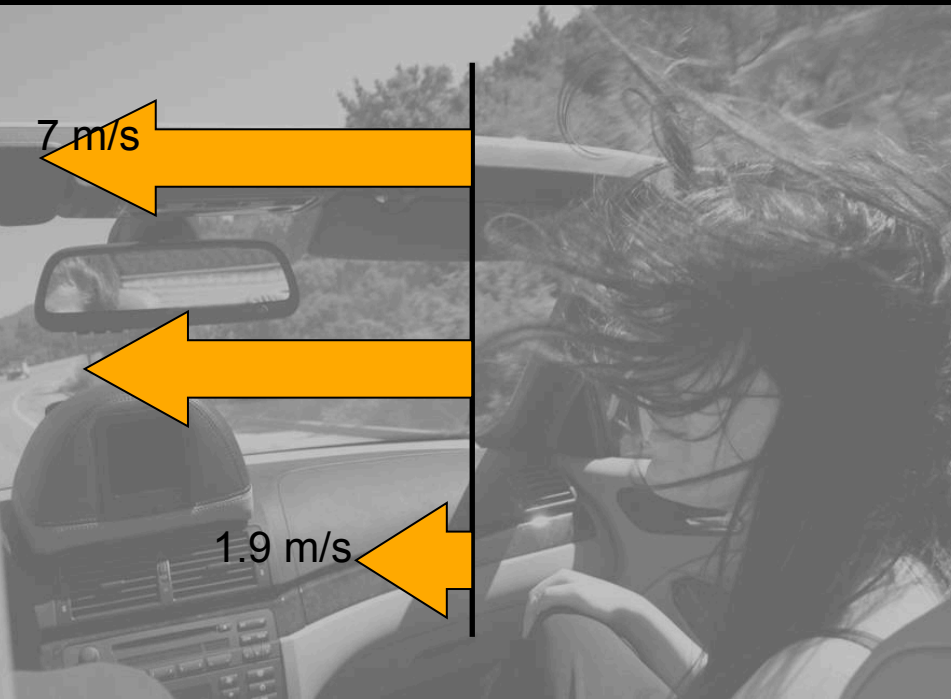


re-circulation
creates bad-air
in the cabin



re-circulating bad-air
is eliminated by the
good-air jet stream

validating airspeed measurement but watch her hair





a better convertible, problem eliminated

human centered
Panasonic 2008



ICT safety
driver vehicle interface
for the Audi of 2019
(done in 2009)

beyond cool

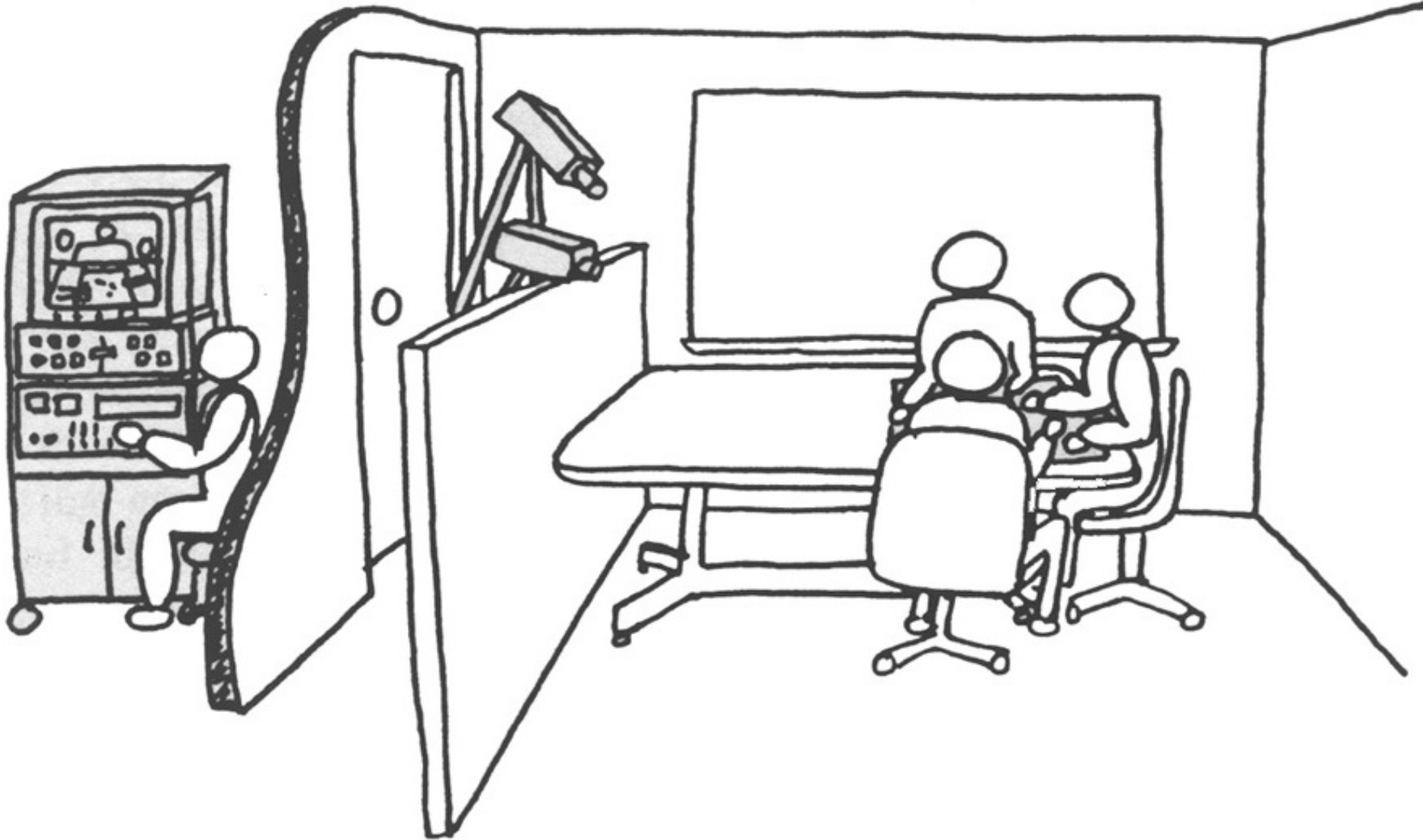


re-designing innovation

things we have learned from
instrumenting design innovation in our
“**flight simulator**”

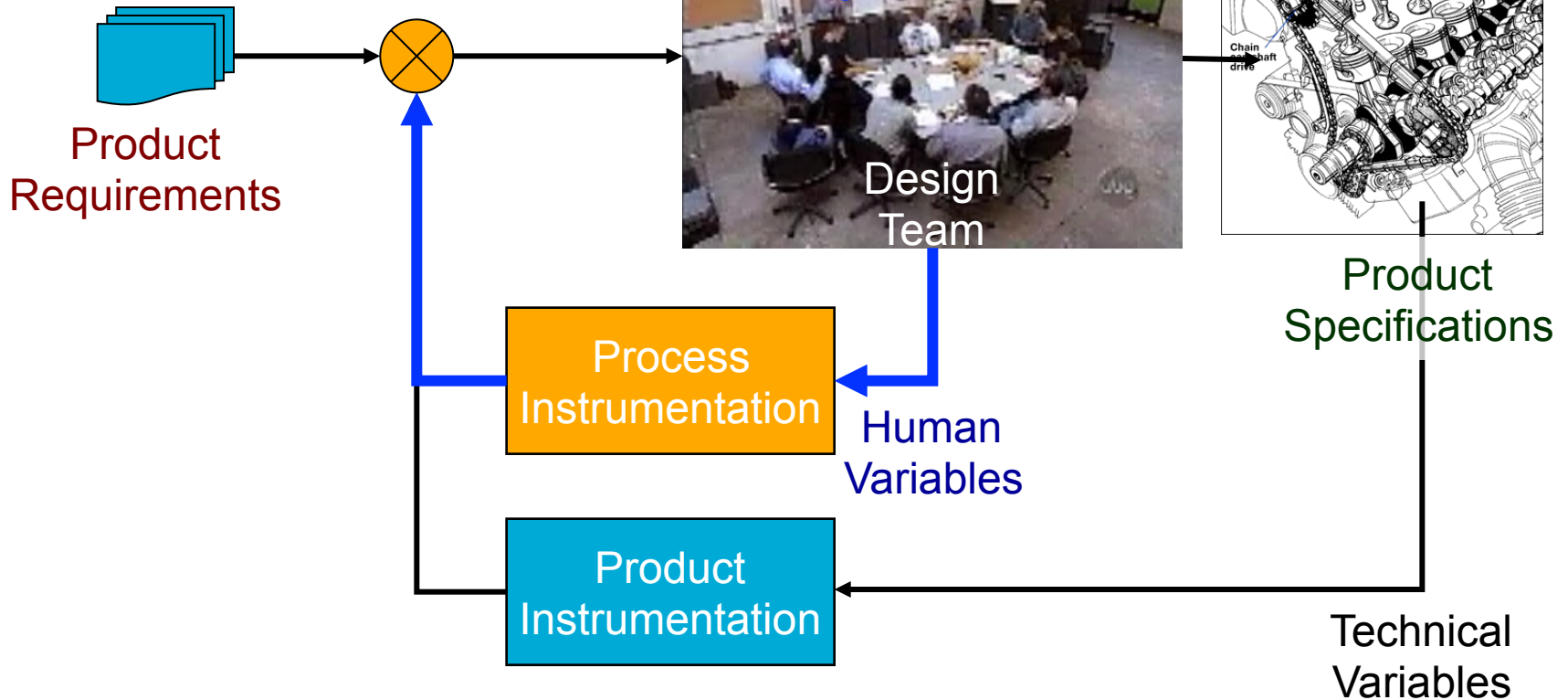
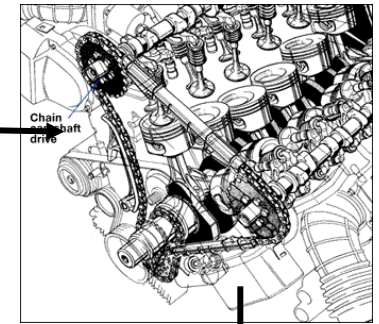
the power of observation

