

design thinking
theory from practice

dancing with ambiguity

the case for human-centered systems engineering

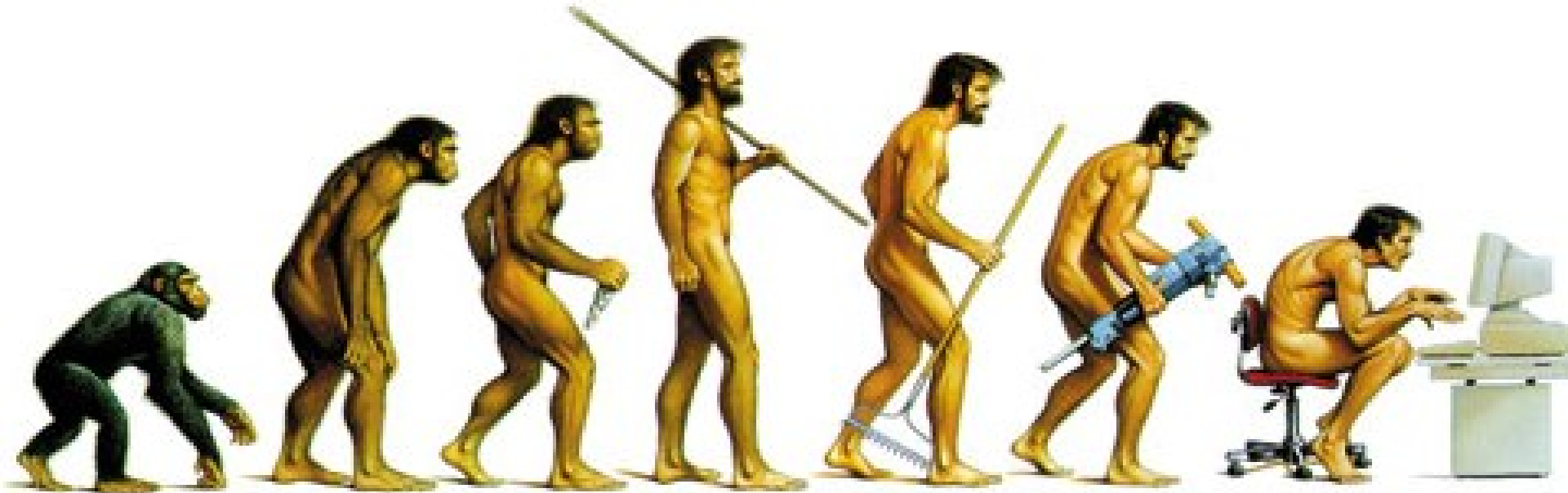
Swiss Chapter of the International
Council on Systems Engineering
Zurich, CH, 8 September 2015

Larry Leifer

Professor, Dr., Director, Center for Design Research at Stanford
Director, Hasso Plattner Design Thinking Research Program at Stanford

<http://cdr.stanford.edu>

**context is always knowledge
worth having.
my context**

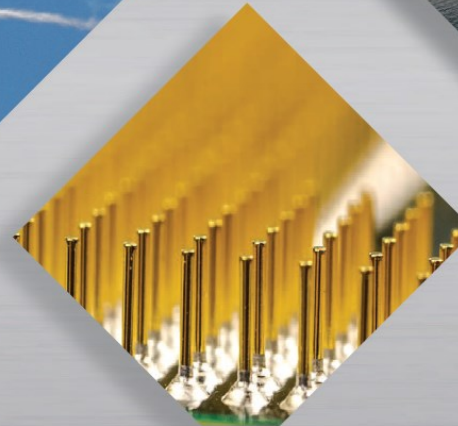
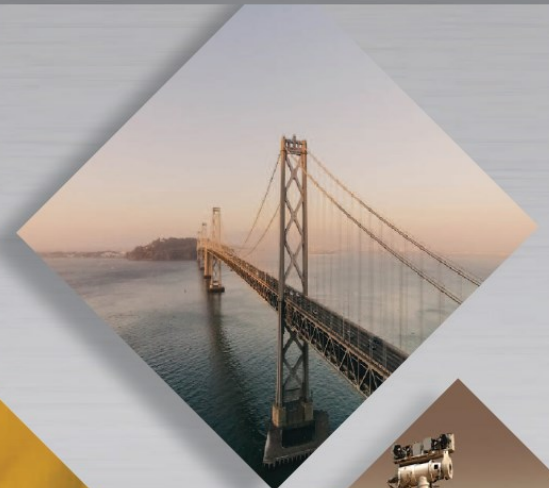


your context



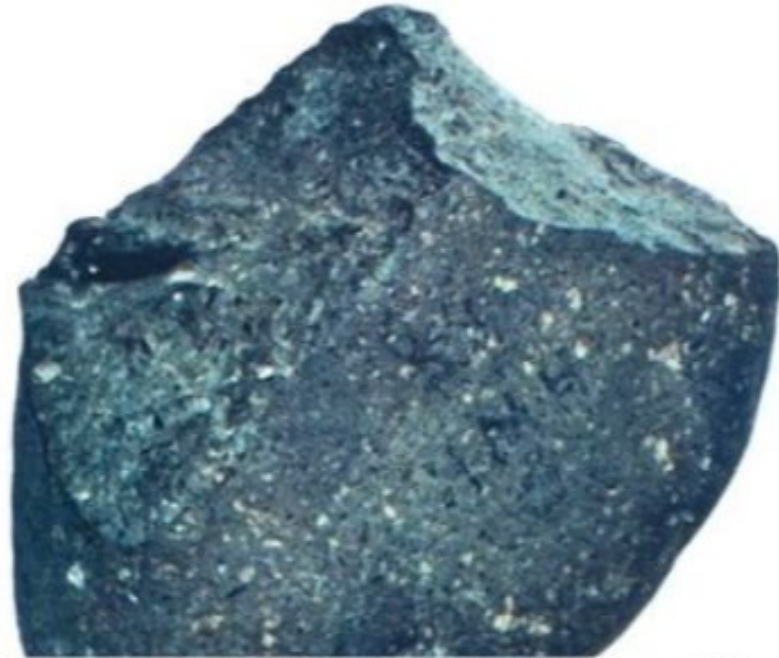
The Swiss Chapter of the International
Council on Systems Engineering
SYSTEMS ENGINEERING IN THE REAL WORLD

