Administrative Stuff

Info on the presentation posted on the website

Order will be by group number

Any other questions?

Last Week

What is the difference between *taxonomy* and *taskonomy*?

What is the CI motto? "The user is . . . "

What is the core premise of CI?

What are four principles of CI?

What does the master-apprentice relationship involve?

What is a "think-aloud?"

What does "withdraw and return" means?

Last Week

How does affinity diagramming help us?

What are some roles that the CI team members can play in focus meetings?

What are the five work models?

What are key components of the sequence model?

Intent, triggers, breakdowns

What kinds of observations pose opportunities for design?

Describe the difference between flow and communication models

Sketching

Irene Rae
Computer Sciences
University of Wisconsin–Madison

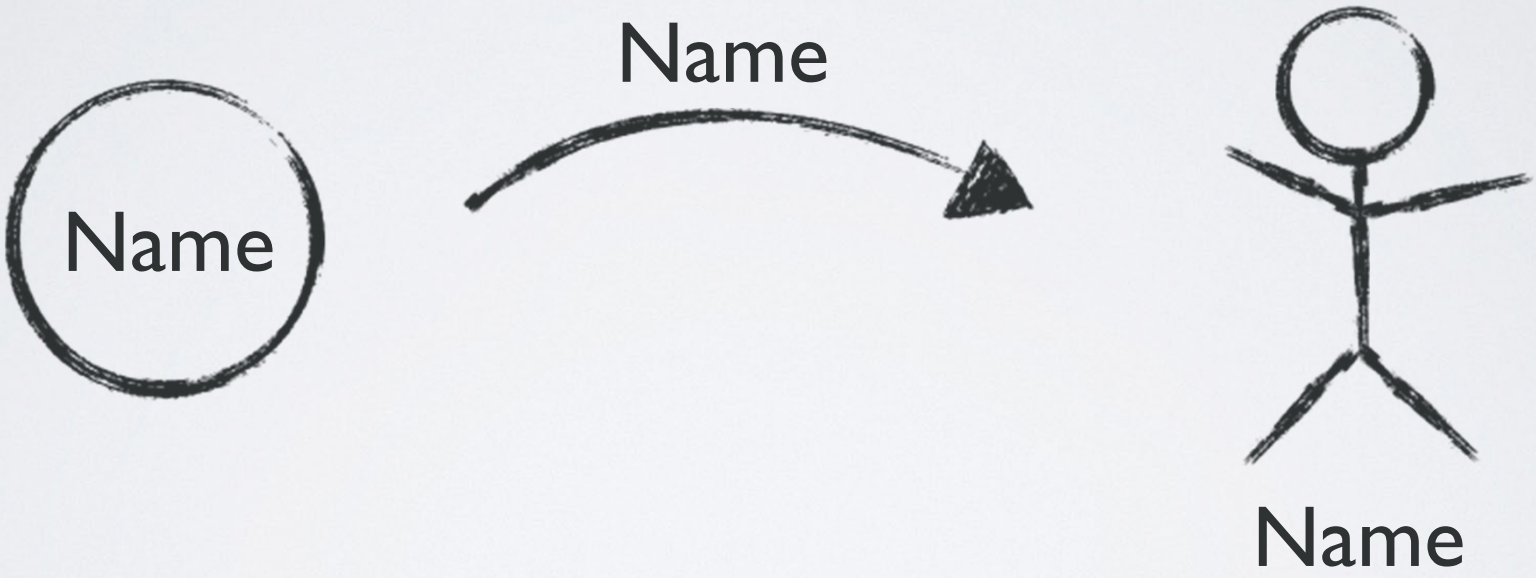
CS-570 Introduction to Human-Computer Interaction