Tang, PhD'89



design thinking research in context

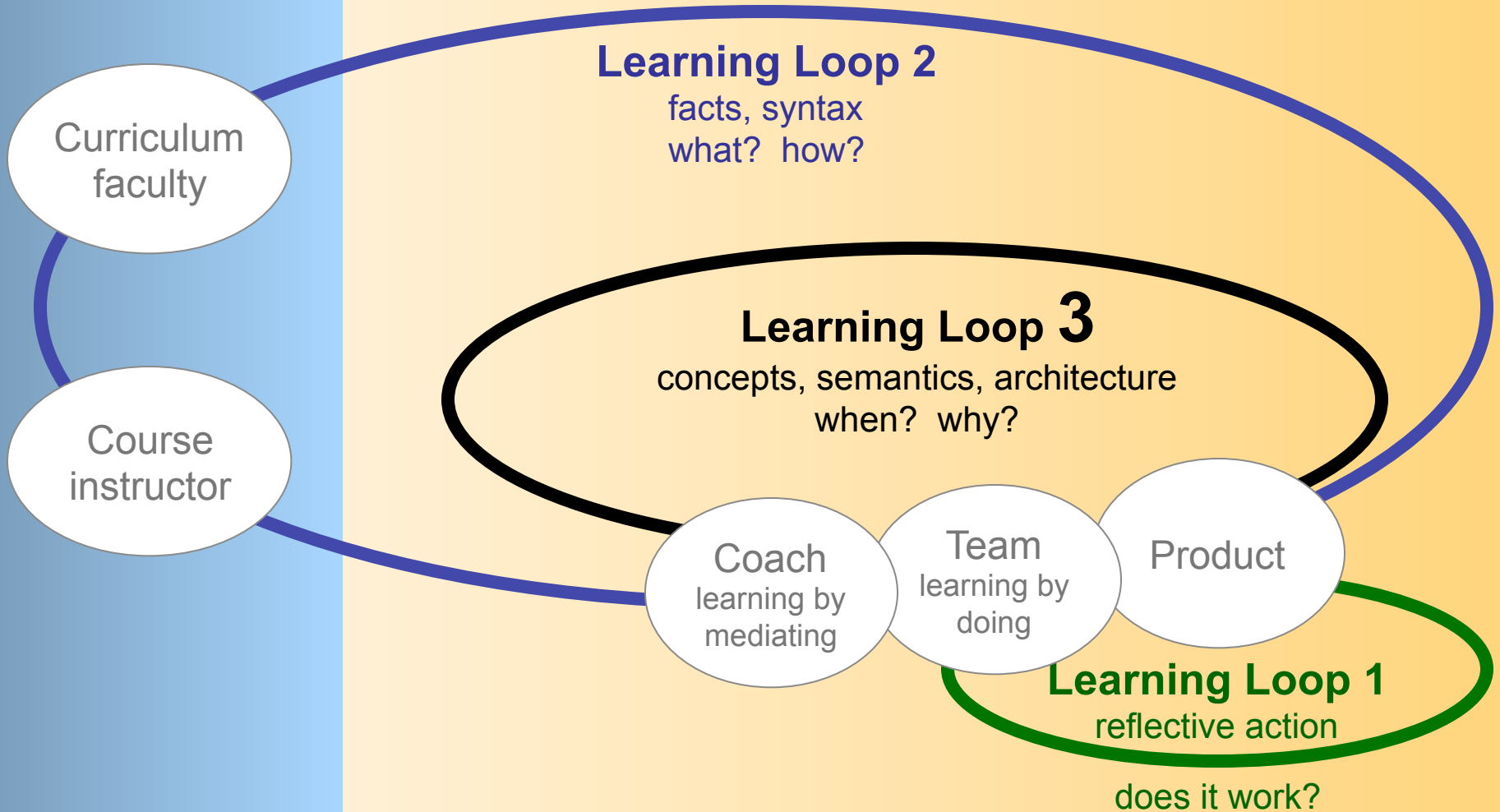
(Leifer'04)



triple-loop-learning in complex teams

FORMAL
knowledge

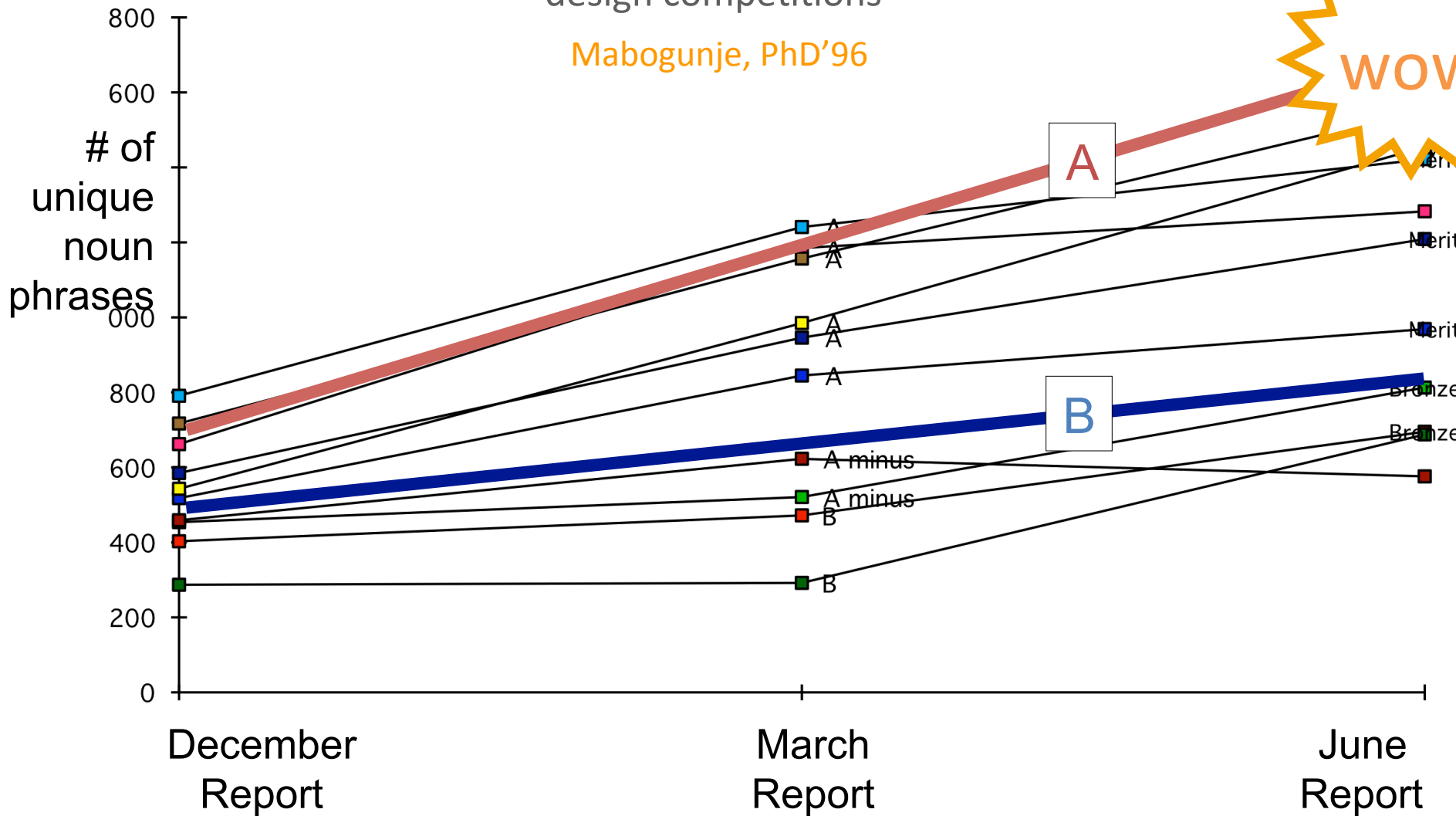
INFORMAL
knowledge



creative language matters

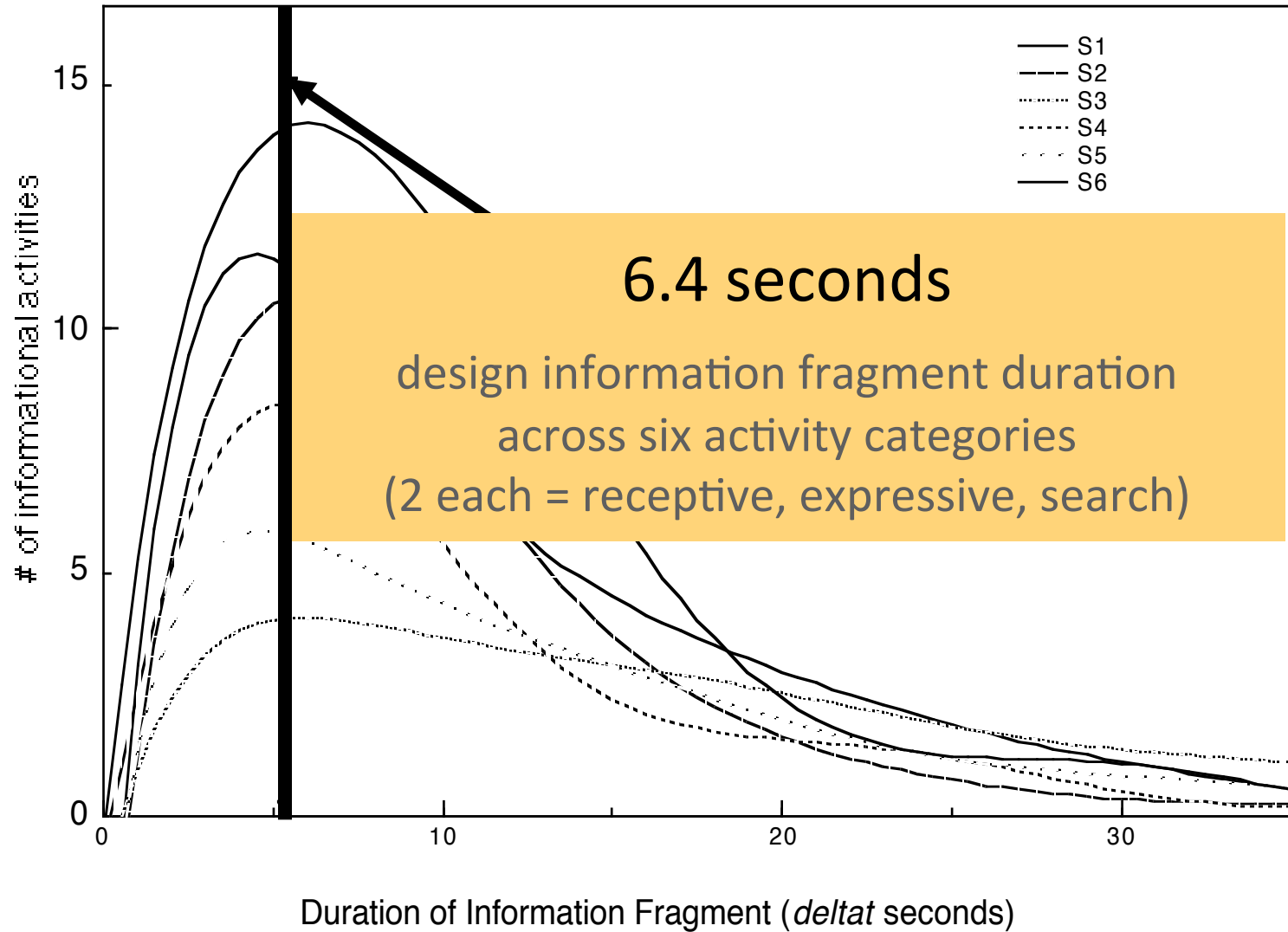
noun-phrases in formal documents
predict awards in peer-reviewed
design competitions