+SSSE



September, 8th Kongresshaus Zurich
+SWISSED15

our context



1,035,968 BCE

60 years in the making

Creative Design

John Arnold and GSB



Product Design Program with Fine Arts Department

Robotic Systems Design with Computer Science and Aero

Team-Based Systems Design (310) with Industry Partners

Smart Product Design (218) with EE and CS

Center for Design Research (CDR) with Industry Partners

Manufacturing Systems Design with GSB and MS&E

Micro Electro Mechanical Systems Design (MEMS) with EE

Human Computer Interaction Design with CS

Learning Design & Technology with Education

Learning Lab with Wallenbergs of Sweden

ME310-global & SUGAR across the world

BioDesign with Biology & Medicine

Foresight Engineering with Industry Partners

Hasso Plattner Institute of Design with HPI Pottsdam

Venture Design in India, Nigeria

1960

1970

1980

1990

2000

2014

validated best practices

30 years of design research



... now including the
Hasso Plattner Design Thinking Research Program
and “Understanding Innovation”
Design Thinking Research series, vol.1-6

INSTAGRAM INSTA-HIT

first available, in October 2010, it quickly became the most downloaded app. In the year following its launch, it was downloaded over 11 million times and the app ranked in the top-10 free apps on the App Store.

Instagram owners snap pictures and post them to a feed. Users can select among 15 filters to make their photos look more interesting, fun, or even boring, run-of-the-mill. The filters are all very different—better than anything else out there.

Instagram still has fewer than ten employees, but CEO Kevin Systrom and co-founder Mike Krieger are Stanford graduates. The app was funded by Sequoia Capital.

Stanford Engineering

That idea and \$7 million in funding and Instagram was on its way. **S**

Stanford Engineering alumni have generated

2.2
million new jobs
and
\$1.6
trillion annual
revenues worldwide.



As of November 2011, the application has been downloaded over 11 million times.



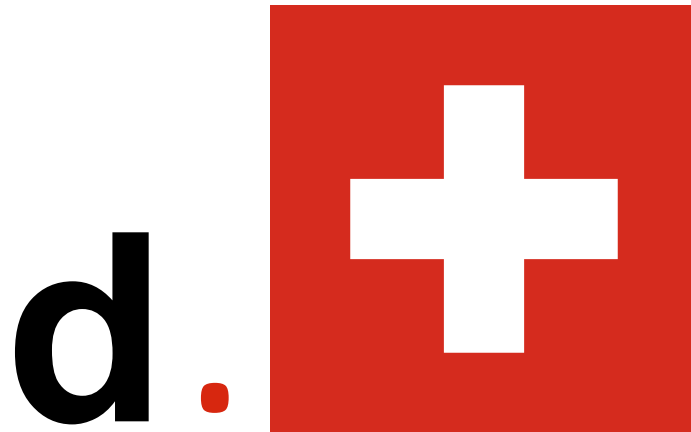
10,900
companies created by
Stanford Engineering
alumni over the decades

silicon valley eco-system



ORACLE
BENCHMARK NEA E*TRADE
KLEINER PERKINS tyco facebook
LIGHTSPEED VENTURE PARTNERS Menlo Park TIBCO ACCEL
SEQUOIA CAPITAL greylockpartners. SurveyMonkey
ANDREESSEN HOROWITZ khosla ventures amazon.com cloudera GILEAD NORTHROP GRUMMAN VISHAY MARVELL KUL Tencor Milpitas LINEAR
XEROX SAP Google Palo Alto Palantir SPACE SYSTEMS LORAL LOCKHEED MARTIN DELL BROADCOM FireEye nanometrics
STANFORD UNIVERSITY nest GigaS Google EMC YAHOO! MOTOROLA DOLBY intel citrix NEC Gigamon CISCO
TESLA vmware Microsoft intuit ruckus JUNIPER Raytheon Google NetApp EMC Akamai Ommision APPLIED MATERIALS
MERCK hp VARIAN box AUDIENCE amazon.com RAMBUS ARUPA ERICSSON AVAYA HITACHI Finisar
Aol. Google ventures TELEDYNE SAMSUNG ST. JUDE MEDICAL riverbed COHERENT Abbott FLETRONICS Polycom
PURESTORAGE Mountain View Mozilla Mercedes-Benz Microsoft ACCURAY Santa Clara ST JDS Uniphase
Omnicell MedImmune MobileIron Walmart.com TELEN maxim BROCADE webex QUALCOMM intel capital
speck SIEMENS NUANCE AVI Apple Trimble NETAL SANMINA nanosolar SUPERMICRO
Combinator webex hansen SYNOPSIS LinkedIn AMD NVIDIA McAfee CISCO SAMSUNG LSI
500startups Symantec twitter APPLIED MATERIALS paloalto violin BROADCOM
BlueCoat Cepheid TEXAS INSTRUMENTS Sunnyvale FUJITSU SPANSION AFFYMETRIX MiaSolé Agilent
PLUGANDPLAY Ariba NOKIA FORTINET InvenSense San Jose EQUINIX NP
BROADCOM ELEKTA Infinera National Semiconductor NETLOGIC SONY Microsemi zazzle ADERA
EQUINIX INTUITIVE EXACTO FOUNDRY NETWORKS Atmel ebay Adobe IBM
Medtronic NOVELLUS BAE SYSTEMS Canon PayPal bmc software
Cupertino Apple Aptina Infoblox NUTANIX ECHELON Western Digital
Seagate TREND MICRO harmonic cadence Boston Scientific ORACLE NETGEAR

