Why modeling is crucial to designing & design research

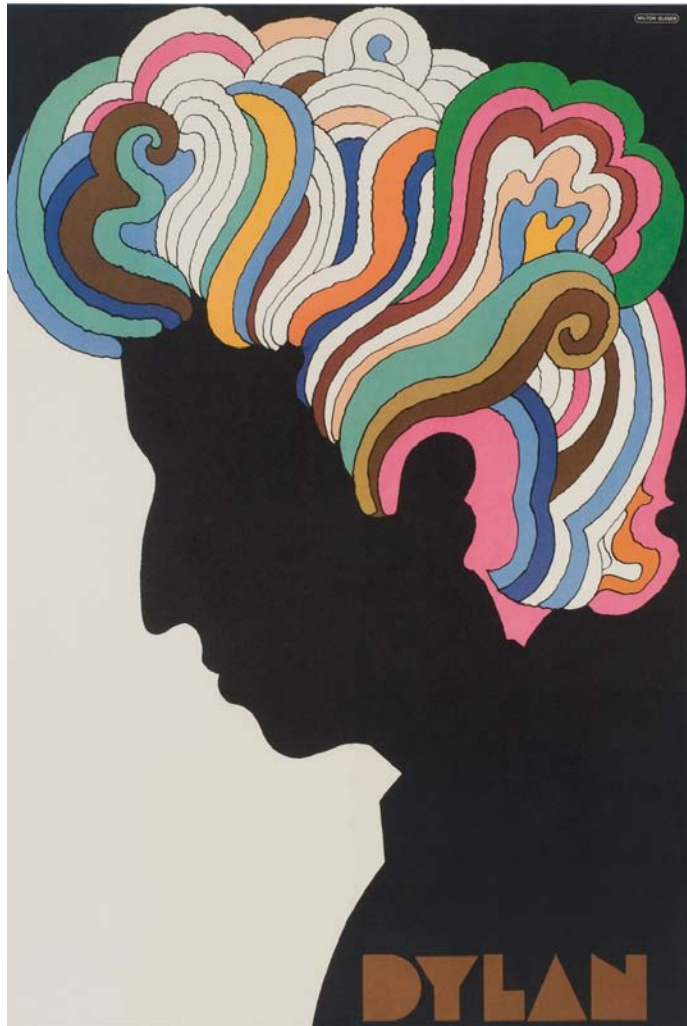Hugh Dubberly
Dubberly Design Office

Let's begin with three embarrassing admissions.

Part 1

Design is stuck.

An example:
1985, AIGA, National Conference, Boston

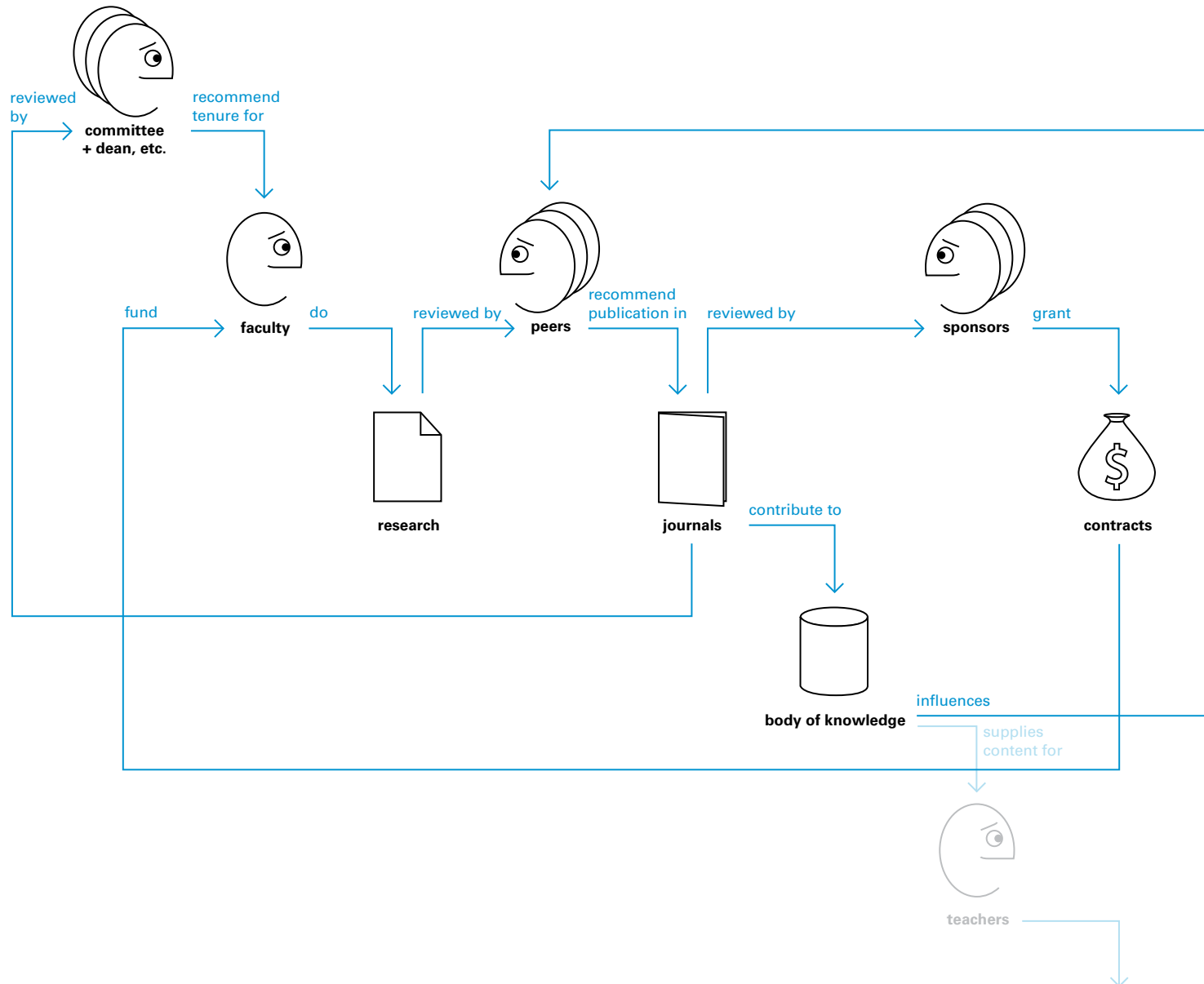## Milton Glaser

Nicholas Negroponte

An example:
2005, AIGA, National Conference, Boston
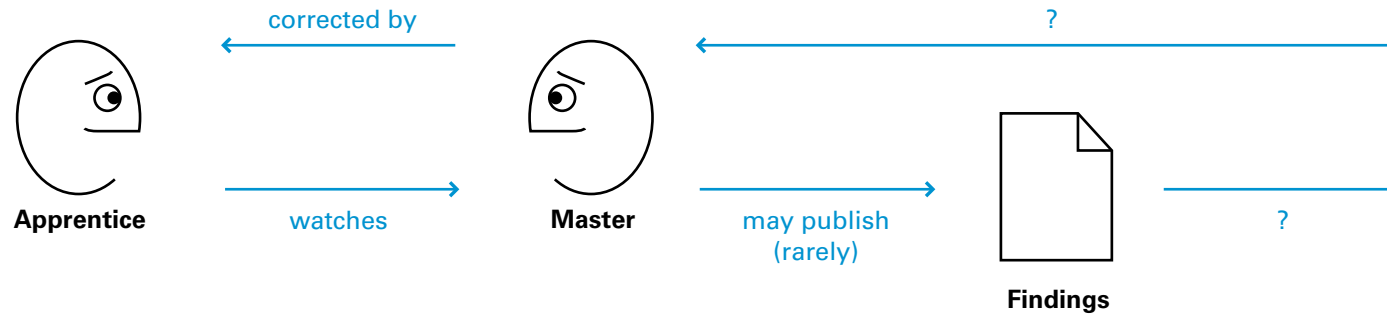
Milton Glaser   Nicholas Negroponte

Most disciplines have well-established structures to build and share knowledge.
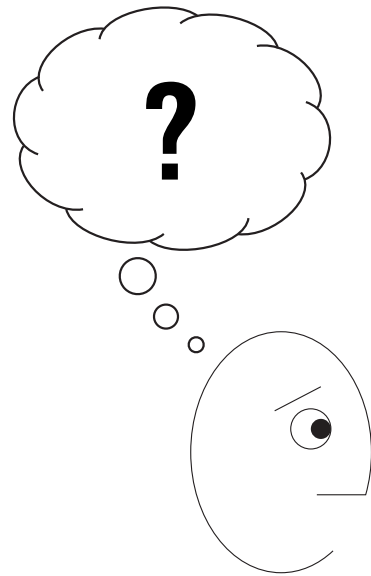
Design has few knowledge building and sharing structures.

Almost 20 years after awarding the first design PhD in the US, we still have not agreed on what design research is.

We don't agree on what design knowledge is. Not everyone agrees there is such a thing.

Part 2
Design is stuck in a bad place:
We don't know how to make successful products.
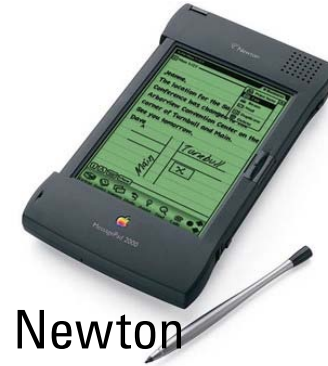
Even Apple and Steve Jobs are not always successful.

Apple iii

Apple Lisa

Newton

Apple QuickTake
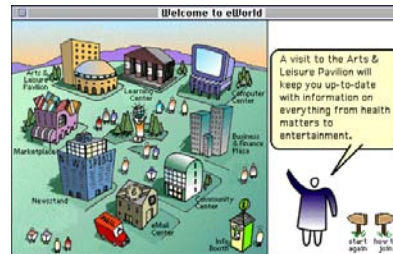
Apple eWorld

NeXT Cube

PowerMac G4 Cube

iPod Hi-Fi

Apple TV

Product management—
the art of making a successful product—
is rarely taught in design schools
or business schools.

Design School

Product Management

Business School

Design

Product Management

Business
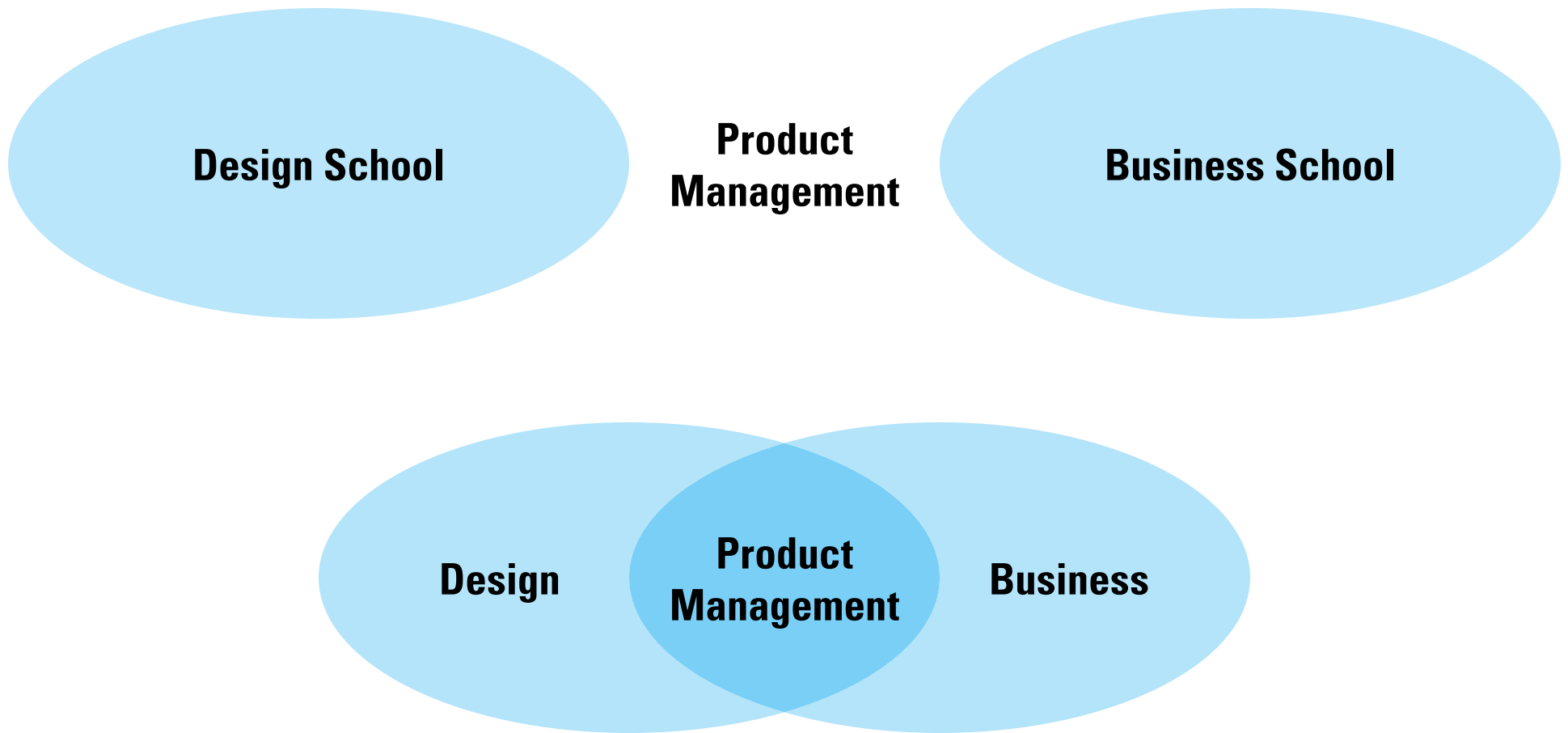
People who make products don't agree on how to do it.

– Who manages the schedule and the budget?

– How do you determine requirements?

– Who owns design? Who owns the spec?

– Who can say, 'No'? Who can say, 'Yes'?

Often, the 'official' process differs from reality:

The PRD is barely begun, but the engineers already have a prototype. That's called being agile.

Agile processes work well in small start-ups building products for people like themselves.

e.g.

37 Signals' Basecamp
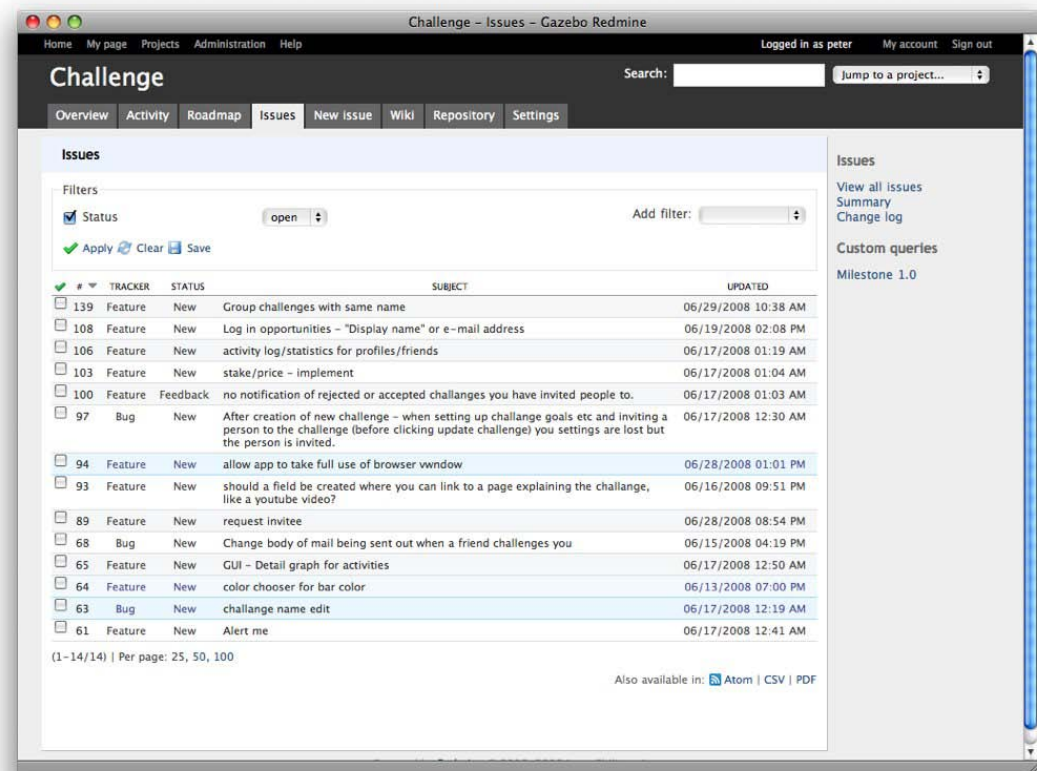
Less clear is how to achieve coherence and scale— how to build platforms or interlocking systems— without rigorous planning.

This is a religious debate.

Design schools and consulting firms promote research that helps us understand people and their contexts.

A few forward-thinking corporations support such 'best practice', but up-front research remains rare for most new products.

The value of research is in doubt.

"*Design research is great when it comes to improving existing product categories,* but **essentially useless when it comes to breakthroughs** . . . *Although we would prefer to believe that conceptual breakthroughs occur because of a detailed consideration of human needs, especially fundamental but unspoken hidden needs so beloved by the design research community, the fact is that it simply doesn't happen* . . . *Major innovation comes from technologists who have little understanding of all this research stuff.*"

— Don Norman

Skeptics often cite Apple as making great products seemingly without formal research.

How do they do it?

Great products have integrity—
a kind of coherence
that stems from a clear product concept
ruthlessly refined.

Product coherence comes from vision, will, and trust; it requires systems thinking.

A vision of what the product needs to be and why: a vision of who the product will serve and how it will fit into their world, a vision of the technology needed and a vision of how it will be funded.

Product visions are based on observation.

Observations need not be formal research, but they must transfer— from observer to maker from researcher to designer from designer to engineer from manager to team and vice versa.

Often, that's where formal research goes wrong. It fails to transfer.

It's not that the research isn't valid. Or that there are no useful insights.

But rather, the designers and product managers and engineers can't connect the research insights to the product.

Part 3

Design is stuck in a bad place: We don't know how to make successful products, and any experience we might have is less relevant because the very nature of products is changing as we move into a new epoch.