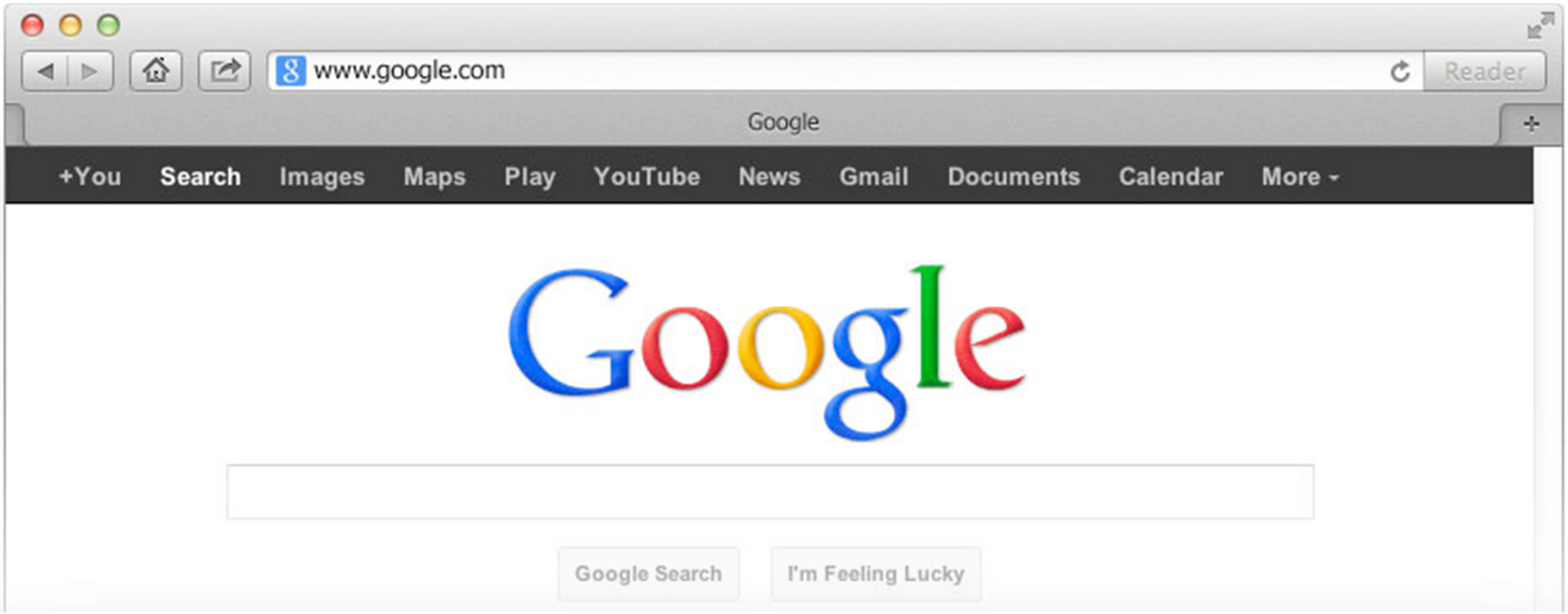
Today:
Sketching Ideas

TopHat Question

Sketching

Sketching Models

