accelerating sustained product innovation

design thinking
in creative practice and theory

one man's view

Larry Leifer

14th ISPE International Conference on Concurrent Engineering
Collaboration, Technology Innovation and sustainability for complex systems development
July 16-20, 2007, Säo José dos Campos, SP, Brasil

cdr

d.school

accelerating at Stanford
a French-Bavarian view

3 steps to sustained innovation

(Leifer 200X)

1 **Designing is a socio-technically mediated activity.**

Learning is a socio-technically mediated activity.

Coaching is a socio-technically mediated activity.

2 **Designers must preserve ambiguity.**

Learners must preserve ambiguity.

Coaches must preserve ambiguity.

3 **All designing is re-designing.**

All learning is re-learning.

All coaching is re-coaching.

… and the corollary that all learning requires UN-learning …

(John Seely Brown 1998, CTO, Xerox PARC)

innovation
ideas and concepts
that are successful
in the world (market place)

.

.

.

is not a creativity metric

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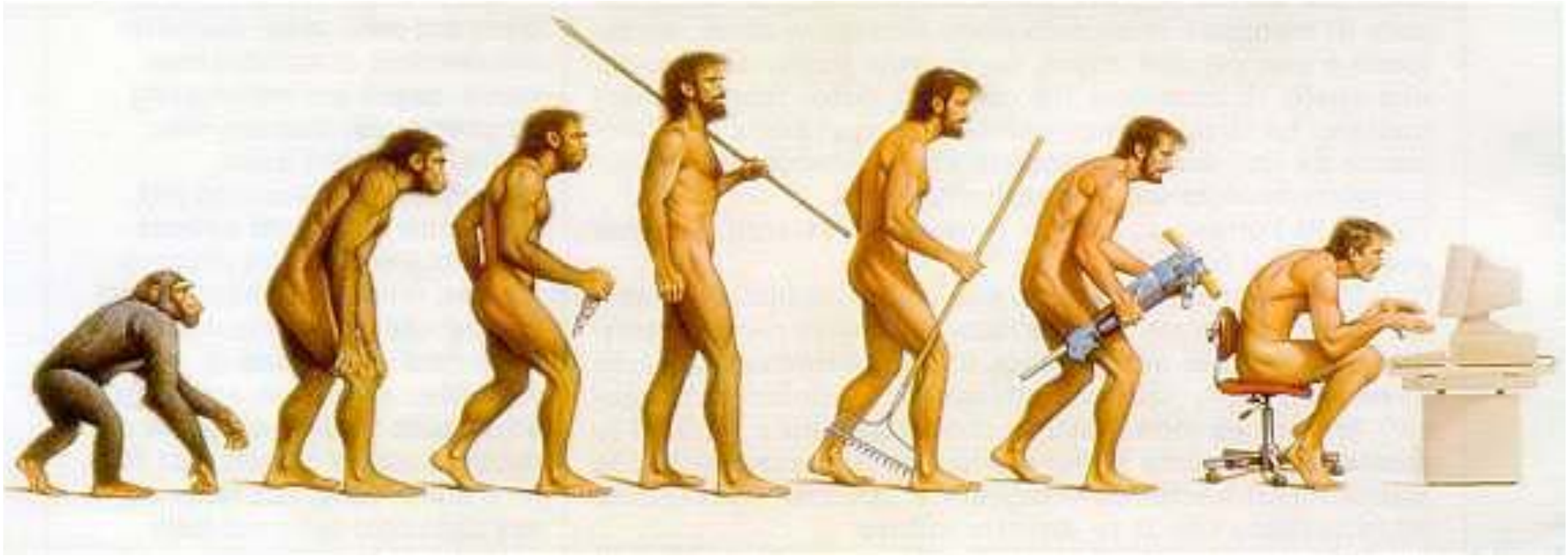
why do we care ?