We are in the midst of a fundamental shift in how we view the world.
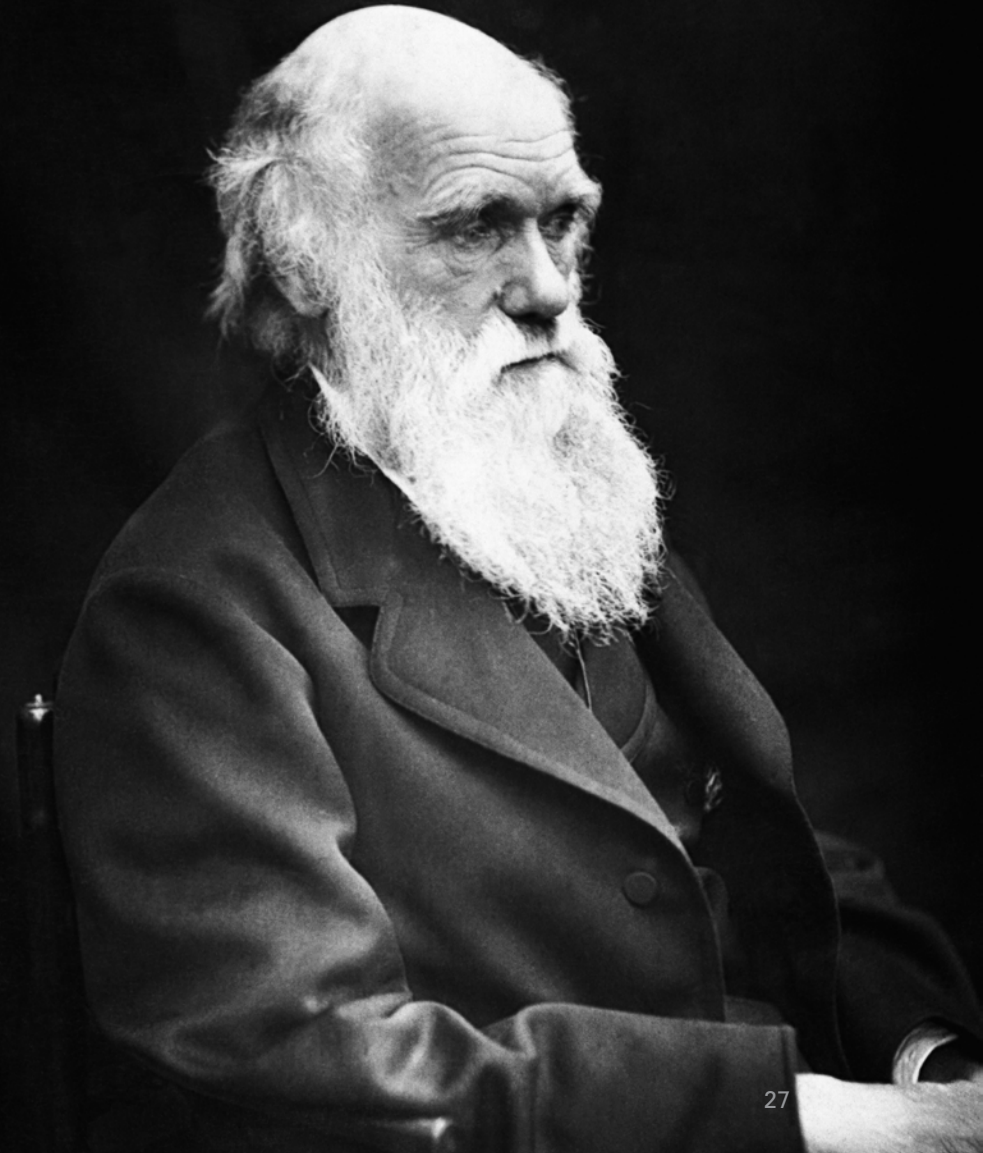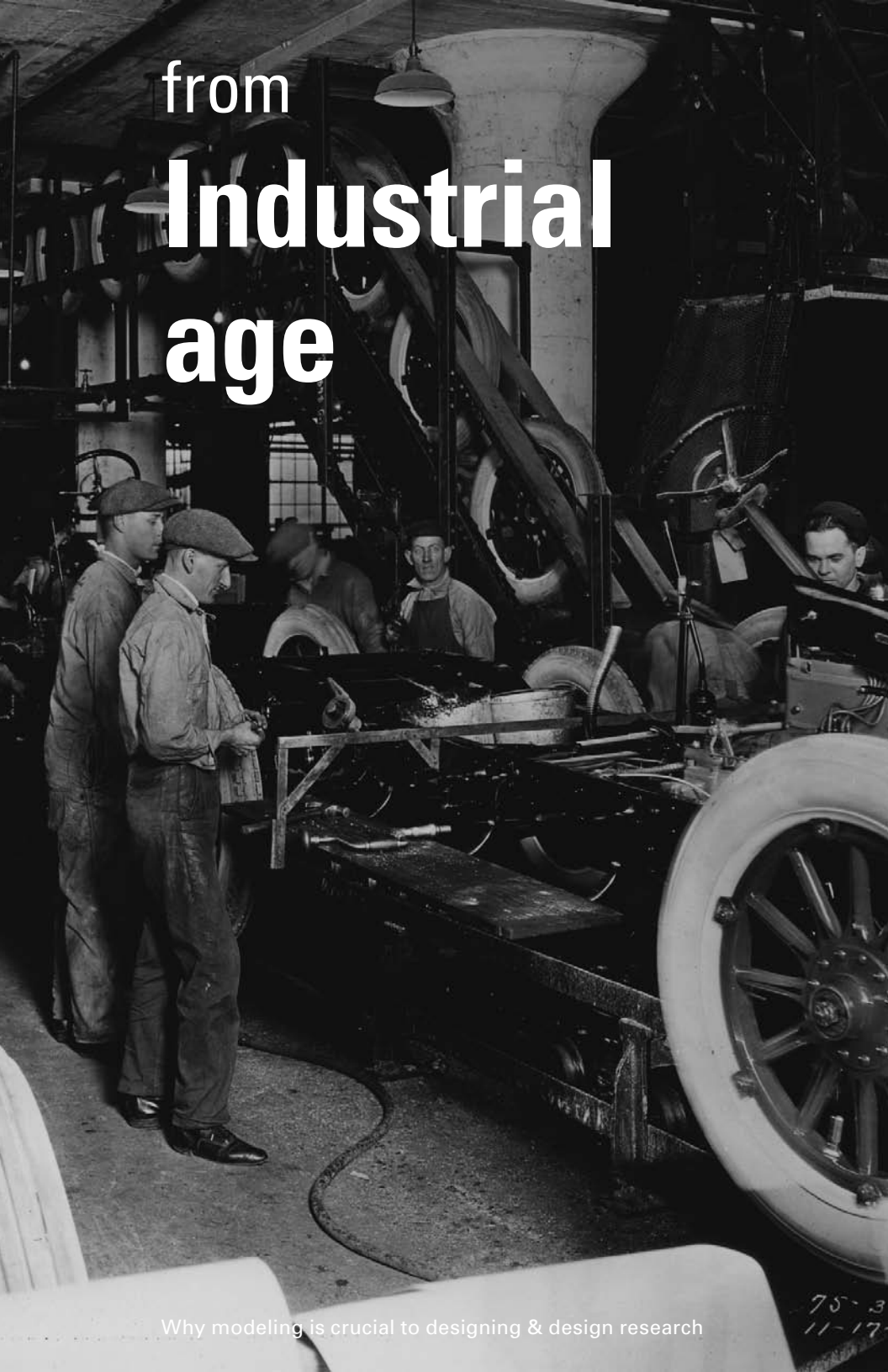
from
Mechanical

to
Biological

from
Newton

to
Darwin

from
Industrial age

to
Information age
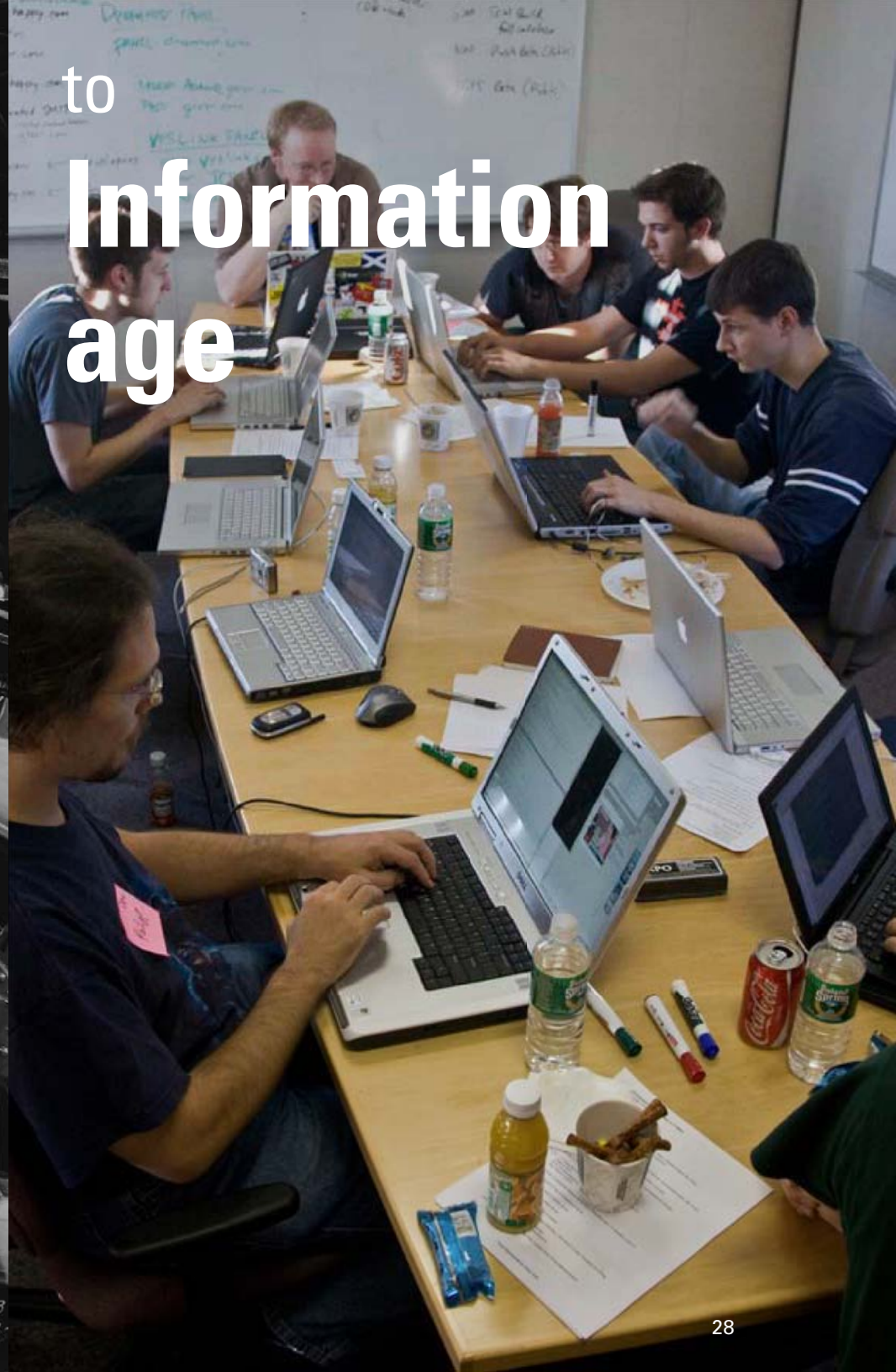
from
Cathedral

to
Bazaar

The shift in world view is changing the nature of products.

from
Hierarchical

to
Distributed
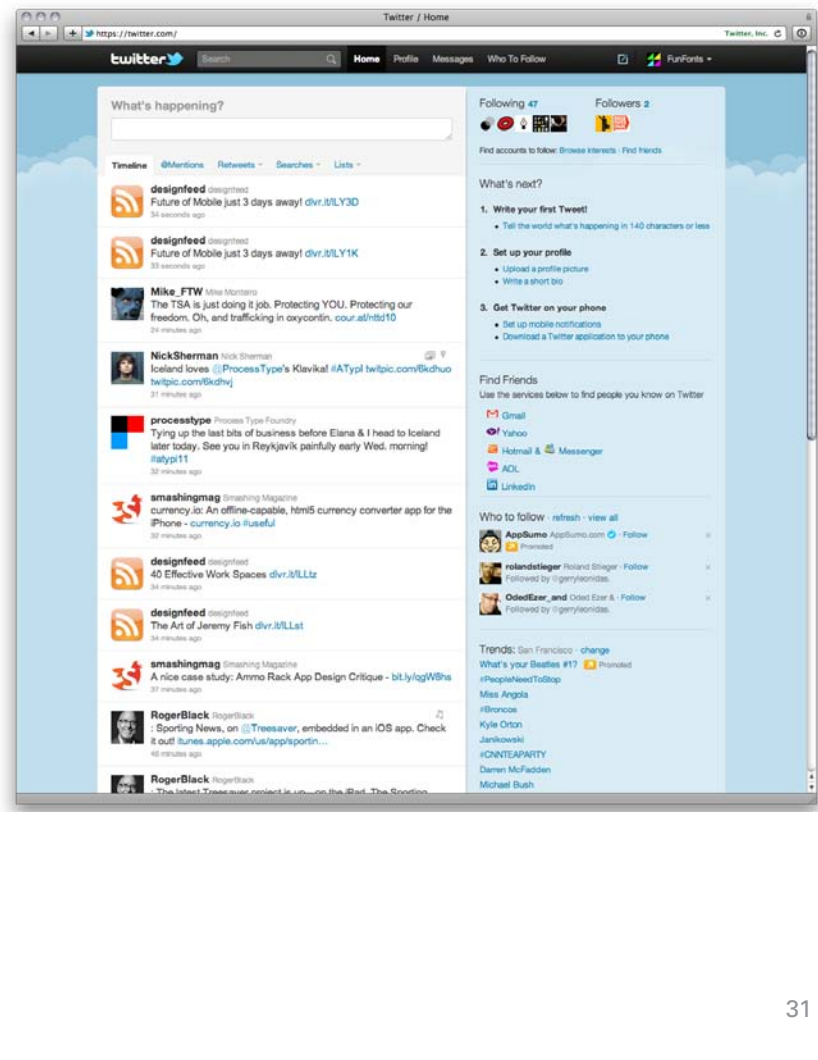
from
Planned
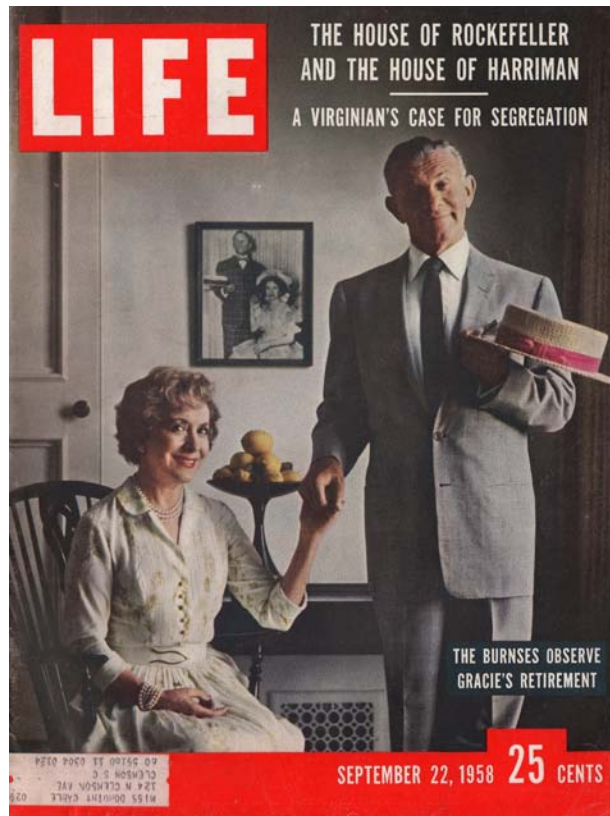
to
Emergent
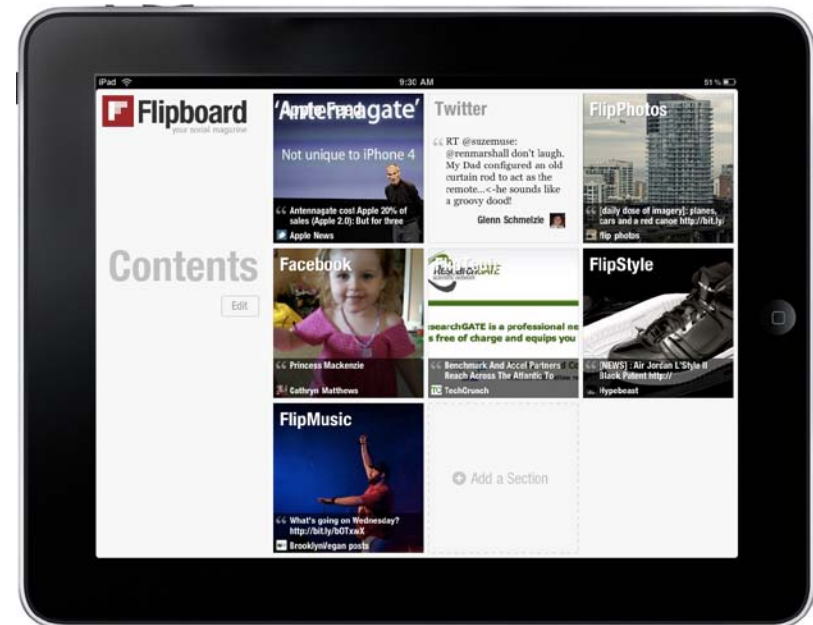
from

Complete edition

to

Continuous beta
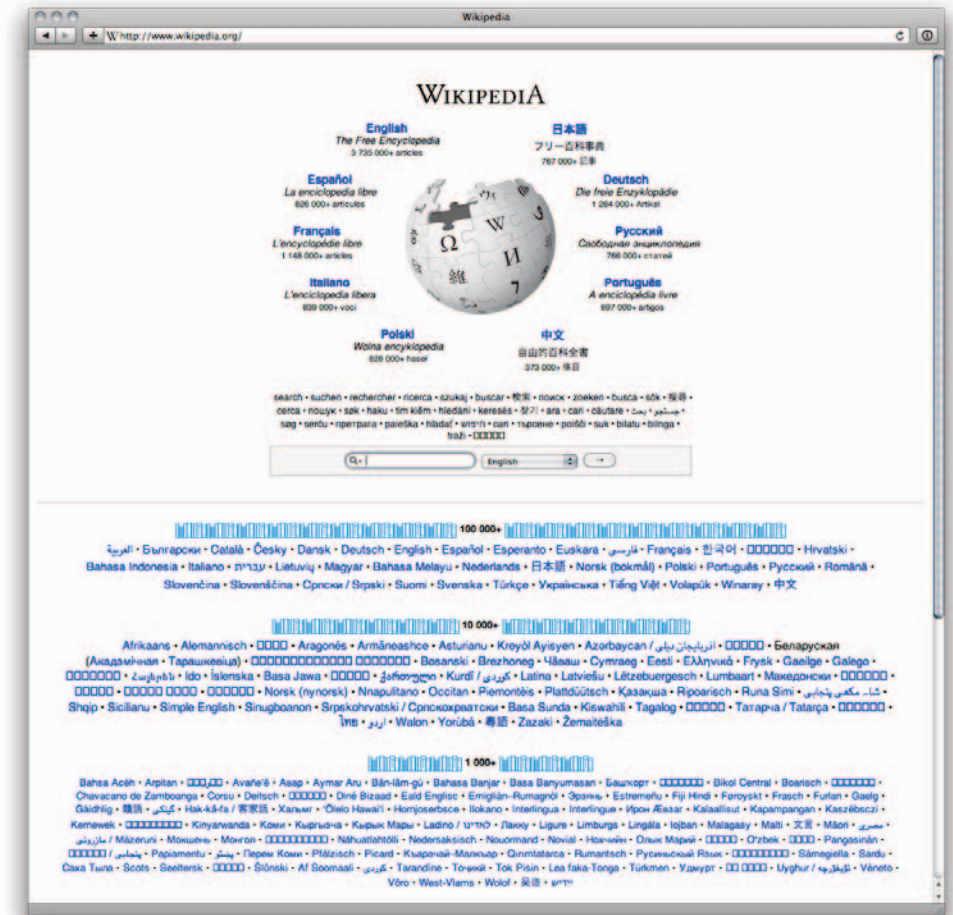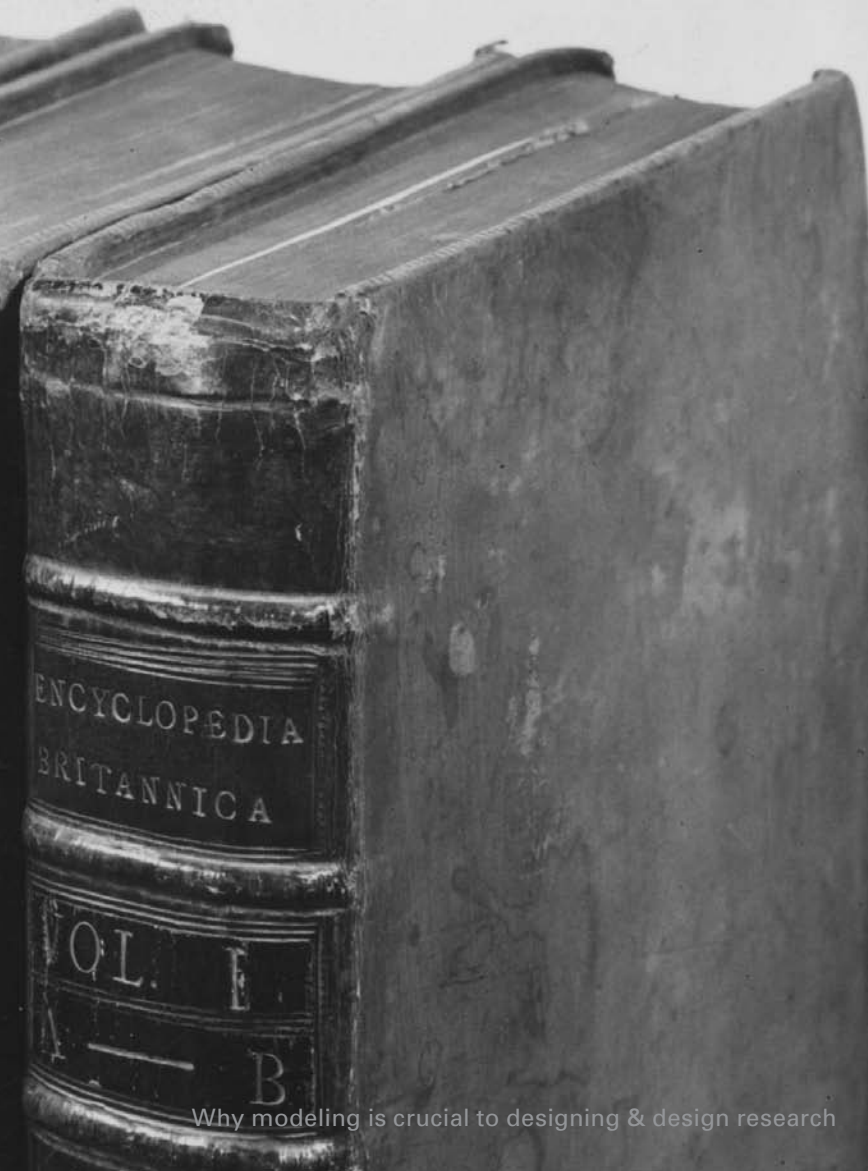
from
Objects