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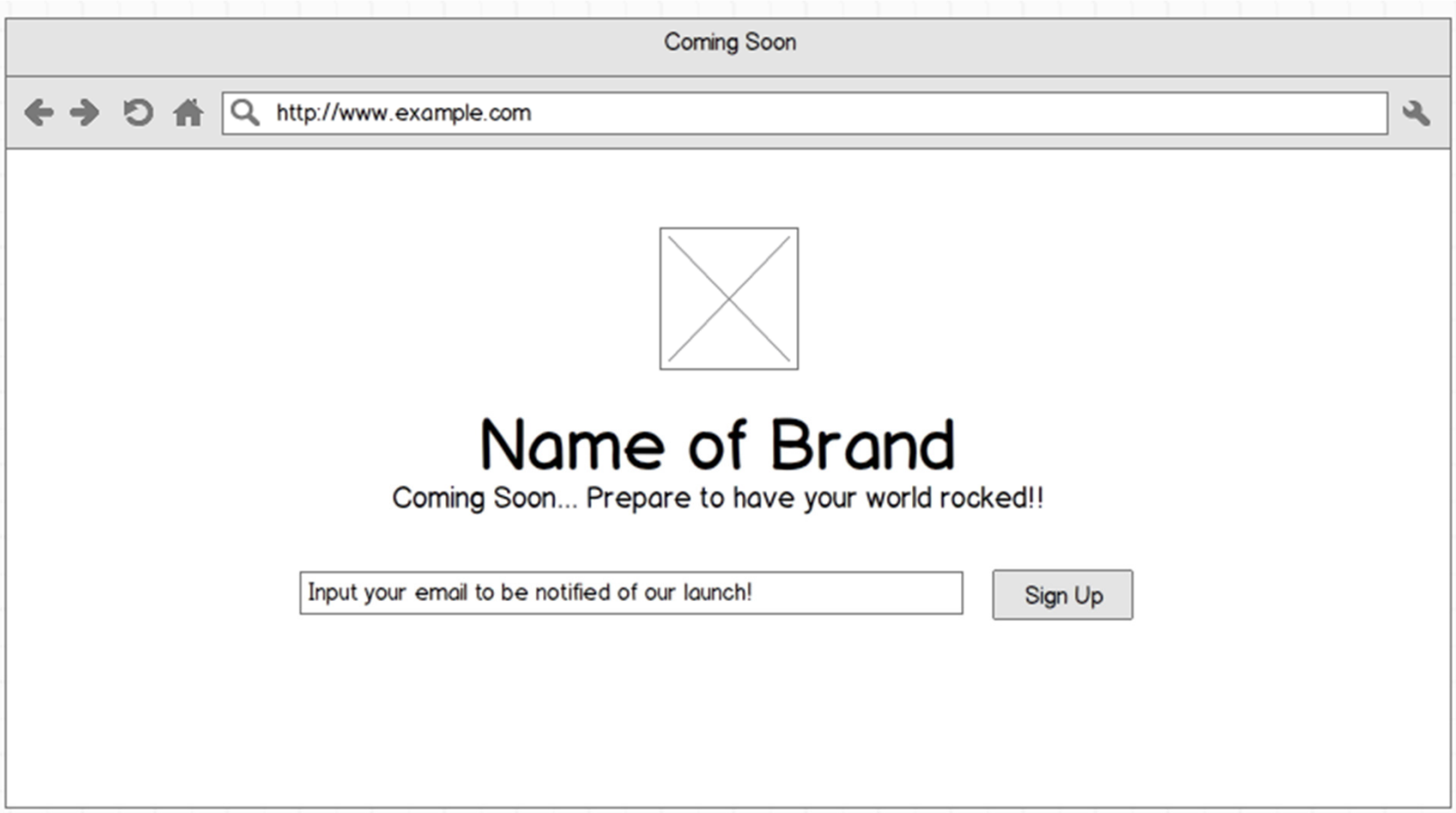
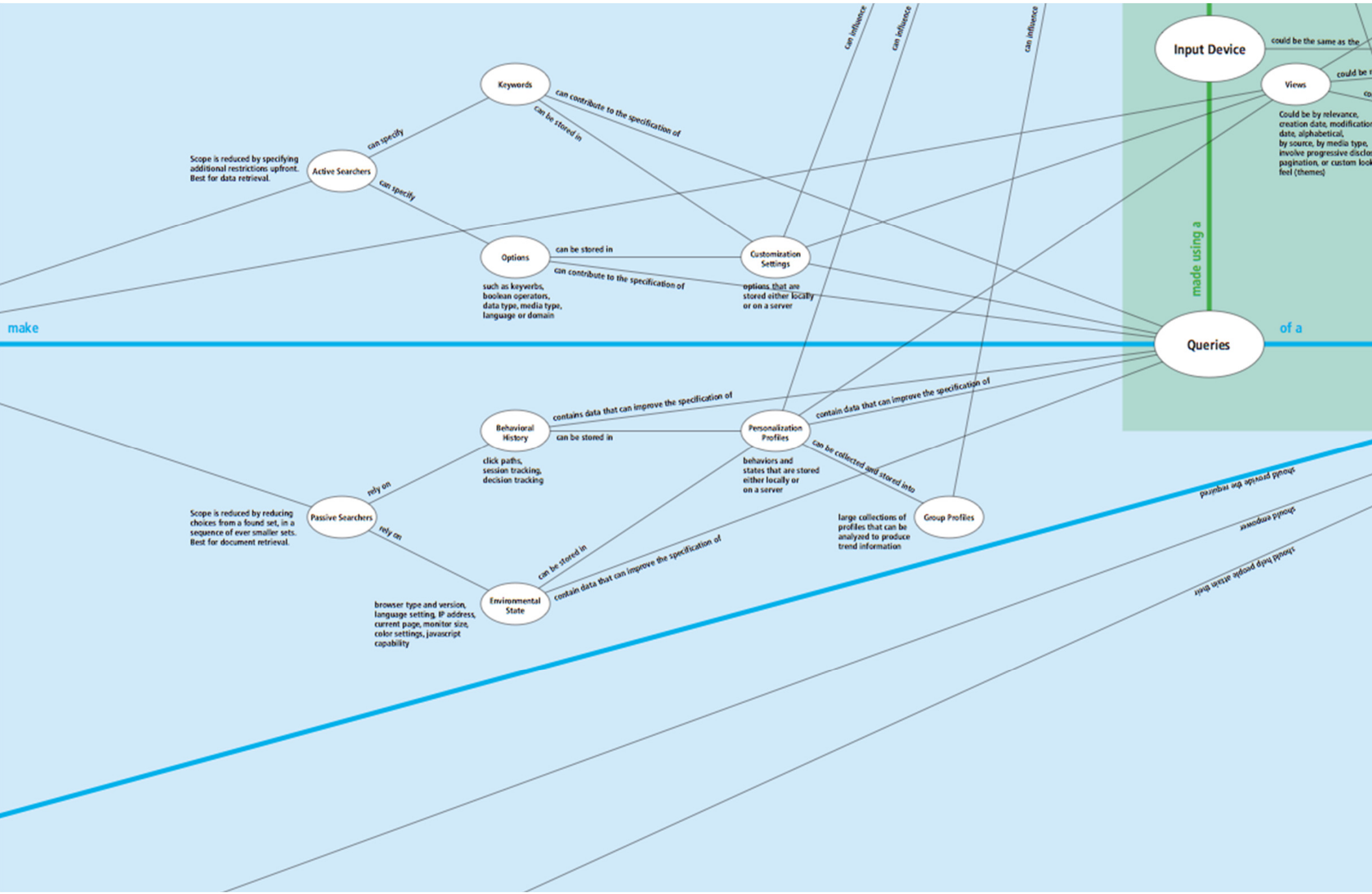