Mabogunje, PhD'96



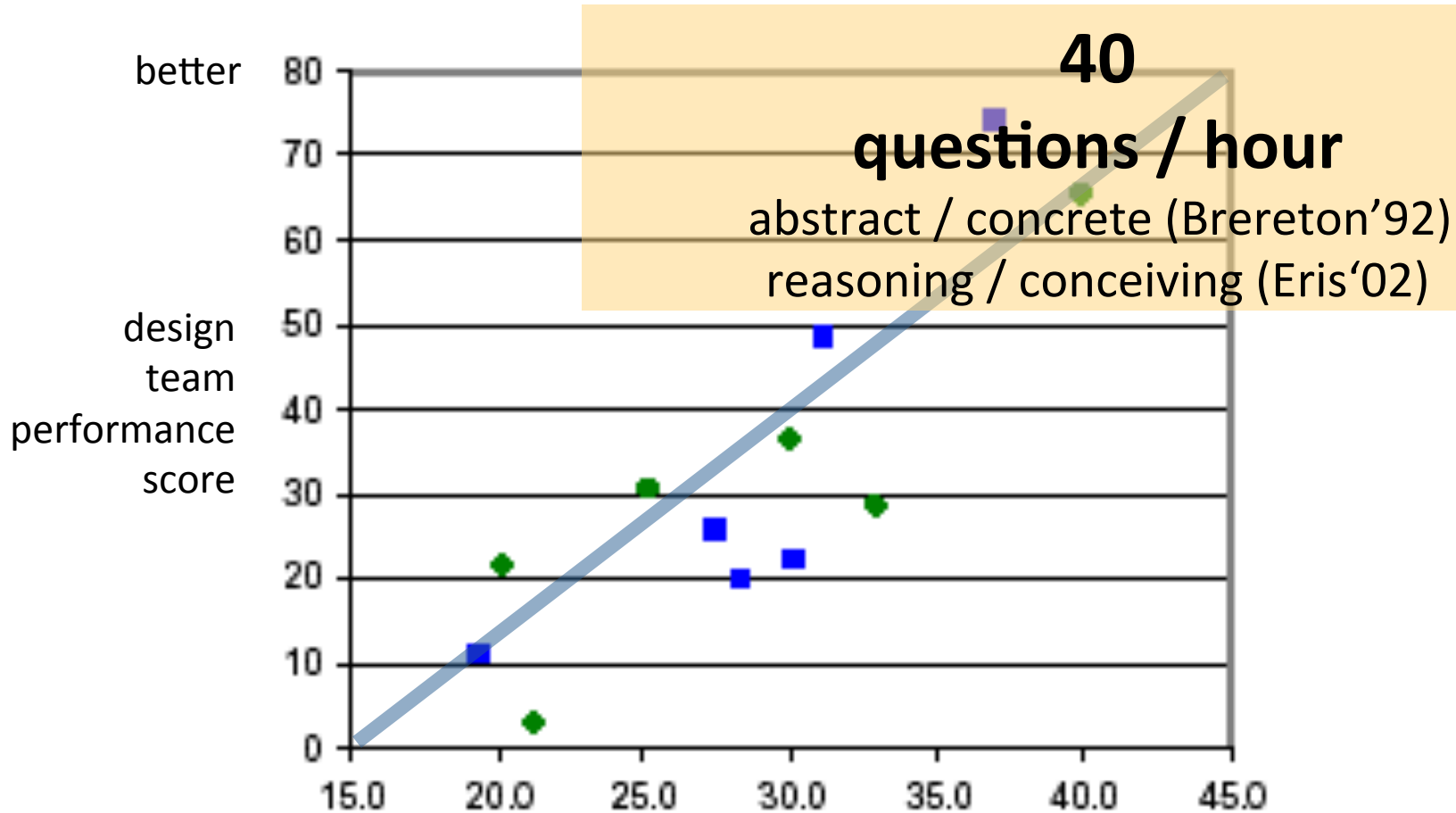
our attention time constant

(Baya'97)



questions drive performance

(Eris'02)

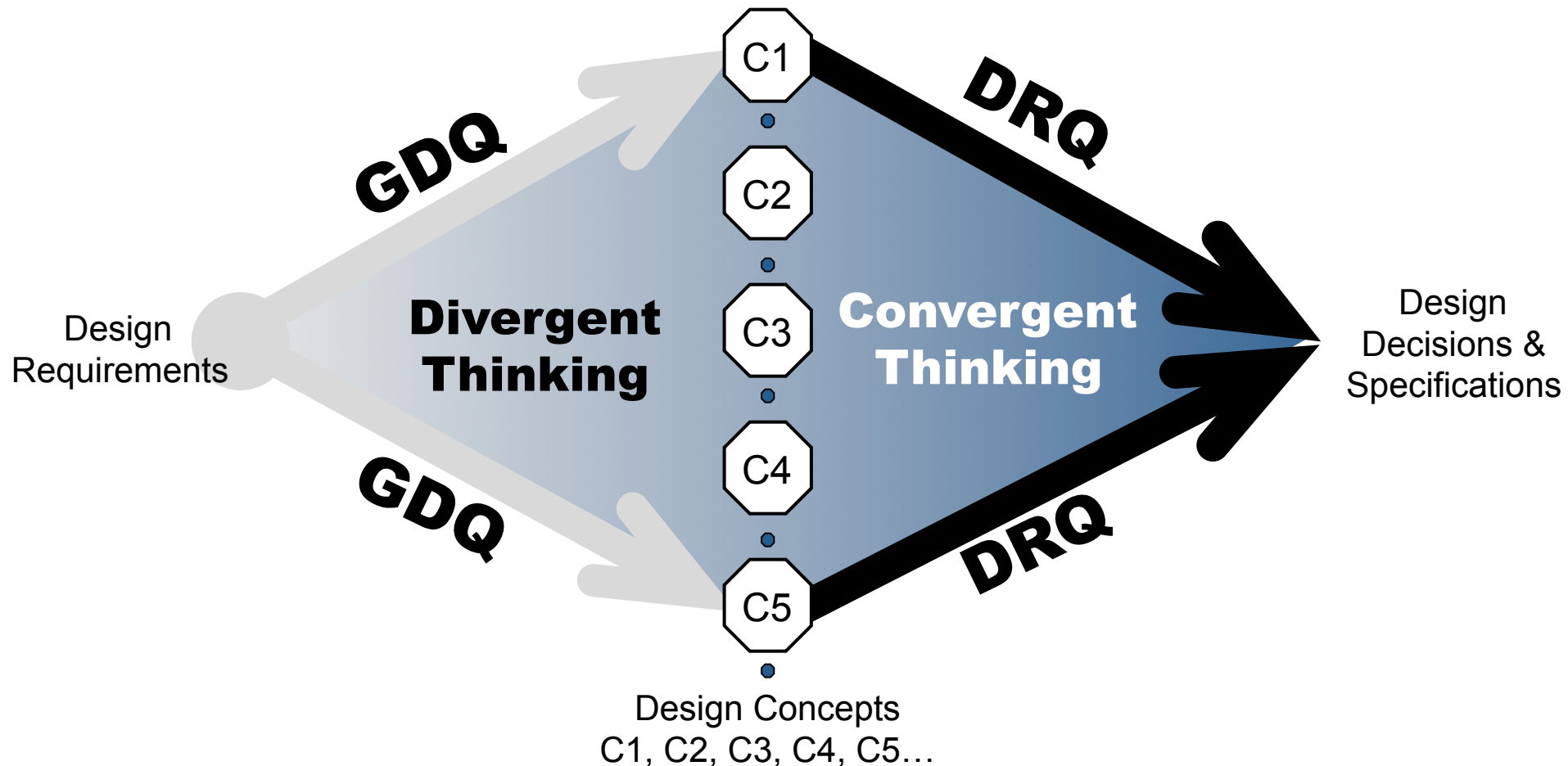


combined rate of DRQ+GDQ (questions/hour)