today we go
opportunity hunting



mission

**build talent
to create break-through
new product, service,
and business**

relationships

hypothesis

**the shortest path to better
products, services & relationships
is through better**

**teams of teams
and their dynamics**

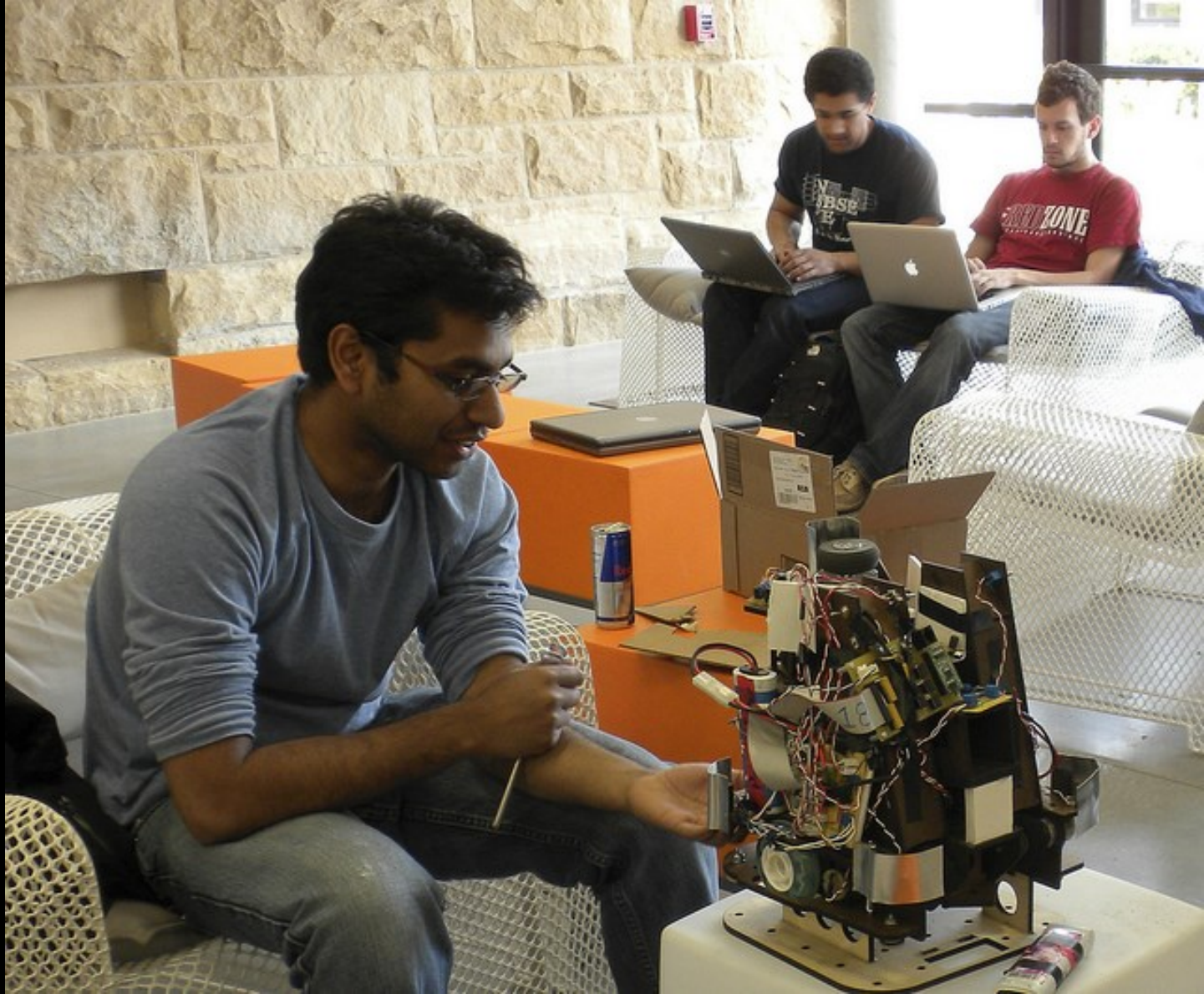
value-proposition

**create a place where
design research shapes practice
& practice shapes research**

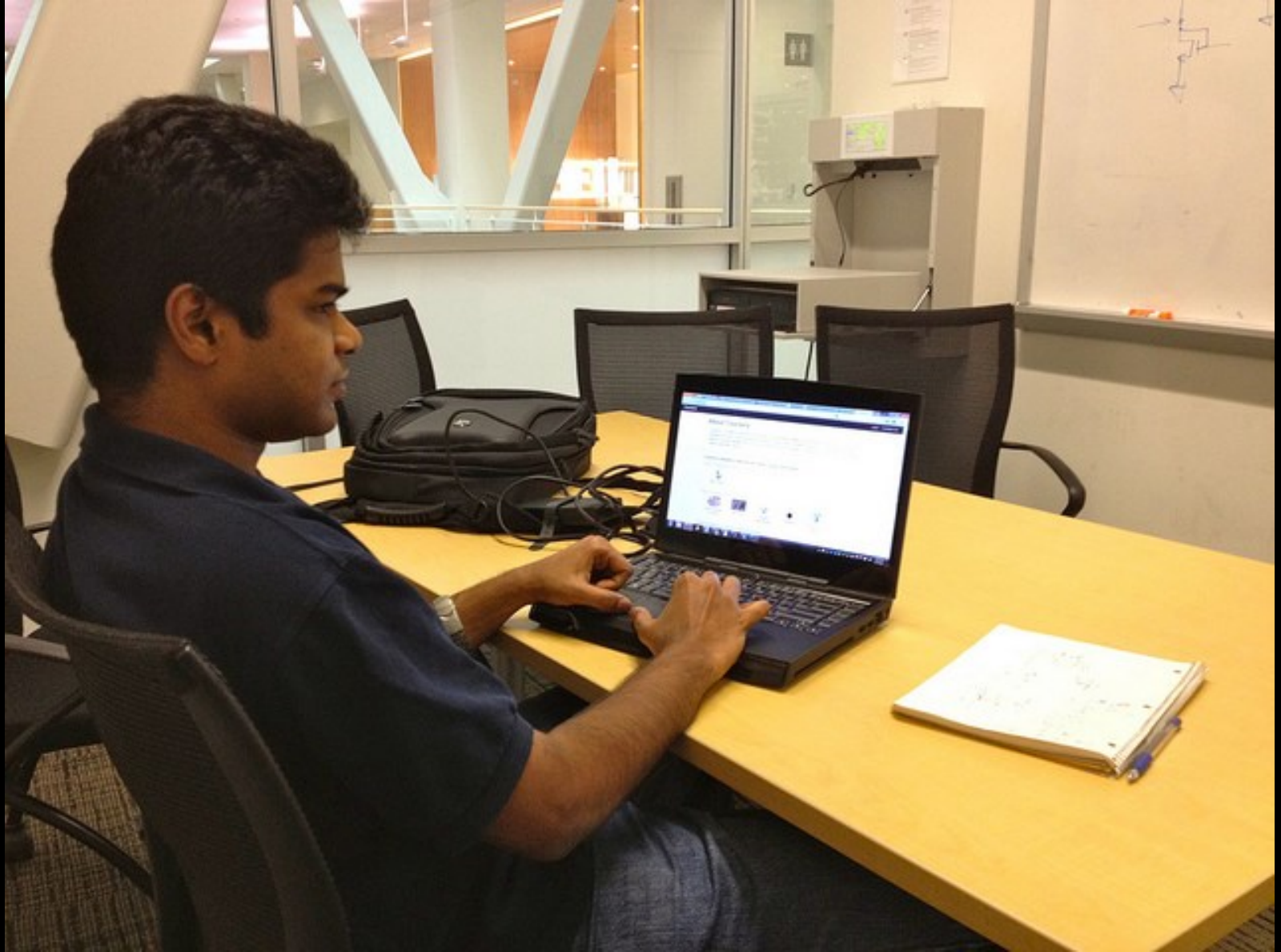
d.innovation

**while most engineering education is about
the facts, figures, and physics of
what we know**

**design innovation is about
the intentions, actions, and values that guide
how we use
what we know**



smart systems



software systems

free online classes enrolled **335,000** world wide in 2013



executive boot-camp

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



hunting is all about people



tangible communication



prototype storming



accelerated learning



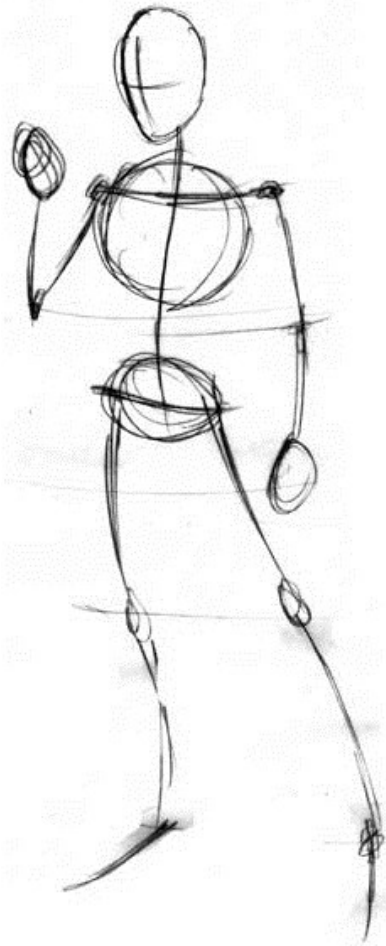
defying gravity



creating ambiguity



building “T” people & “T” teams



in the moment,
should **i** be an
“**I**” shaped or
“**T**” shaped
person

(Suzuki'2011)



Design Thinking Behavior

“I”

shaped by
knowledge
in depth

“T”