Coming Soon
http://www.example.com
Name of Brand
Coming Soon... Prepare to have your world rocked!!
Input your email to be notified of our launch!
Sign Up



A model of search

Sketching Models

Based on “Models of Models” by Hugh Dubberly

What is a Model?

Models are ideas about the world — how it might be organized and how it might work.

E.g., the sun rises in the east, moves across the sky, and sets in the west. Or the earth orbits the sun.

What is a Model?

Models describe...

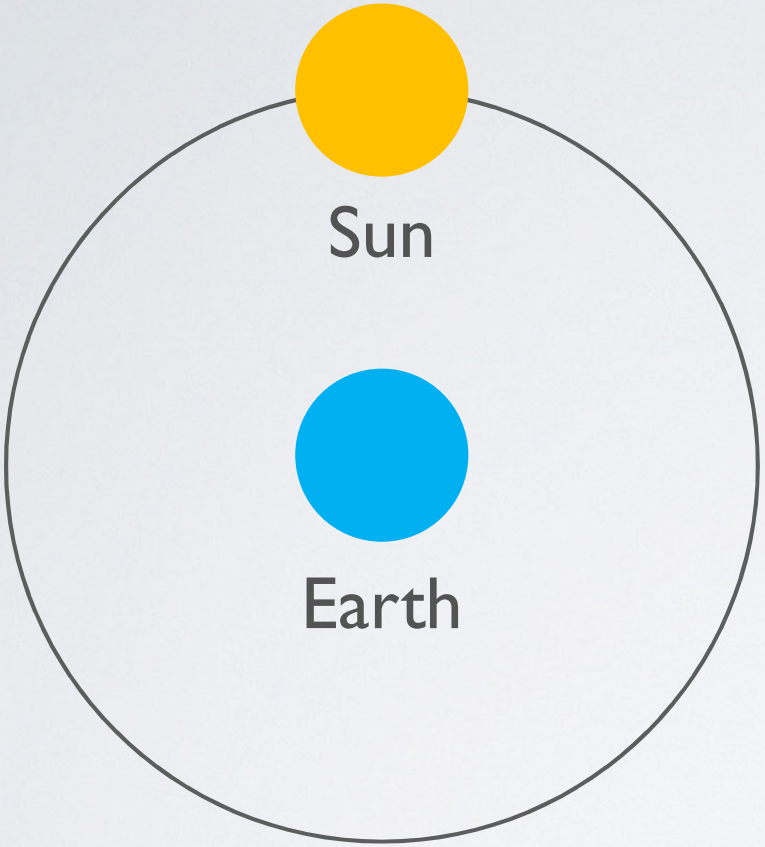
Relationships,

Parts that make up wholes,

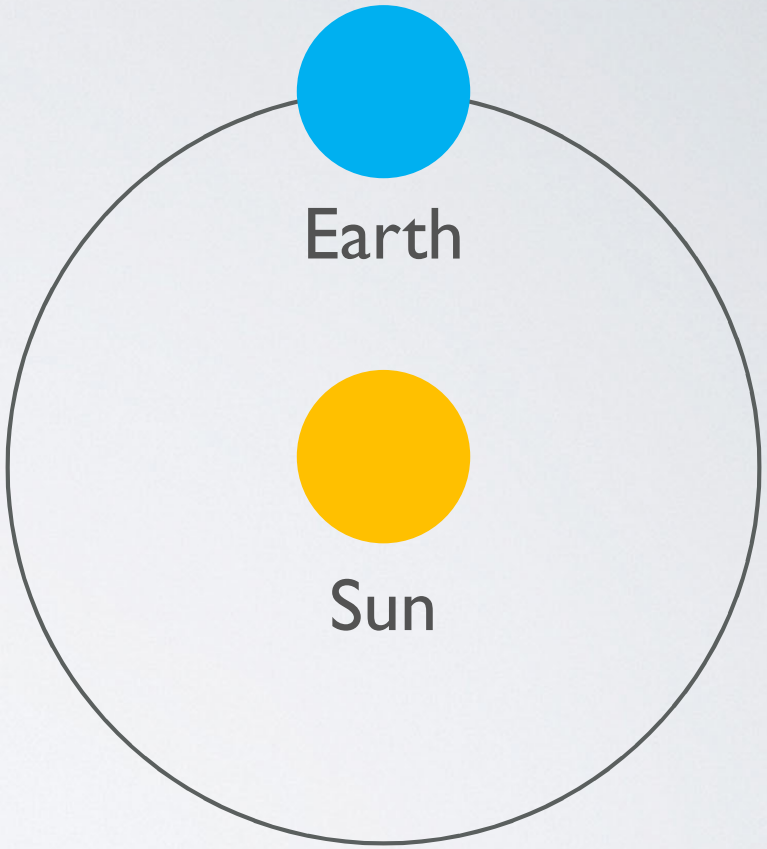
Structures that bind them,

How parts behave in relation to one another.

What is a Model?



A representation of the Ptolemaic model of the "world system"— a geocentric view.



A representation of the Copernican model of the "solar system"— a heliocentric view.

What is a Model?

"A *useful* representation of how experience is organized for (the user/stakeholder) and a brief explanation of each part of it."

— *Rick Robinson*

A framework or conceptual model represents some aspect of the experience such as elements, organization, dynamism or movement, scale or behavior over time.

What Are Models Good For?

Models

Supports sense-making.

Support communication and learning.

Help bridge the gap between observing and making, between research communities and design communities.

Integrate your data or findings from research into a meaningful structure or map of the opportunities they present.

Help you think.

Models for Sense-making

Now in trying to account for the behavior of a complicated system, the scientist has first to represent it in the formal terms [the scientist] knows how to manipulate…

The formal representation of the system that [the scientist] builds in called a model. This model is something different than the diagrams that are drawn.

— *Stafford Beer*

Models for Sense-making

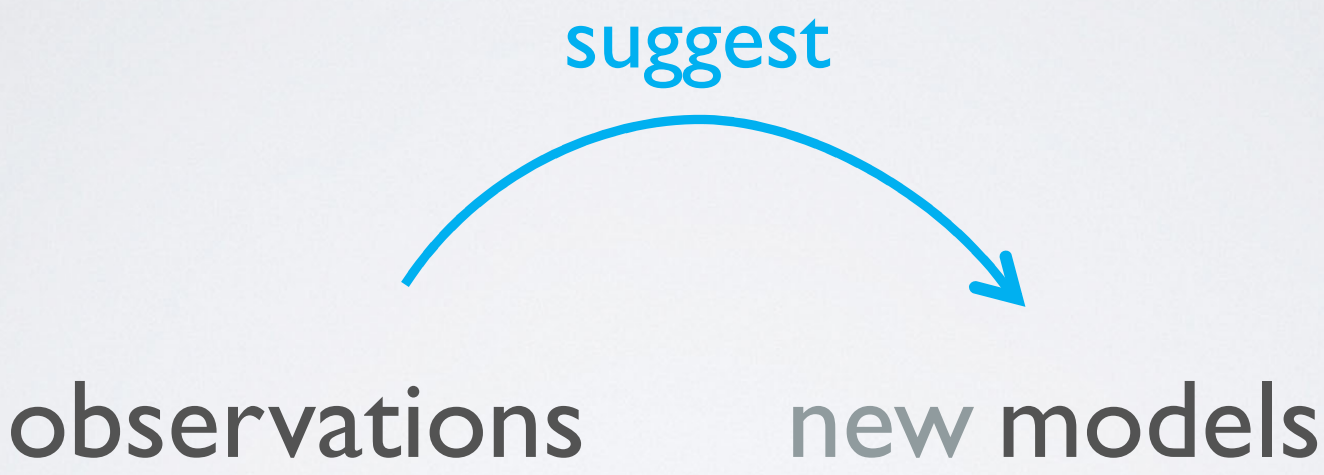
Models are our voodoo dolls.