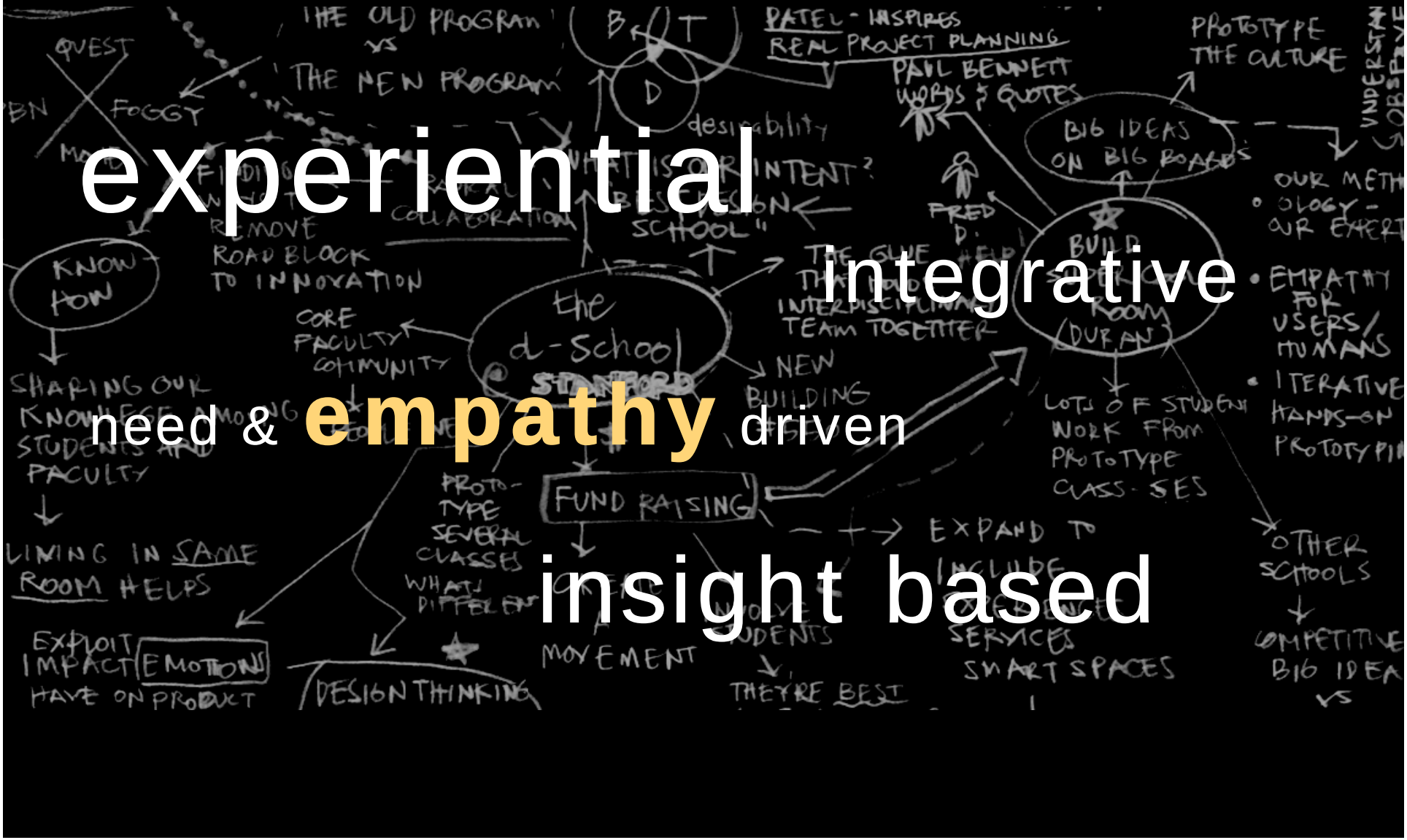


designing is a socio-technically mediated activity

step-1
people

Hasso Plattner Institute of Design at Stanford drives learning

design thinking



experiential

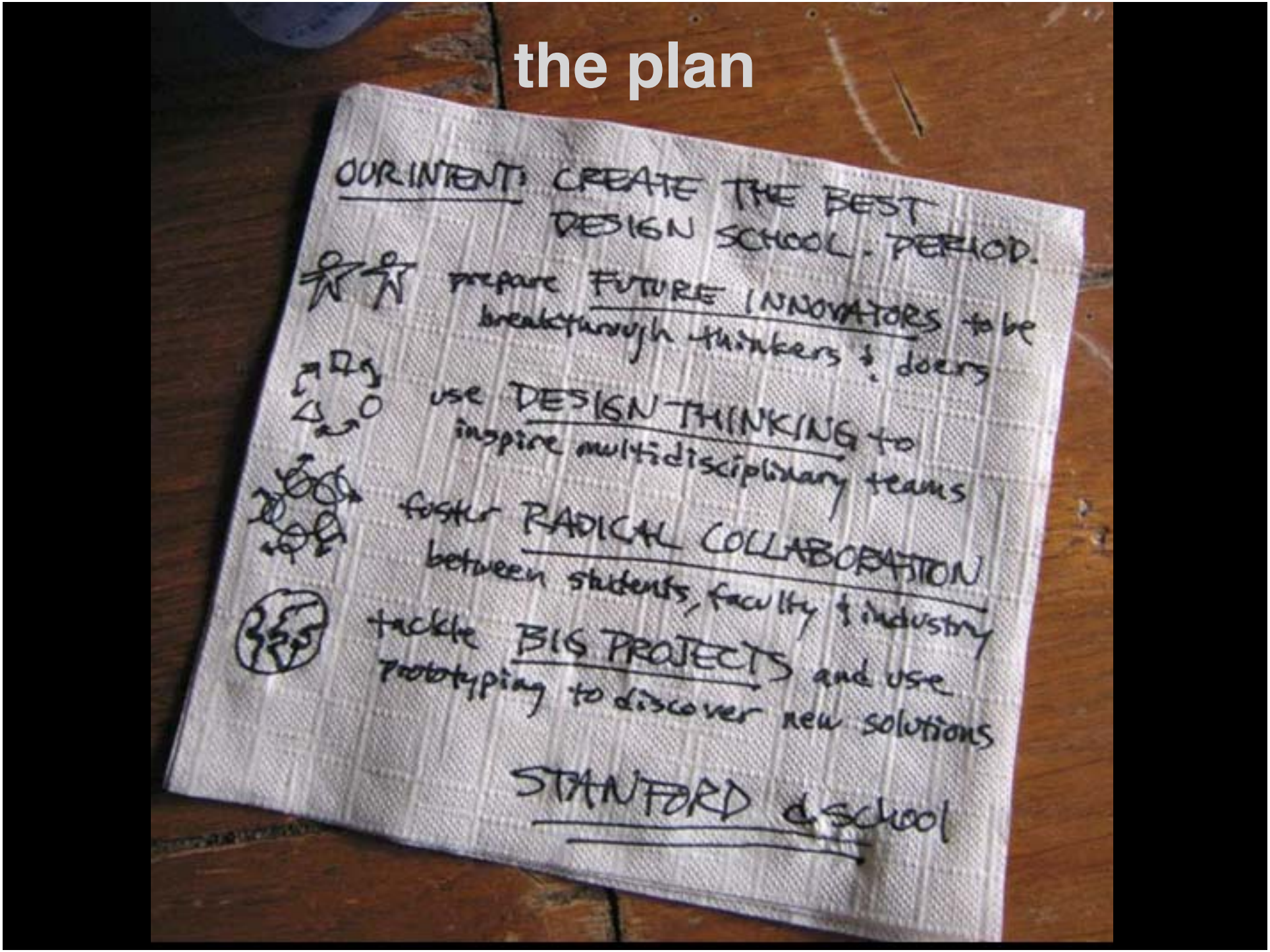
integrative

need & **empathy** driven

insight based

Hasso Plattner Institute of Design at Stanford

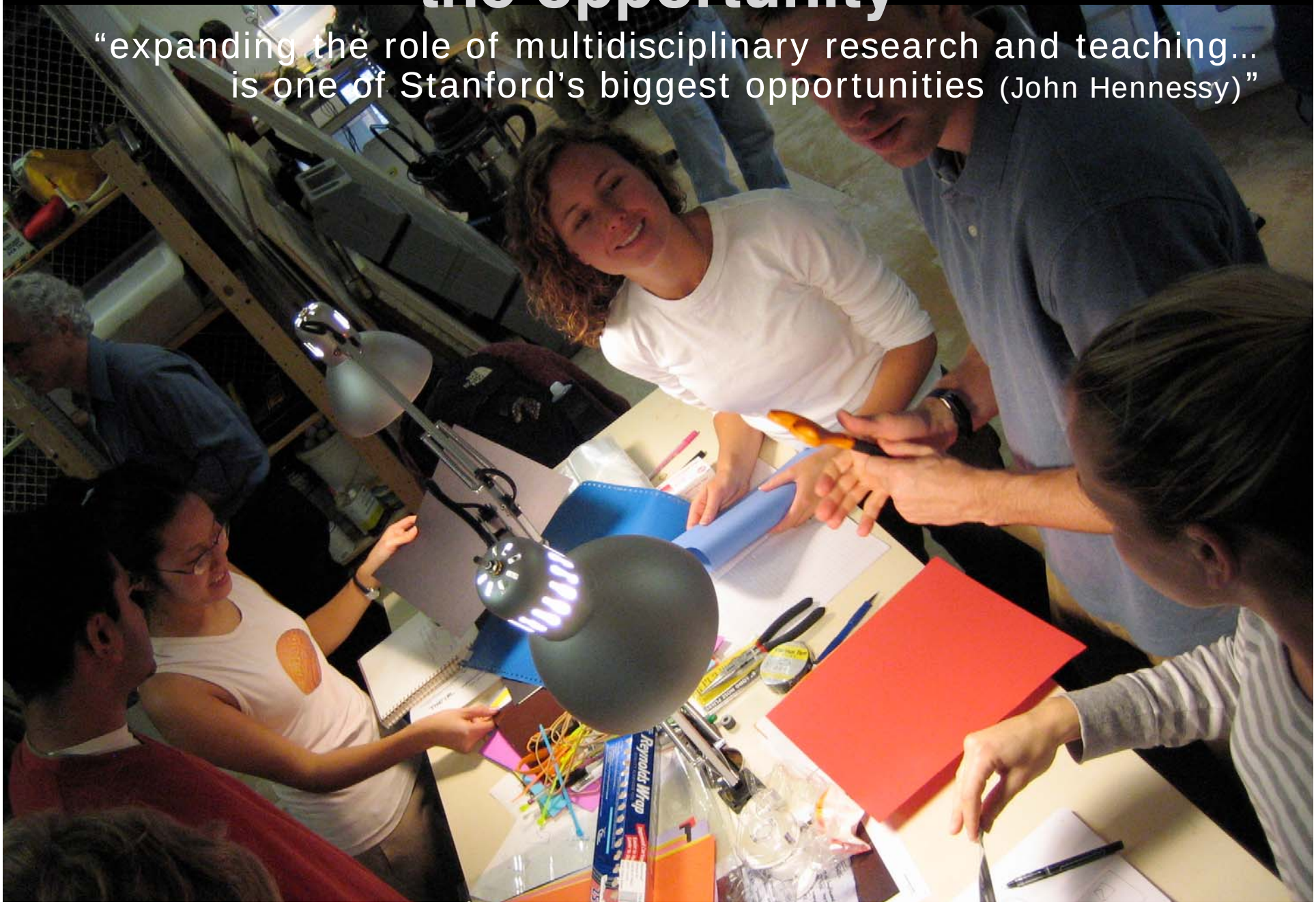
the plan


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

the start-up team

the opportunity

"expanding the role of multidisciplinary research and teaching… is one of Stanford's biggest opportunities (John Hennessy)"



the break through

intense collaboration

extreme product based “design learning”

a prototyping culture accelerates discovery

students as experts

reverse mentoring

students engaged and confident
about creating their own innovation process

“T” people in the making

DESIGN THINKING

THINKING

surprise & delight

designers must preserve ambiguity

step-2
ambiguity management

d.310 industry projects
drive academic learning


Abbott "Diabetes Care"
"Artificial Copilot" Audi
BMW "Enhanced Passenger Communication"
"Making Air Conditioning Personal" Daikin
Daimler Chrysler "Touch screen haptics with branded applications"
"The Wireless Car" General Motors
Panasonic "New Human-Machine Interaction Method for Unfamiliar Functions"
"Future Elderly Environments" Sirius
Volkswagen "Novel In-Car Entertainment System"
"Driver Interface for Shift-by-wire" Volkswagen
The Teaching Team "Running the best damn class at Stanford"


Copilot

laboratory project - A

need-finding, conceiving, and building
can you make a BMW 3-series
car door smart

?


product innovation
innovative learning

example

smart door

d.310

comparable courses deal with mechatronics, facilities engineering, computer science, satellite design, aircraft design, entrepreneurship, medical device design,environmental policy, human computer interaction research, film, video, bio-technology, communications

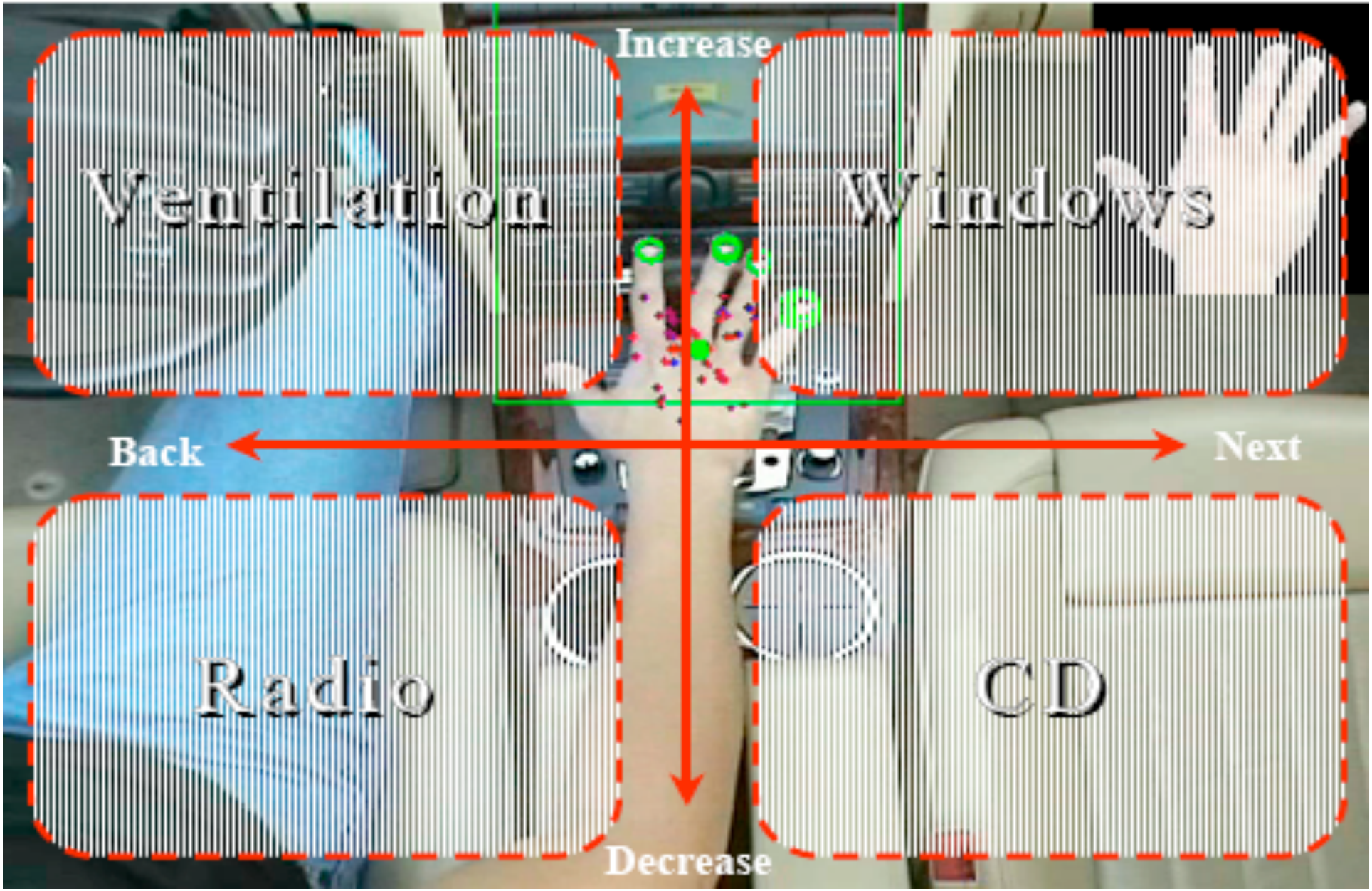
laboratory project - B

need-finding, conceiving, and building
can driver hand gestures be used to mediate vehicle command & control

?


Infrared Camera
Debugging Display
Gesture region

gesture control of remote functions



driver gesture control design studies

laboratory project - C

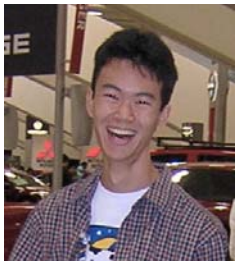
need-finding, conceiving, and building
can you make a co-pilot
for the Audi of 2020

?

global design team

STANFORD ENGINEERING

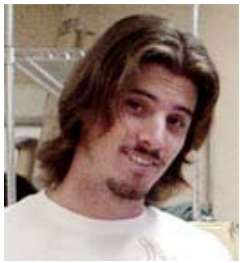
Edith Arnold



Mike Ho

Toni Obermueller

Joe Schmid



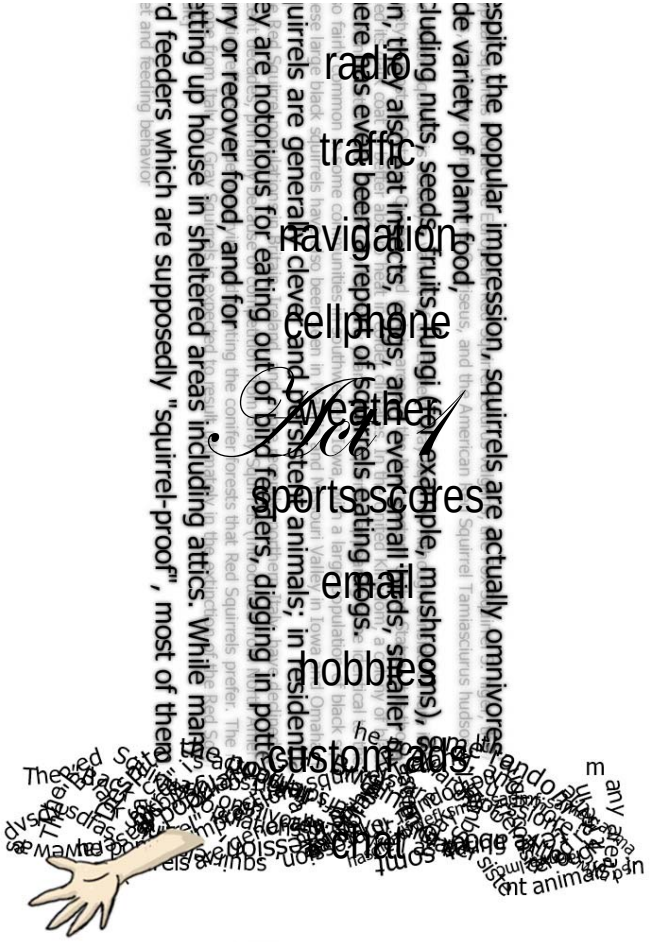
Dave Jackson

David Klaus

Tim Horenburg

Markus Hoerwick

need-finding



Challenge

to keep driving the real time task !

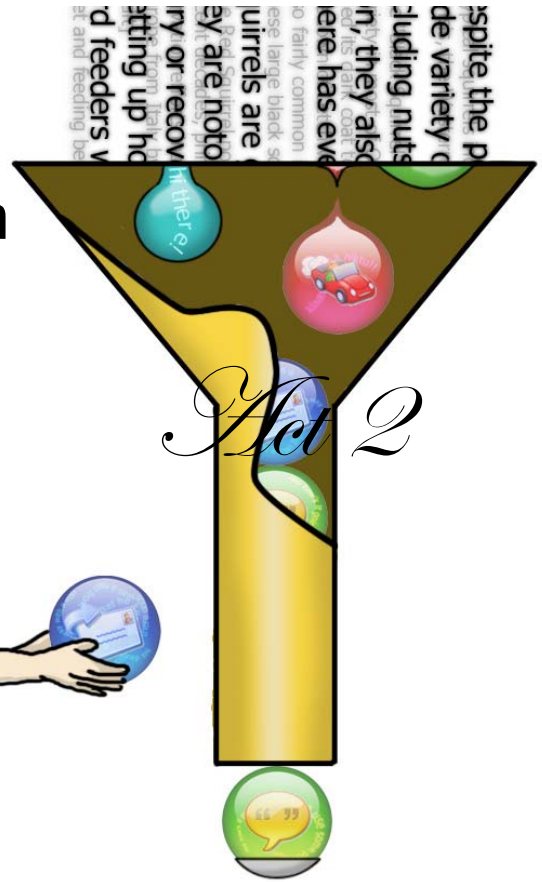
communication must be taken off-line !