DRQ = deep reasoning question

GDQ = generative design question

design thinking is the fractal iteration of this basic cycle



collaboration research
human machine interaction

Wendy Ju 2008

exploring the social behavior of doors

Ju'08

field research

electronic arts corporation

does programmer activity

predict code performance

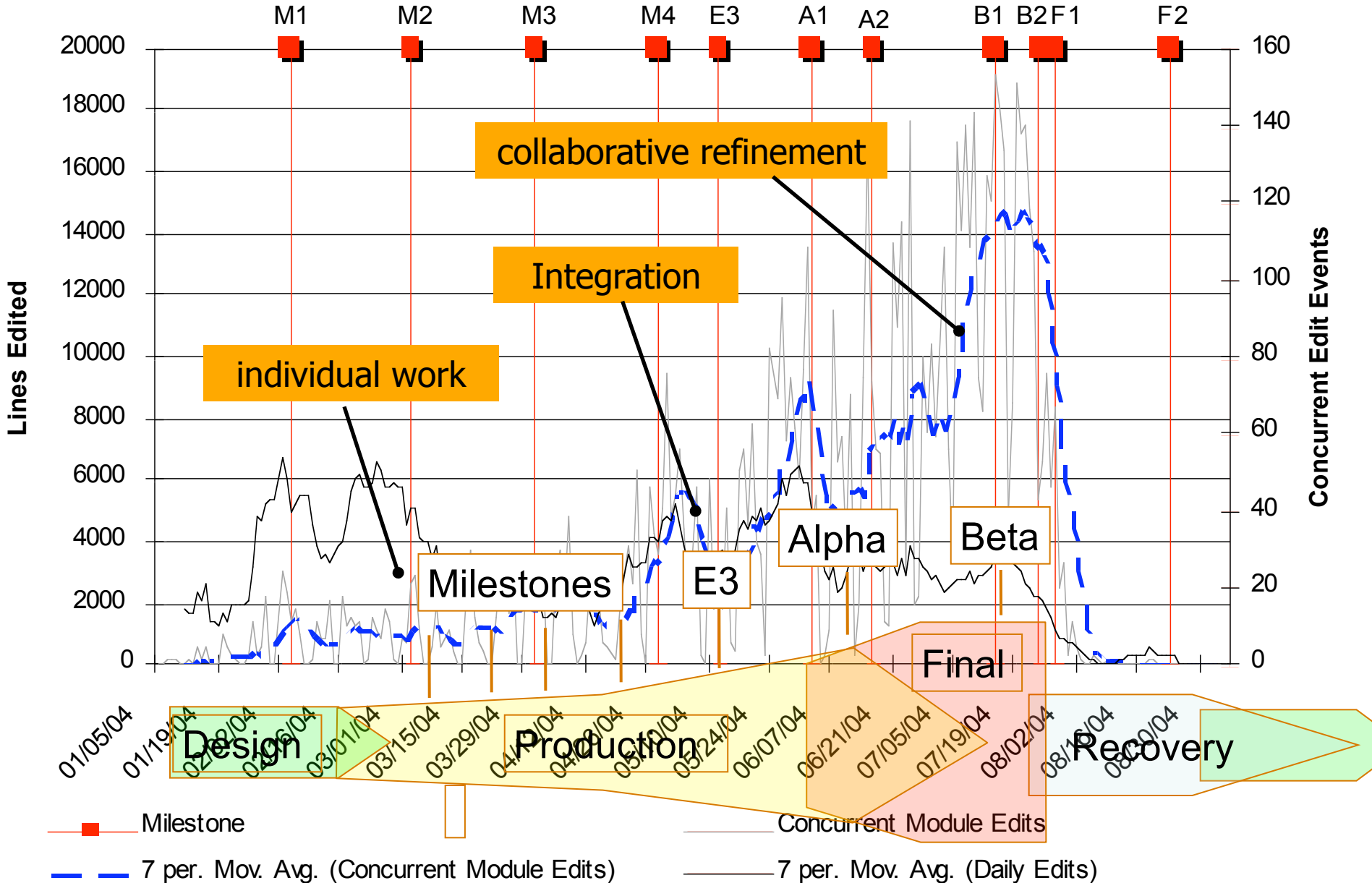
Reiner'05

features of the computer games industry

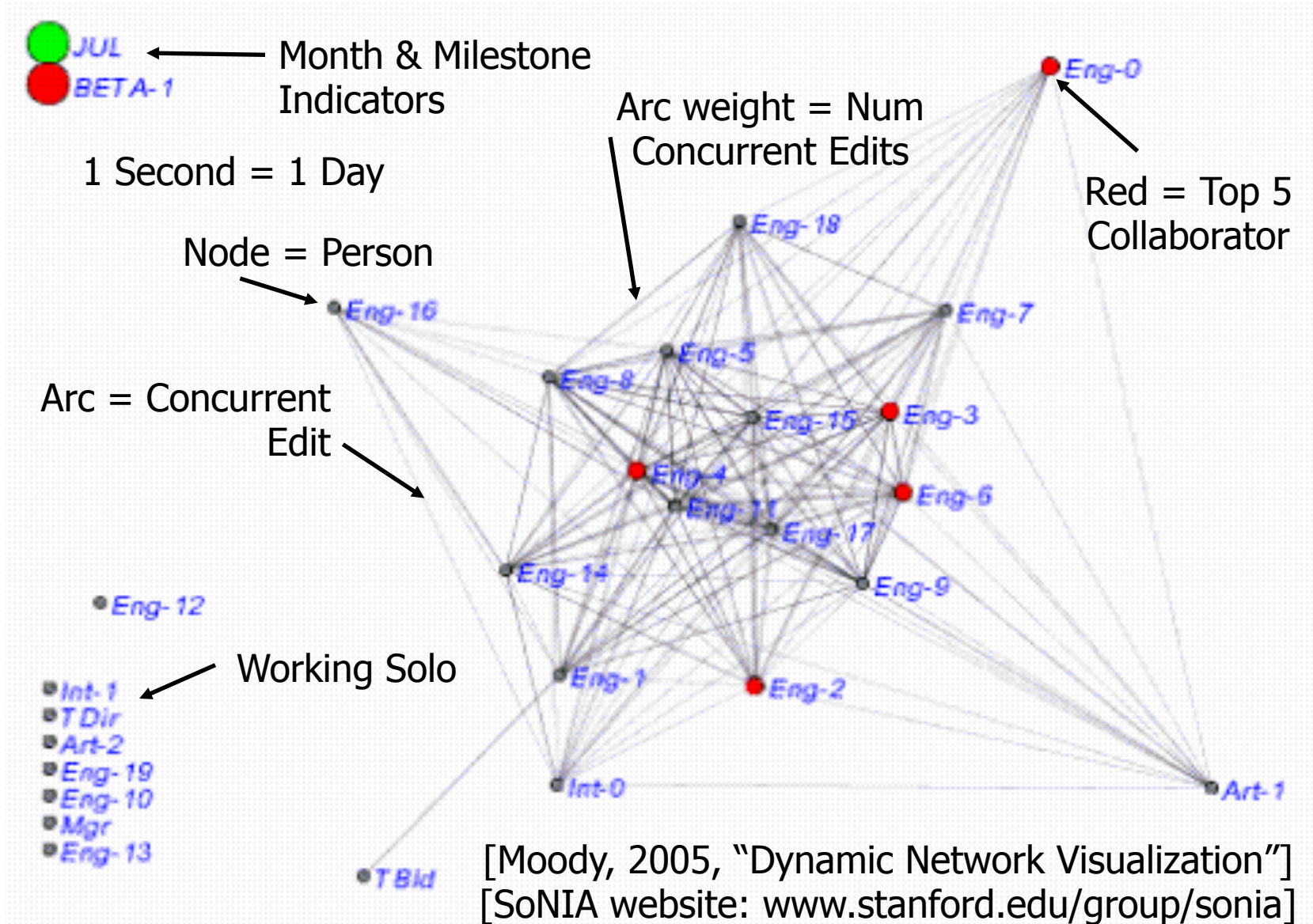
Reiner'05

- ◆ Multidisciplinary Teams of 75 to 200 people
- ◆ Producers, Designers, Artists, Engineers, Testers
- ◆ Most assets tracked in a database repository
- ◆ Word docs, 3D models, animation, 2D art, audio,
- ◆ Yearly, “Fast Track” development cycles
- ◆ High performance teams
- ◆ Industry-wide recognition, high review scores
- ◆ Innovative, patented tech reused by other teams
- ◆ Sales quadrupled+ in last three years

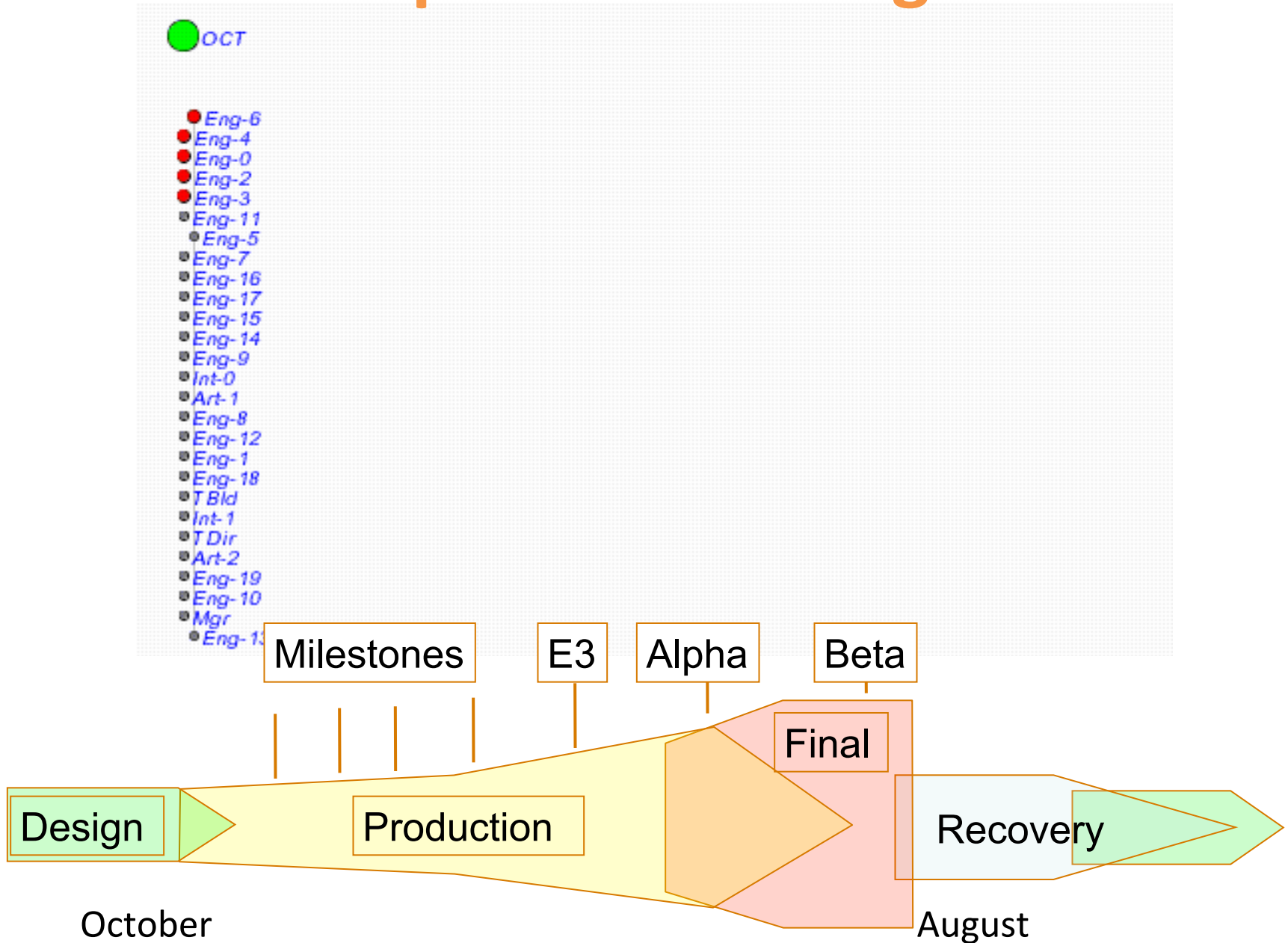
Daily and Concurrent Edits TW 2005 8 Months - January through August