to
Experiences
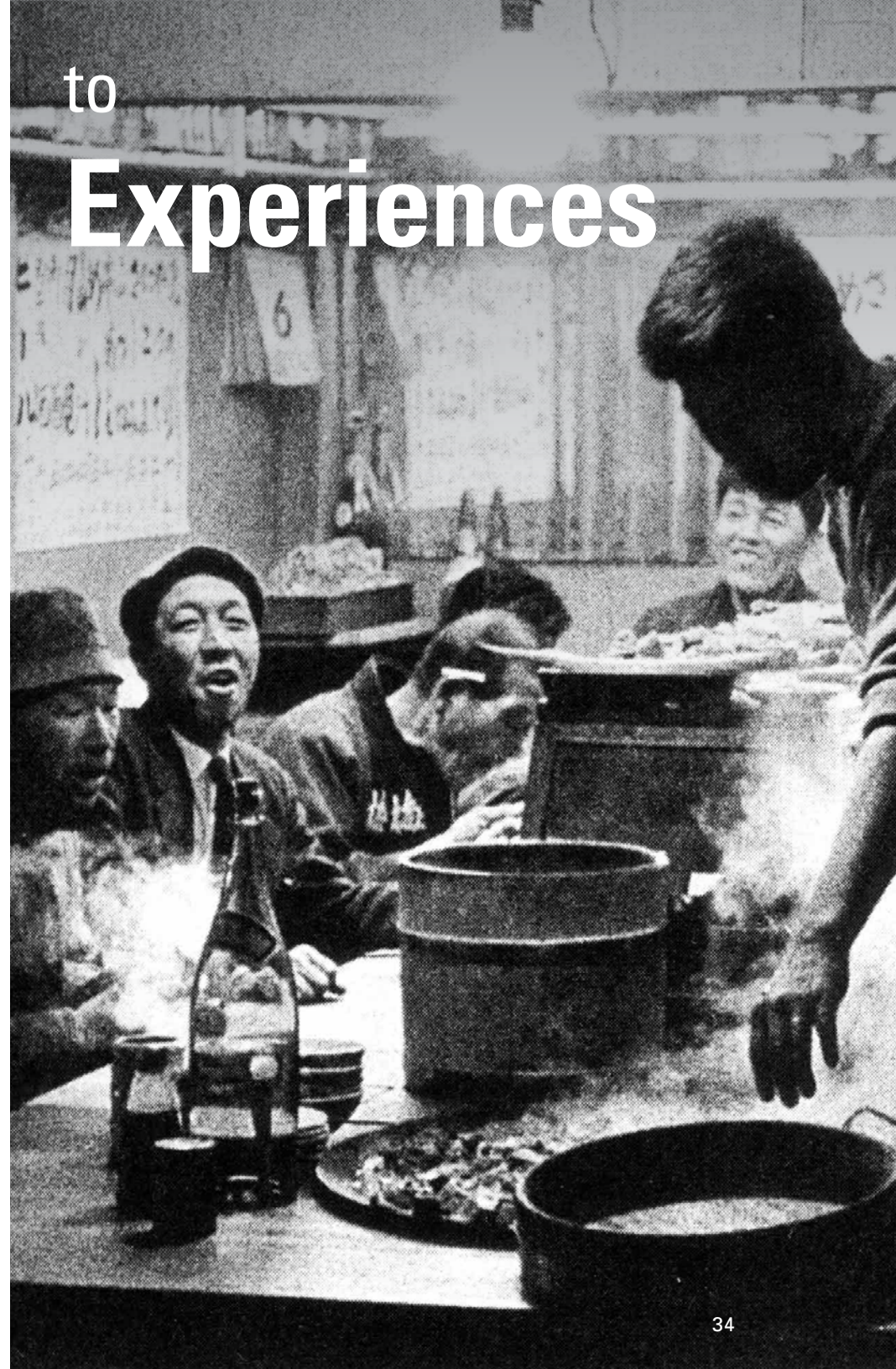
And the changing nature of products requires new approaches to designing.

from
Objective
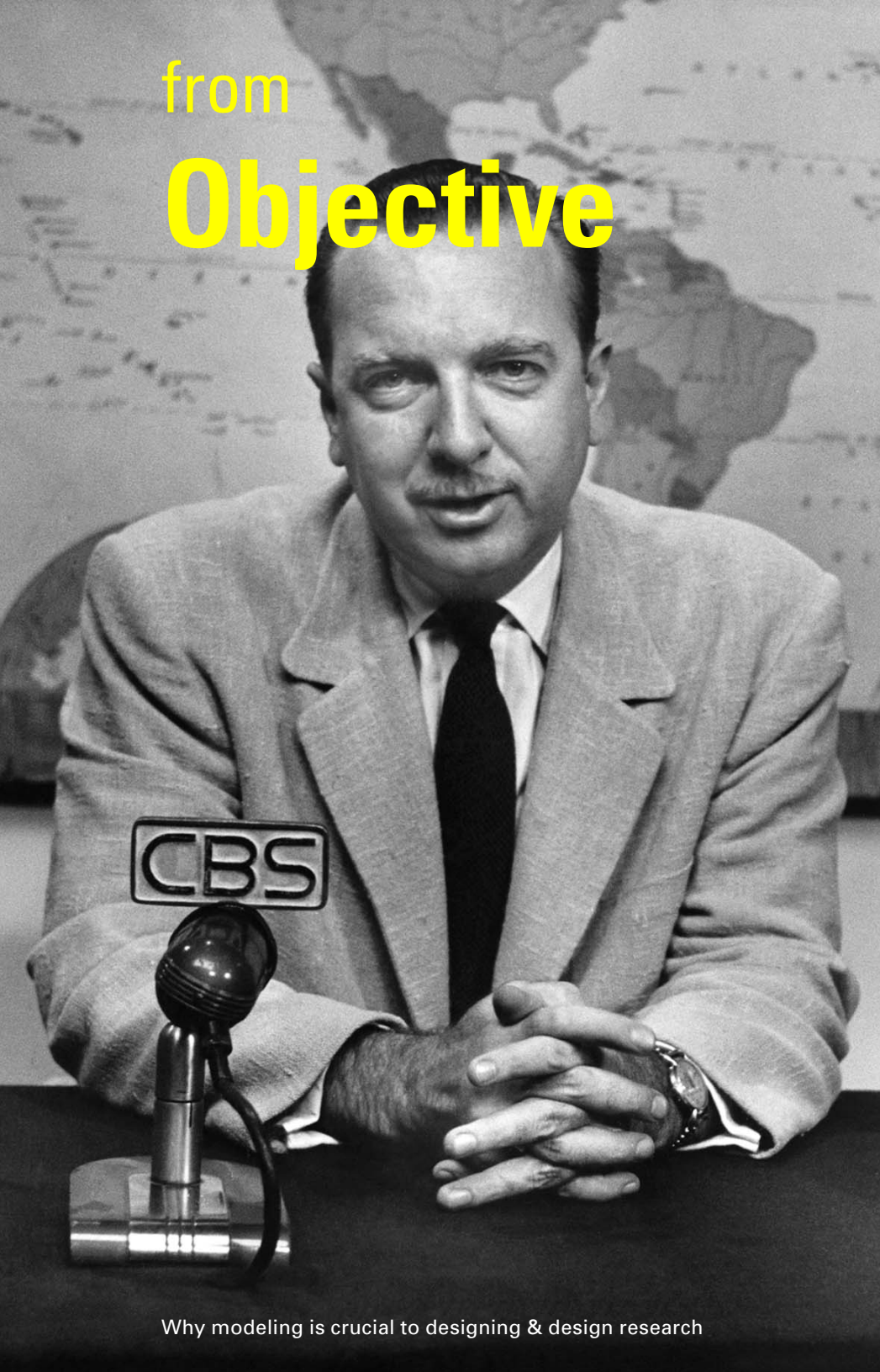
to
Subjective

from
Expert / patient

to
'Symmetry of ignorance'
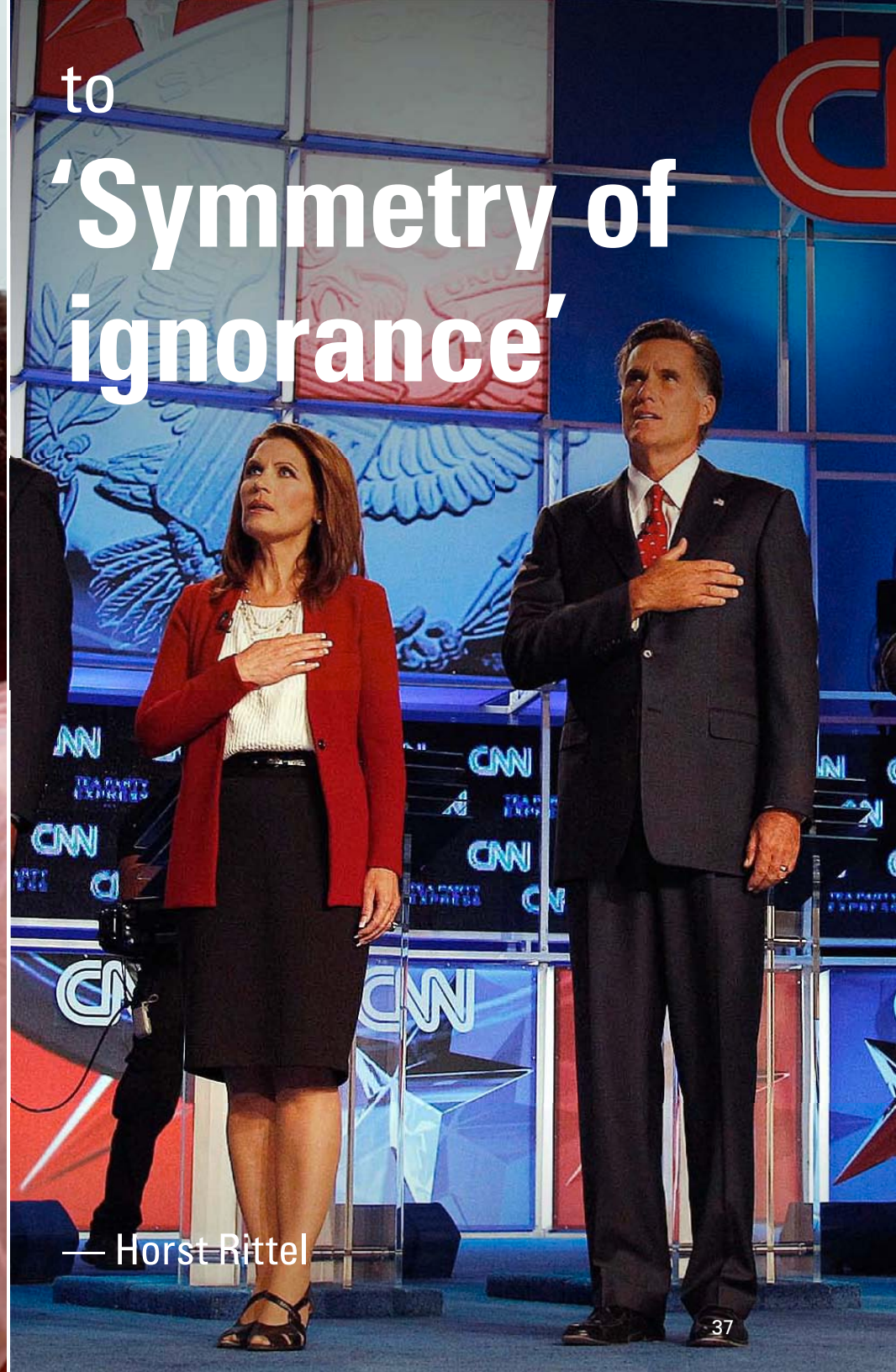
— Horst Rittel

Why modeling is crucial to designing & design research

from
Author

to
Facilitator

from
Perfecting
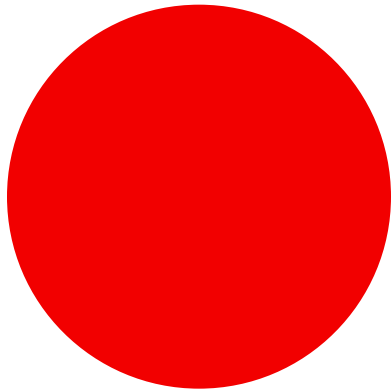
to
Growing
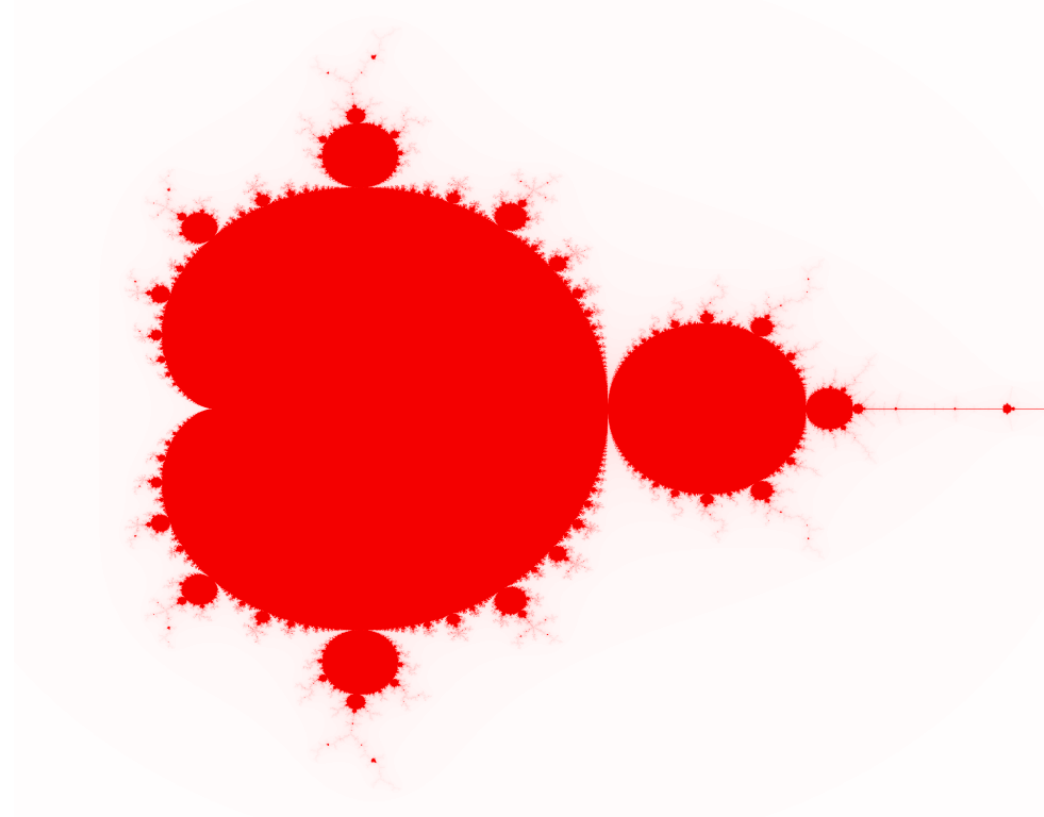
We can no longer focus on the form of static objects; we must create conditions in which ecologies can flourish.

Why are we making this?
Context/Need
Pragmatic

What are we making?
Meaning/Definition
Semantic

How are we making it?
Form/Grammar
Syntatic

Team
Explicit
Shared

Individual
Intuitive
Idiosyncratic

Object
Component

System
Systems of components
Organism

Ecosystem
Systems of systems
Community
Market
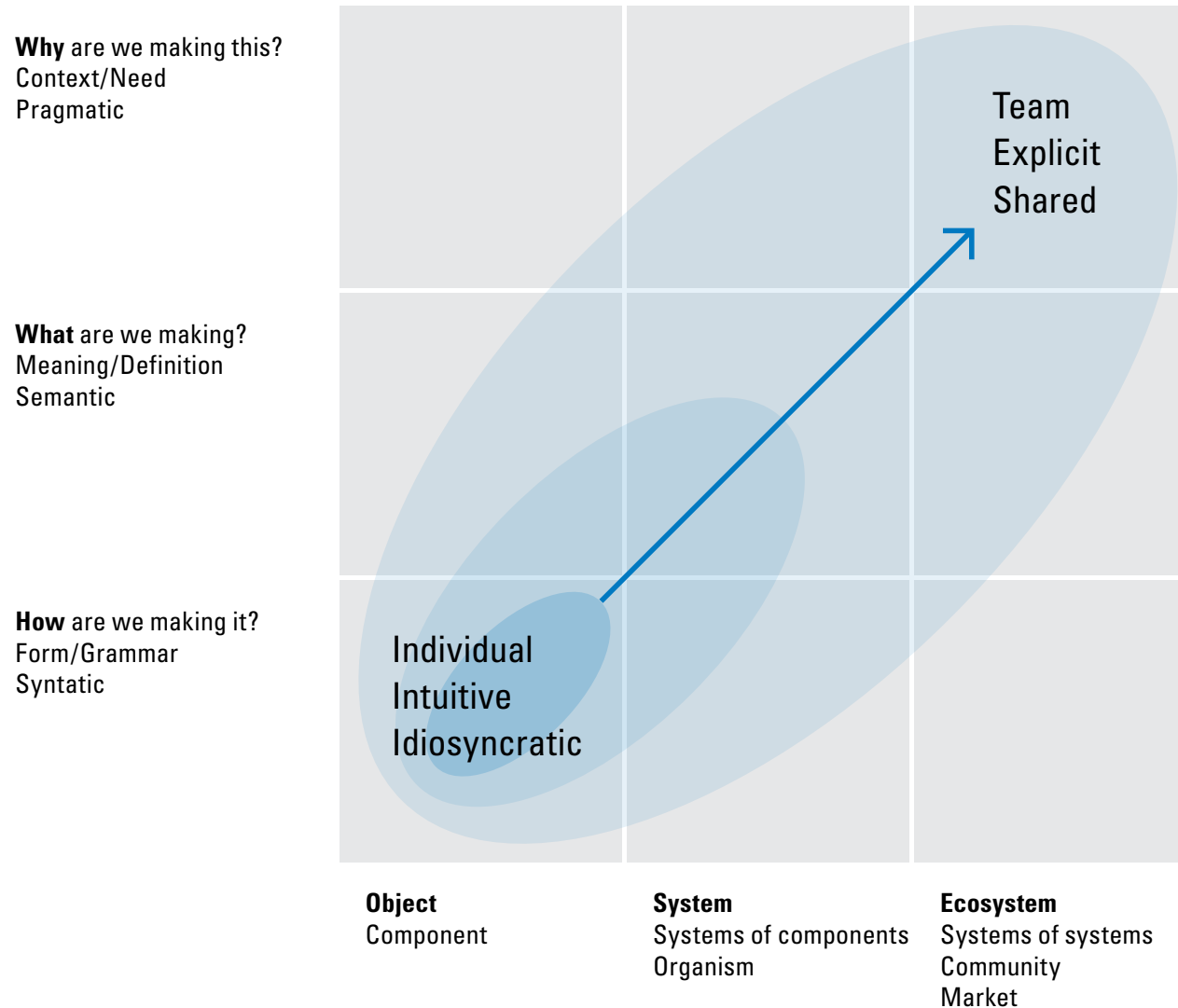
Part 4

What is the solution to these problems?