Solution

Solution

Data filter

Social connection

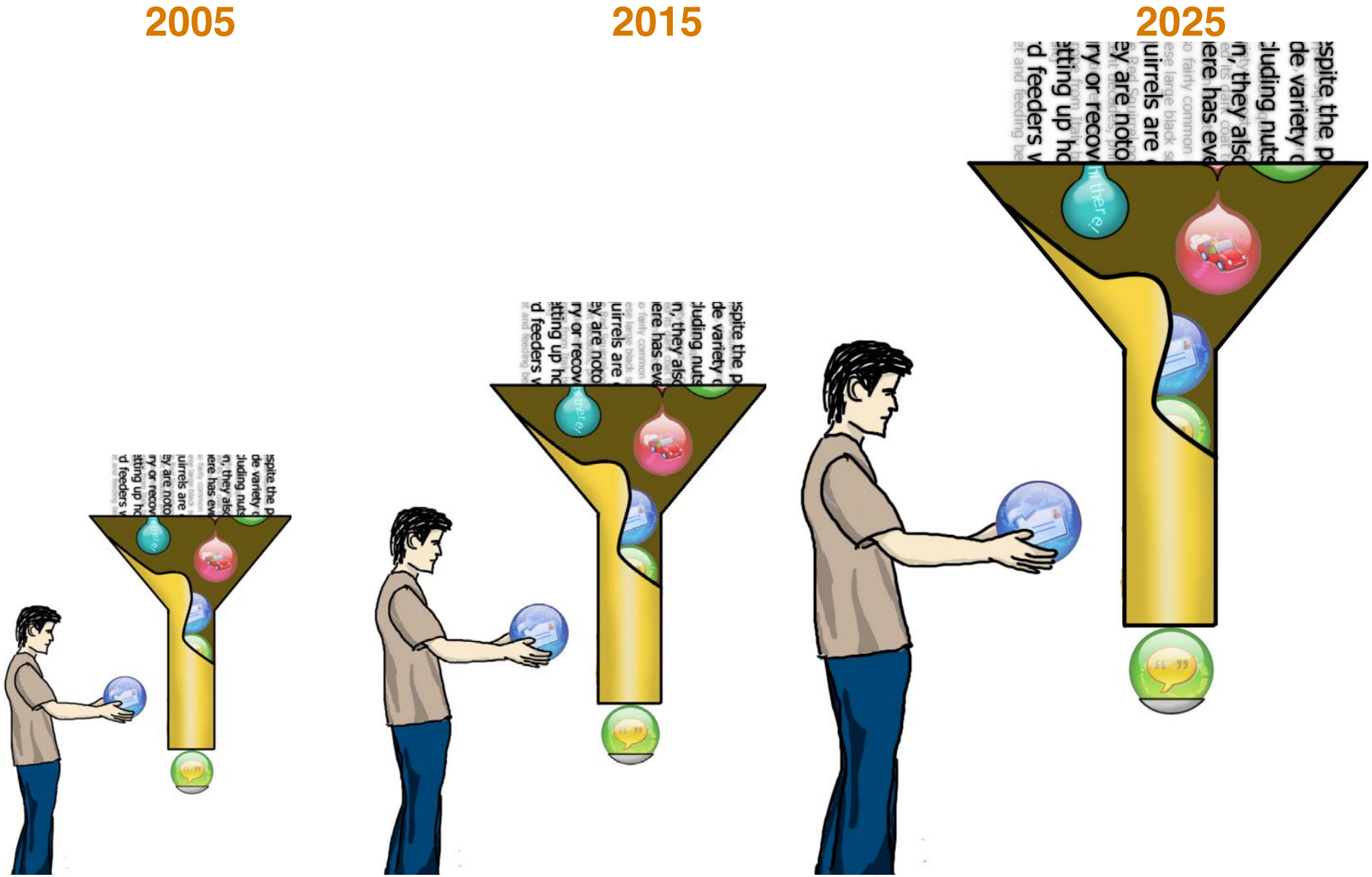


Act 2

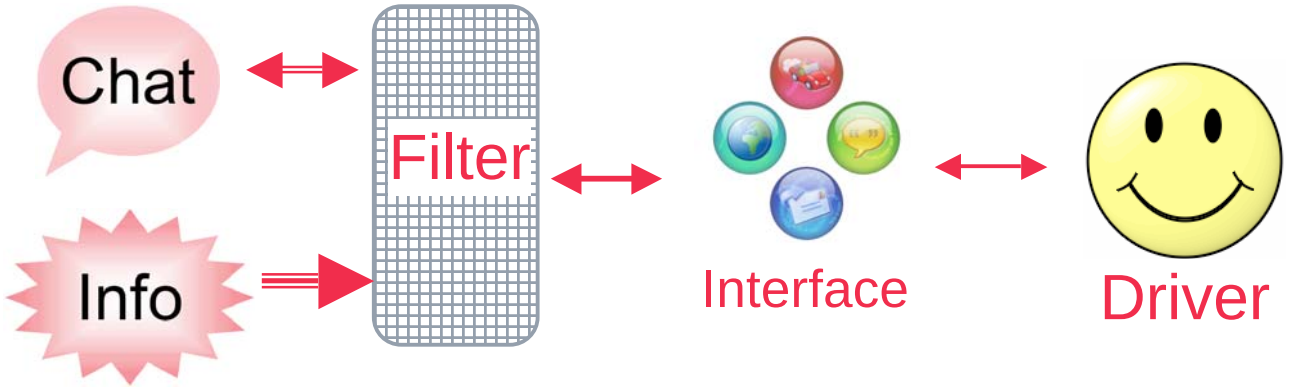
Information pacing

Intuitive interface

foresight

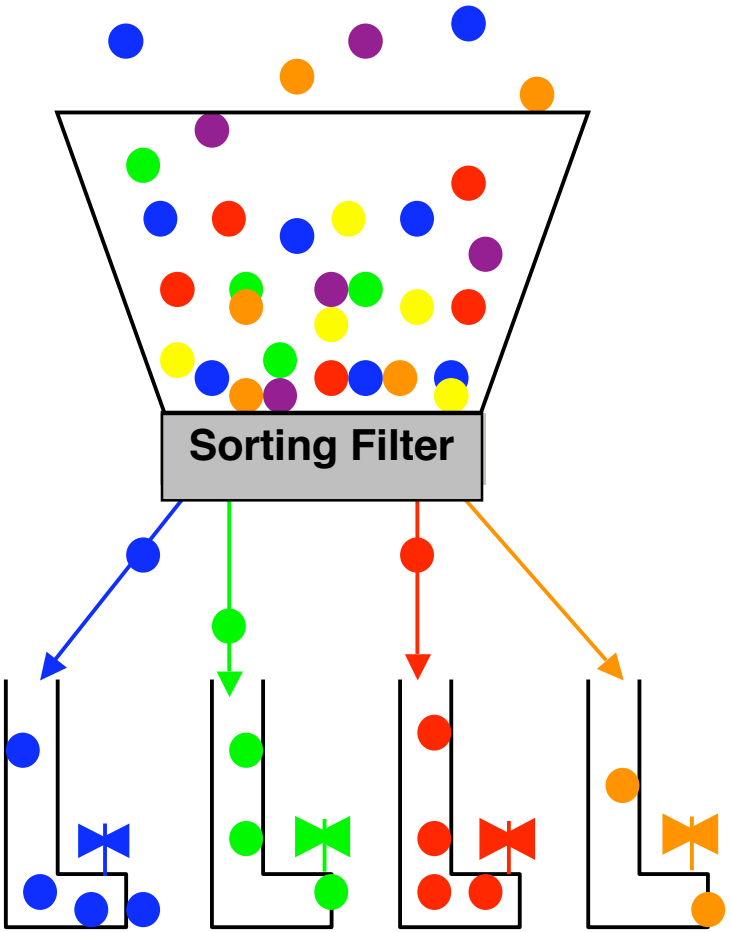


solution part_a



solution part_b

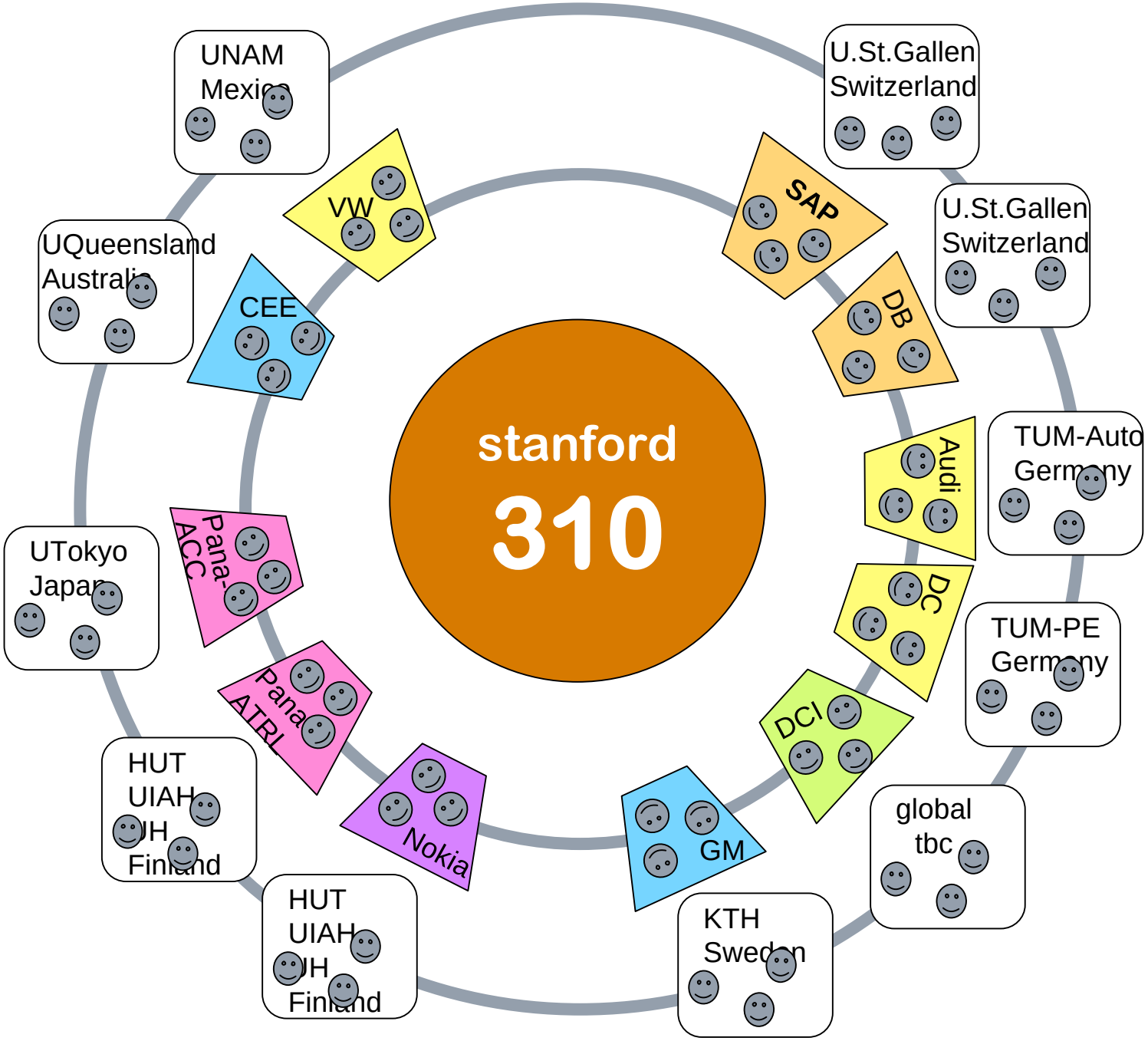
- **Data Management Strategy**



Solution

Solution

design-knowledge management framework and laboratory

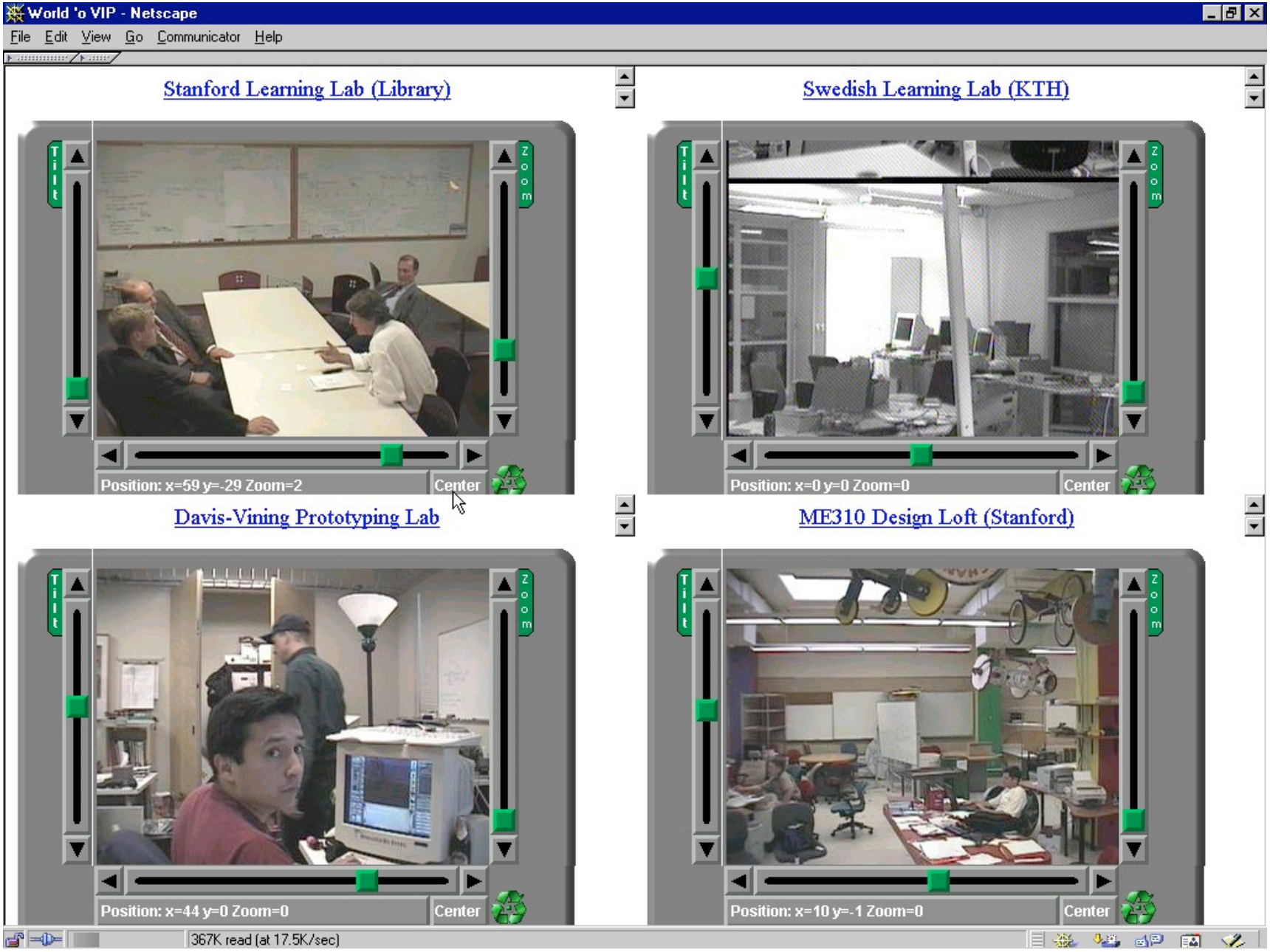

stanford
310
UNAM
Mexico
VW
U.St.Gallen
Switzerland
SAP
U.St.Gallen
Switzerland
UQueensland
Australia
CEE
DB
Audi
TUM-Auto
Germany
UTokyo
Japan
Pana-
ACC
DC
TUM-PE
Germany
Pana
ATRI
DCI
HUT
UIAH
UH
Finland
Nokia
GM
global
tbc
HUT
UIAH
UH
Finland
KTH
Sweden