shaped by
breadth
in behavior



Design Thinking Behavior

Design Thinking Behavior

Design Thinking Behavior

In-depth knowledge

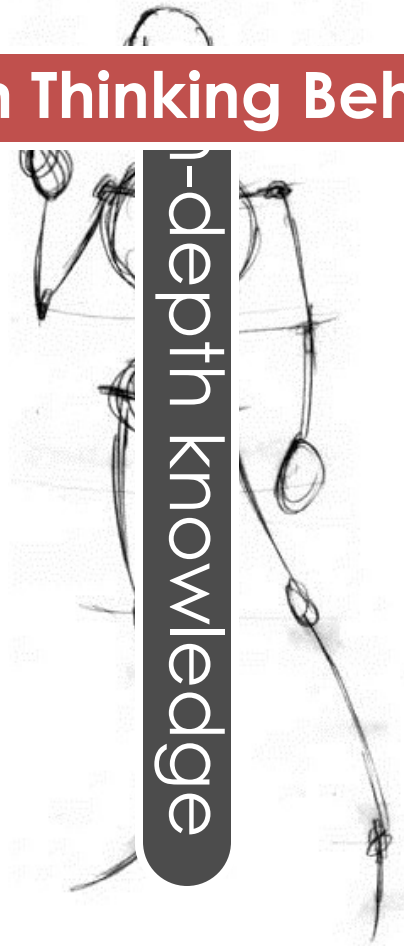
In-depth knowledge

In-depth knowledge

“T”
people
teams

why is it so hard

Design Thinking Behavior



to be an adaptive “T” person

FORESIGHT
thinking
working
& learning

DESIGN
thinking
working