Models.

How can we build knowledge in design practice?

How can we build knowledge in design practice?
By collecting and sharing models.

How can we make research actionable?

How can we make research actionable?
By collaborating on models.

How can we cope with the increasingly intangible nature of the systems and services that we are called on to design?

How can we cope with the increasingly intangible nature of the systems and services that we are called on to design?
By modeling them.

Part 5

What is a model?

A model is an idea about how part of the world works; representing the idea aids its refinement.

Idea

Subject

Representation
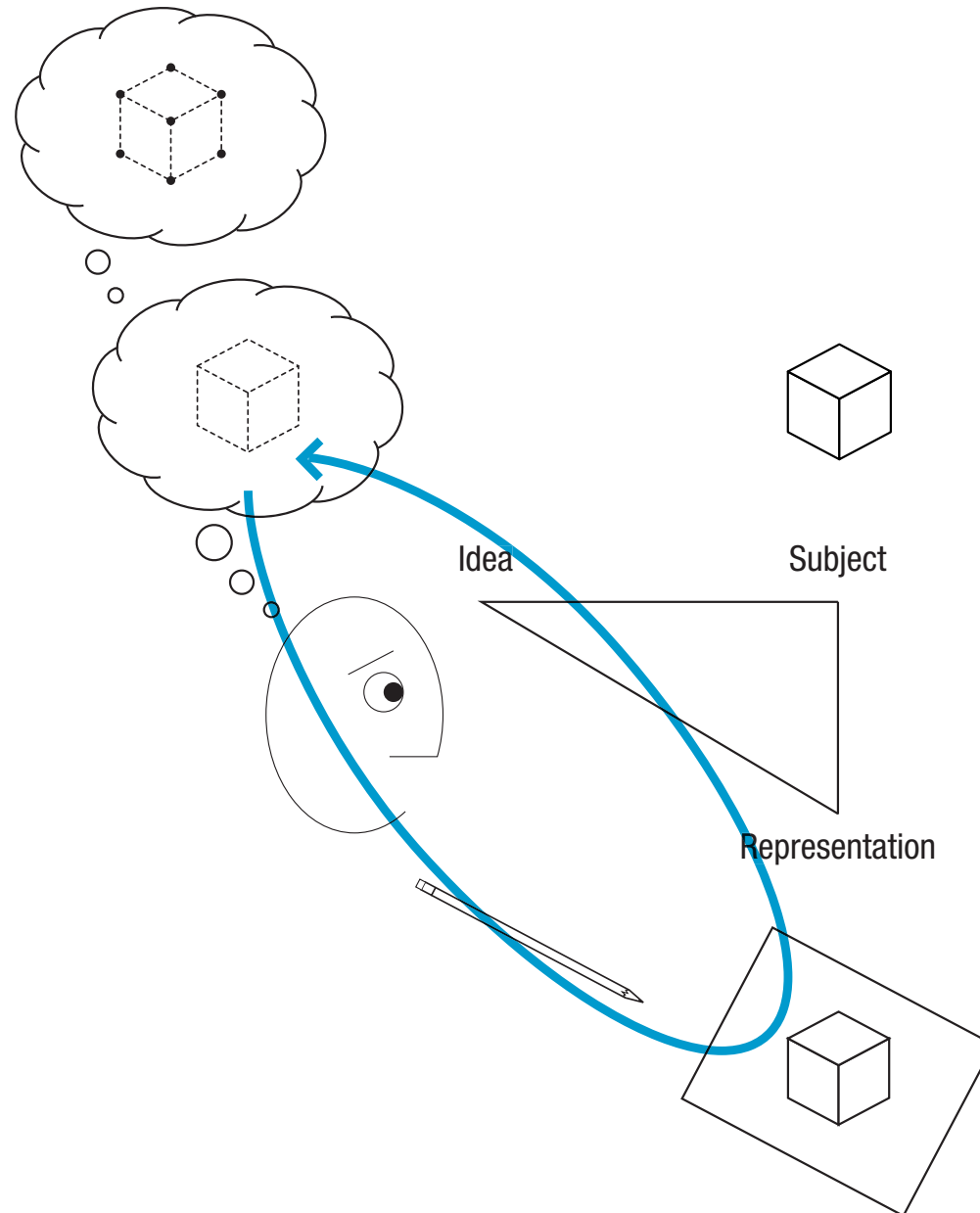
"Models are our voodoo dolls. We do most of our thinking in models."

— Alan Kay

Part 6

A few examples from practice.

Phases of a cold.
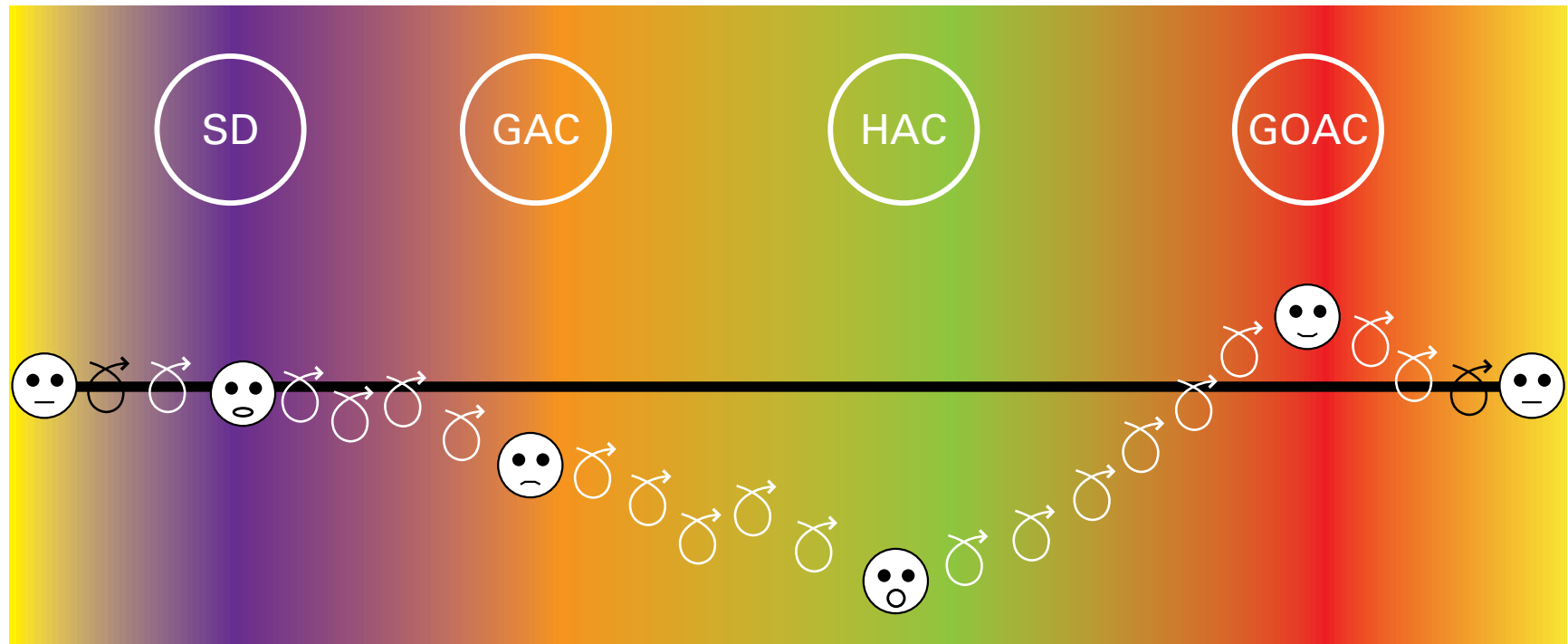
— E-Lab

The requirements of health extend beyond traditional healthcare.

Goals

Quality of everyday living

Means / Goals

Health:
Complete physical, mental, and social well-being*

Other goal/means, such as:
– Love of family + friends
– Work valued by self + others
– Physical and financial security
– Fun + joy

Means / Goals

| Eliminate or minimize acute diseases and infirmities | Manage chronic conditions; avoid or slow deterioration leading to acute problems | Self-management supported by HCPs, family, friends, and peers | Other means, such as:
– Employer practices
– Social policies
– Providing essentials:
  clean air + water,
  food + shelter,
  education + stability |

Means

| Medicine and other therapies administered by HCPs with patients' consent; patients have little say in means | Medicine and other therapies prescribed by physicians and administered by patients, who may have other priorities or may reject means | People actively involved in their own:
– Monitoring...
– Goal-setting
– Experimenting...
– Understanding...
– Reflecting...

...in relation to their:
– Bodies
– Diet
– Activities
– Relationships
–Environment |

Connecting sensors with coaching offers a new blend of self-management or chronic care—imagine 'QS + Facebook + University of Phoenix'.

Family, Friends + HCPs   inform

informs

inform + provide context for

Information + Tools + Coaching

Goals

inform

Sensors

inform

observed; compared to goals by   **Person**   takes   **Actions** (Daily Living)

New observations...   ...suggest new Actions...

measured by

affect the

Body

affect the

Disturbances
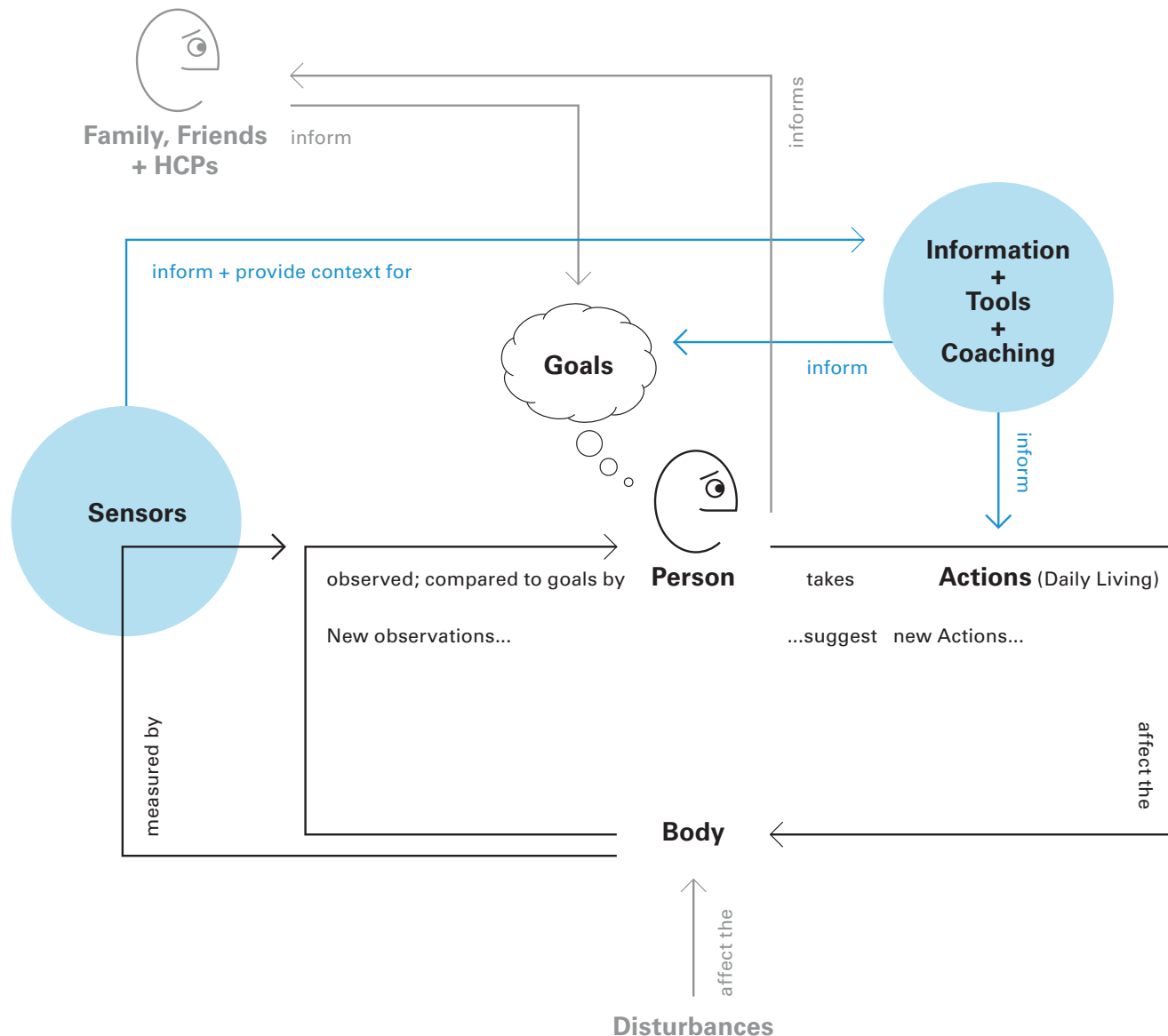
iPod =
Hardware/Software/Networked Service/Marketplace

Music Listener   iPod   iTunes   iTunes Music Store   Record Companies   Artists

— Dubberly Design Office

The iPhone will connect with Apple's existing system of systems.
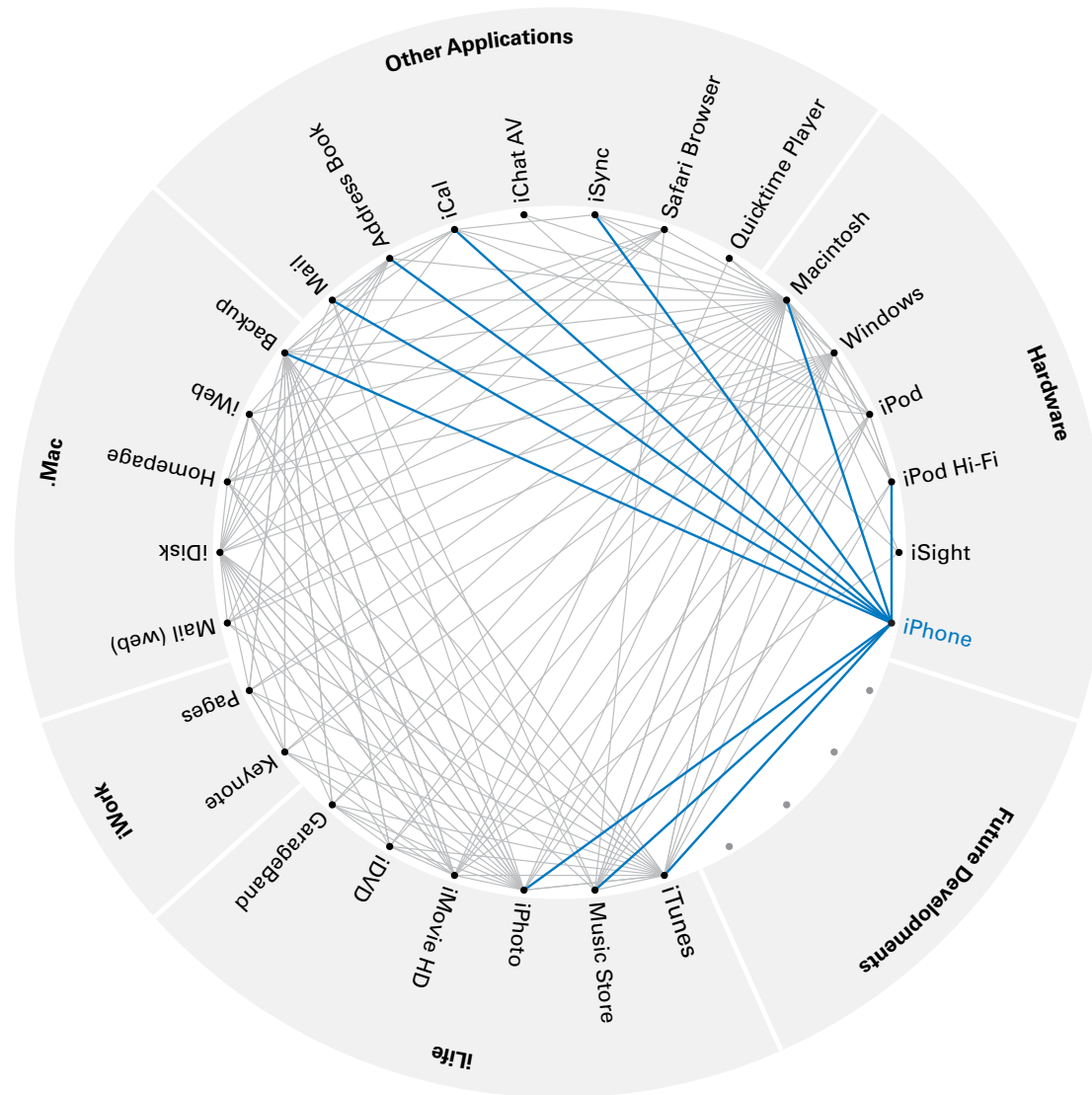
— Dubberly Design Office for Samsung, 2006

What set of models is necessary and sufficient to describe a new product?
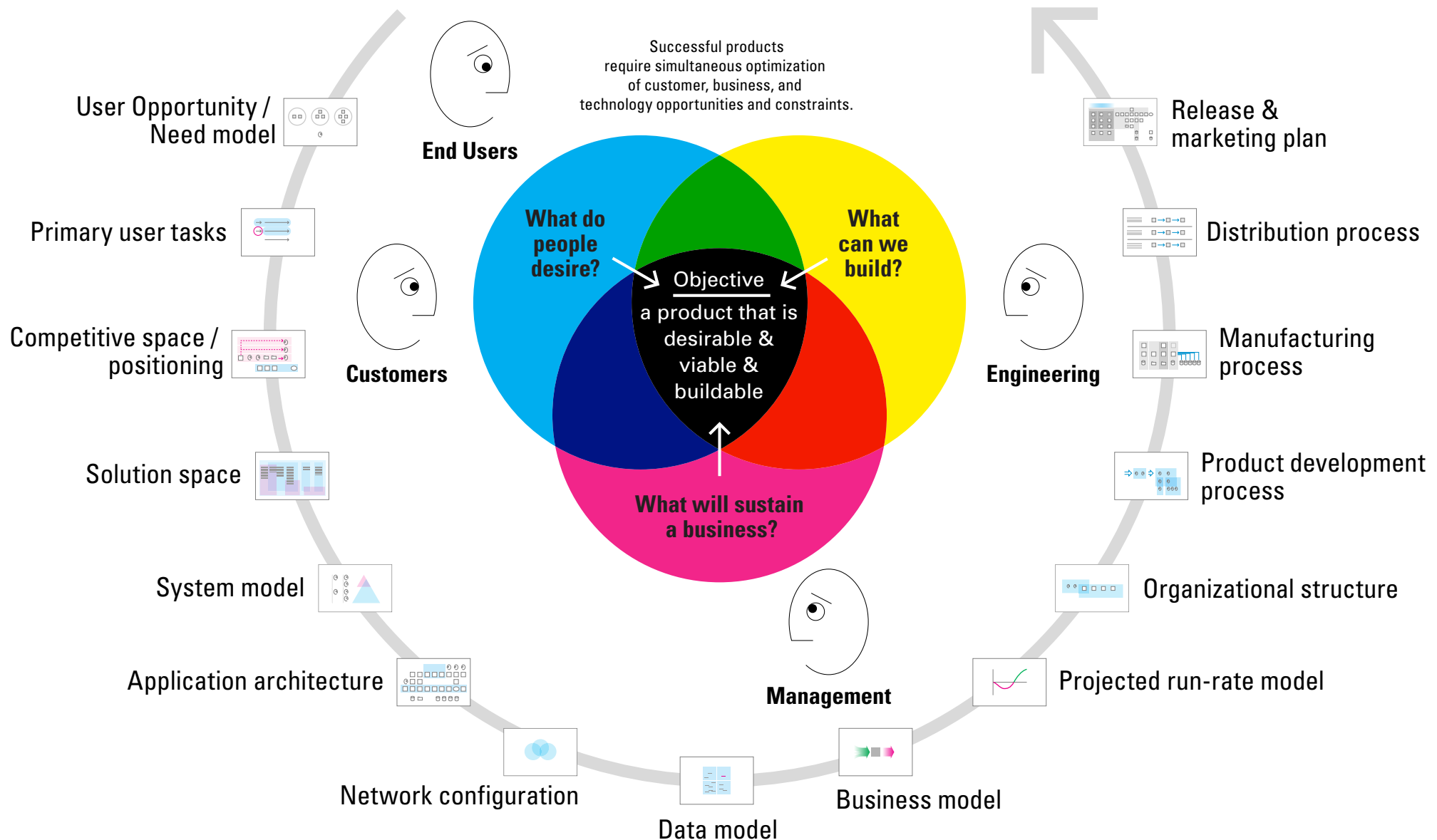

Successful products require simultaneous optimization of customer, business, and technology opportunities and constraints.