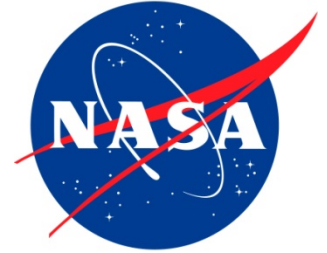


concurrent editing as a social network



surprise & no delight





making design tools for computational fluid dynamics user friendly

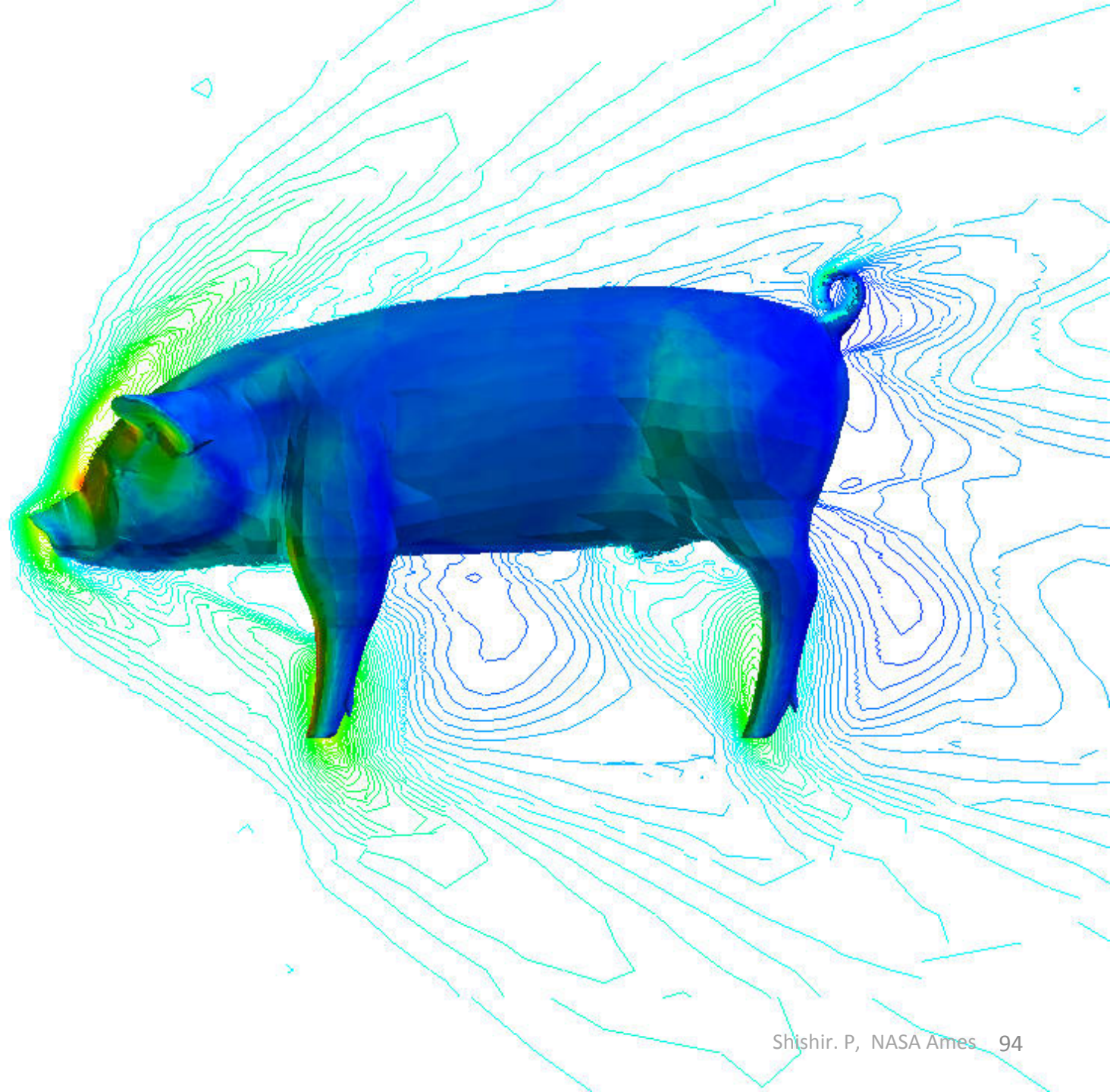
Noah Kim

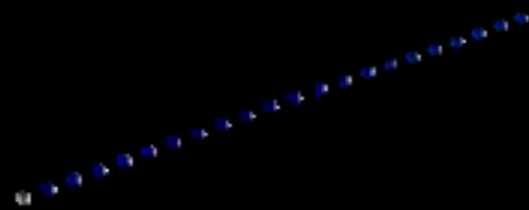
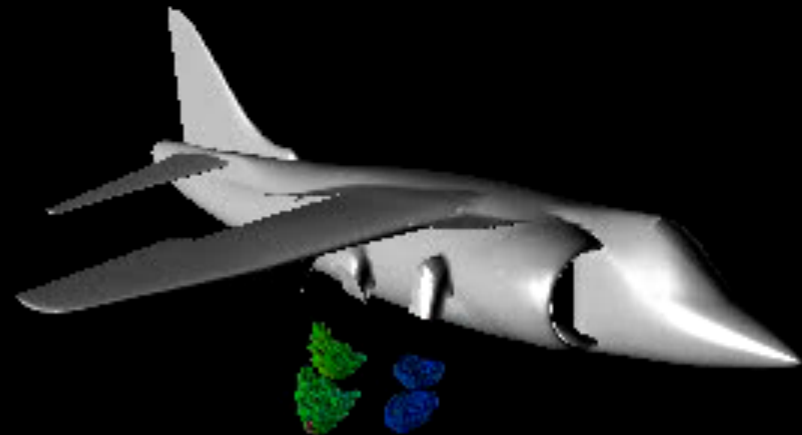
overview of the work at NASA Ames Research Center

19apr2010

what is computational fluid dynamics

- ◆ Digital simulation fluid flow
 - ◆ Discretizing the flow space (Grid)
 - ◆ Physical process is mathematical modeled
 - ◆ Solve the governing equations

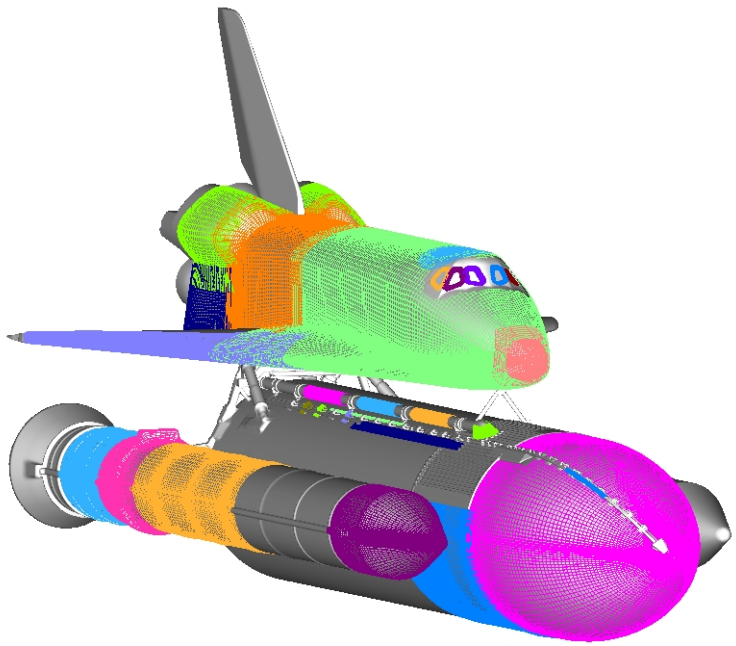




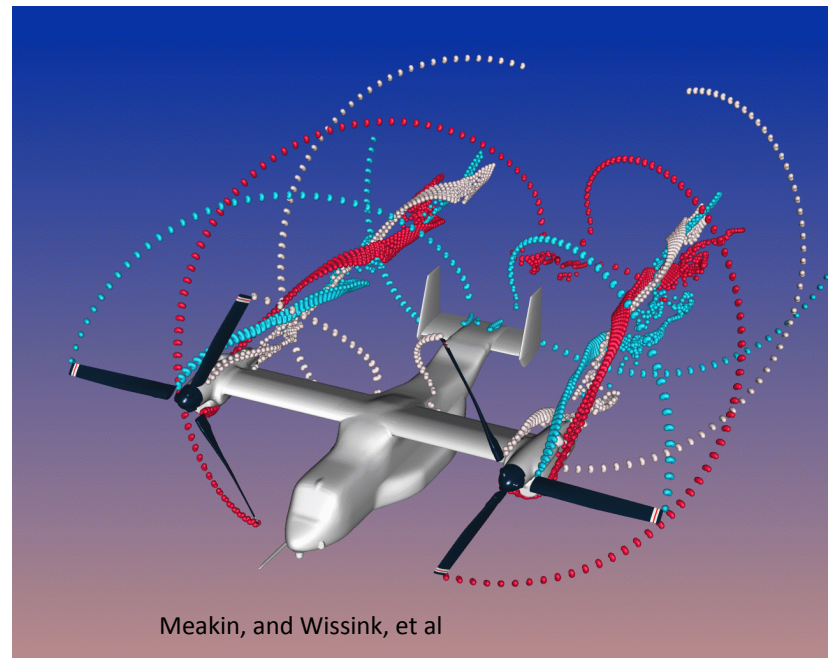
$T = 0.100000$

**what are computational fluid dynamicists doing
when they do CFD work?**

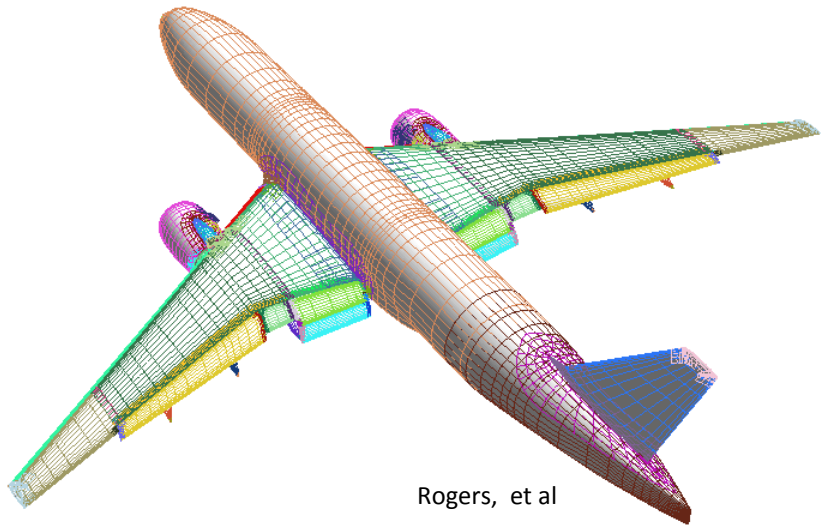
how can we help?