& learning

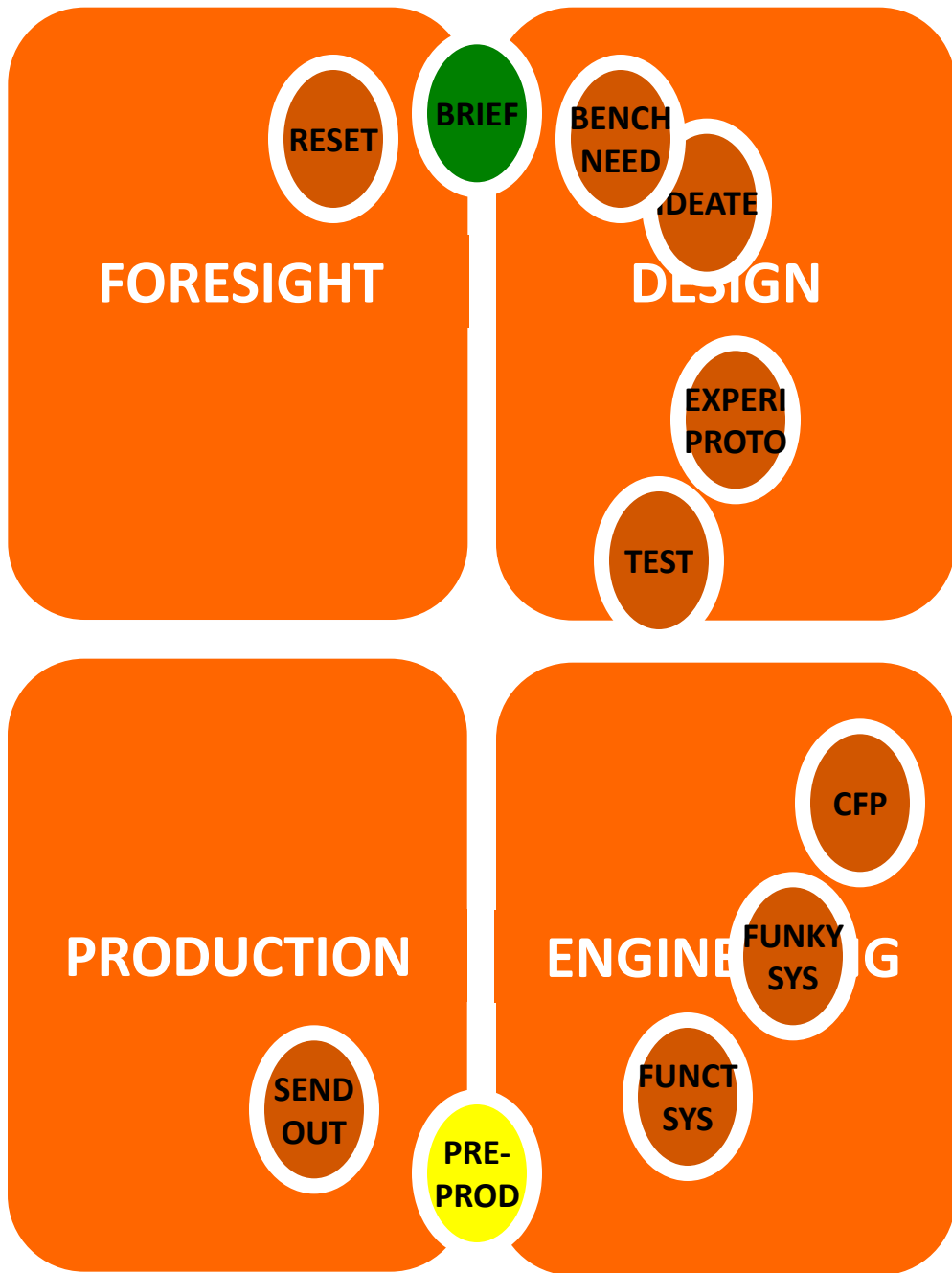
PRODUCTION
thinking
working
& learning

ENGINEERING
thinking
working
& learning

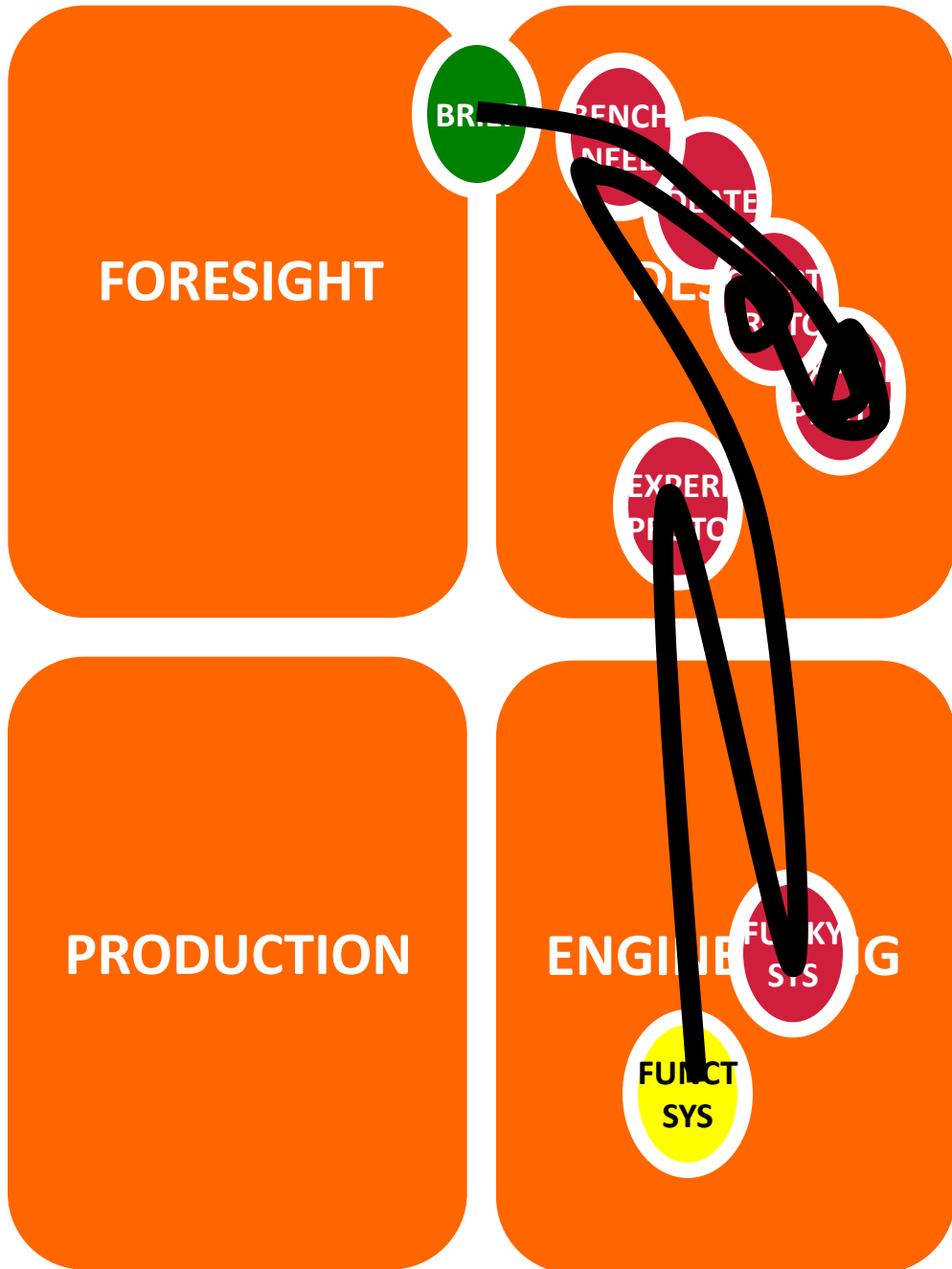
people

have different
ways of thinking,
working, and
learning

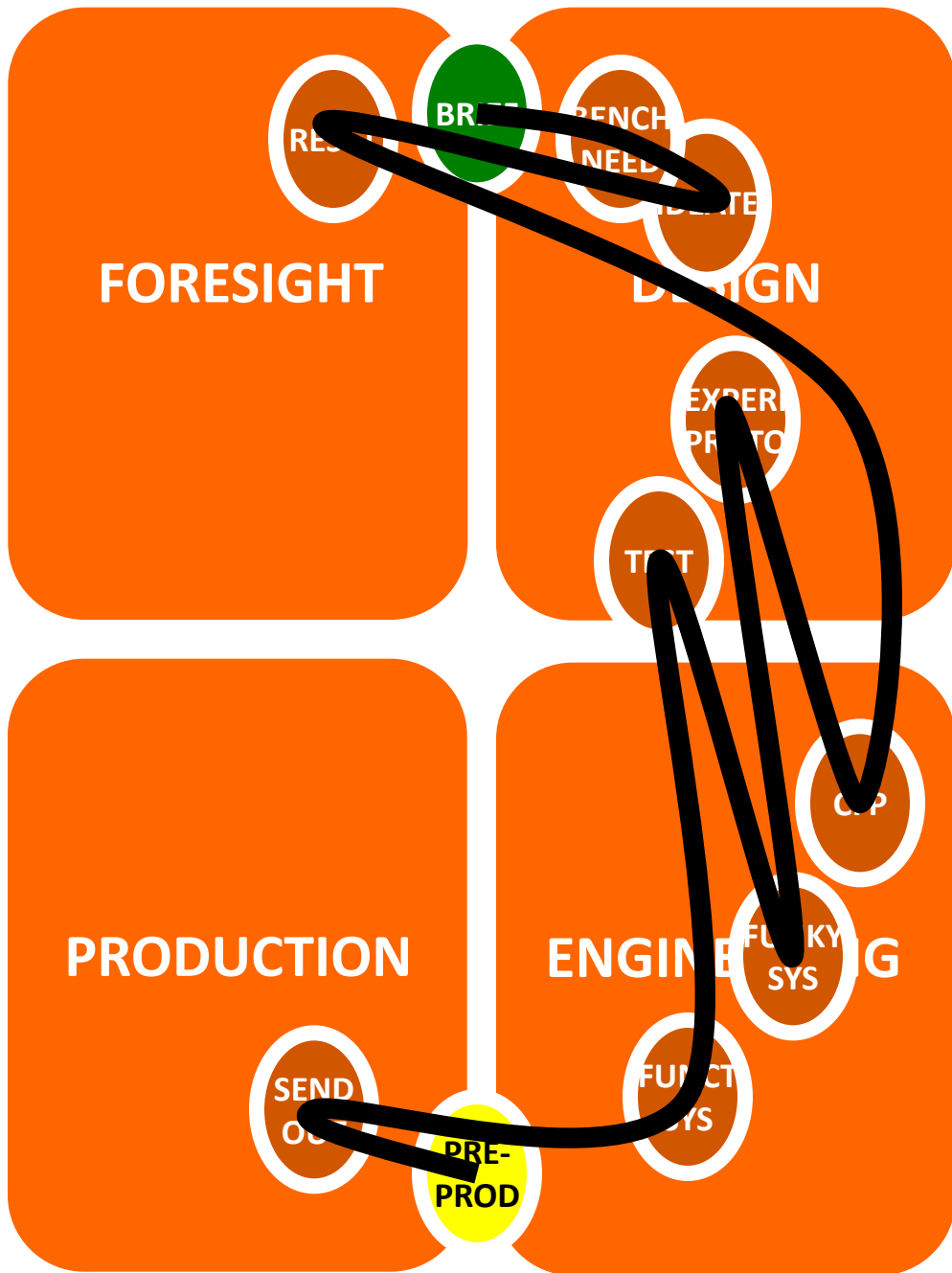
Lande 2009



way points
 along the
 passage from
 a concept to
 functional
 proof-of-concept