End Users

Customers

Engineering

Management

What do people desire?

What can we build?

What will sustain a business?

Objective
a product that is desirable & viable & buildable

User Opportunity / Need model

Primary user tasks

Competitive space / positioning

Solution space

System model

Application architecture

Network configuration

Data model

Business model

Projected run-rate model

Organizational structure

Product development process

Manufacturing process

Distribution process

Release & marketing plan

Without modeling,

research & design will not be effective.

**Saying that
one understands a system
is saying
one has a model
of the system.**
**No model:
no understanding**

Understanding implies an ability to accurately predict behavior **No model: no predictions—** **the system remains 'a black box'**
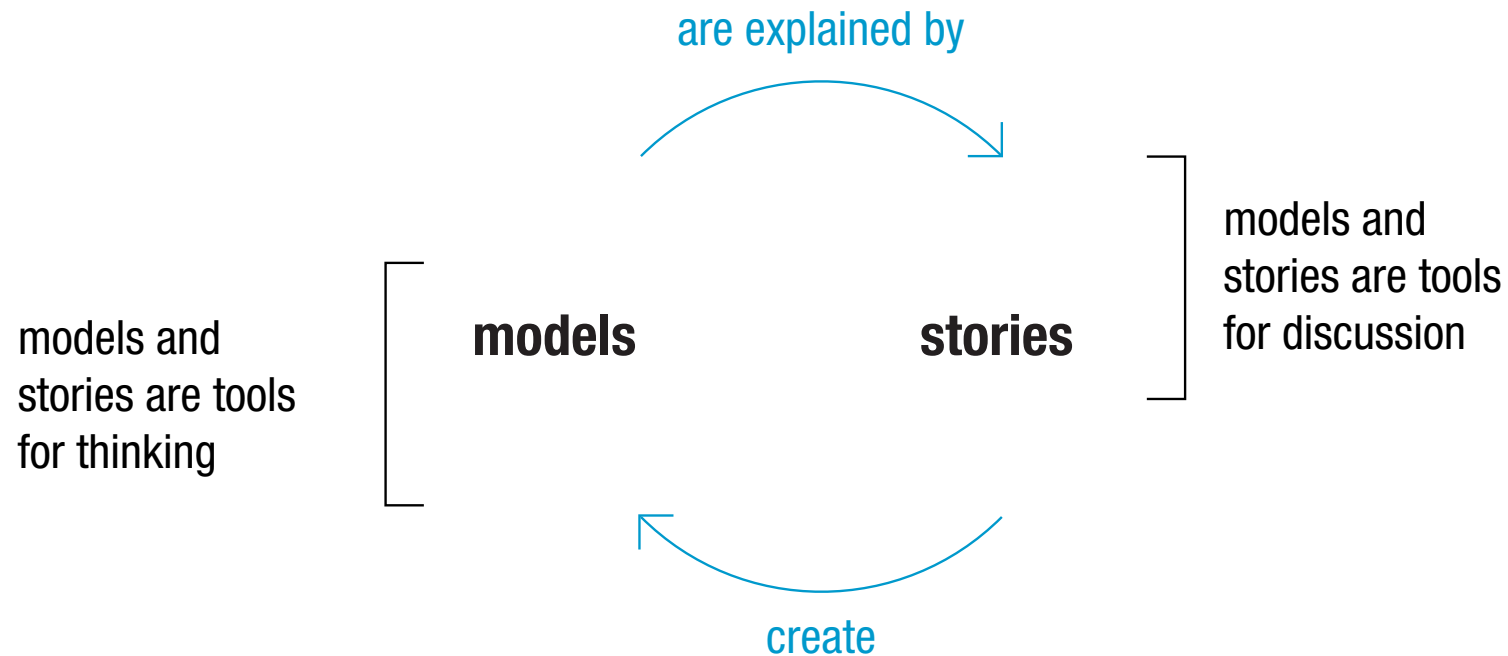
Understanding implies an ability to manage
No model:
no management

Understanding implies an ability to 'debug'

No model:
no debugging
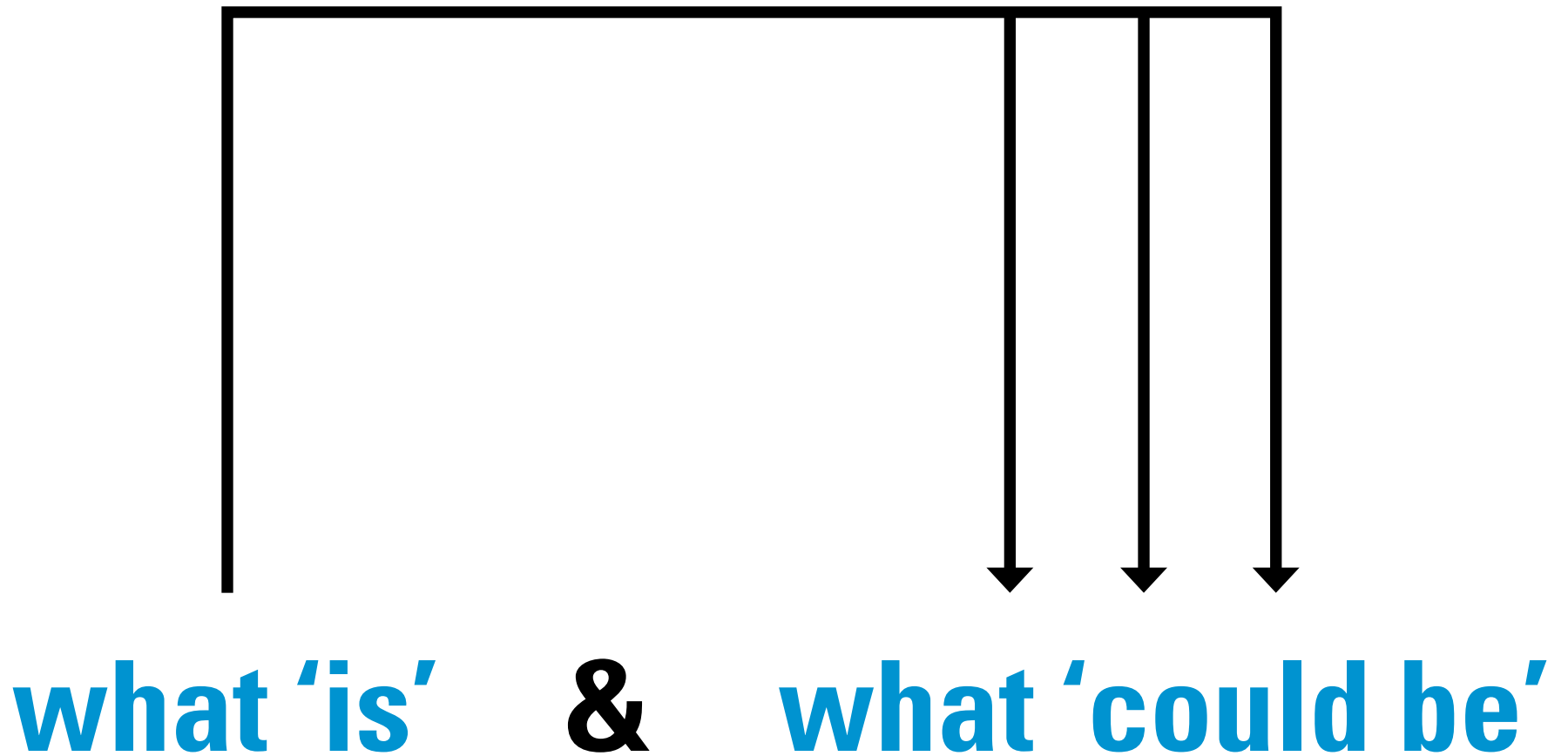
Understanding implies an ability to communicate.
No model:
no conversation

are explained by

models

stories

models and
stories are tools
for discussion

models and
stories are tools
for thinking

create

Part 7

How do models 'work' in design & research?
A model of modeling.

Designers bridge the gap between

what 'is'   &   what 'could be'
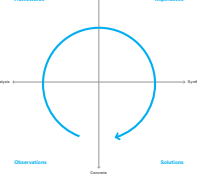
or 'should be'

Models are the tools designers use to bridge between what is and what should be.

Analysis-Synthesis Bridge Model
Dubberly, Evenson & Robinson
(2008)

Researching   Prototyping

Interpret   Abstract

Model of
what "is"   —suggest→   Model of
what
"could be"

distilled to   manifest as

Describe   Concrete

What "is"   What
"could be"

Existing – Implicit   Preferred – Explicit
(Current)   (Future)
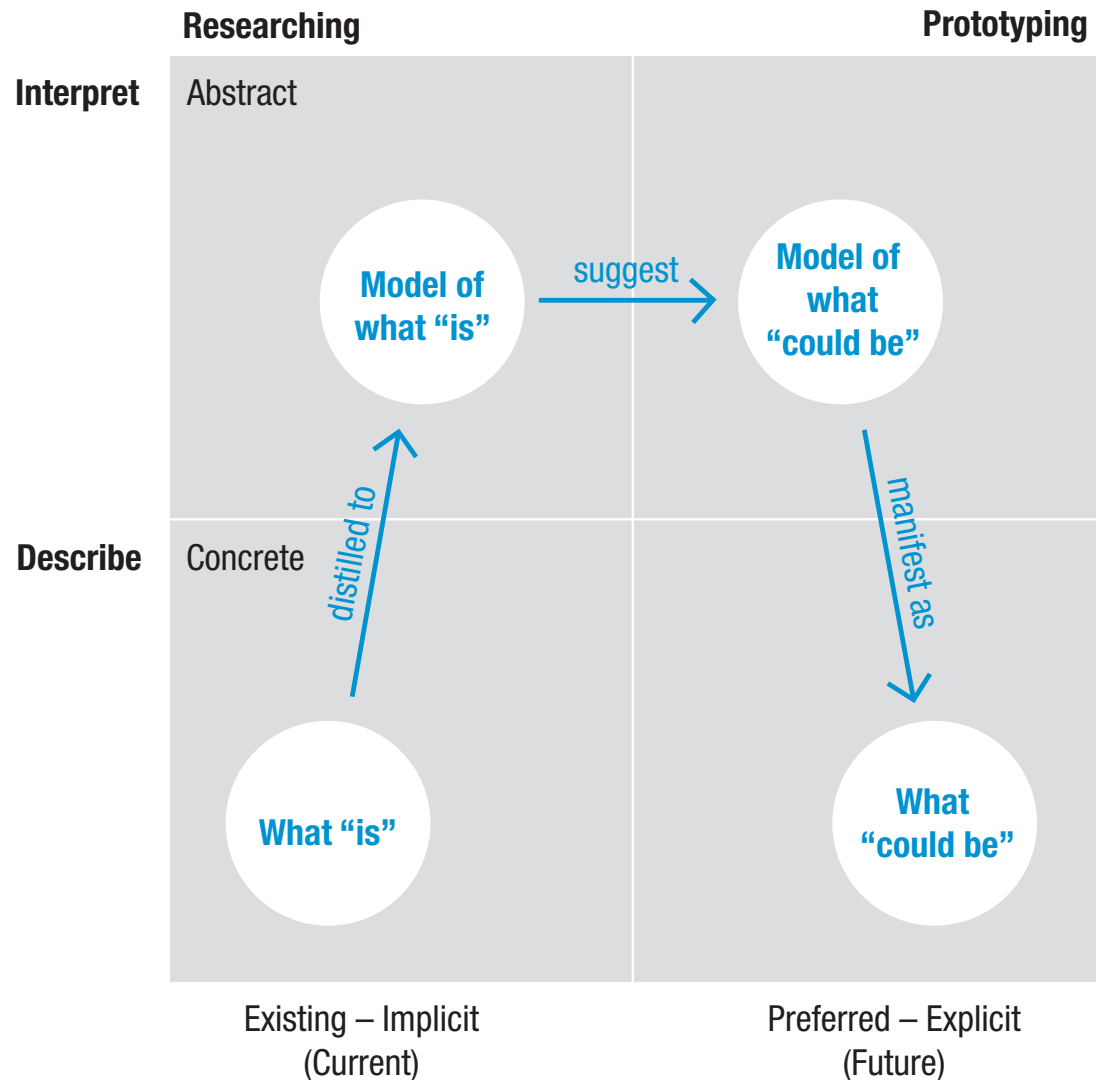
The bridge model
has many variations
and is shared by many others.
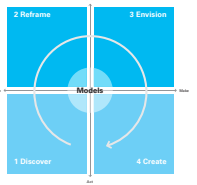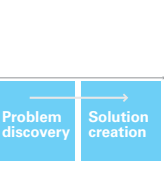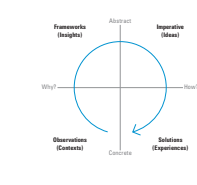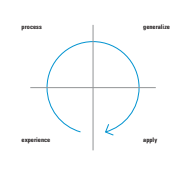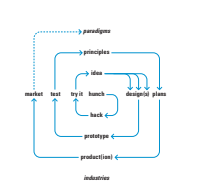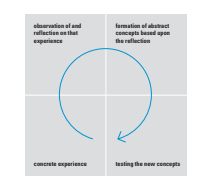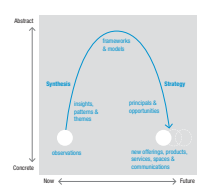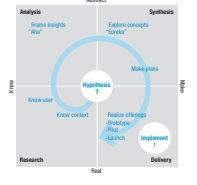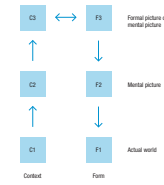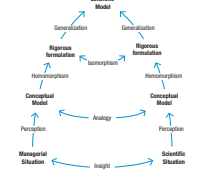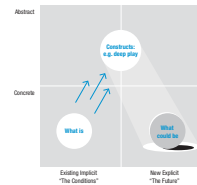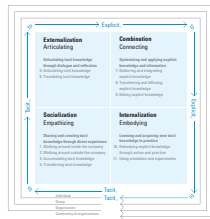
1

Robinson Model
Rick Robinson
(2005)

Abstract

Concrete

Constructs:
e.g. deep play

What is

What
could be

Existing Implicit
"The Conditions"

New Explicit
"The Future"
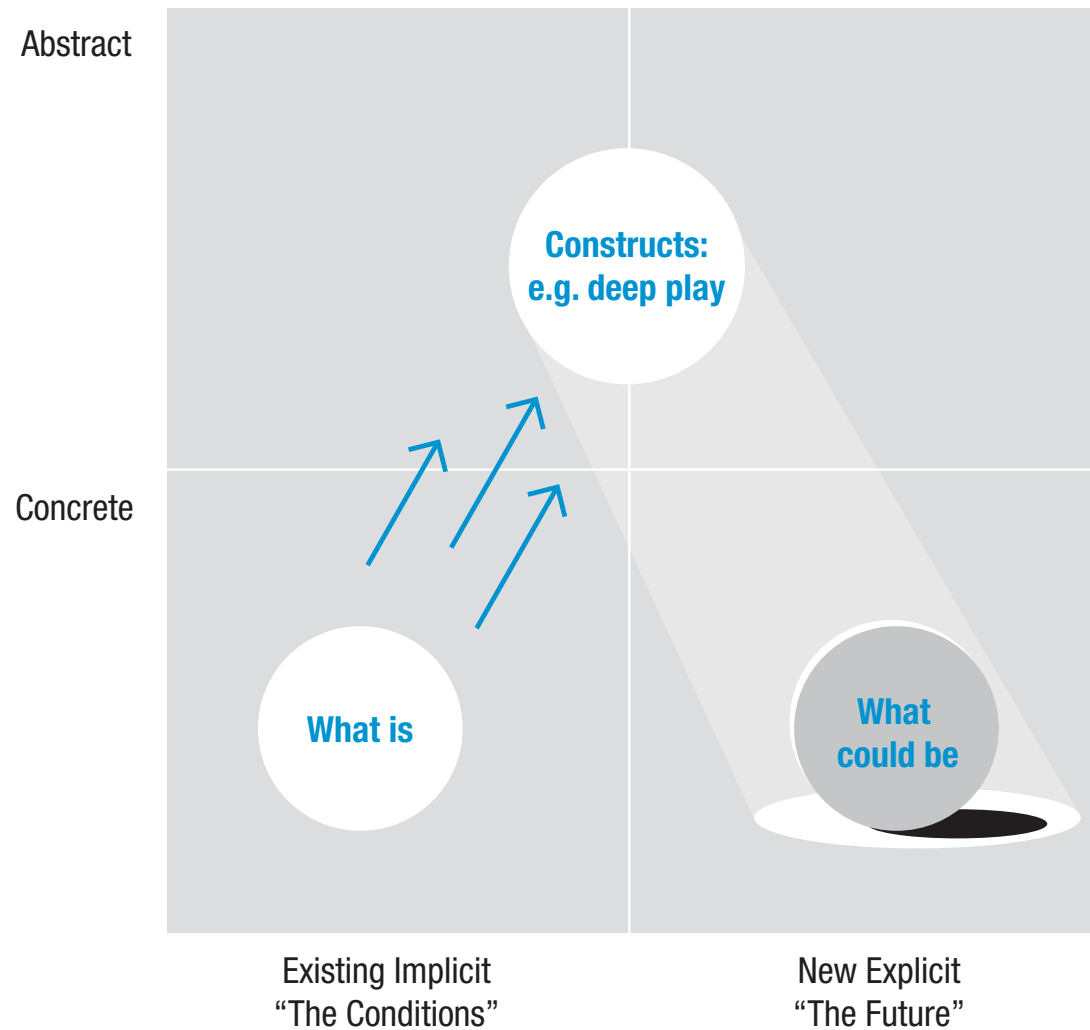
2

Design Research Process
Rick Robinson & John Cain, E-Lab
(1993)