where is the laboratory

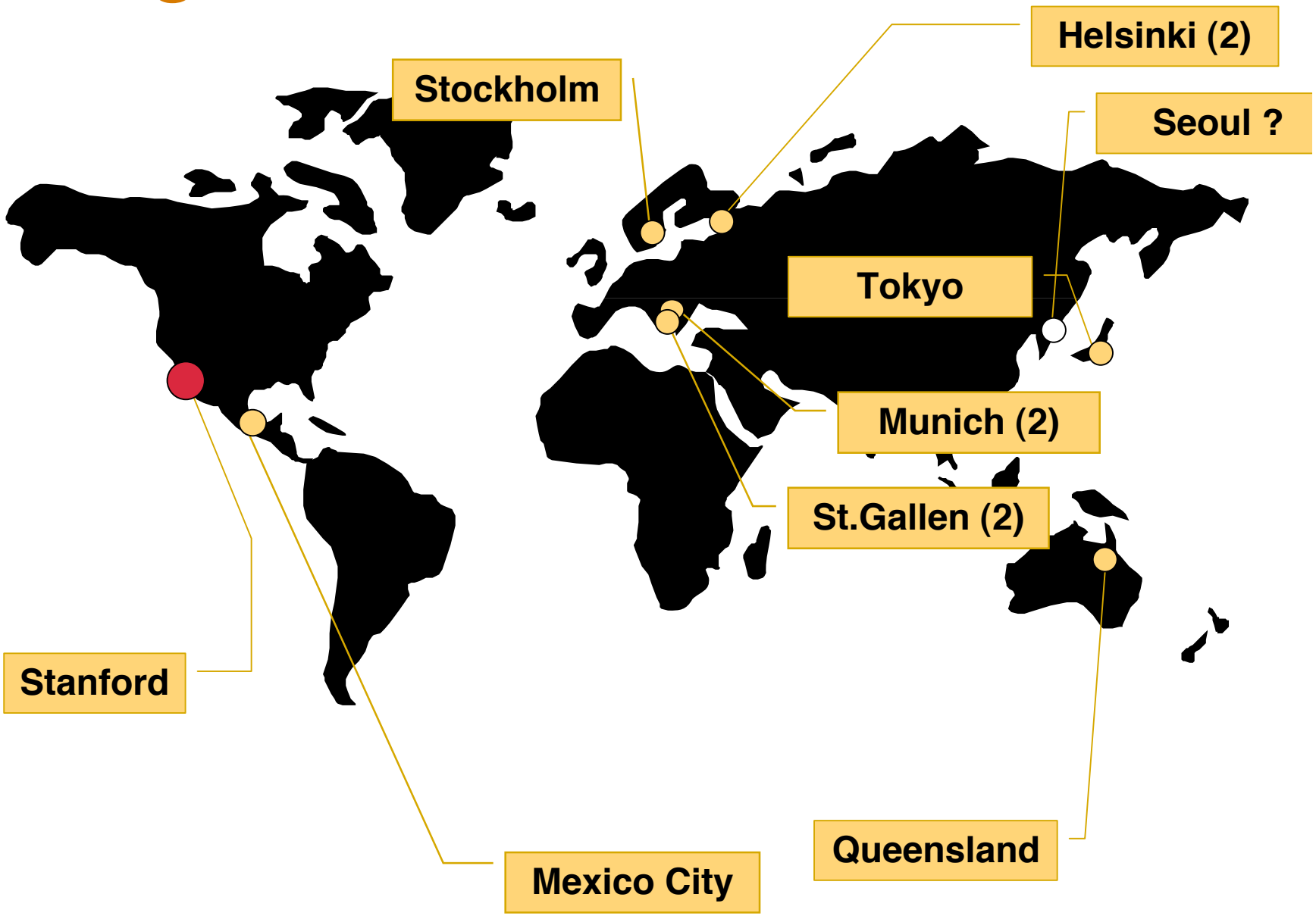
extreme project based learning in d.310 2006-2007

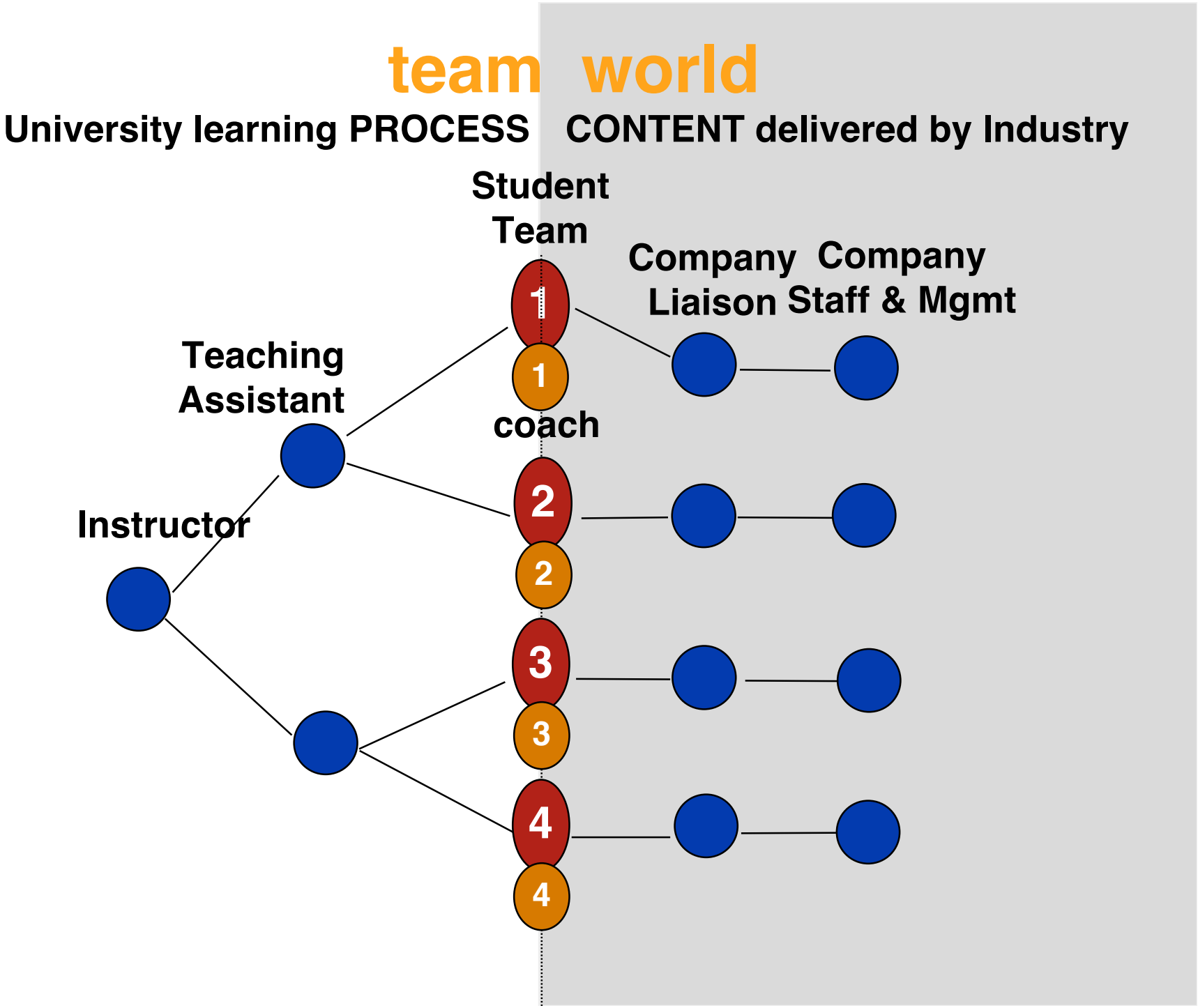
- **SAP** (DE) (global with HSG, CH)
  - User Interface for an Executive **Decision**-Context Device
- **Deutche Bahn** (DE) (global with HSG, CH)
  - Future **Workplace** of the Knowledge Worker
- **Audi** (DE) (global with TUMunich, DE)
  - Audi Artificial **Trainer**
- **Panasonic-ACC** (JP) (global with UTokyo, JP)
  - **Walkatronics**: wearable navigator for independent living
- **Panasonic-ATRL** (JP) (global with Helsinki, FI)
  - Wearable Consumer Technology for Sensing and **Relaxation**
- **DaimlerChrysler** (DE) (global with TUMunich, DE)
  - **GUI** Development
- **CEE** (Stanford) (global with Queensland, AU)
  - **iRoom** Transformer Space
- **VW-IRL** (DE) (global with UNAM, MX)
  - VW Intelligent **Display**
- **DCI International** (USA) **(seeking global partner)**
  - **Dental** Compressed Air & Vacuum Delivery System
- **GM** (USA) (global with KTH, SE)
  - Multi-media Information **Console**
- **NOKIA** (FI) (global with Helsinki, FI)
  - Very **Human** Technology

what does it look like?



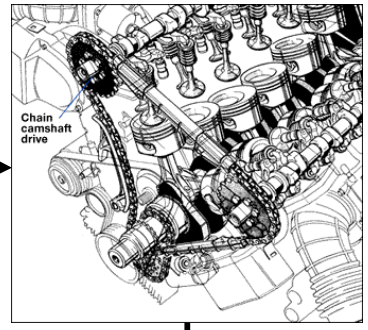
global-team labs 2006-2007




team world
University learning PROCESS
CONTENT delivered by Industry
Student Team
Company Liaison
Company Staff & Mgmt
Teaching Assistant
coach
Instructor
1
1
2
2
3
3
4
4

design thinking research in context

(Leifer'04)