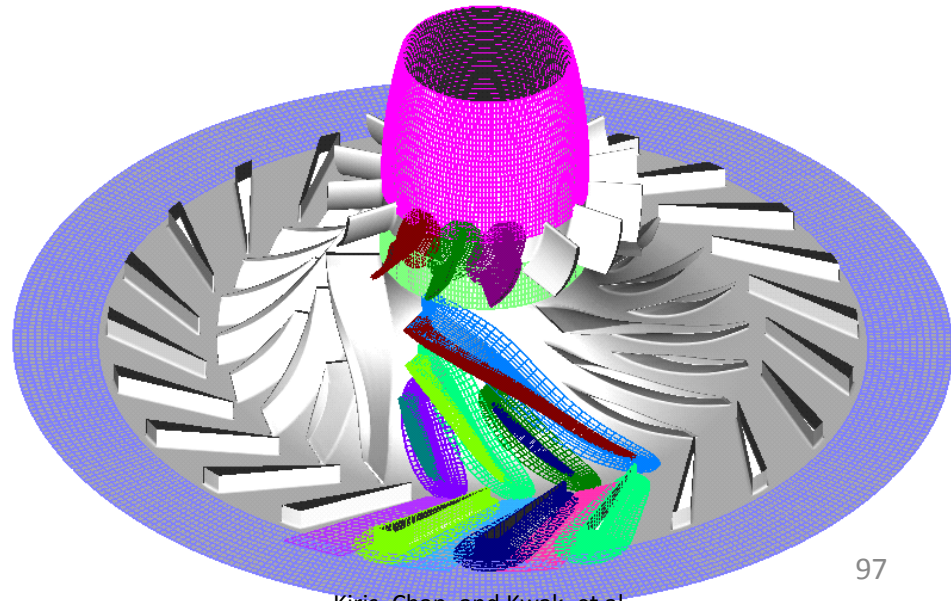
Gomez, et al



Meakin, and Wissink, et al



Rogers, et al



Kiris, Chan, and Kwak, et al



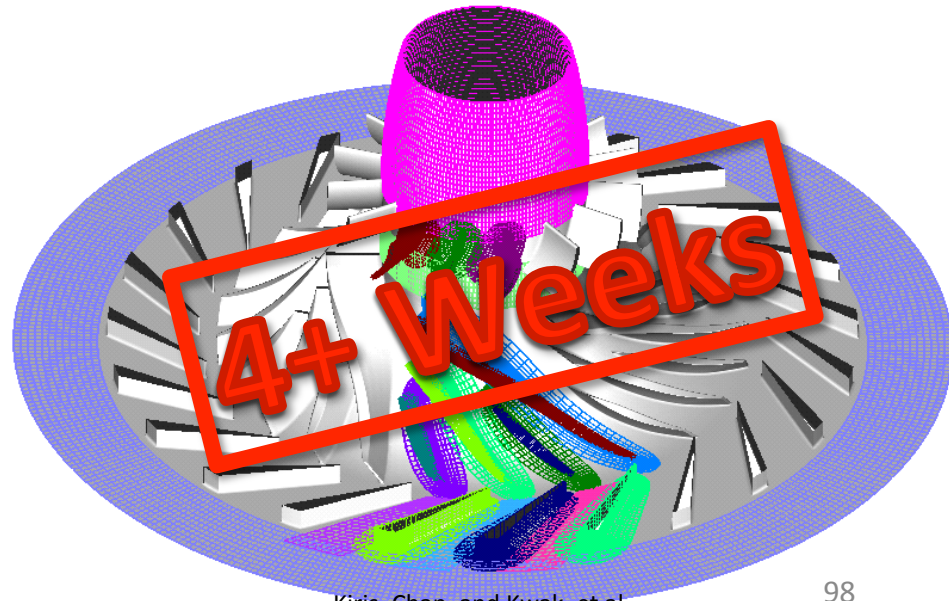
Gomez, et al



Meakin, and Wissink, et al



Rogers, et al



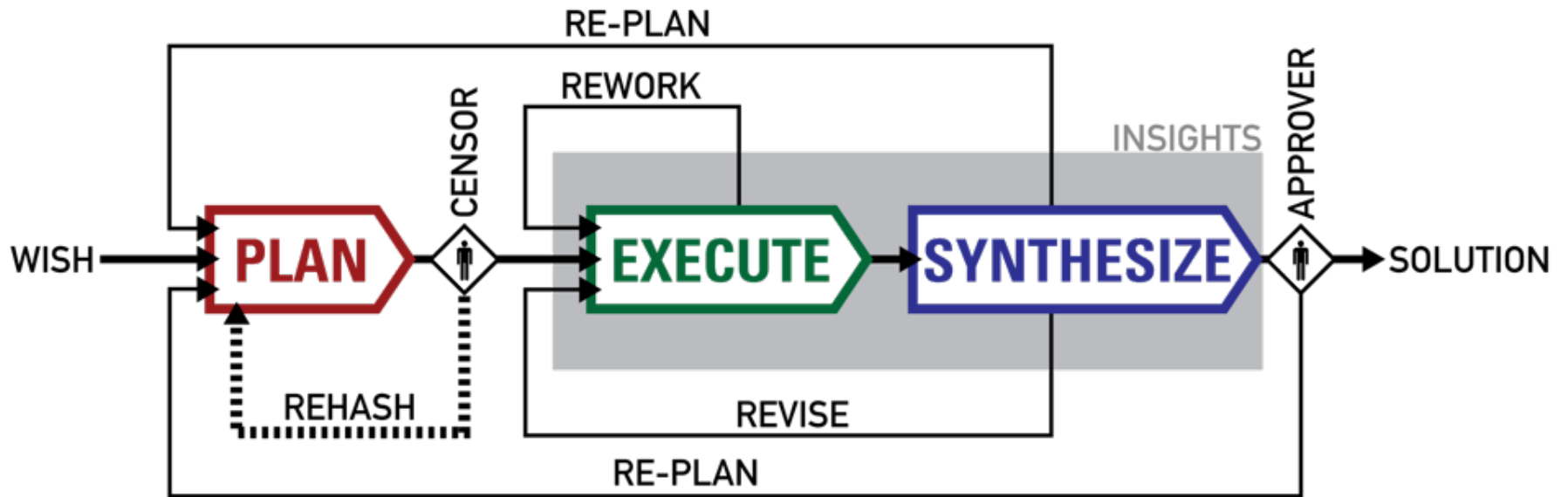
Kiris, Chan, and Kwak, et al

what do we know about censorship
in new product and service development

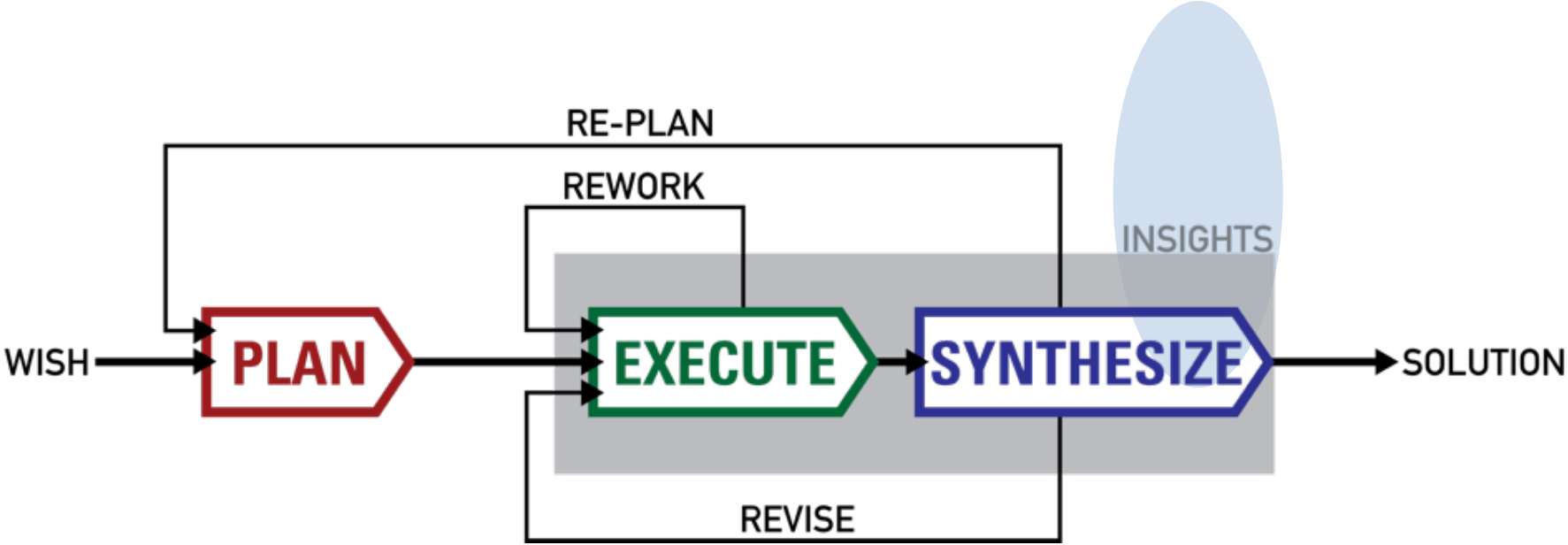
Skogstad 2009

design process management model

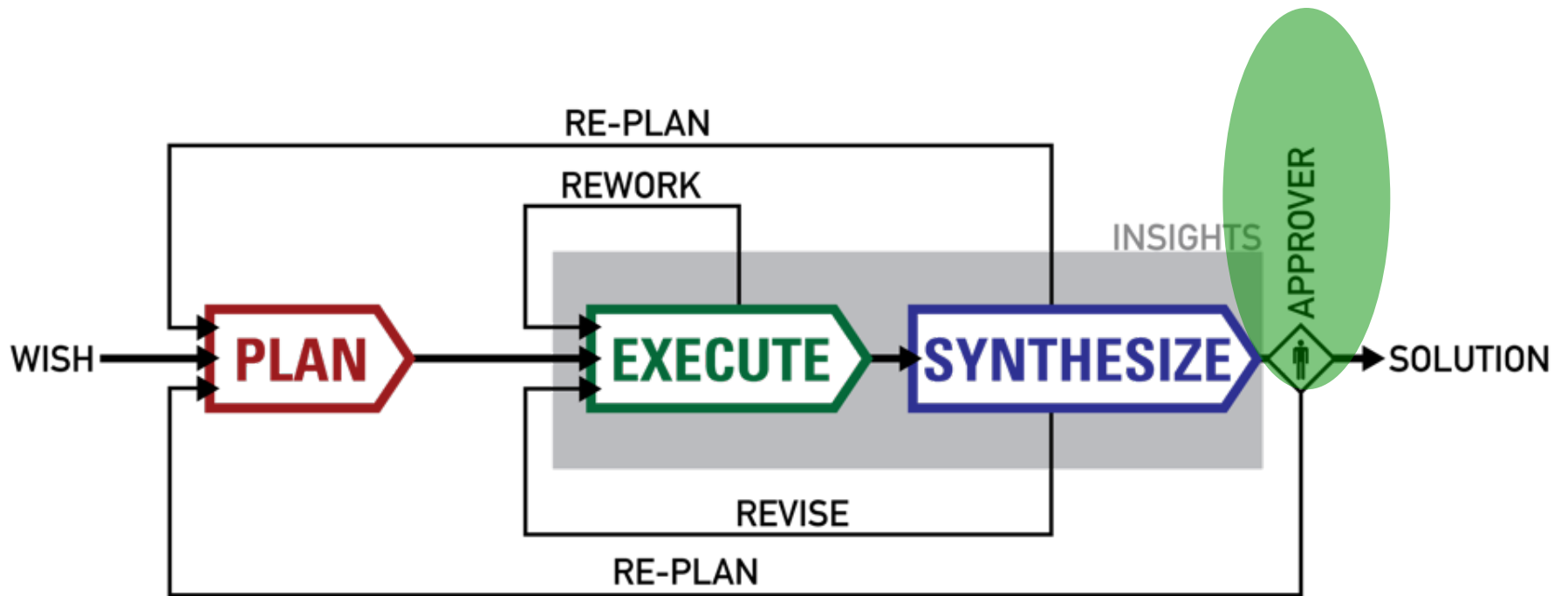
Skogstad 2009



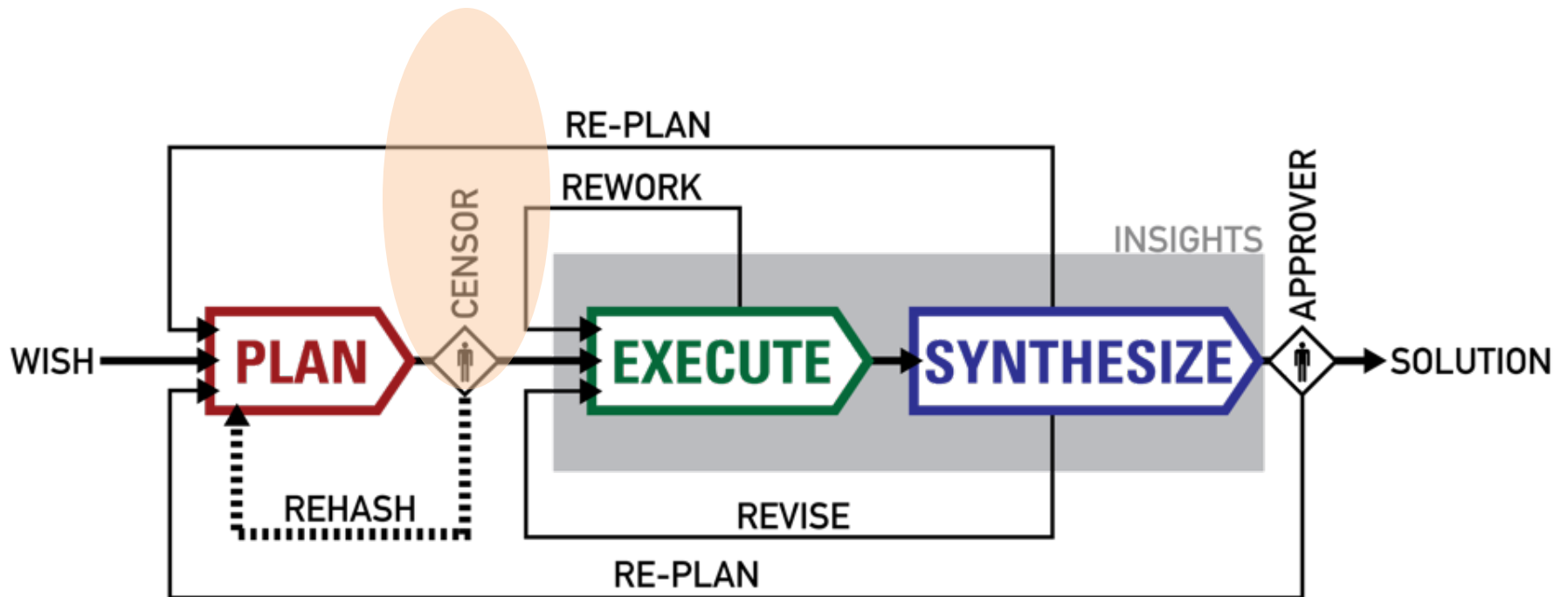
design is all about gaining insights from experiments (prototypes)



the approver let's an insight live to maturity



the **sensor** aborts insights development prematurely



what do we know about the team

Schar 2010



“Converger”

“Diverger”



problem solving preference
measured by 3
neuro-cognitive instruments

2 teams of 6 students each

all of the same problem solving preference



“Converger”

Team

HBDI-A

KAI-A



“Diverger”

Team

HBDI-D

KAI-I



making design decisions together
in the design observatory



KINETIC Concept Views

Shoe Design Task



MERRELL Designs



Shoe Design
Task