We do most of our thinking in models.

— *Alan Kay*

Where Do Models Come From?

Models begin with things or events that we observe.



Models as Theories

Models are *conjectures*, *hypotheses*, *theories*.

We create models "inferring the most likely story to explain the evidence."

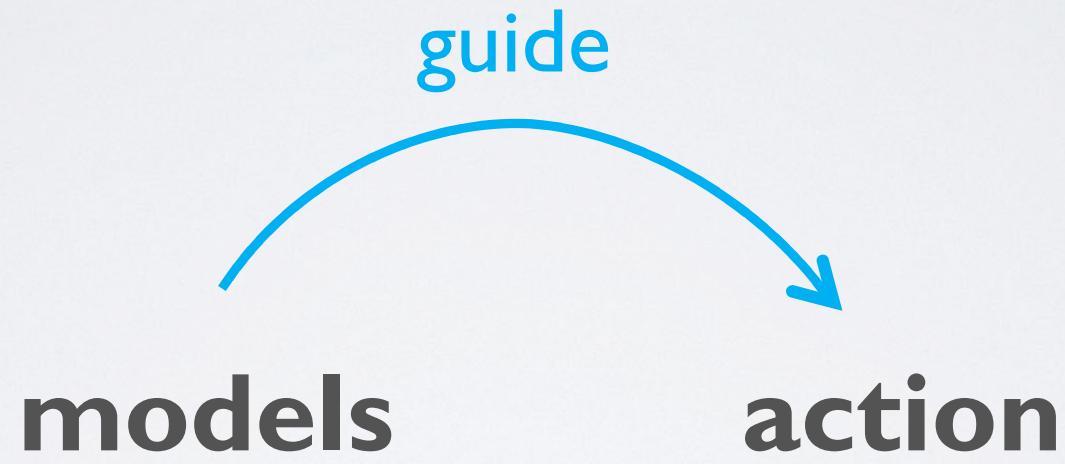
Models help us recognize new situations as similar to others we have encountered.

Without a model, recognizing the similarities might be difficult.

Models also help us predict likely futures: what actions other actors may take, consequences of those actions, and what actions best respond to threats or most efficiently help us pursue our goals.

Where Do Models Take Us?

Models lead to action.