Abstract

Structures

Conceptual
Models

E-Lab
processes

E-Lab
deliverables

Patterns

Design
Concepts

E-Lab
field research

Concrete

Situations

Prototypes

Existing/
Implicit

New/
Explicit
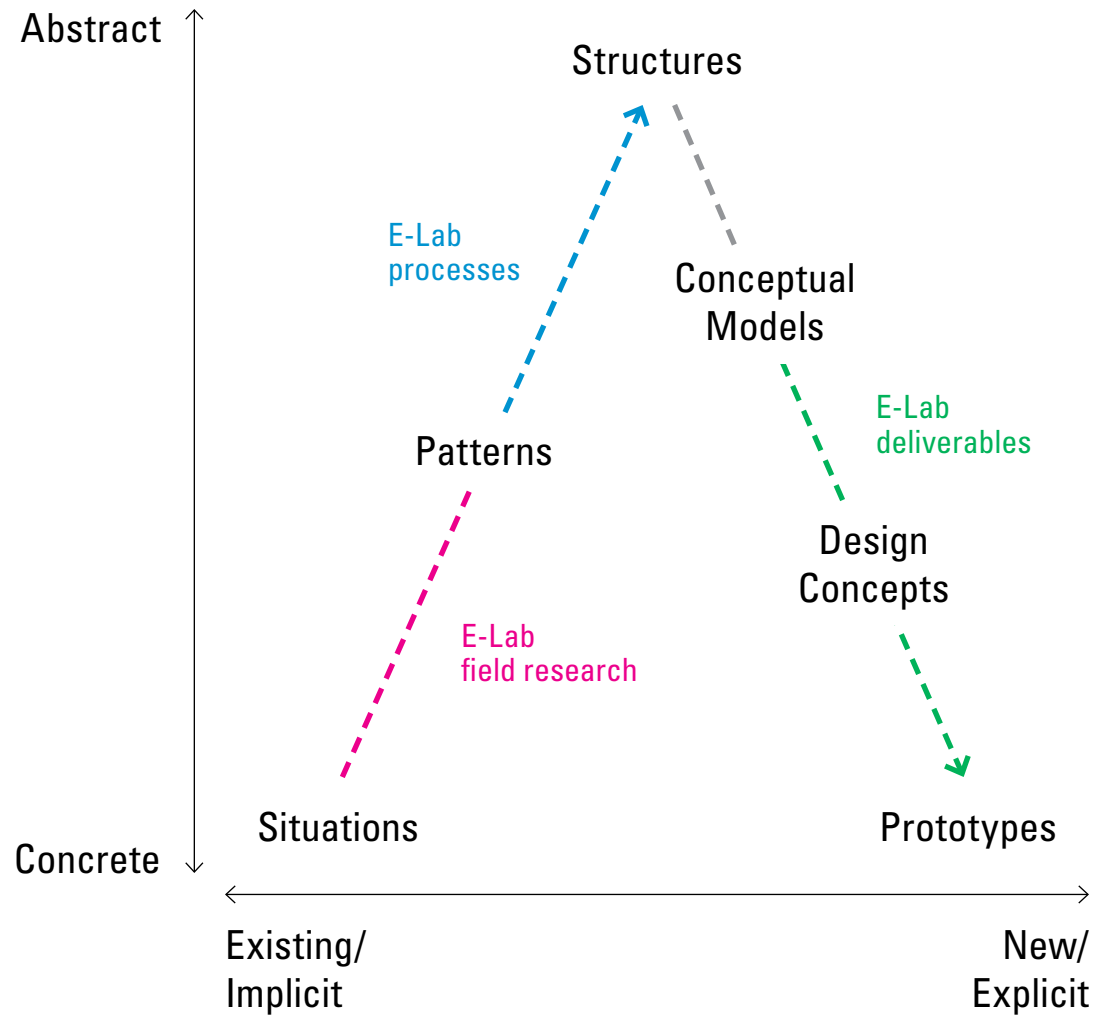
3

Beer Model
Stafford Beer
(1966)

Scientific Model

Generalization — Generalization

Rigorous formulation — Isomorphism — **Rigorous formulation**

Homomorphism — Homomorphism

Conceptual Model — Analogy — **Conceptual Model**

Perception — Perception

Managerial Situation — Insight — **Scientific Situation**
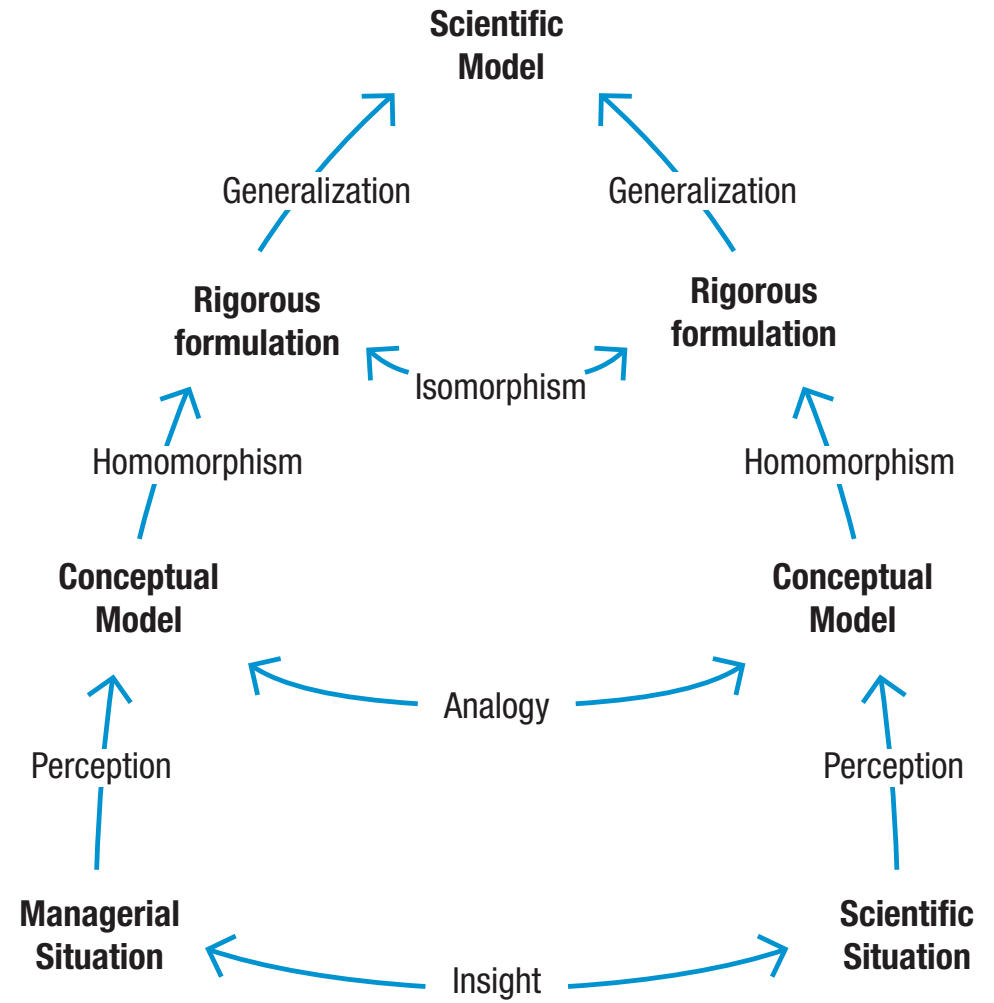
4

Alexander Model
Christopher Alexander
(1964)

C3 ⟷ F3		Formal picture of mental picture
↑ ↓		
C2 F2		Mental picture
↑ ↓		
C1 F1		Actual world
Context Form		
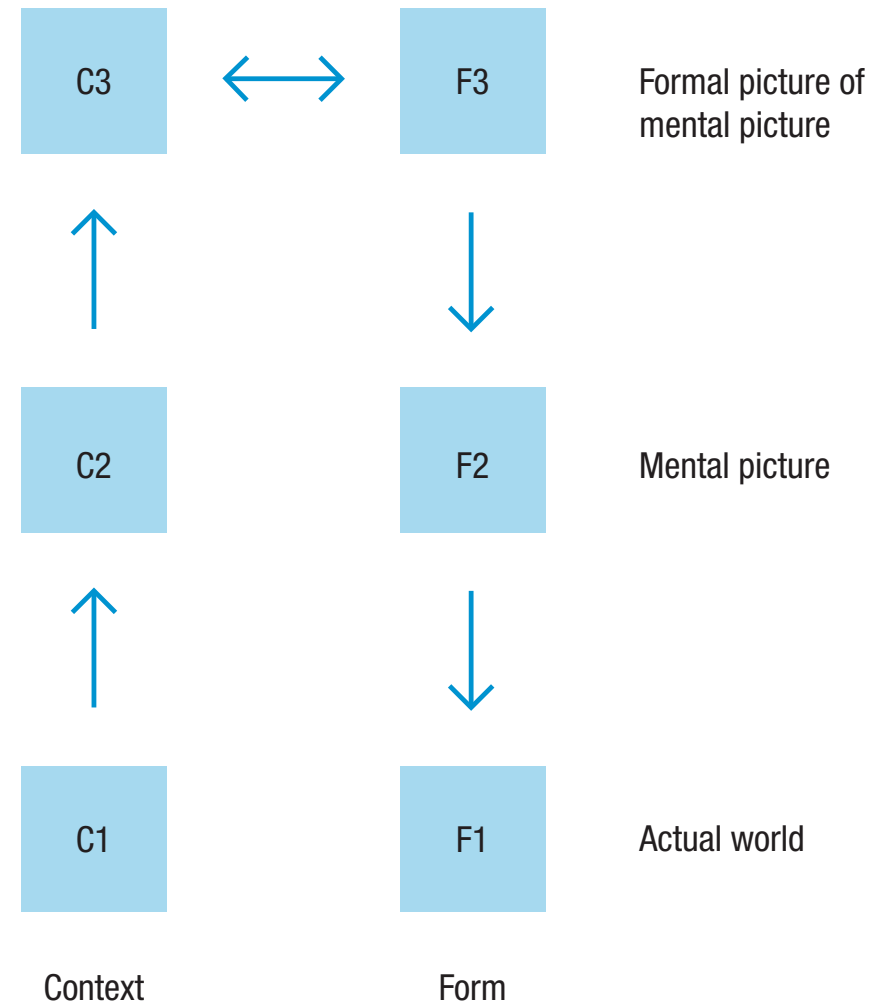
5

Kumar Model
Vijay Kumar
(2003)

Abstract

Analysis   **Synthesis**

Frame insights   Explore concepts
"Aha"   "Eureka"

                                    Make plans

Know

Hypothesis
?

Make

Know user

Know context   Realize offerings
                    -Prototype
                    -Pilot   Implement
                    -Launch   !

Research   **Delivery**

Real
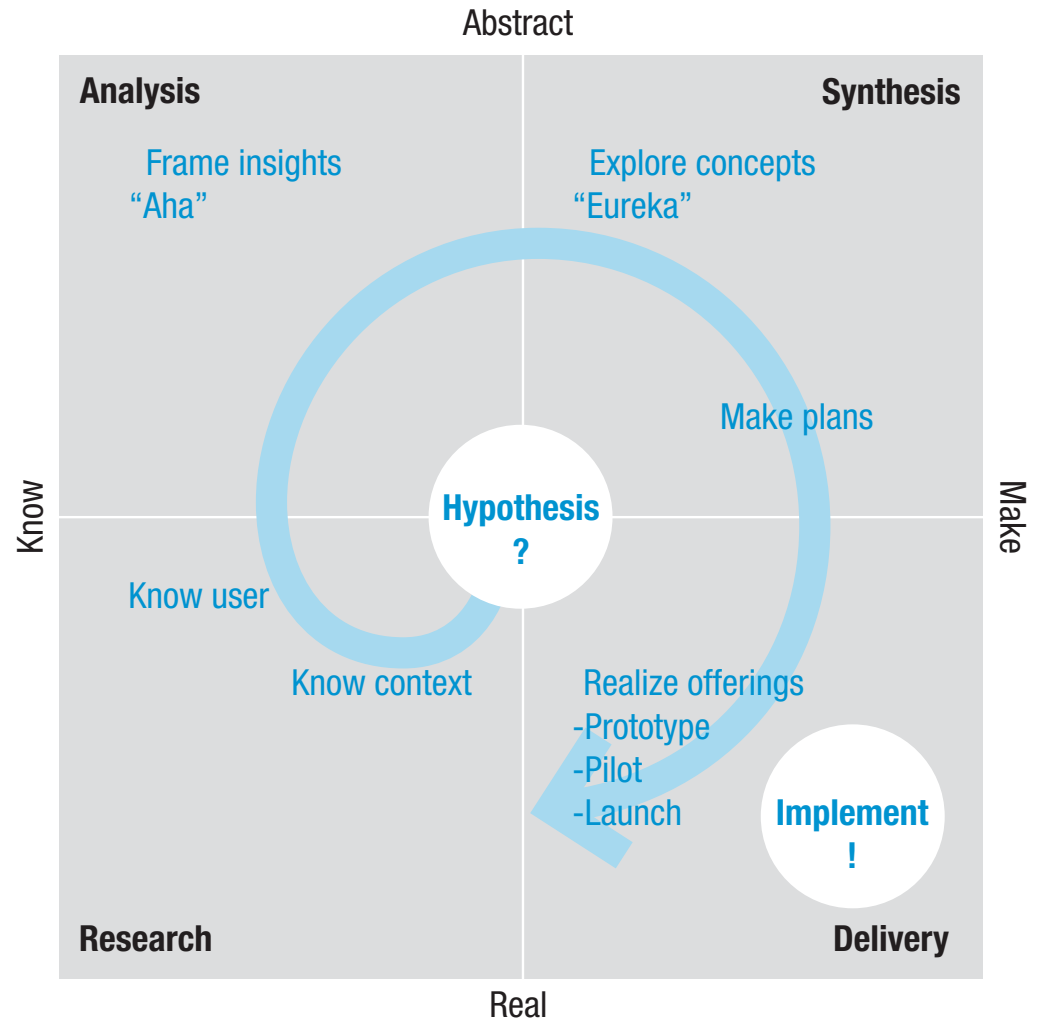
6

Kaiser-IDEO Model
Kaiser Innovation Center + IDEO
(2004)

Abstract and thematic

Storytelling
and analysis

Brainstorming
and concept generation

Learning and understanding

Making and trying

Design Research
and data gathering

Prototyping
and concept development

Real and concrete

7
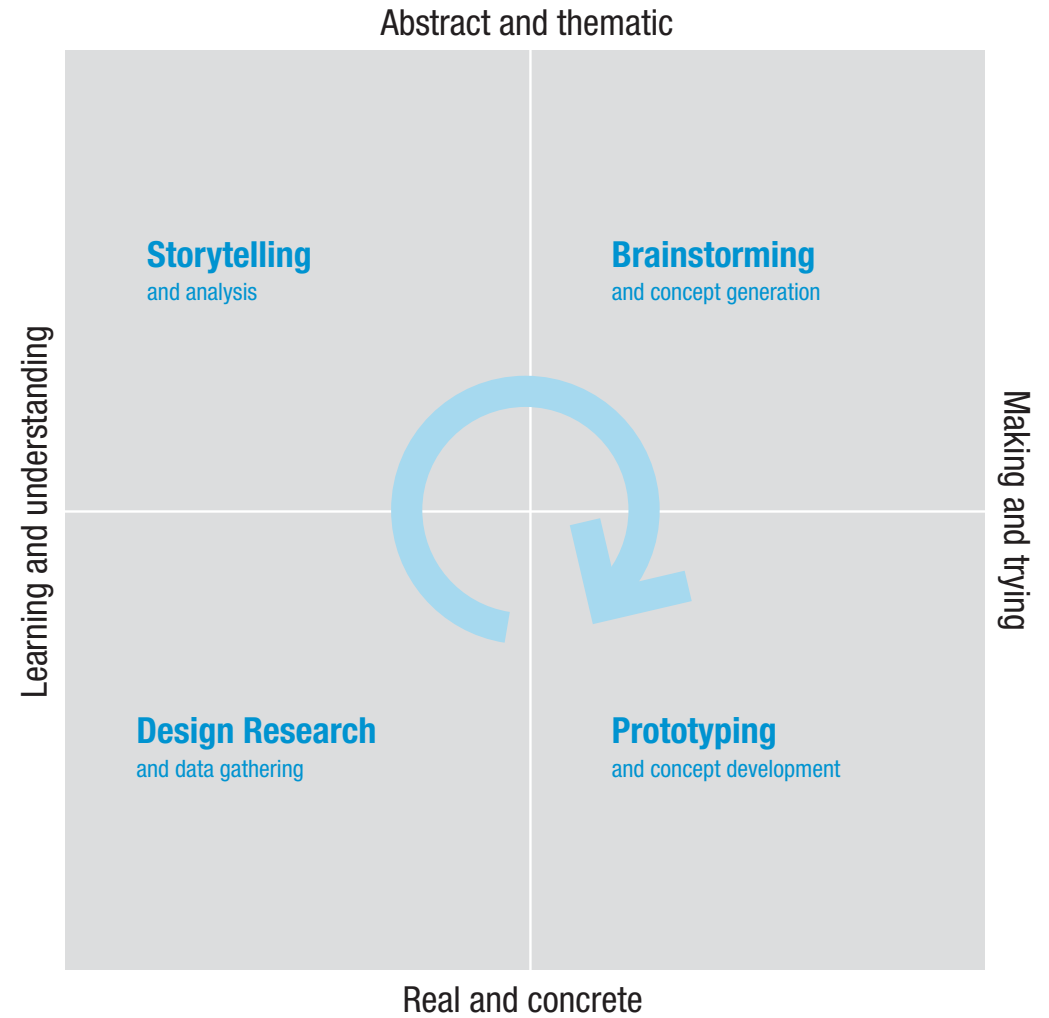
Suri-IDEO Model
Jane Fulton Suri
(2006)