 hardware,
 software, and
 experience ...



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

precision innovation

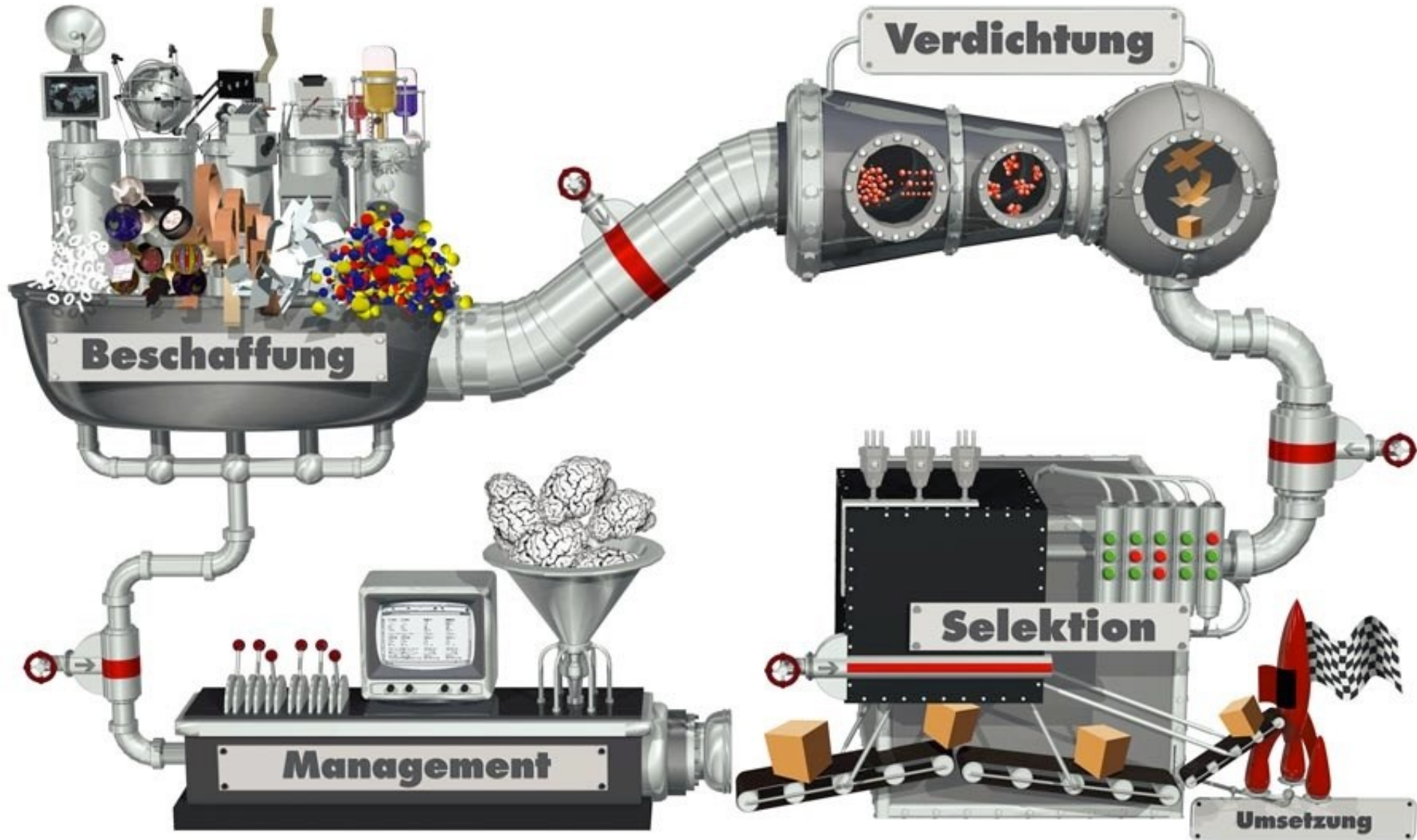
the 1st law

never go hunting alone

respect an ancient dictum

this is not hunting

image via Malte Jung, PhD 2012



introducing Stanford's
formula-1 simulator for
for extreme design innovation

...