Product Requirements

Process Instrumentation

Human Variables

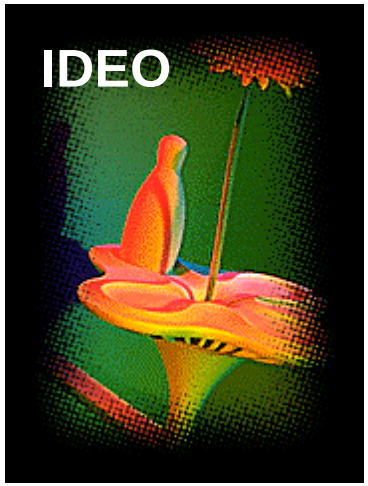
Product Specifications

Product Instrumentation

Technical Variables

the team is the product

ATLAS SNOW-SHOE COMPANY

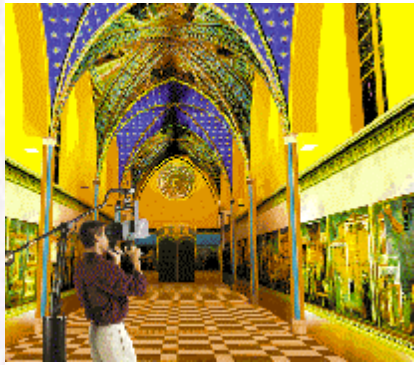


Gyration

big island

welcome to the island

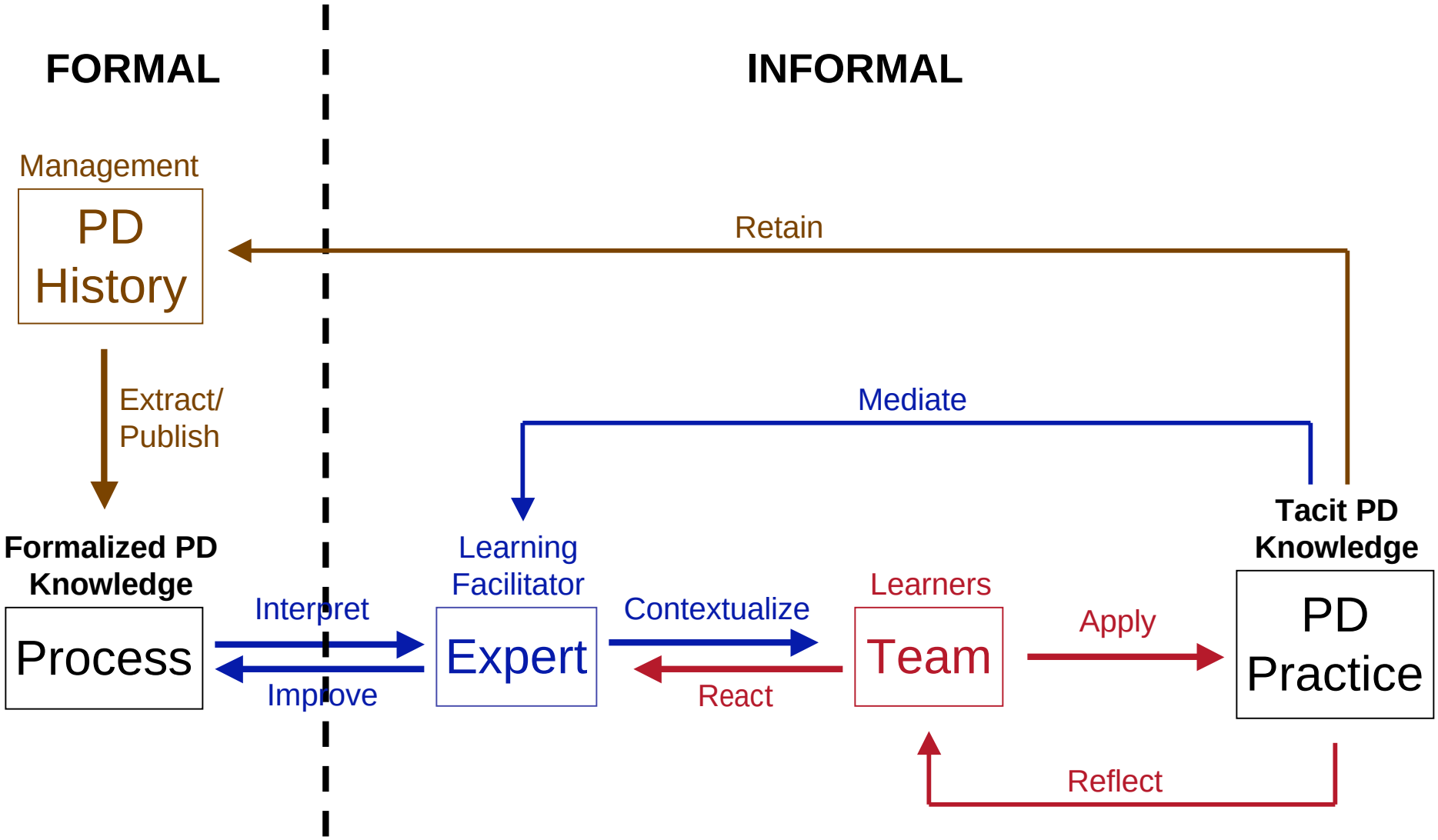
Immersion Inc.



CROSS ROUTE
Enterprise Systems Integration
EXTENDING THE ENTERPRISE
SITE MAP

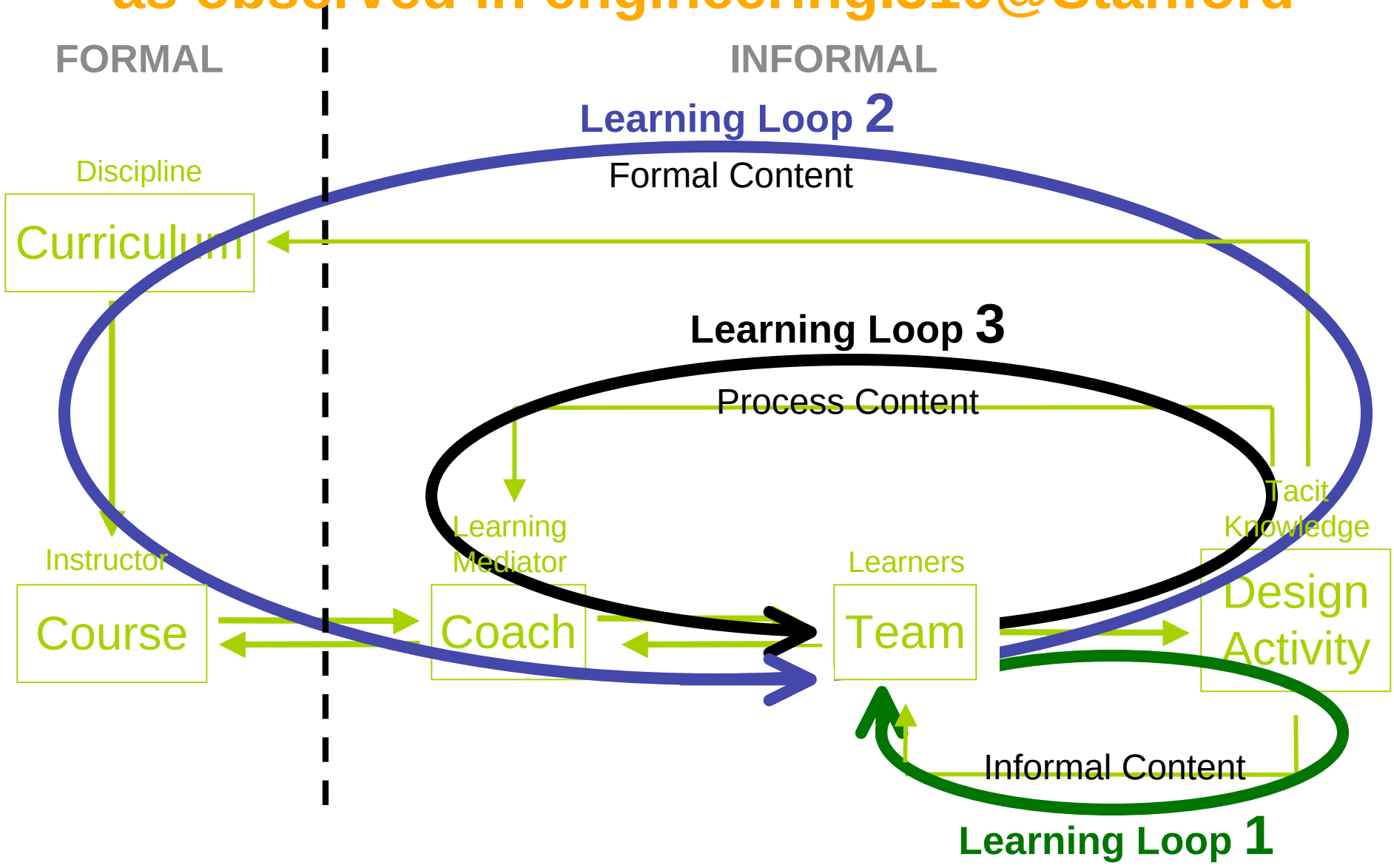
VIRTUAL TECHNOLOGIES

knowledge acquisition and management as observed in a major US automotive company



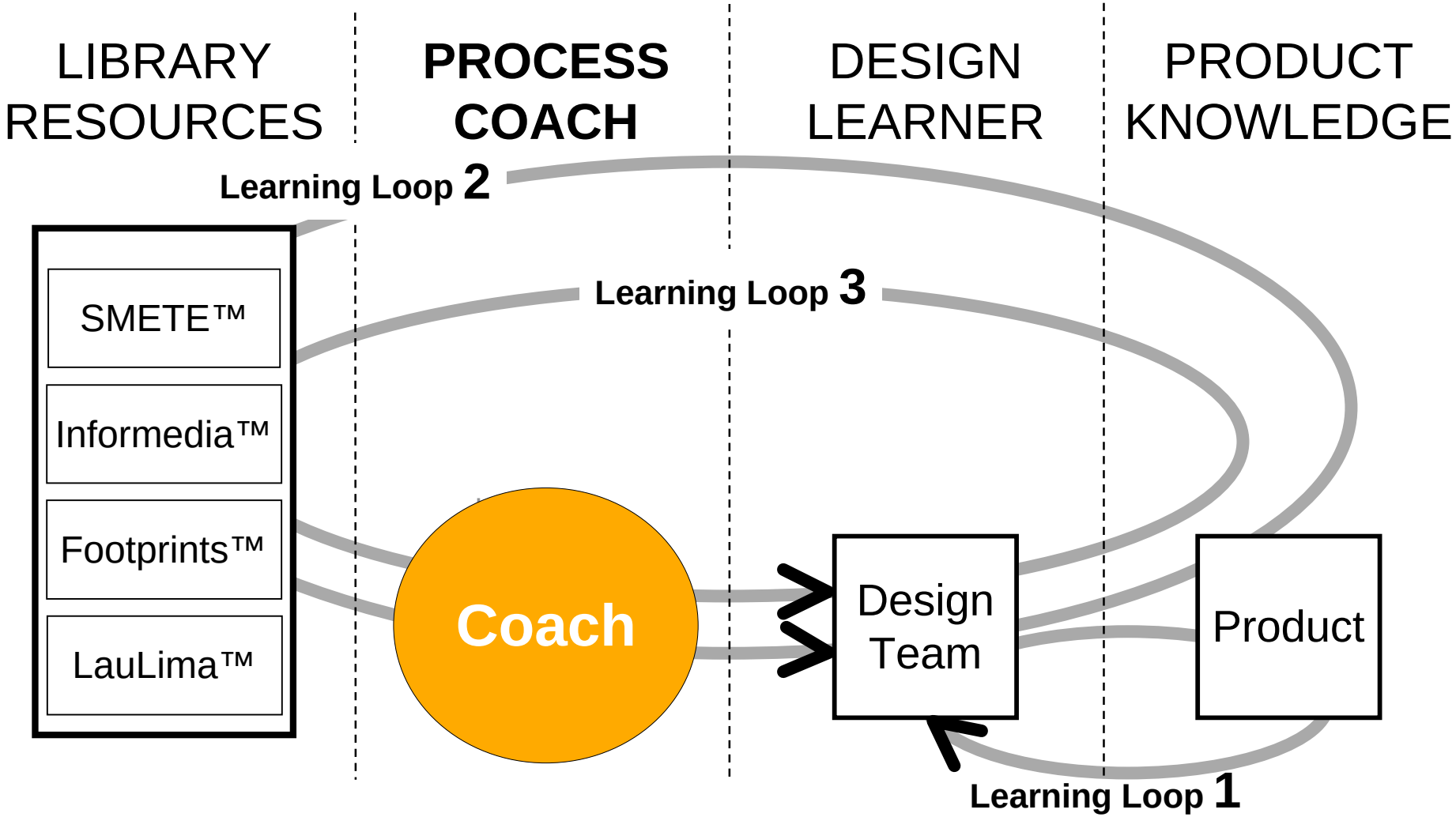
[Ozgur Eris, Larry Leifer, 2002]

knowledge acquisition and management as observed in engineering.310@Stanford



[Ozgur Eris, Larry Leifer, Ade Mabogunje, 2003]