Abstract

Synthesis

frameworks
& models

Strategy

insights,
patterns &
themes

principals &
opportunities

observations

new offerings, products,
services, spaces &
communications

Concrete

Now ⟵——————⟶ Future

8
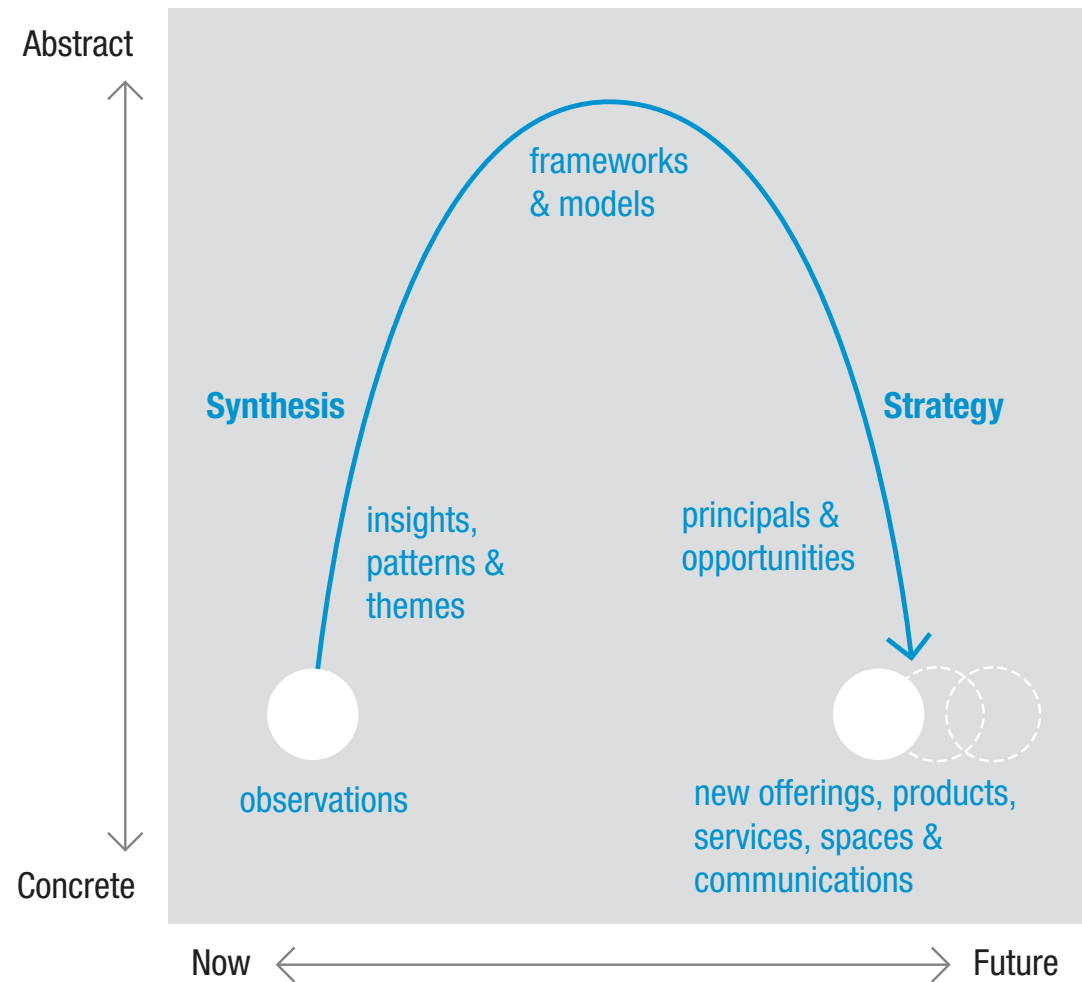
Verplank's Spiral
Bill Verplank
(2000)

paradigms

principles

idea

market   test   try it   hunch   design(s) plans

hack

prototype

product(ion)

industries
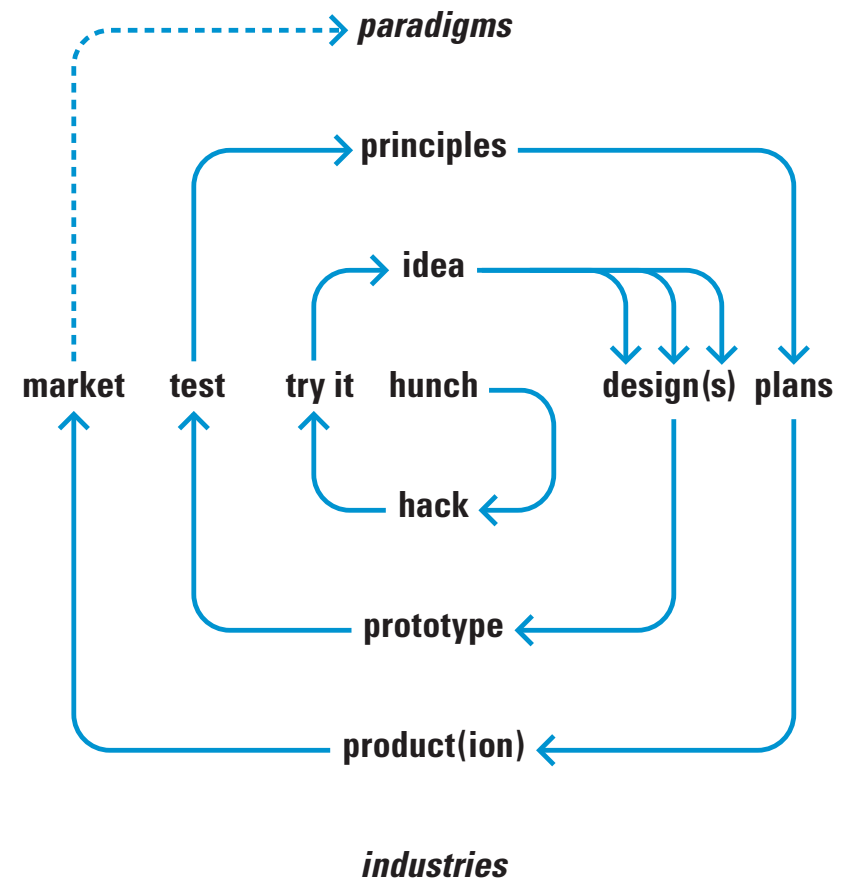
9

The Jump Explore Process
Colleen Murphy, Jump Associates
(2009)

Abstract

Frameworks

Imperatives

Analysis ← → Synthesis

Observations

Solutions

Concrete

10
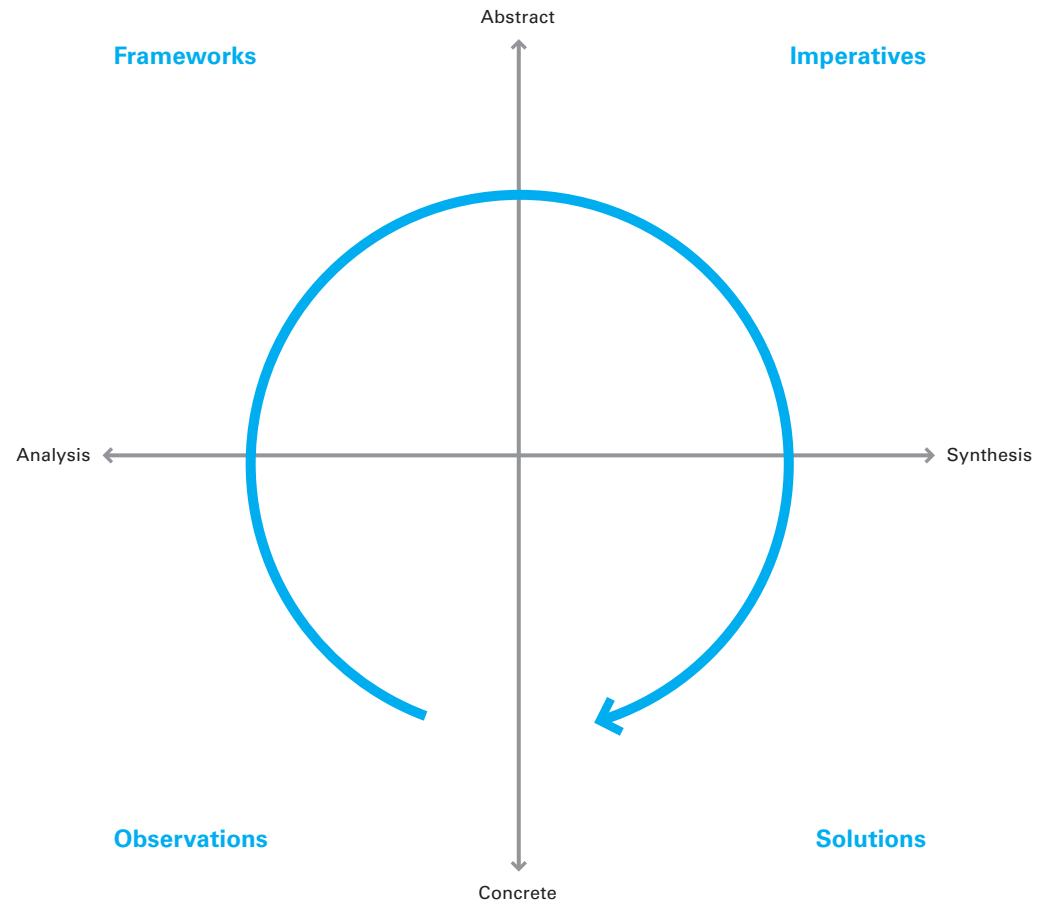
Differentiation Model
Joanne Mendel
(2010)

Know ⟵———————————⟶ Make

Problem discovery	**Solution creation**
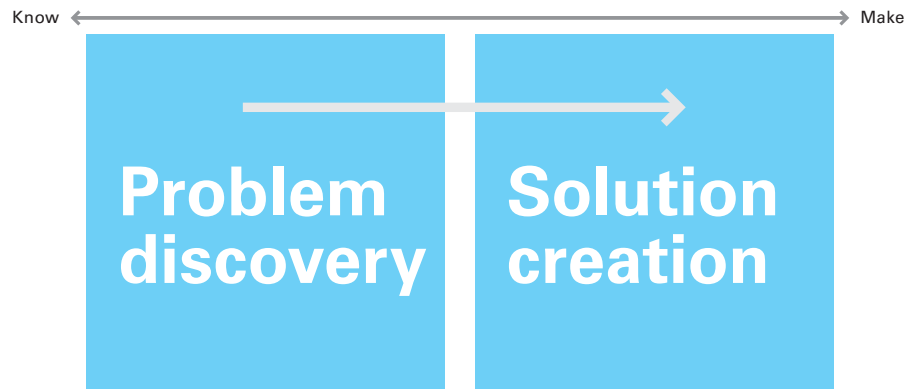
Incremental improvement

Reflect

2 Reframe	3 Envision

Know ⟵——— **Models** ———⟶ Make

1 Discover	4 Create

Act
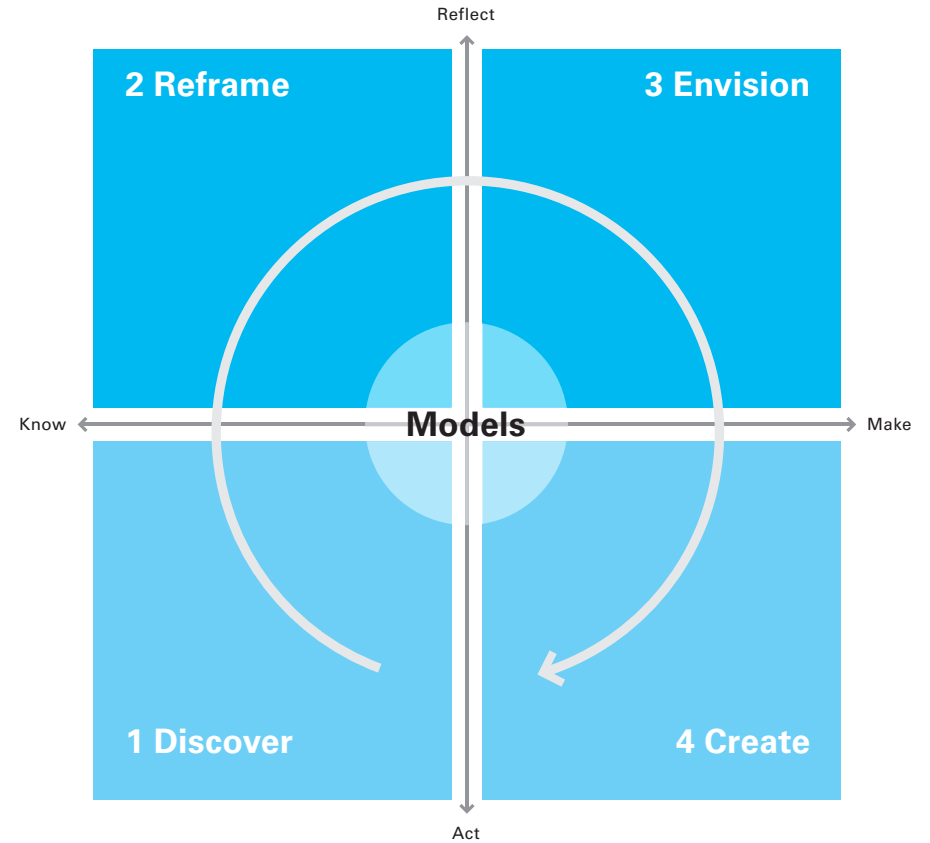
Differentiation

Design Process
Sara Beckman
(2010)

Abstract

Frameworks
(Insights)

Imperative
(Ideas)

Why? — How?

Observations
(Contexts)

Solutions
(Experiences)

Concrete
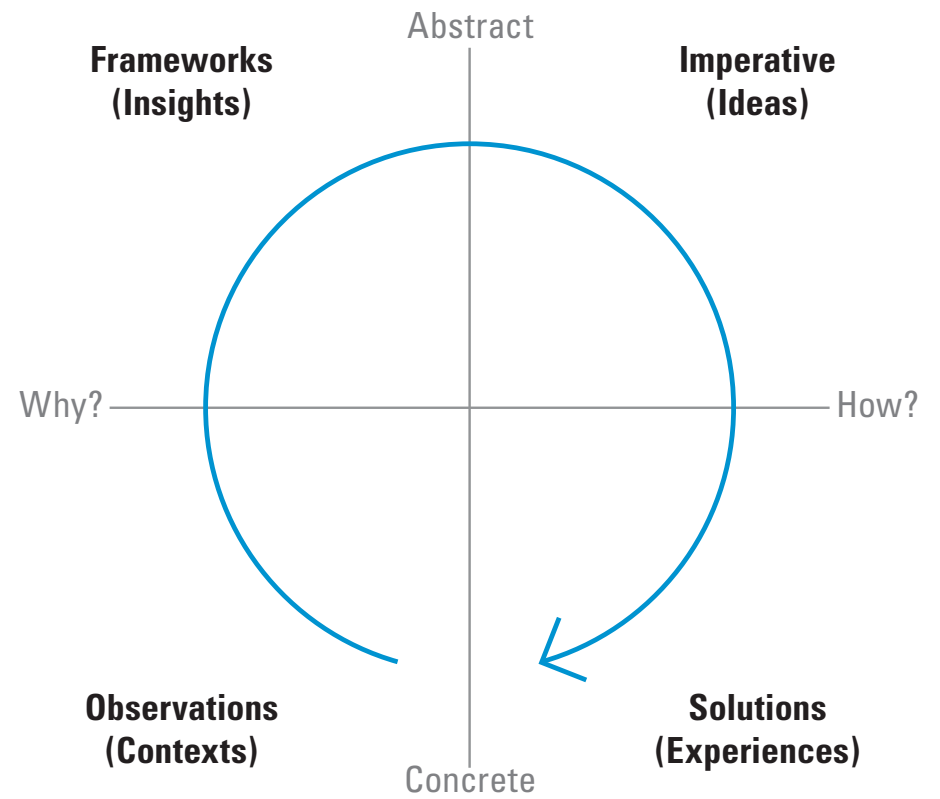
Learning bridges the gap between

tacit & **explicit**
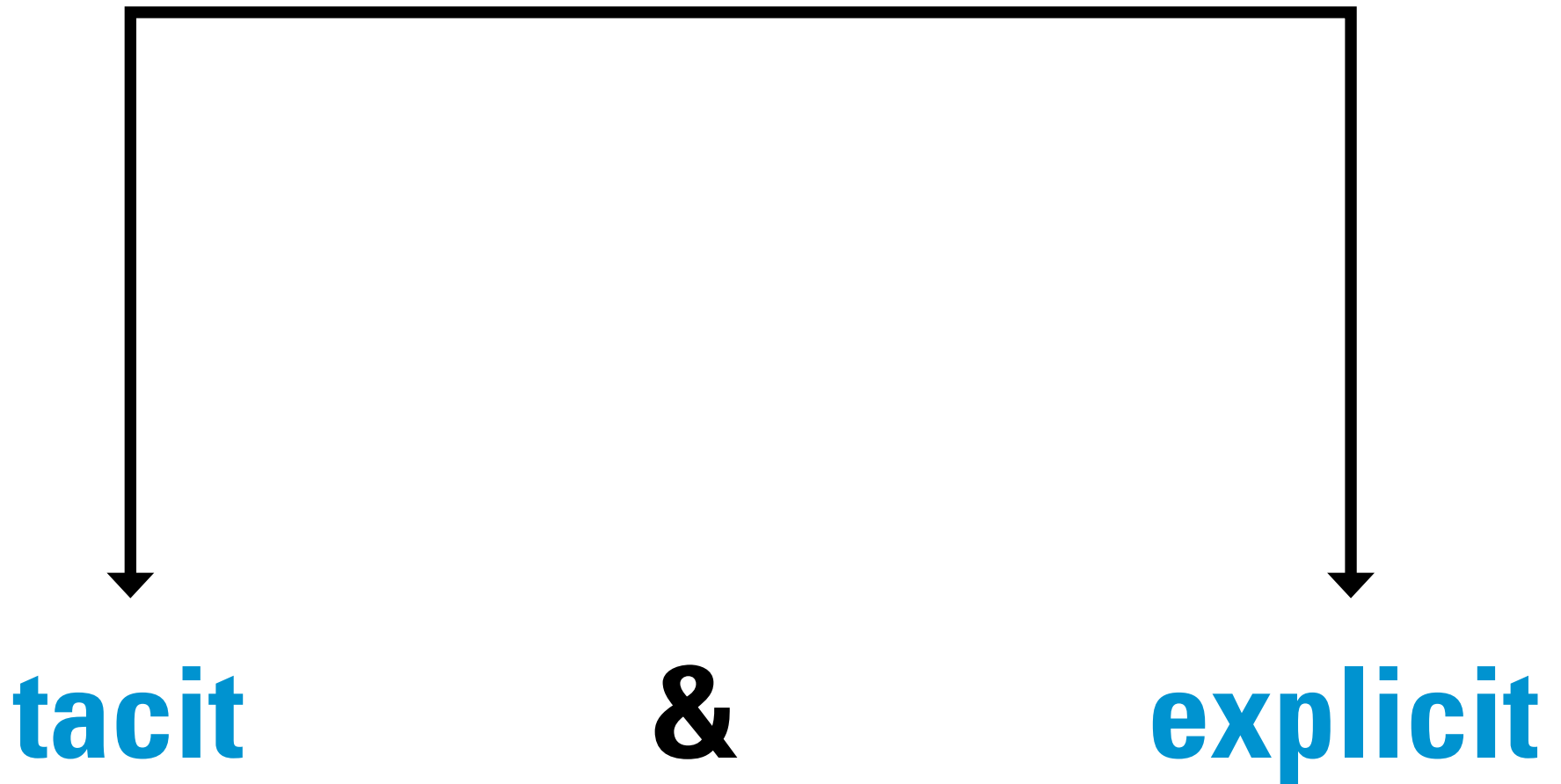
This model describes the learning process.