“Divergers”





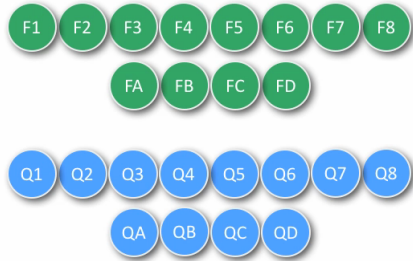
Shoe Design
Task

“Convergers”





“Shoe Design”
Task



“Divergers”



“Convergers”



Subject Group

Divergers

Convergers

Information
Items Discussed:

Facts	9/12 (75%)	9/12 (75%)
Questions	7/12 (58%)	2/12 (17%)
Total	16/24 (67%)	11/24 (46%)

Information
Item Rating

Facts	3.42	3.26
Questions	3.32	2.96
Difference	+ .10	+ .31

“How important was the information?
(5 – Important, 1-Not Important)

NEUTROGENA Styling Essence

Product Selection
Task



Toronto



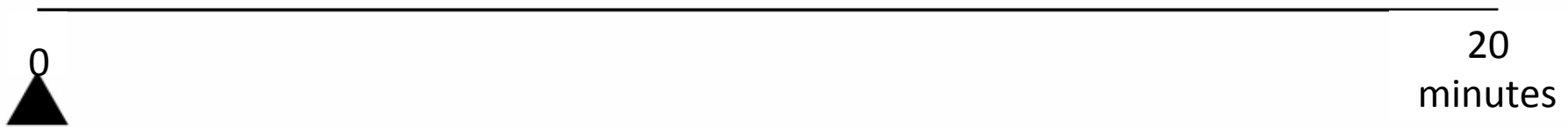
Trebbin



Tianjin

“Divergers”

“Product Selection”
Task



“Convergers”

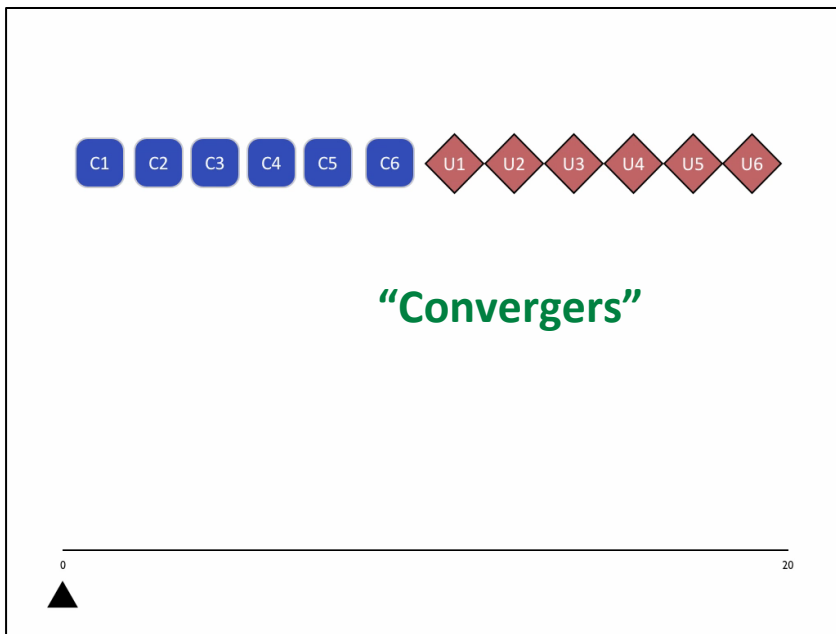
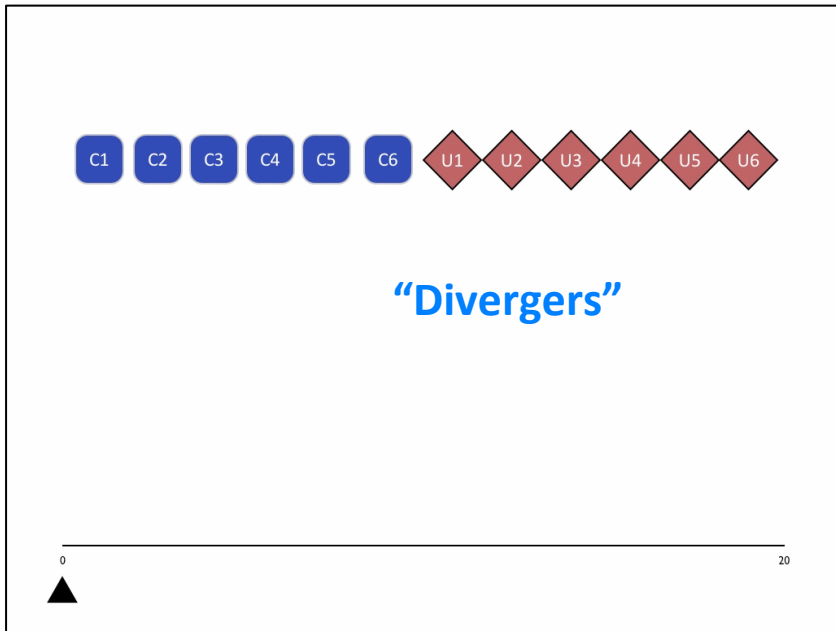
Product Selection Task



20
minutes



Product Selection Task



Subject Group

Divergers

Convergers

Items Discussed:

Common	6/6 (100%)	5/6 (83%)
Unique	5/6 (83%)	5/6 (83%)
Total	11/12 (92%)	10/12 (83%)

Decision Making:

Elapsed	16:50	6:53
Process	Review then Decide	Rate then Review

collaboration research
business process modeling using
tangible media

Grosskopf, Weske, **Edelman, Leifer** 2010
Hasso Plattner Institute, Potsdam
Stanford University, California