coaching helps
technology hinders



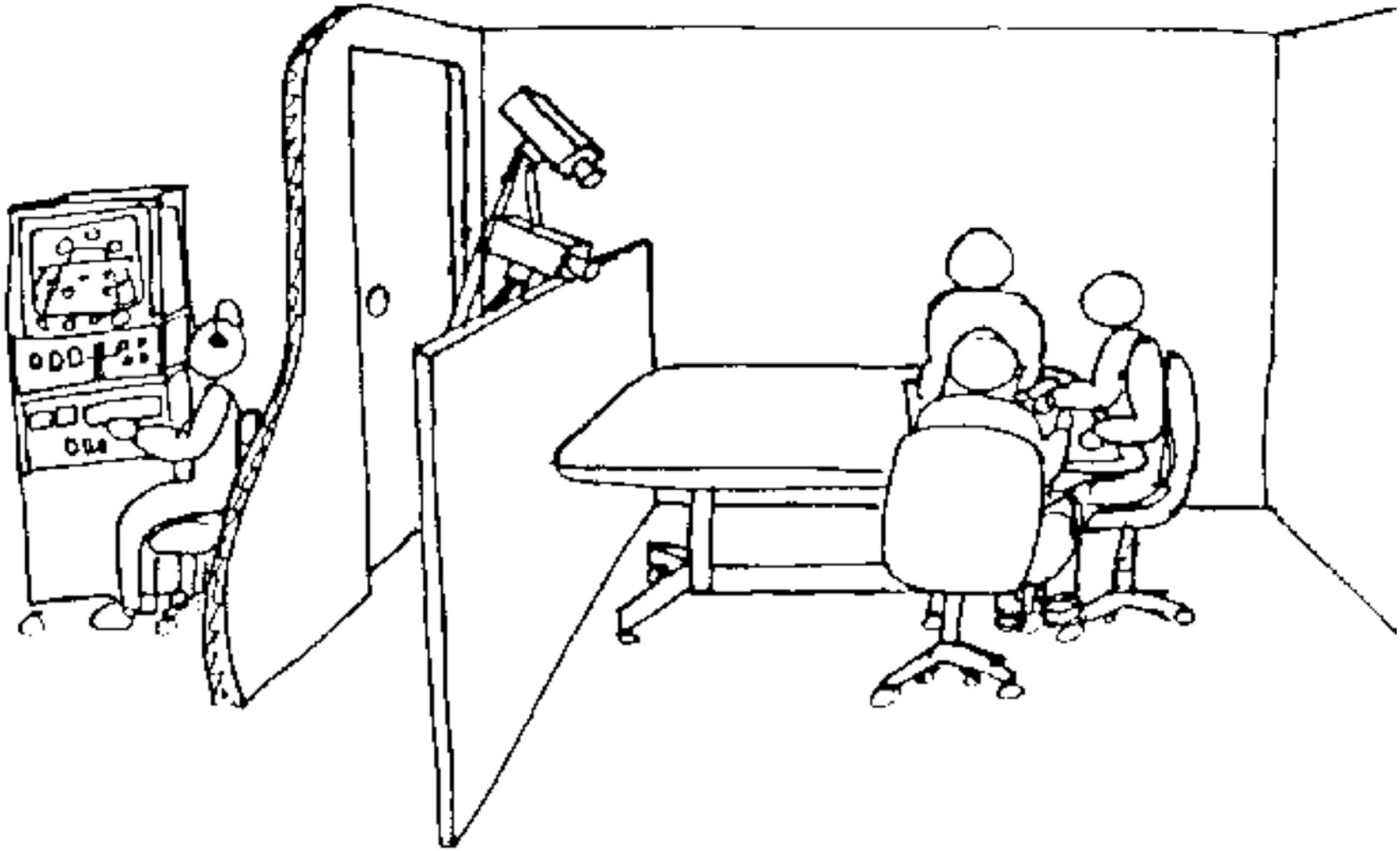
all designing is re-designing

step-3
re-designing designers

design-thinking research
what do we know from
instrumenting design
team activity

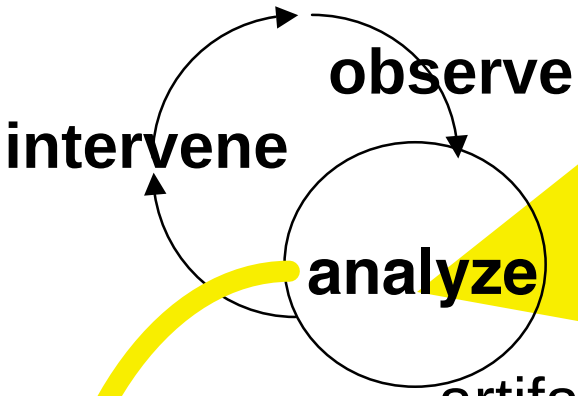
the power of observation

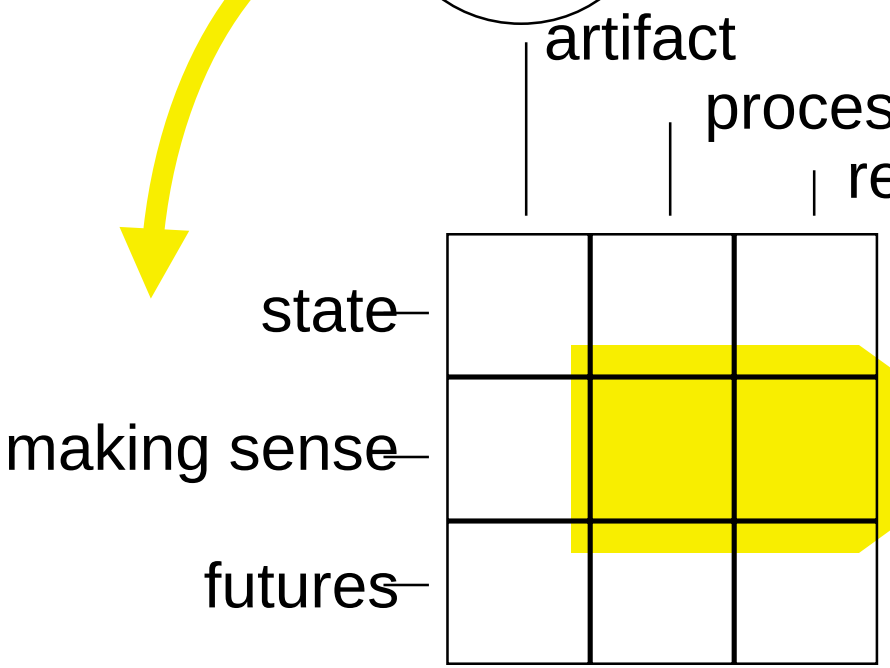
Tang ‘89, video interaction analysis



learning paradigm

since Minneman'92 corporate field studies





Curriculum Change

- negotiating
- preserving ambiguity
- tailoring talk
- performance metrics

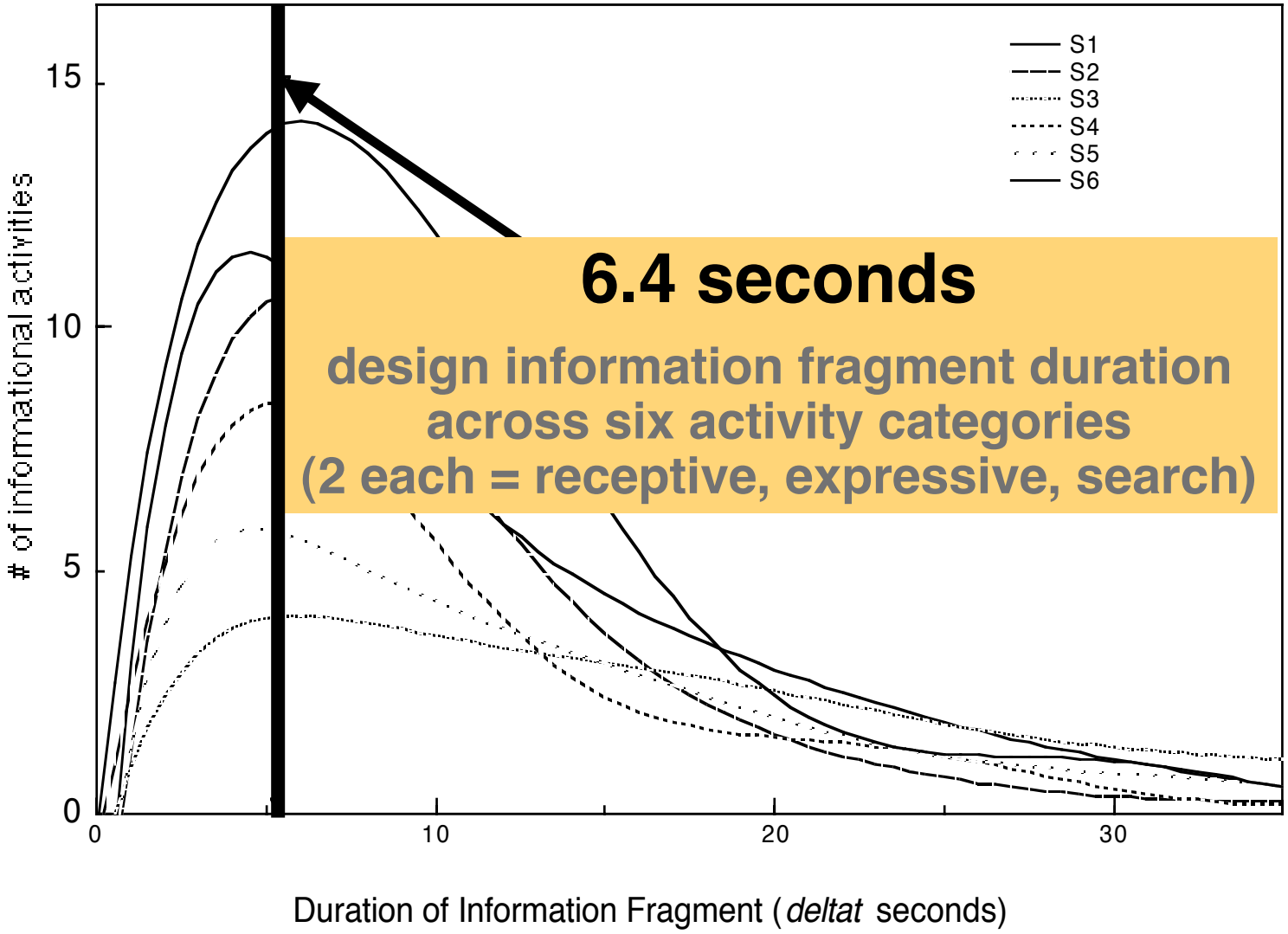
the importance of mediation

(Tang'89)

Function	Text Activity	Draw Activity	Gesture Activity	
Store Knowledge	40	19	1	27%
Express Ideas	2	63	33	43%
Mediate Interaction	0	21	46	30%
	19%	46%	35%	

the attention time constant

(Baya'97)



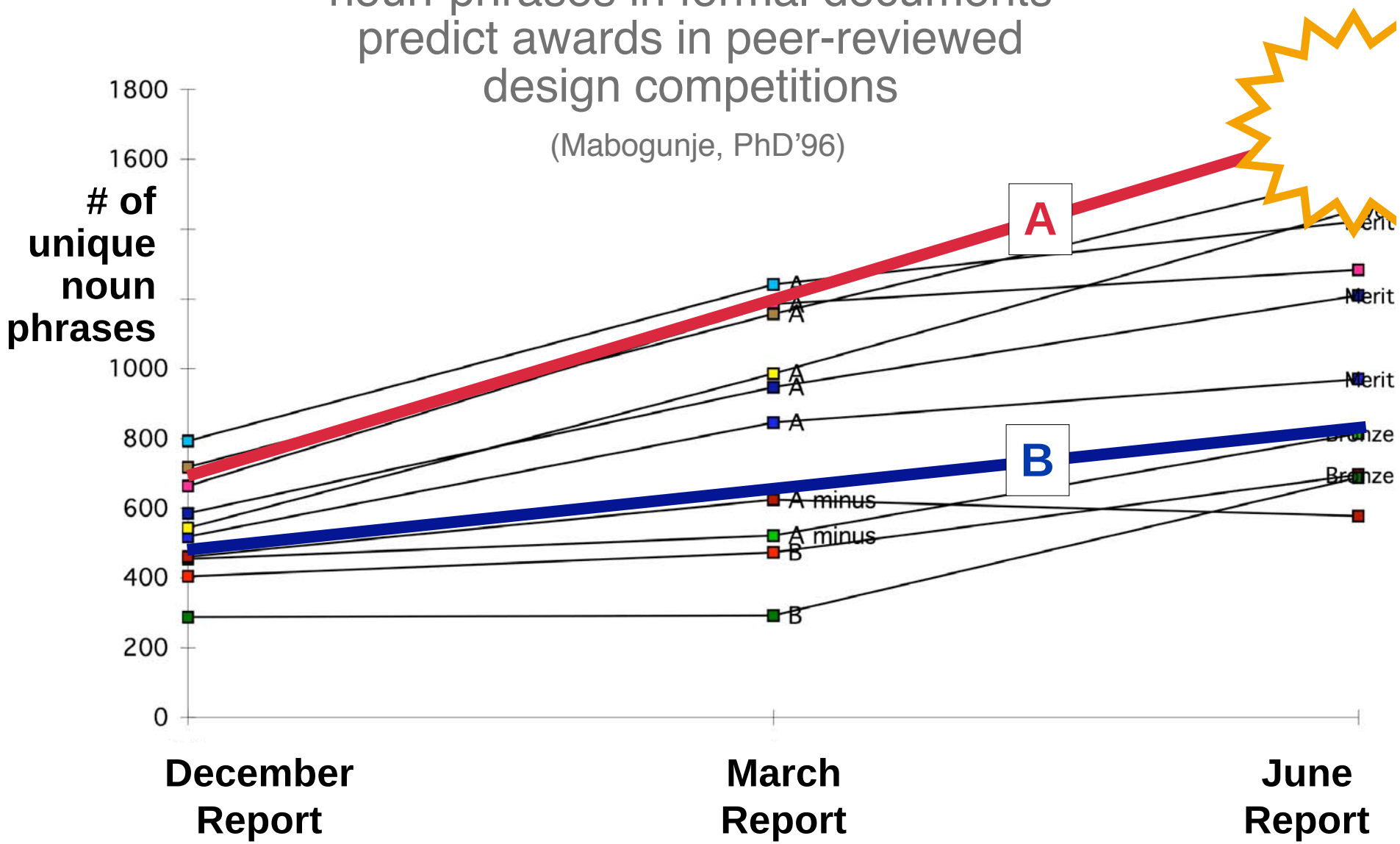
6.4 seconds

design information fragment duration across six activity categories (2 each = receptive, expressive, search)