SECI model of knowledge creation
Ikujiro Nonaka
(1995)

Explicit$_1$

to — to

Externalization
Articulating

Articulating tacit knowledge through dialogue and reflection
5. Articulating tacit knowledge
6. Translating tacit knowledge

Combination
Connecting

Systemizing and applying explicit knowledge and information
7. Gathering and integrating explicit knowledge
8. Transferring and diffusing explicit knowledge
9. Editing explicit knowledge

Tacit$_2$

Explicit$_2$

Socialization
Empathizing

Sharing and creating tacit knowledge through direct experience
1. Walking around inside the company
2. Walking around outside the company
3. Accumulating tacit knowledge
4. Transferring tacit knowledge

Internalization
Embodying

Learning and acquiring new tacit knowledge in practice
10. Embodying explicit knowledge through action and practice
11. Using simulation and experiments

to

Tacit$_1$
Tacit$_3$

to

Individual
Group
Organization
Community of organizations
Knowledge conversion spiral

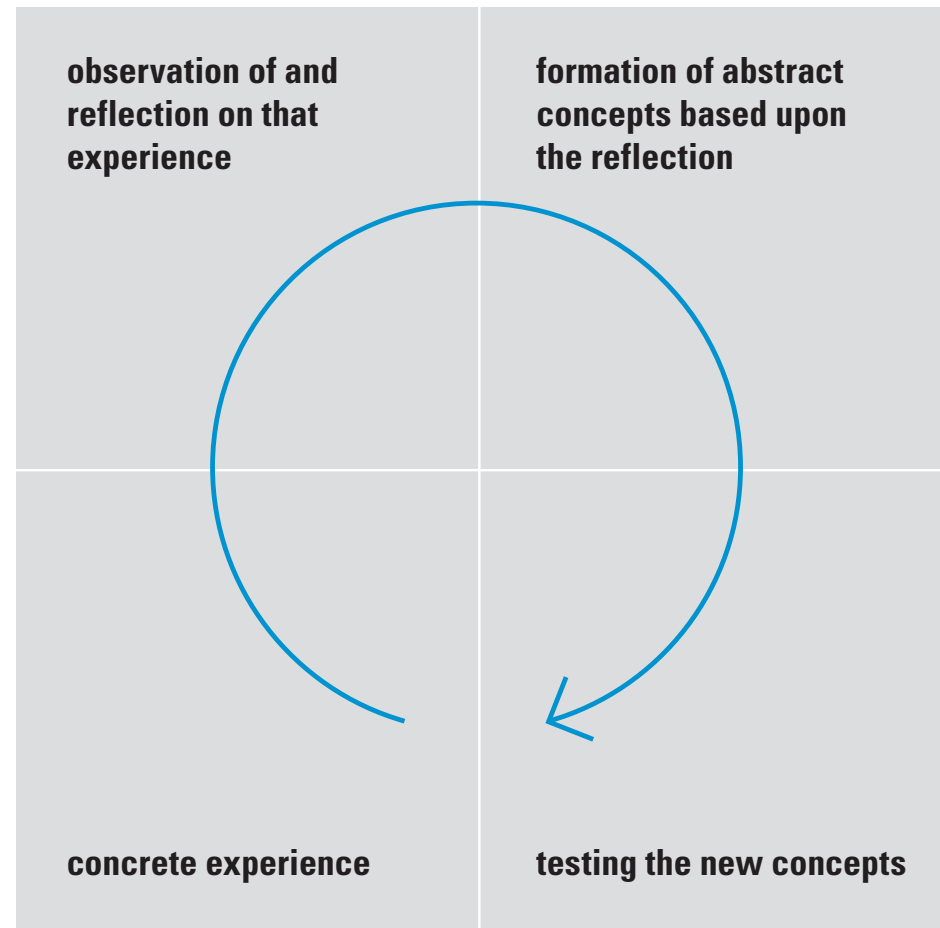# Designing is analogous to learning.
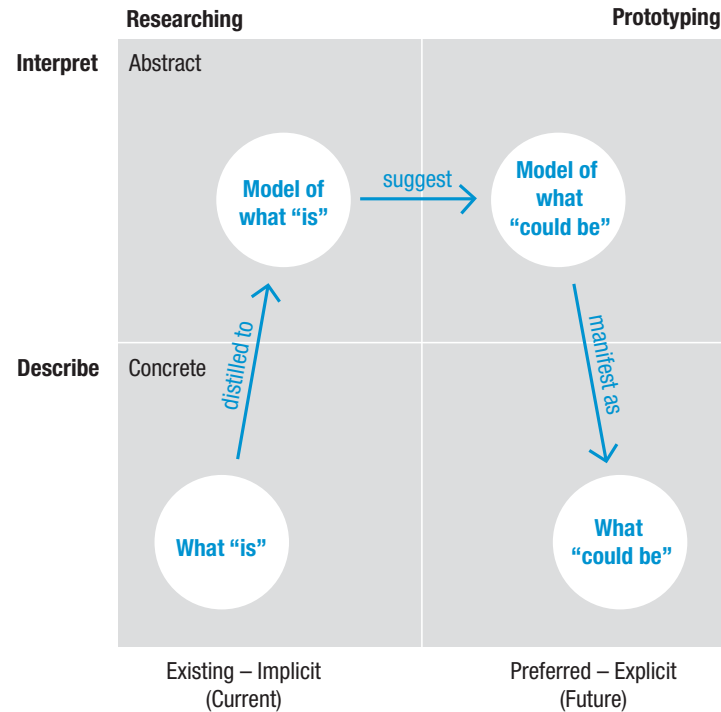
Analysis-Synthesis Bridge Model
Dubberly, Evenson & Robison (2008)
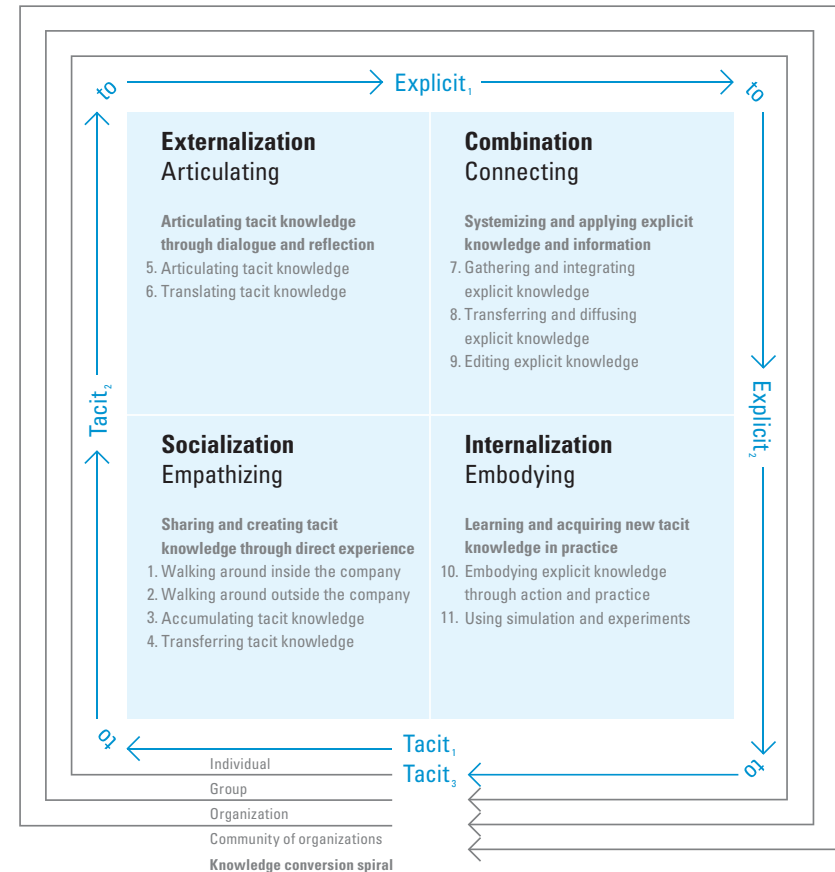
SECI model of knowledge create
Ikujiro Nonaka (1995)

12

Experiential Learning
David Kolb
(1975)

observation of and
reflection on that
experience

formation of abstract
concepts based upon
the reflection

concrete experience

testing the new concepts

13

Learning Styles
M. Tennant
(1997)

converger
(moving from generalization to
experimentation or application)

assimilator
(moving from reflection
to generalization)

accommodator
(moving from experimentation
to concrete experience)

diverger
(moving from concrete
experience to reflection)

14
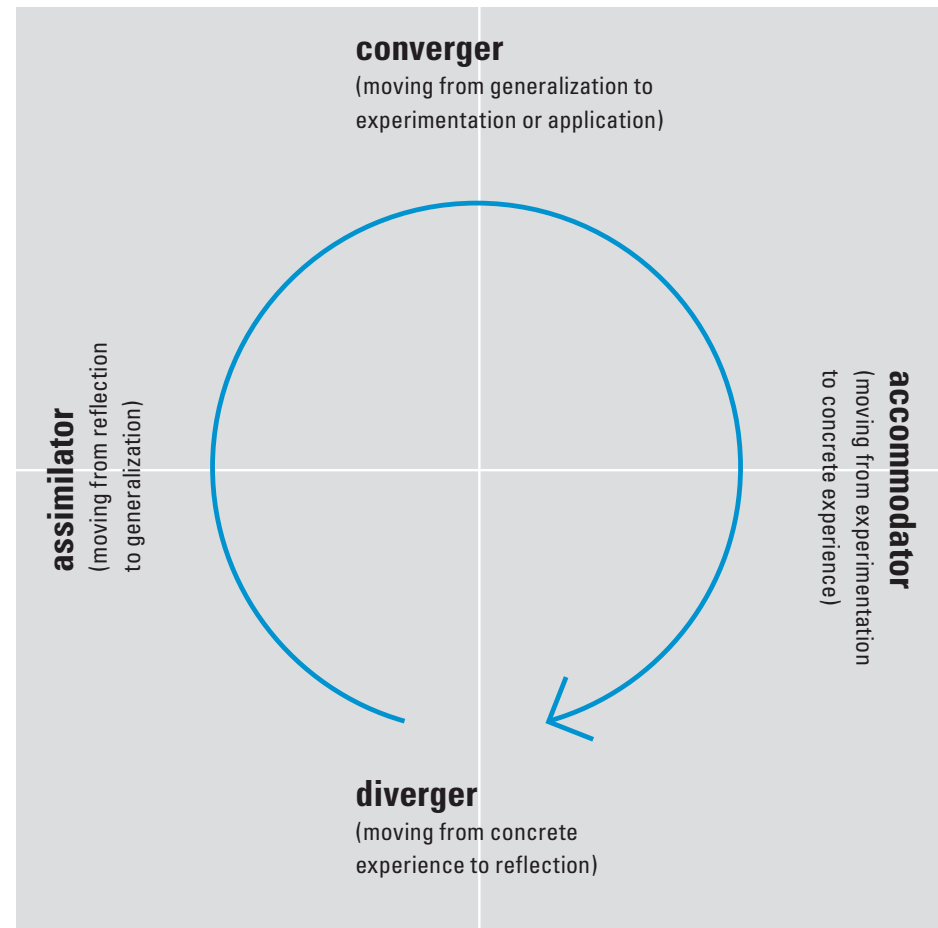
Experiential Learning Cycle
McCaffery
(1986)

process   generalize

experience   apply
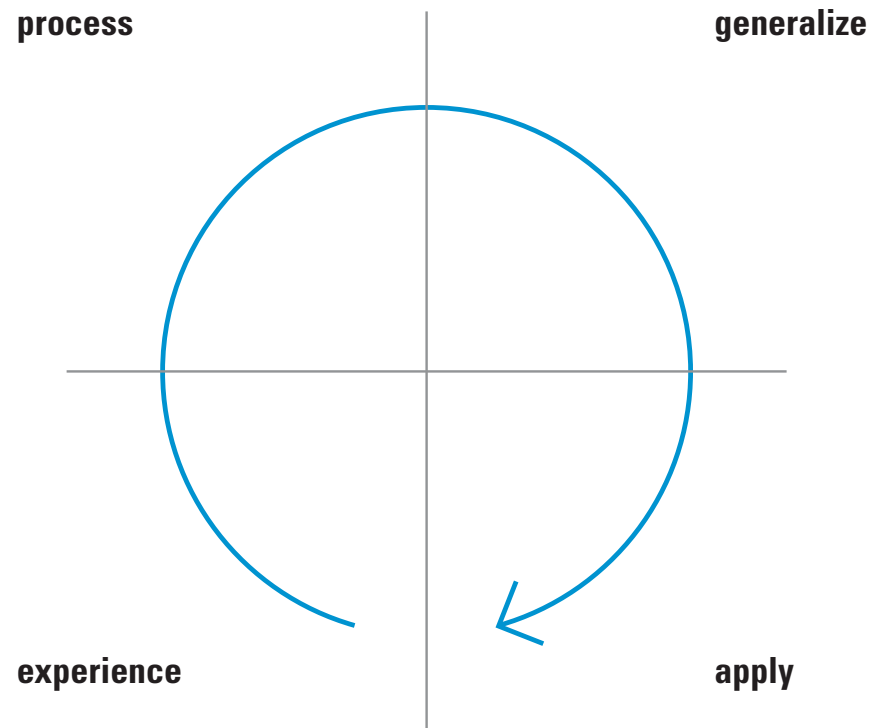
Models are a form of 'boundary object'— artifacts that bridge the gap between disciplines.

Idea   Subject   Idea

Representation
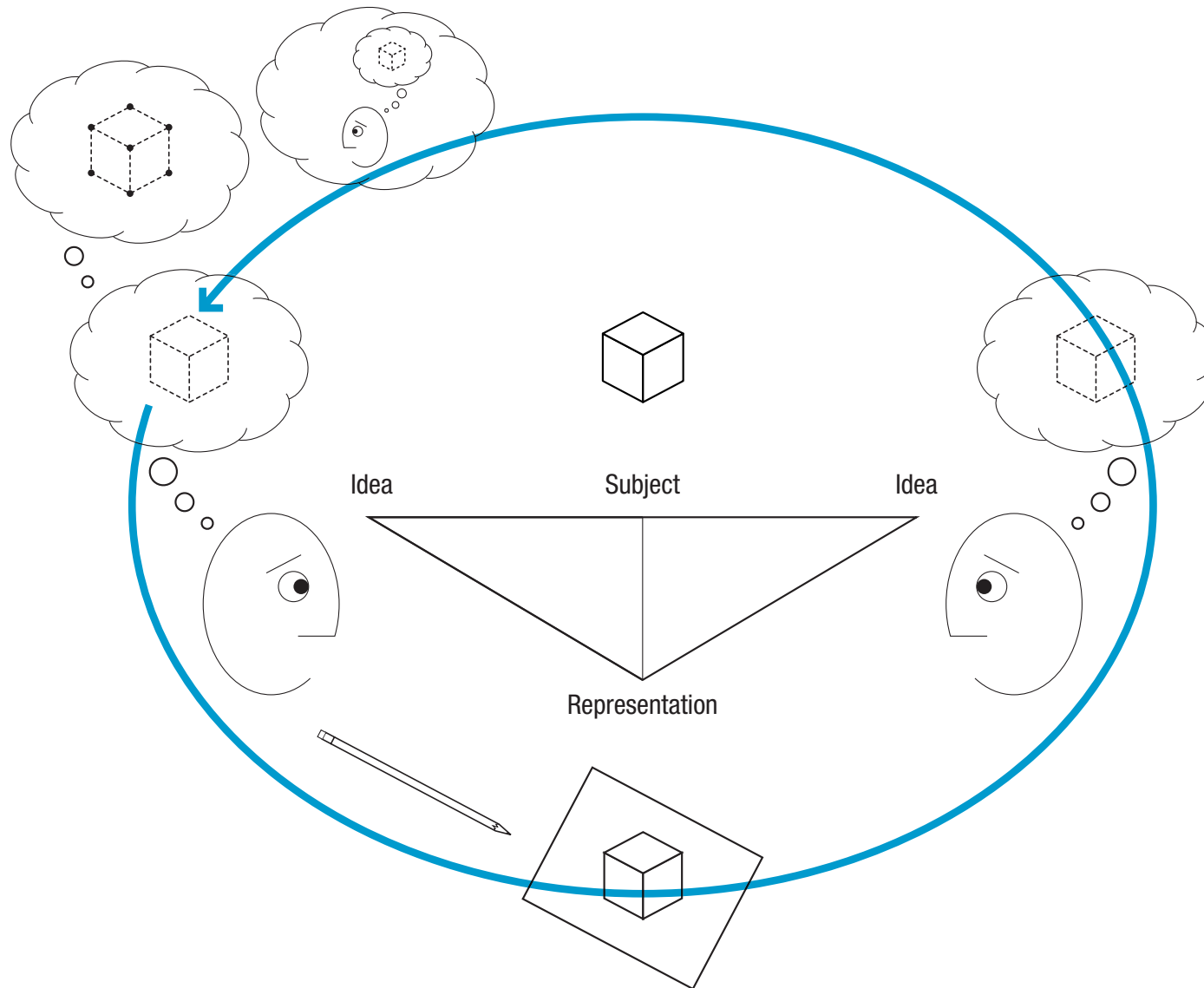
"Most scientific work is conducted by extremely diverse groups of actors . . . Simply put, scientific work is heterogeneous. At the same time, **science requires cooperation**— *to create common understandings, to ensure reliability across domains and to gather information which retains its integrity across time, space, and local contingencies."*

— Susan Leigh Star and James R. Griesemer

". . . boundary objects are produced when sponsors, theorists and amateurs collaborate to produce representations of nature. Among these objects are specimens, field notes, museums and maps of particular territories. Their boundary nature is reflected by the fact that they are simultaneously concrete and abstract, specific and general, conventionalized and customized."

— Susan Leigh Star and James R. Griesemer

"Scientists have made headway
in standardizing the interfaces
between different worlds . . .
by reaching agreements about methods,
different participating worlds establish protocols
which go beyond mere trading
across unjoined world boundaries.
They begin to devise a common coin
which makes possible new kinds of joint endeavor."

— Susan Leigh Star and James R. Griesemer

We need
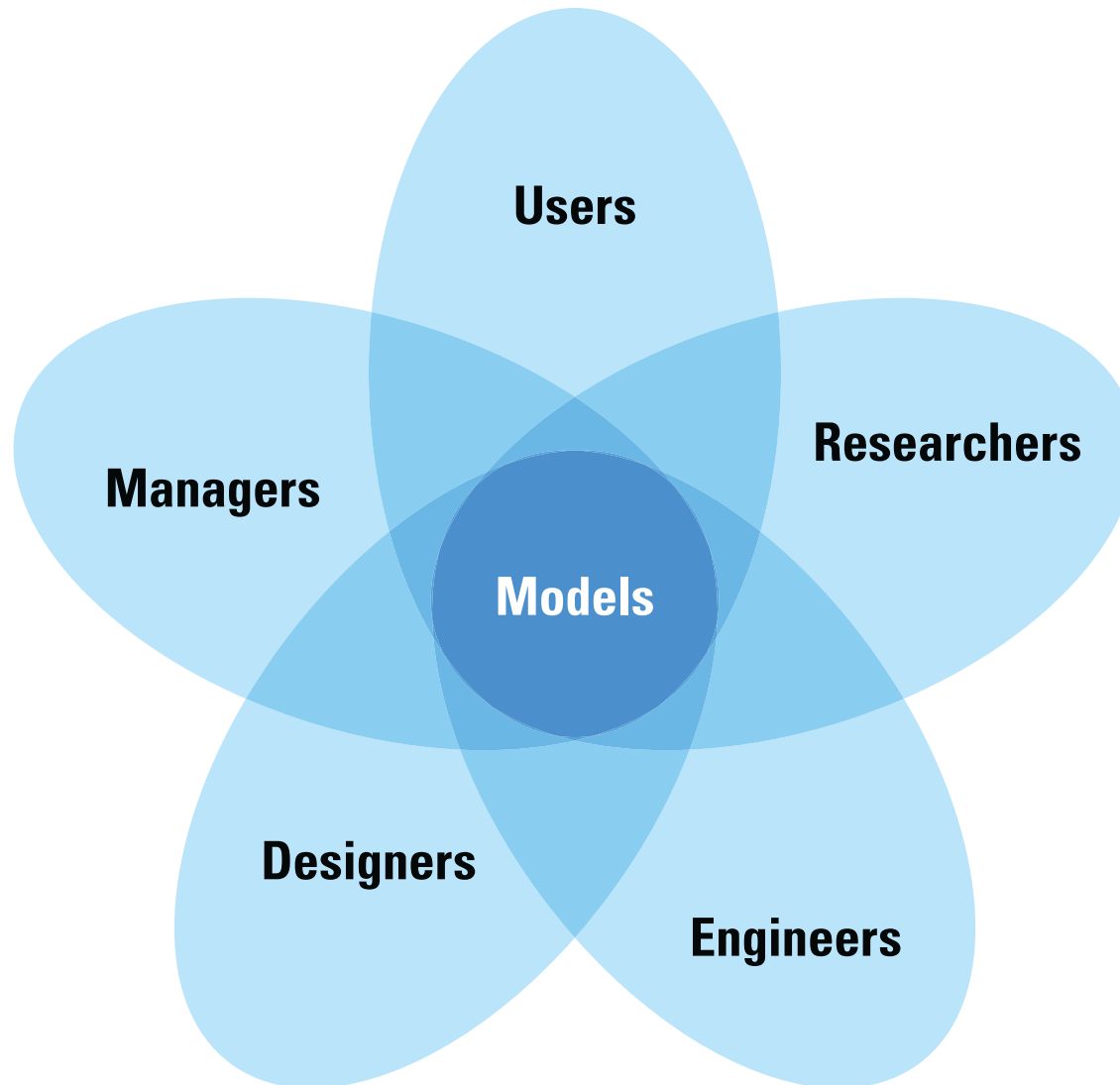# new kinds of joint endeavor.

We need to build bridges between research and design.

We need
to build design knowledge.

We need to build great products.

We need
to build systems and services.

We need to build more models.

Special thanks to
Shelley Evenson
Michael Gallagher
Paul Pangaro
Rick Robinson

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www.dubberly.com/presentations/EPIC_2011.pdf