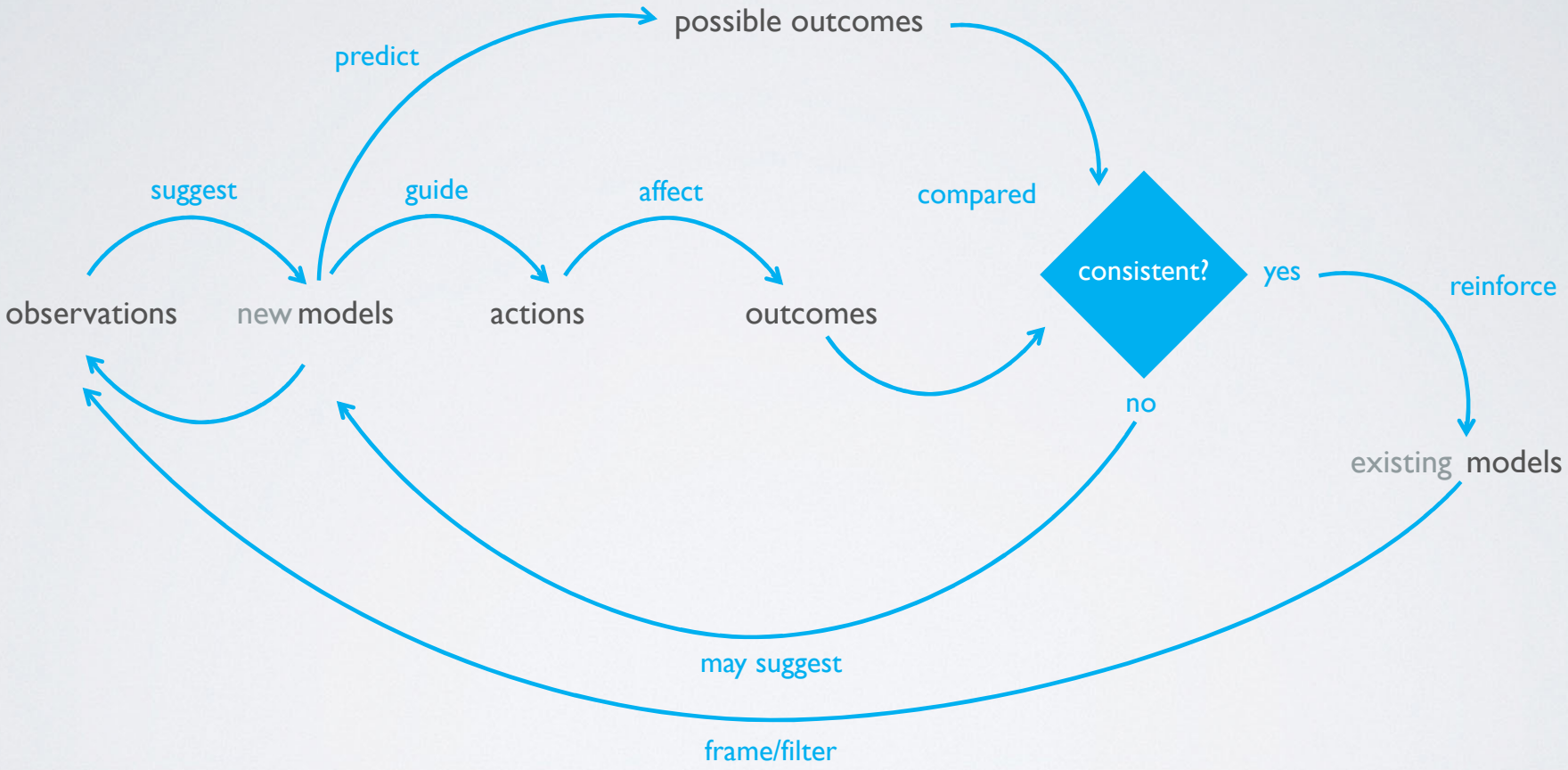
Models Evolve

Learning involves forming models and reforming them based on feedback.

We observe some behavior in our environment; it suggests models, which we use to predict future behavior and guide our actions.

Additional observations provide feedback, which helps us revise and refine our models — we learn.

MODELS EVOLVE



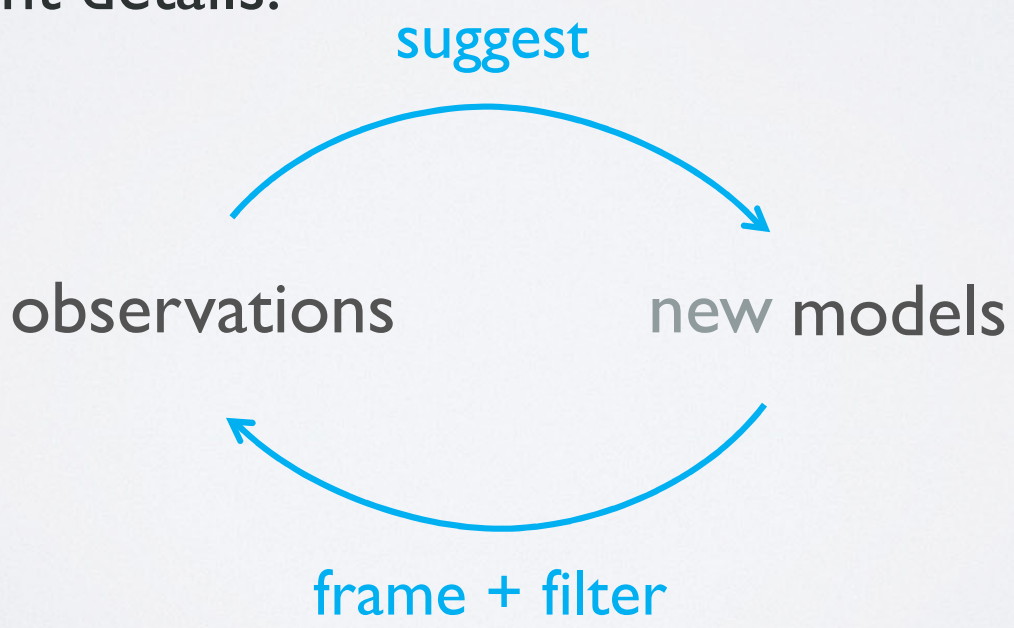
Models Affect What We See

Observations shape models;

Models also shape what we see — what we let ourselves notice.

Models [are] so powerful in affecting what we do... because they affect what we see. Two people with different mental models can observe the same event and describe it differently, because they've looked at different details.