it is our laboratory
so **who** is in the lab

graduate design teams



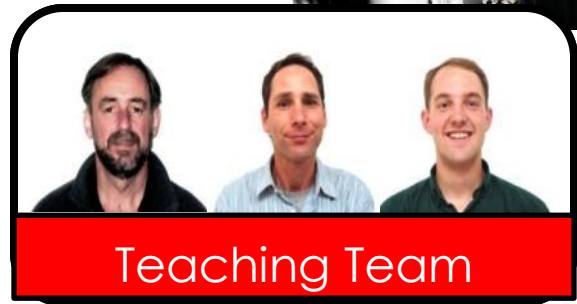
teaching team coaches



Munich Team



Stanford Team



professional coaches



Project
Coach



Project
Coach



Munich
Team



Stanford
Team



Teaching Team



Teaching Team

culture coaches

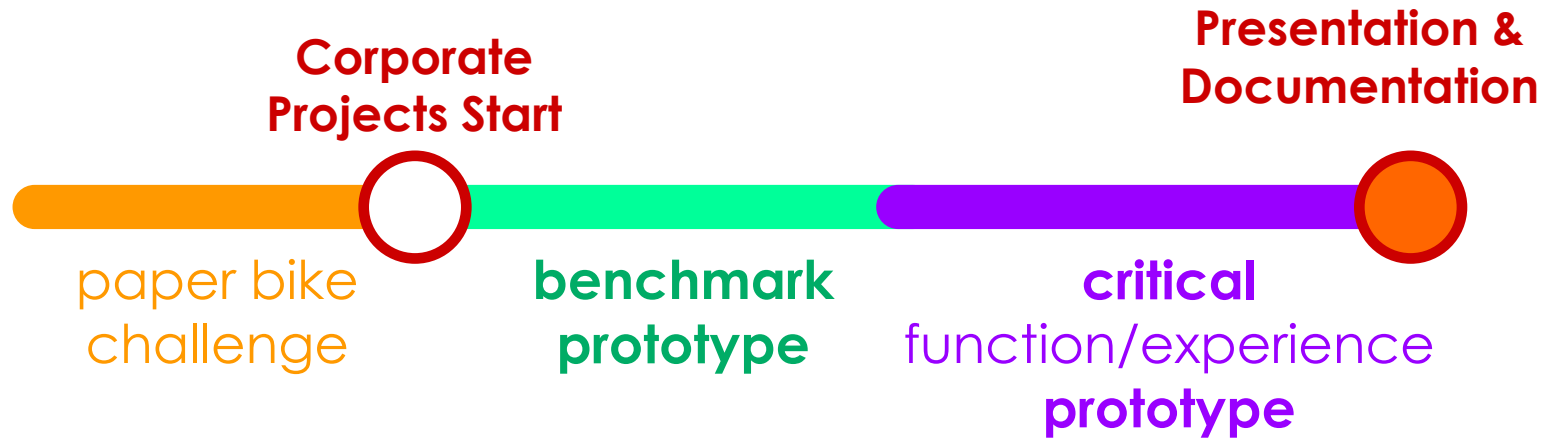


corporate sponsors

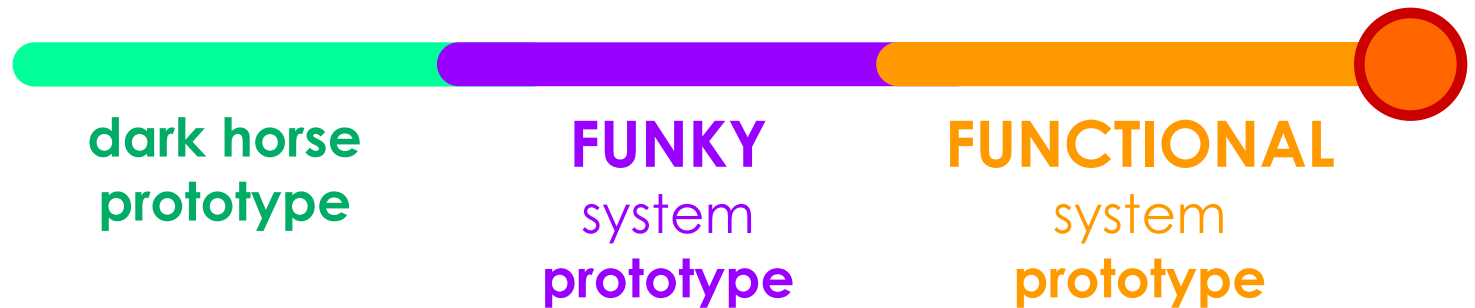


re-inventing the future every 30 weeks

Autumn
explore the problem space



Winter
explore the solution space

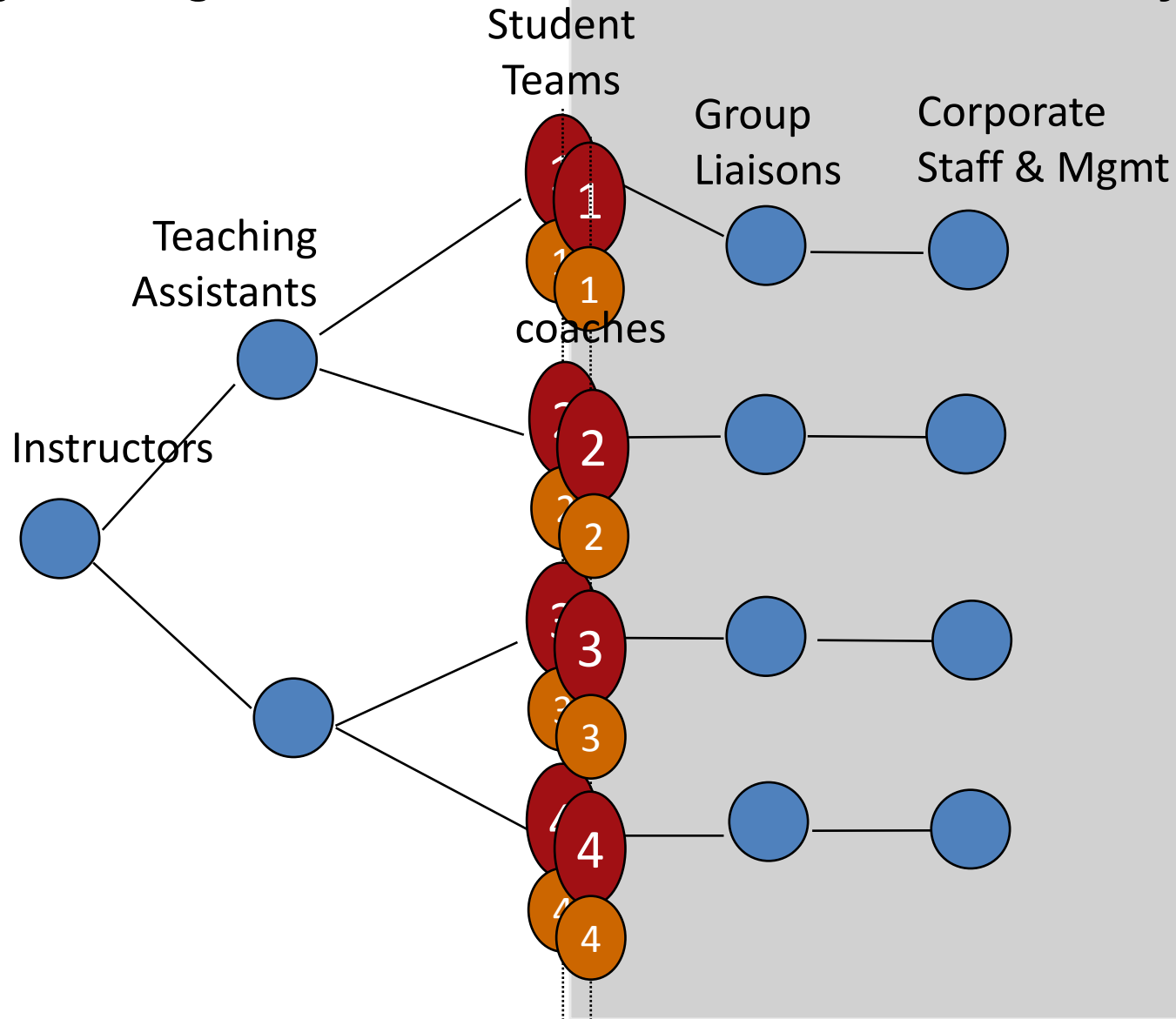


Spring
deliver the functional product

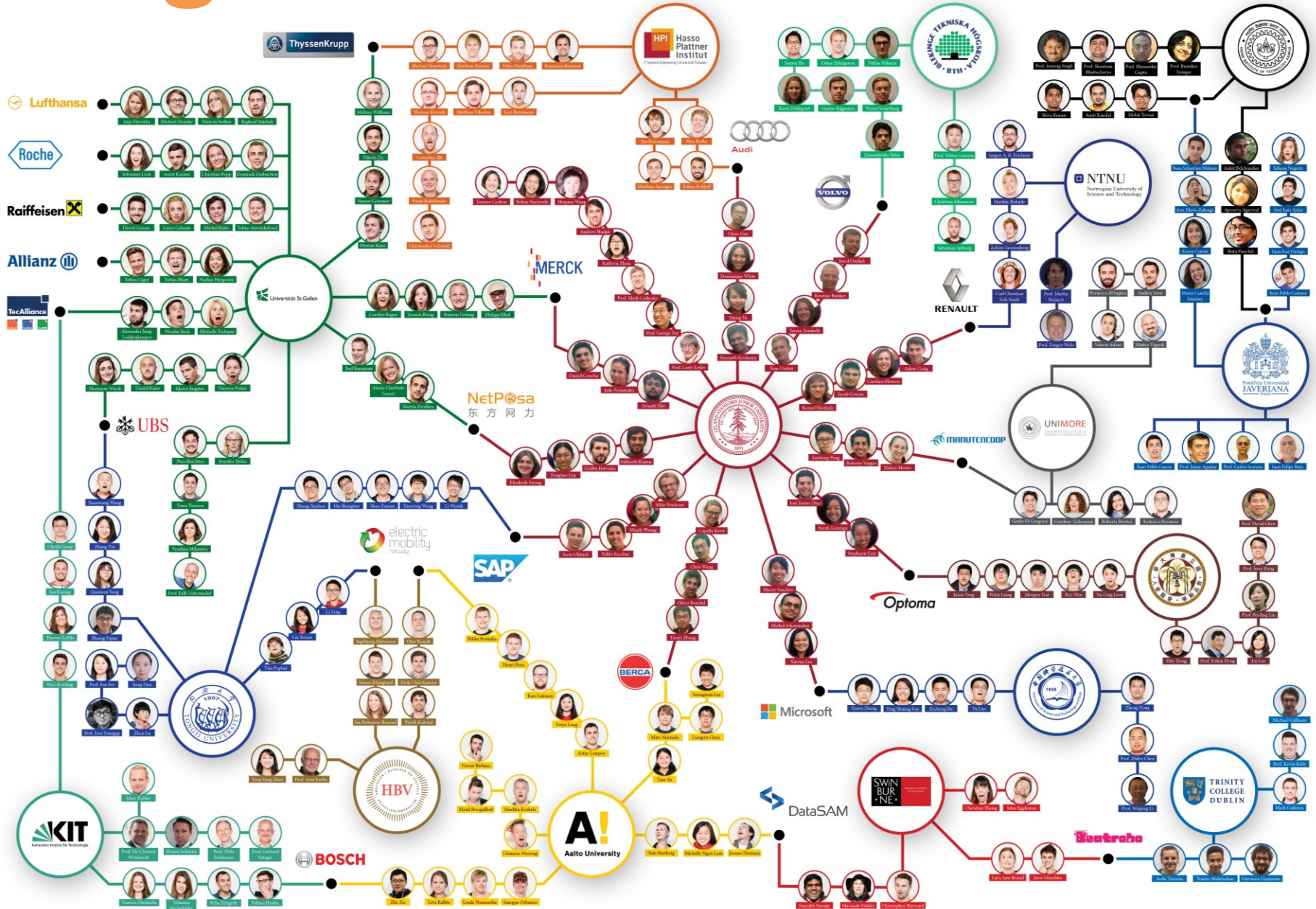


310-global teamwork

university learning **PROCESS** **CONTENT** delivered by industry



global team of teams





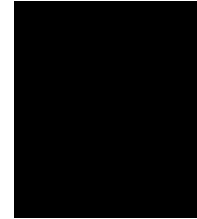
UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA



NTNU
Kunnskap for en bedre verden

Paris

A?



TKK



Technische Universität München



BLEKINGE TEKNISKA HÖGSKOLA





d.space

...

where you work defines

- how you work
- who you work with
- what you do, and
- what you create



tangible access




stand-up action



**video conference
improvisation**



keep them creative

A large, circular object hangs from the ceiling of a modern building. The object consists of a thick red ring with black dots around its perimeter, and a black ring inside it. A white and black object, possibly a penguin or a stylized figure, is visible through the center of the rings. The ceiling is a complex white truss structure with several large windows. A bright, glowing light fixture hangs from the ceiling. In the foreground, there are whiteboards and other office equipment.

past learning
experiences at hand



prototyping tools
accelerate learning