Universitätsklinikum Jena

with scenario consultant

Dr. Markus Güntert

storming the clinical scenario

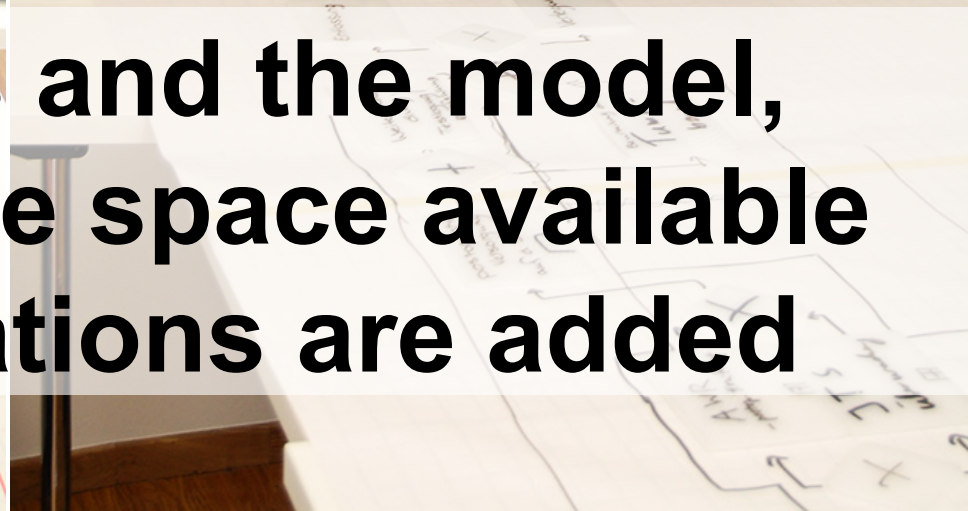
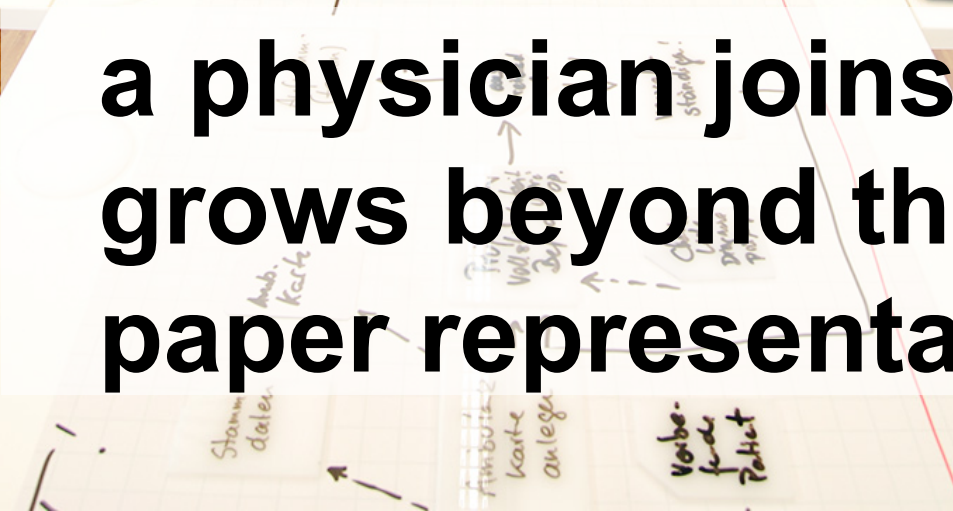




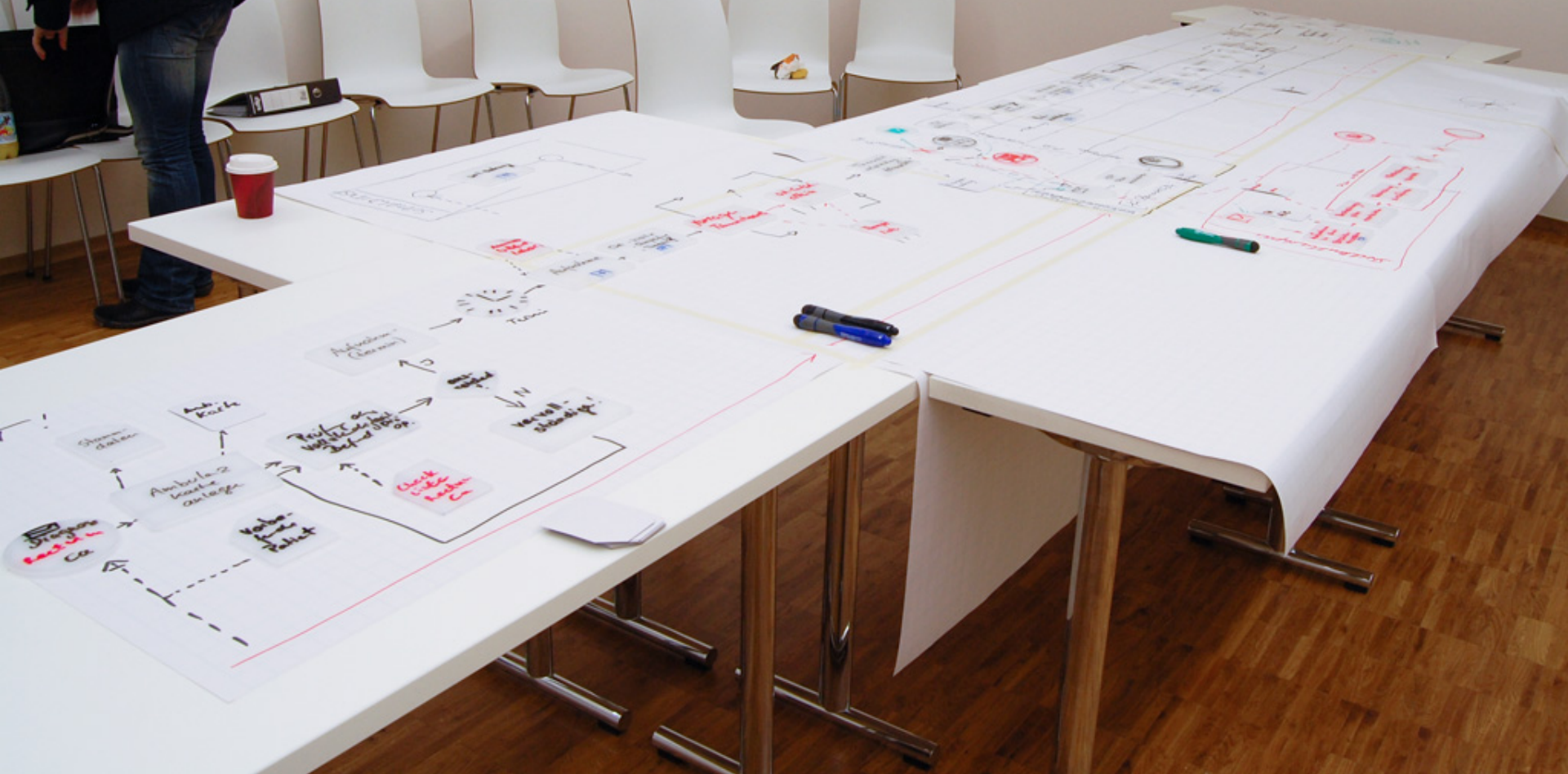
extending the storm using tangible plastic process blocks



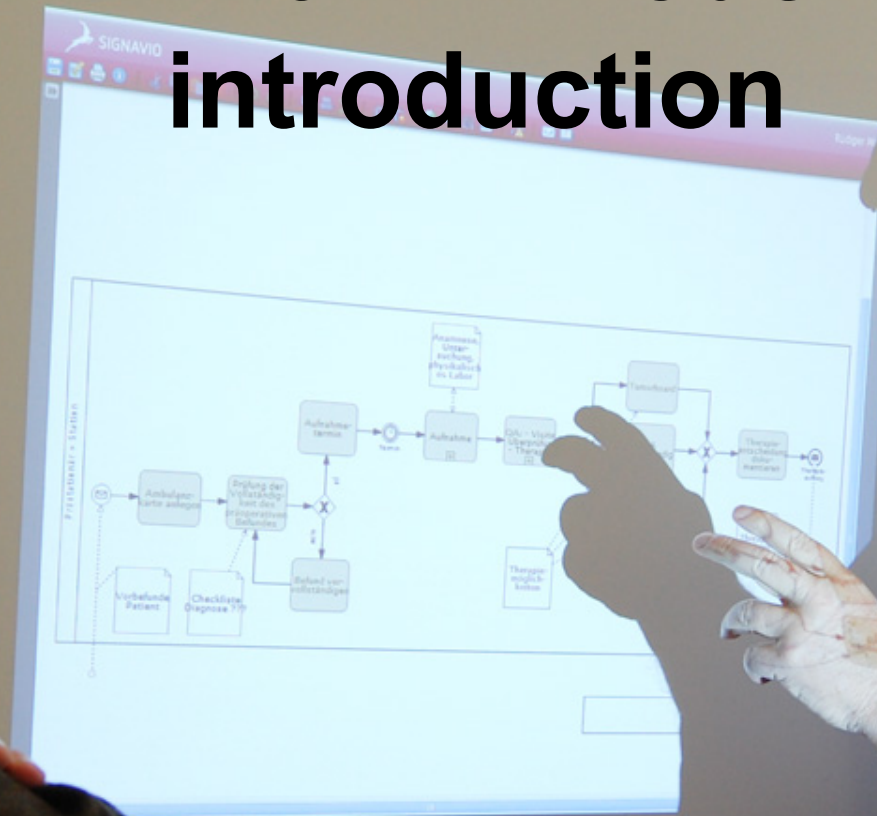
**a physician joins and the model,
grows beyond the space available
paper representations are added**



day 1 – outcome a prototype process model in paper and block media



day 2 – re-boot with IT modeling tool introduction





day – 3

**clinical process modeling exercise
wraps up ahead of schedule with
consensus captured in ICT tool**

an equation for success

$$i = mc^x$$

innovation = **m**inds in **C**ommunication
radical, relevant, & rigorous
working **creatively** together

UNDERSTANDING INNOVATION

H. Plattner
C. Meinel
L. Leifer (Eds.)
Design Thinking

“Everybody loves an innovation, an idea that sells.” But how do we arrive at such ideas that sell? And is it possible to learn how to become an innovator? Over the years Design Thinking – a program originally developed in the engineering department of Stanford University and offered by the two D-schools at the Hasso Plattner Institutes in Stanford and in Potsdam – has proved to be really successful in educating innovators. It blends an end-user focus with multidisciplinary collaboration and iterative improvement to produce innovative products, systems, and services. Design Thinking creates a vibrant interactive environment that promotes learning through rapid conceptual prototyping. In 2008, the HPI-Stanford Design Thinking Research Program was initiated, a venture that encourages multidisciplinary teams to investigate various phenomena of innovation in its technical, business, and human aspects. The researchers are guided by two general questions:

- What are people really thinking and doing when they are engaged in creative design innovation? How can new frameworks, tools, systems, and methods augment, capture, and reuse successful practices?
- What is the impact on technology, business, and human performance when design thinking is practiced? How do the tools, systems, and methods really work to get the innovation you want when you want it? How do they fail?

In this book, the researchers take a system’s view that begins with a demand for deep, evidence-based understanding of design thinking phenomena. They continue with an exploration of tools which can help improve the adaptive expertise needed for design thinking. The final part of the book concerns design thinking in information technology and its relevance for business process modeling and agile software development, i.e. real world creation and deployment of products, services, and enterprise systems.

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Christoph Meinel
Larry Leifer
Editors

Design Thinking

Understand – Improve – Apply

 Springer