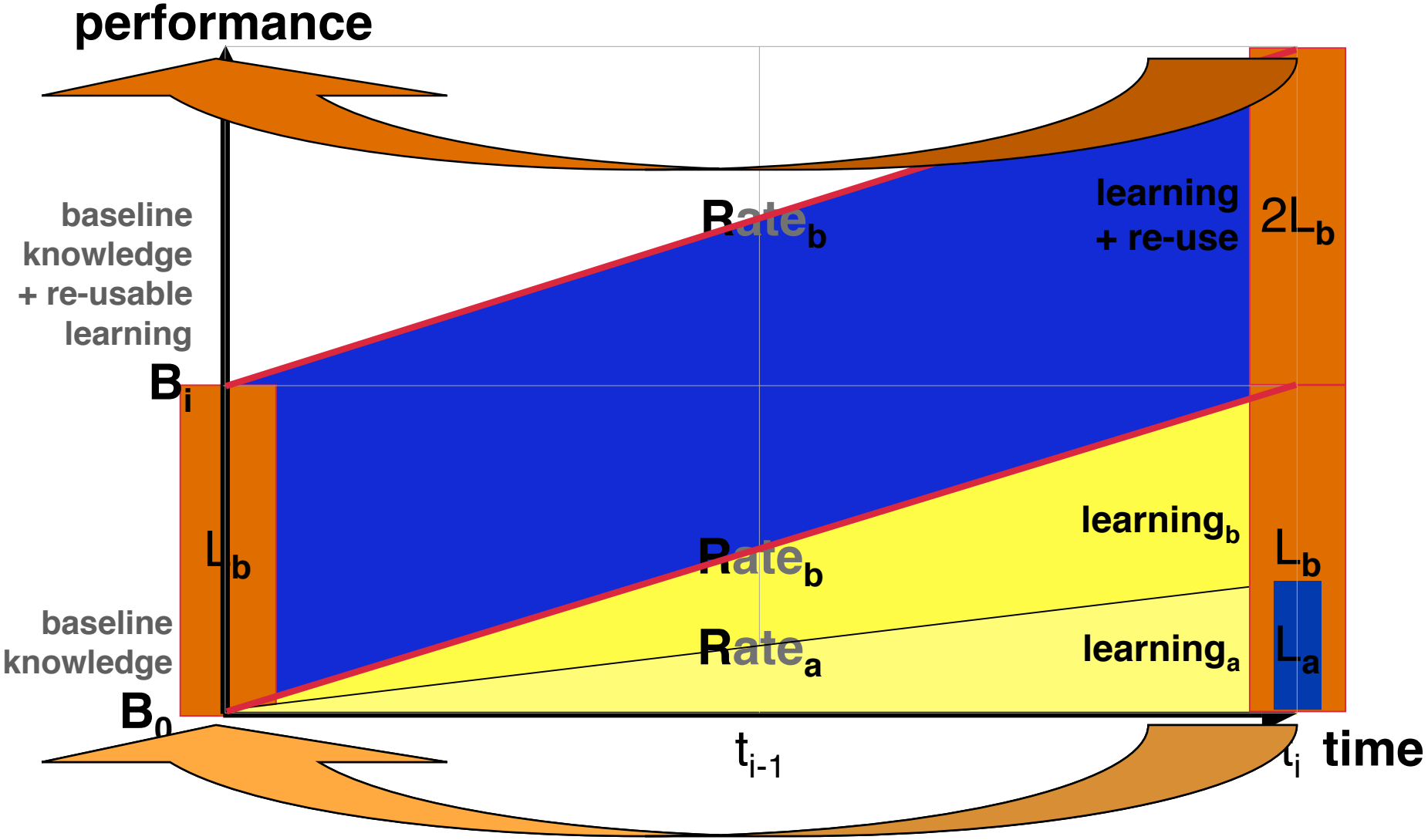
creative content matters

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

(Mabogunje, PhD'96)

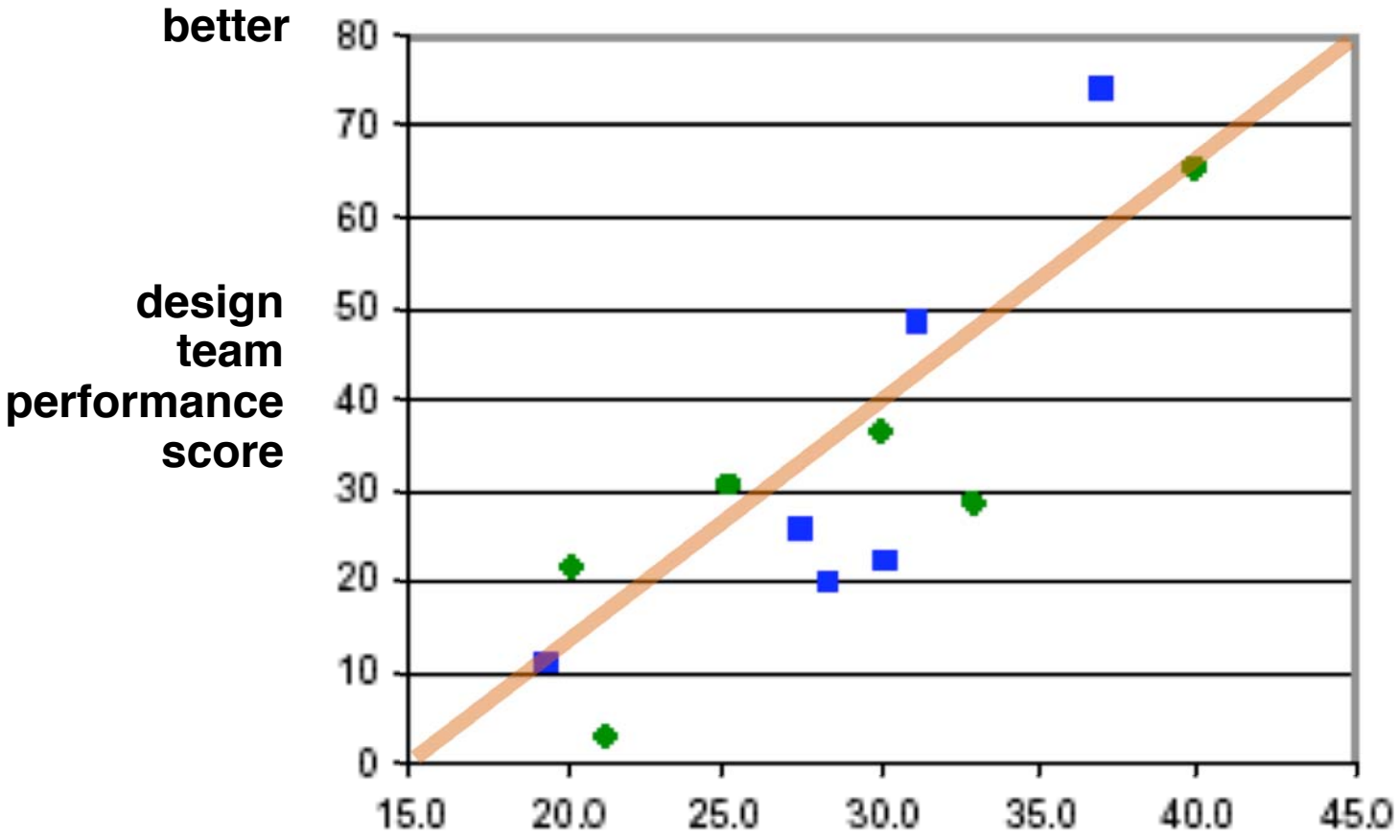


performance is a function of
knowledge baseline + rate of learning

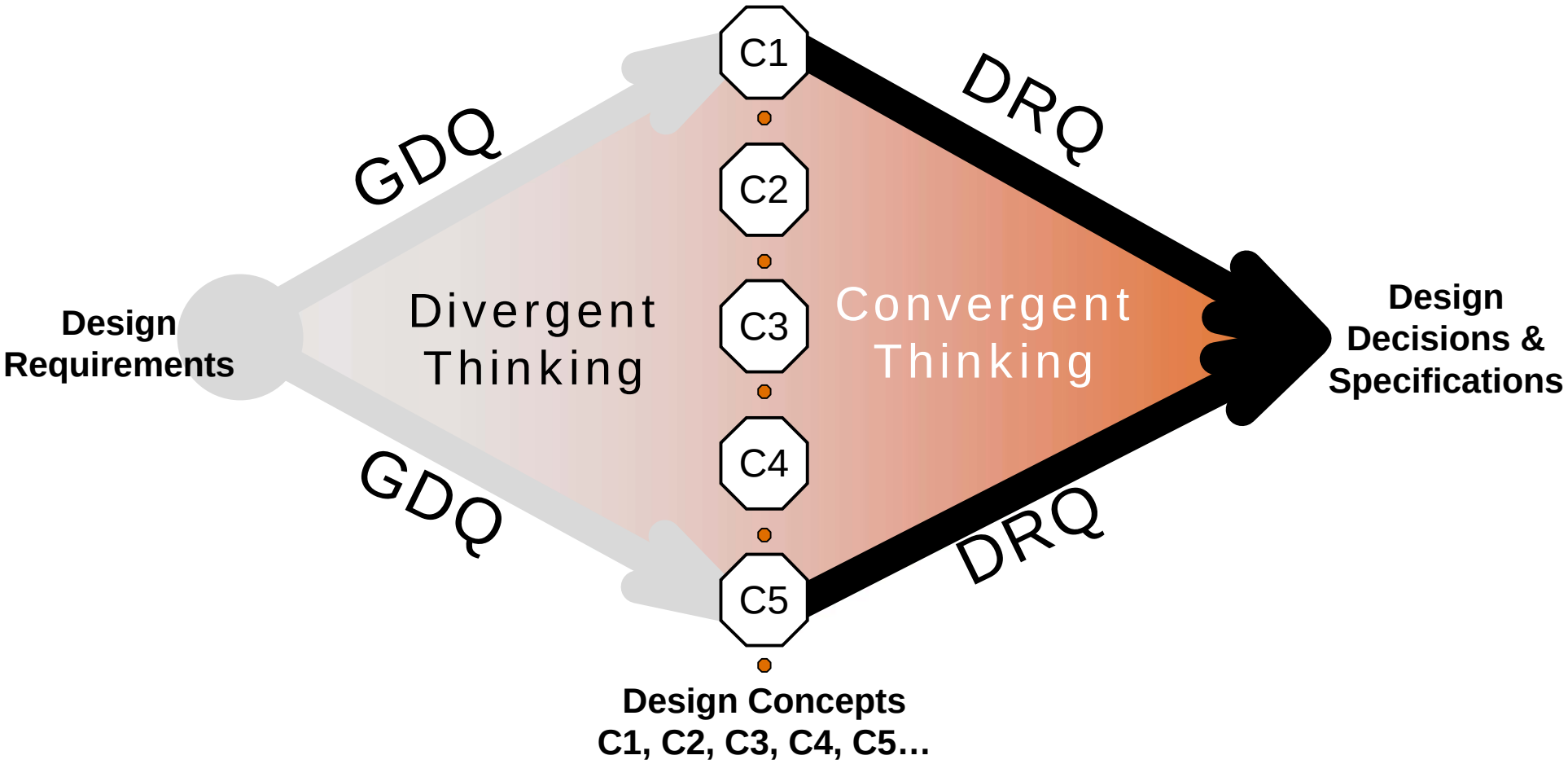


questioning drives performance

(Eris'02)