— *Peter Senge*



Thinking Outside The Box

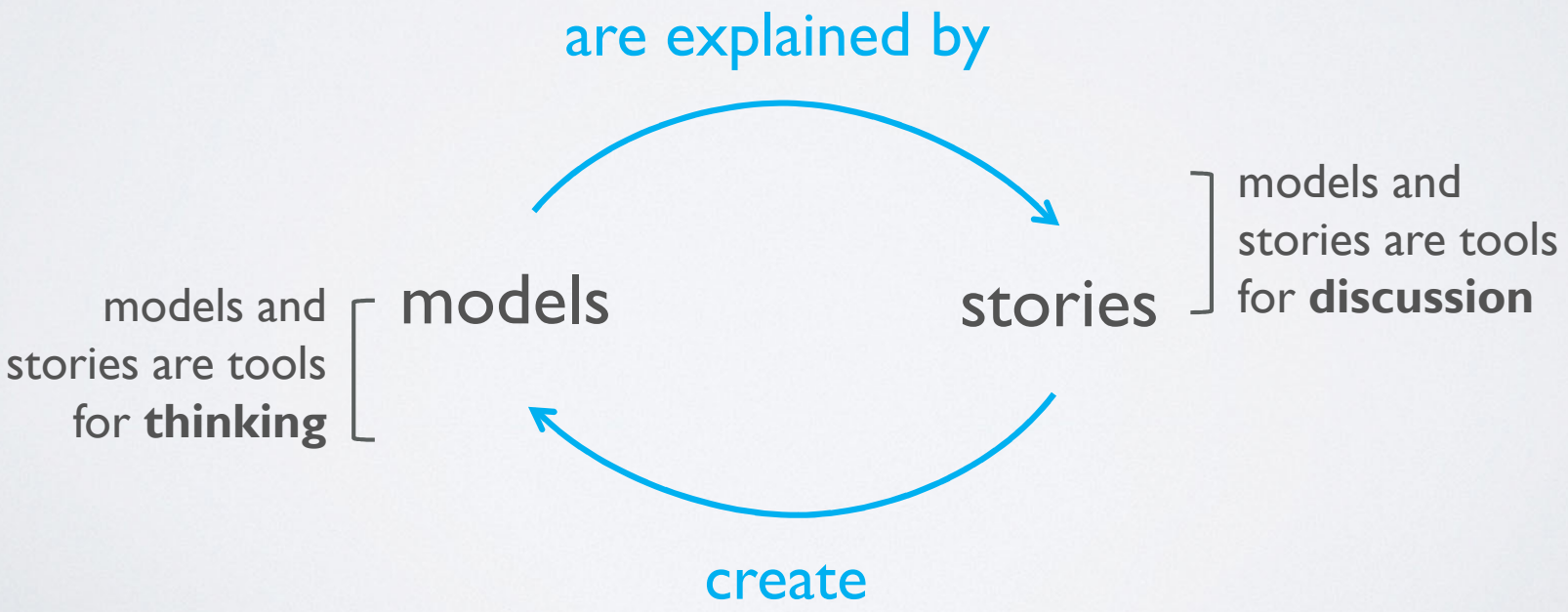
Creating or revising a model is meta-activity, taking us outside the primary activity in which we were engaged. It requires attention, energy, and time.

— *Hugh Dubberly*

Models as Stories

Models are closely tied to stories.

We explain models by telling stories, and when we tell stories, listeners form models—mental pictures of the actors, how they are related, and how they behave.



Sharing Models

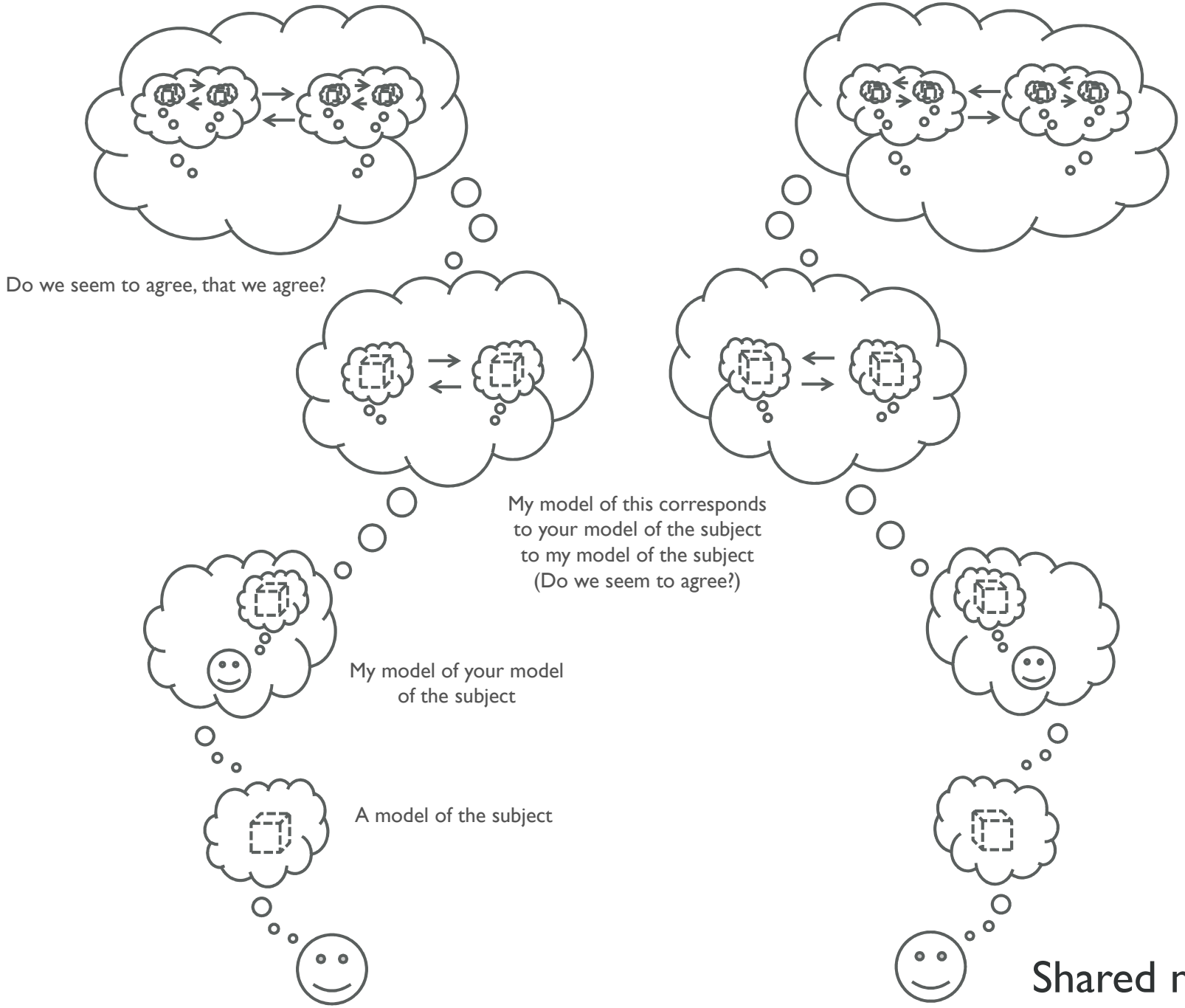
Models are “boundary objects,” artifacts that enable discourse at the boundaries between communities of practice. — Susan Star

By sharing our models, we may be able to confirm where we agree—and discover where we disagree.