design thinking is about questions



axiom

Leifer 200X

no decision can be better than the questions posed

cdr

d.school

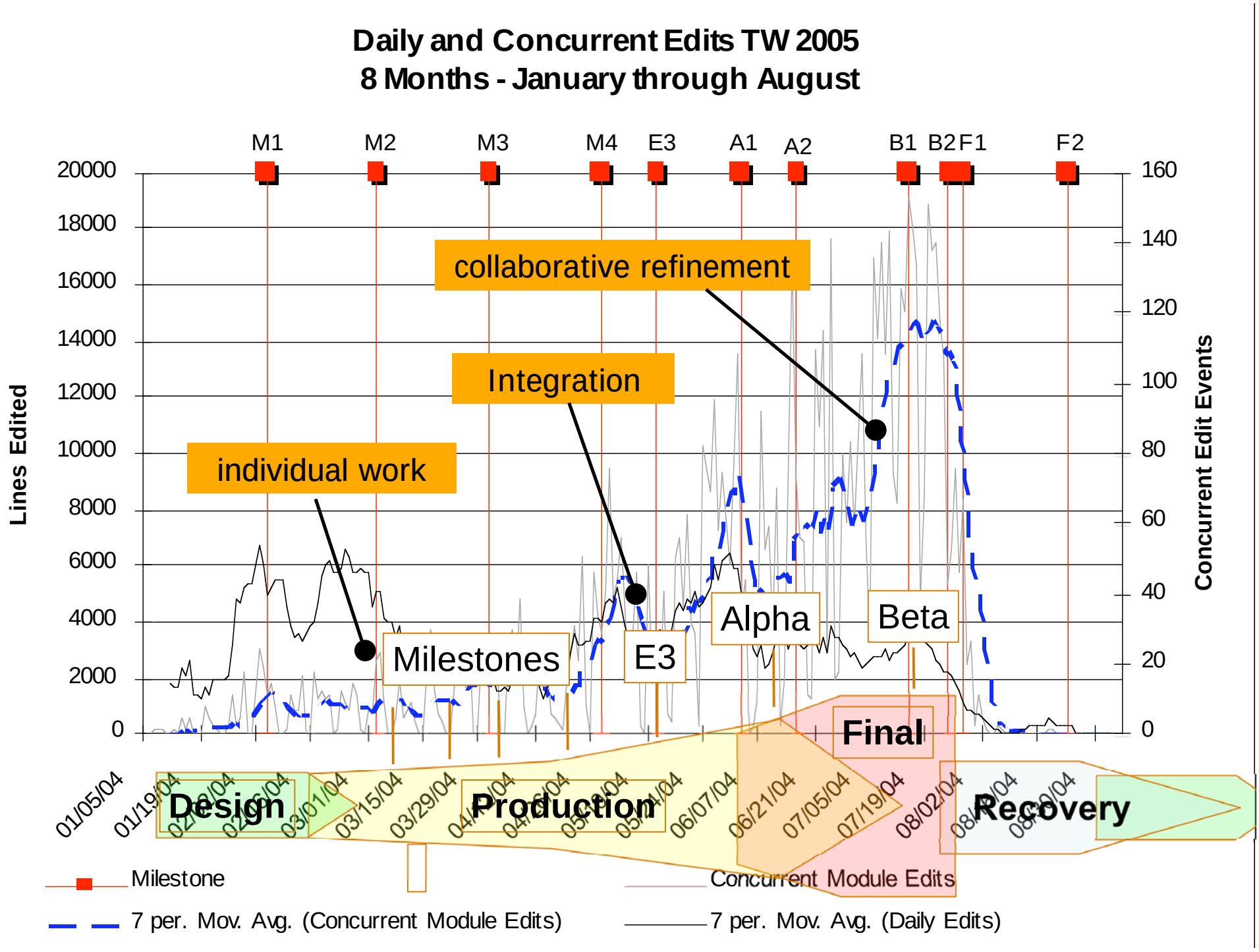
field research case

electronic arts corporation
programming teams in networks

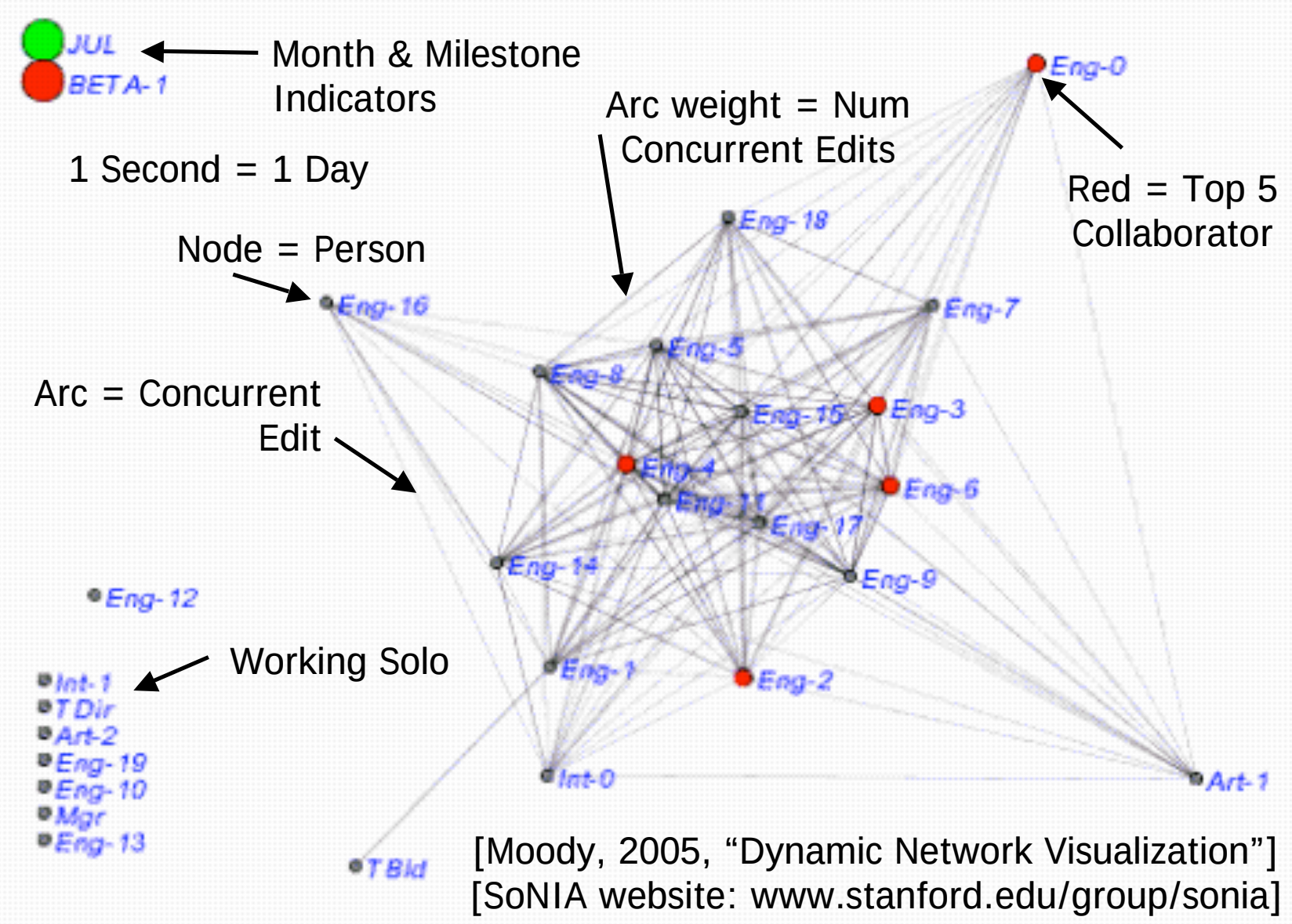
does game programmer activity
predict product code performance **?**
Reiner'05

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 data, 2D art, audio, source code
- 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

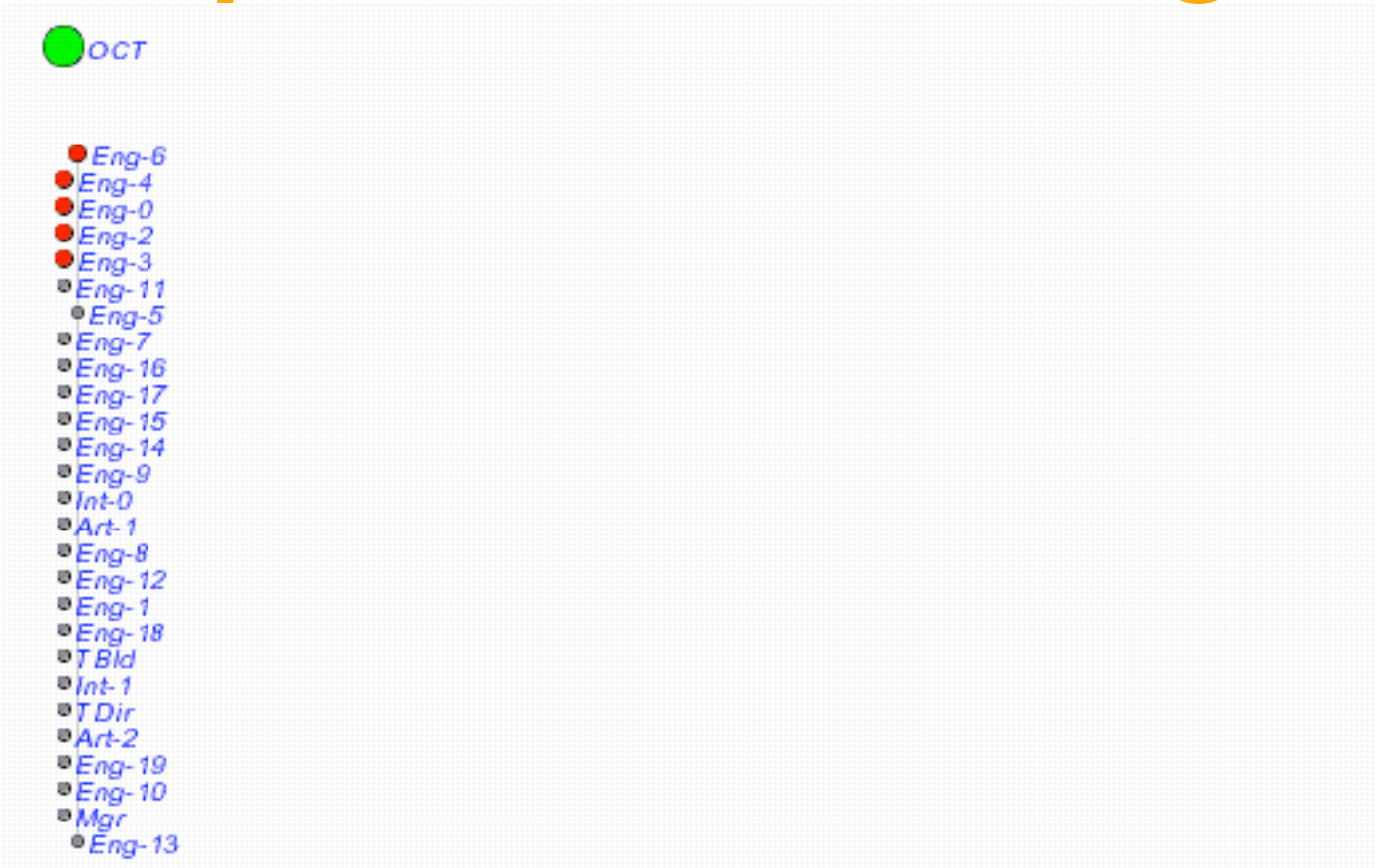

Daily and Concurrent Edits TW 2005
8 Months - January through August
M1
M2
M3
M4
E3
A1
A2
B1
B2
F1
F2
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
160
140
120
100
80
60
40
20
0
Lines Edited
Concurrent Edit Events
collaborative refinement
Integration
individual work
Milestones
E3
Alpha
Beta
Final
01/05/04
01/19/04
02/02/04
02/16/04
03/01/04
03/15/04
03/29/04
04/12/04
04/26/04
05/10/04
05/24/04
06/07/04
06/21/04
07/05/04
07/19/04
08/02/04
08/16/04
08/30/04
Design
Production
Recovery
Milestone
Concurrent Module Edits
7 per. Mov. Avg. (Concurrent Module Edits)
7 per. Mov. Avg. (Daily Edits)

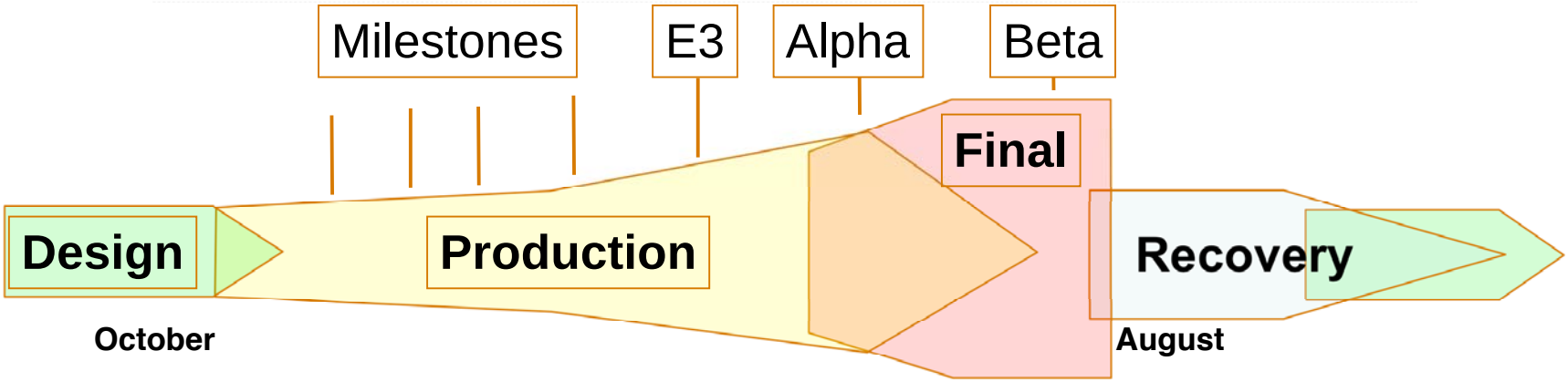
concurrent editing as a social network



[Moody, 2005, "Dynamic Network Visualization"]
[SoNIA website: www.stanford.edu/group/sonia]

surprise without delight





an equation for success

$$i_e = mc^x$$

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