Models

Provide a basis for shared understanding, agreement, and group action.

Build trust and enable collaboration.



Sharing Models

Shared models are the basis for understanding, agreement, and action.

Models in Design

Models and *modeling* are the heart of all design.

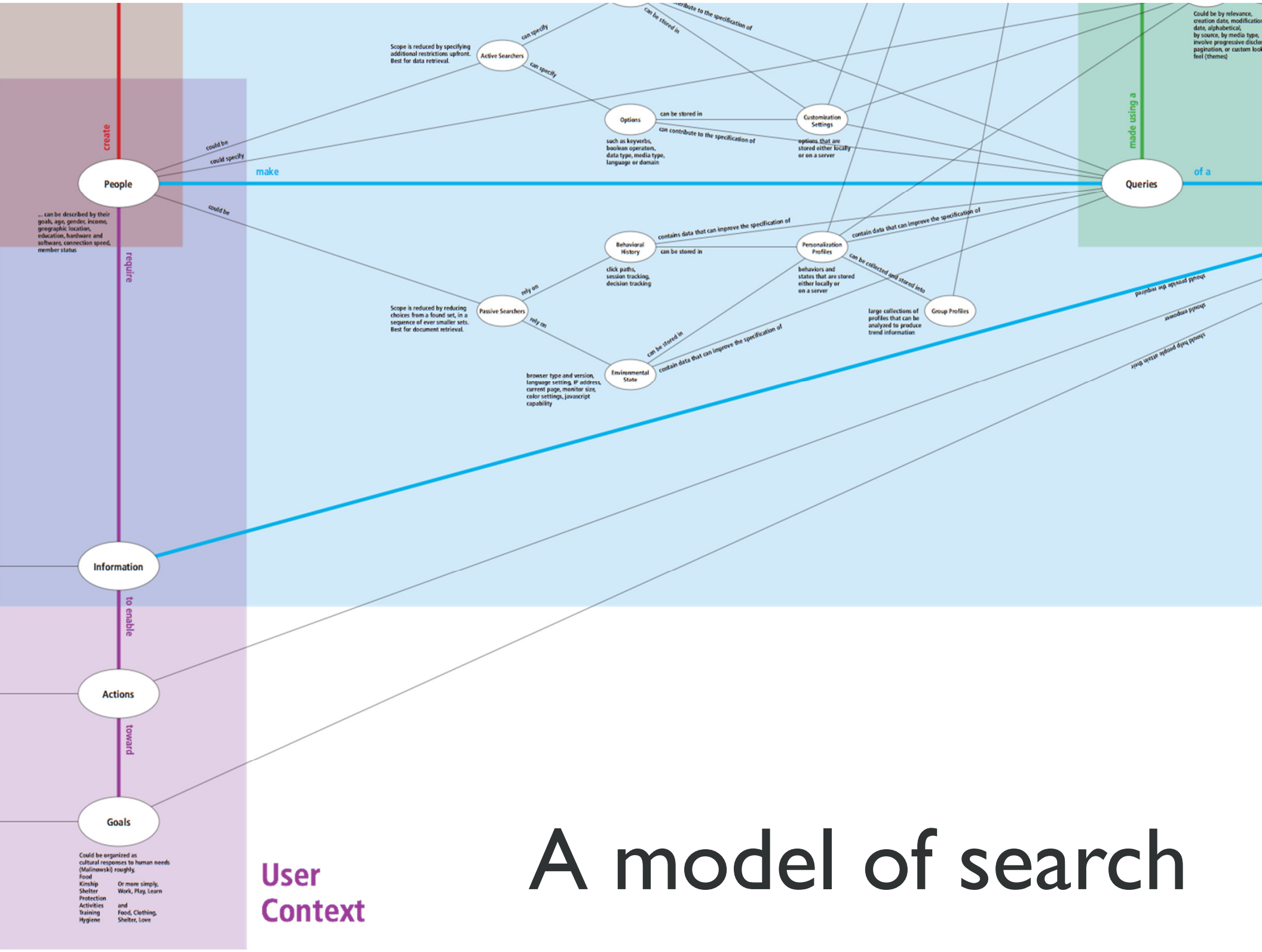
Services and computer applications are partly hidden.

Can stretch across time and space.

Cannot be seen all at once or from a single vantage point.

Models stand in for systems during analysis, design, operation.

Using models, designers can unify otherwise separate artifacts and actions.



A model of search

"… is the Essence of Design."

"Drawing is the essence of design."

— *Bill Buxton*

"When attention turns to systems, modeling becomes the essence of design."

— *Hugh Dubberly*

Drawing ~ Modeling

Sketching ~ Modeling

Advantages & Dangers

"The advantages and dangers of models are well known.

The advantage is in the fact that this is the way to create a theory—i.e., the model permits deductions from premises, explanation and prediction, with often unexpected results.

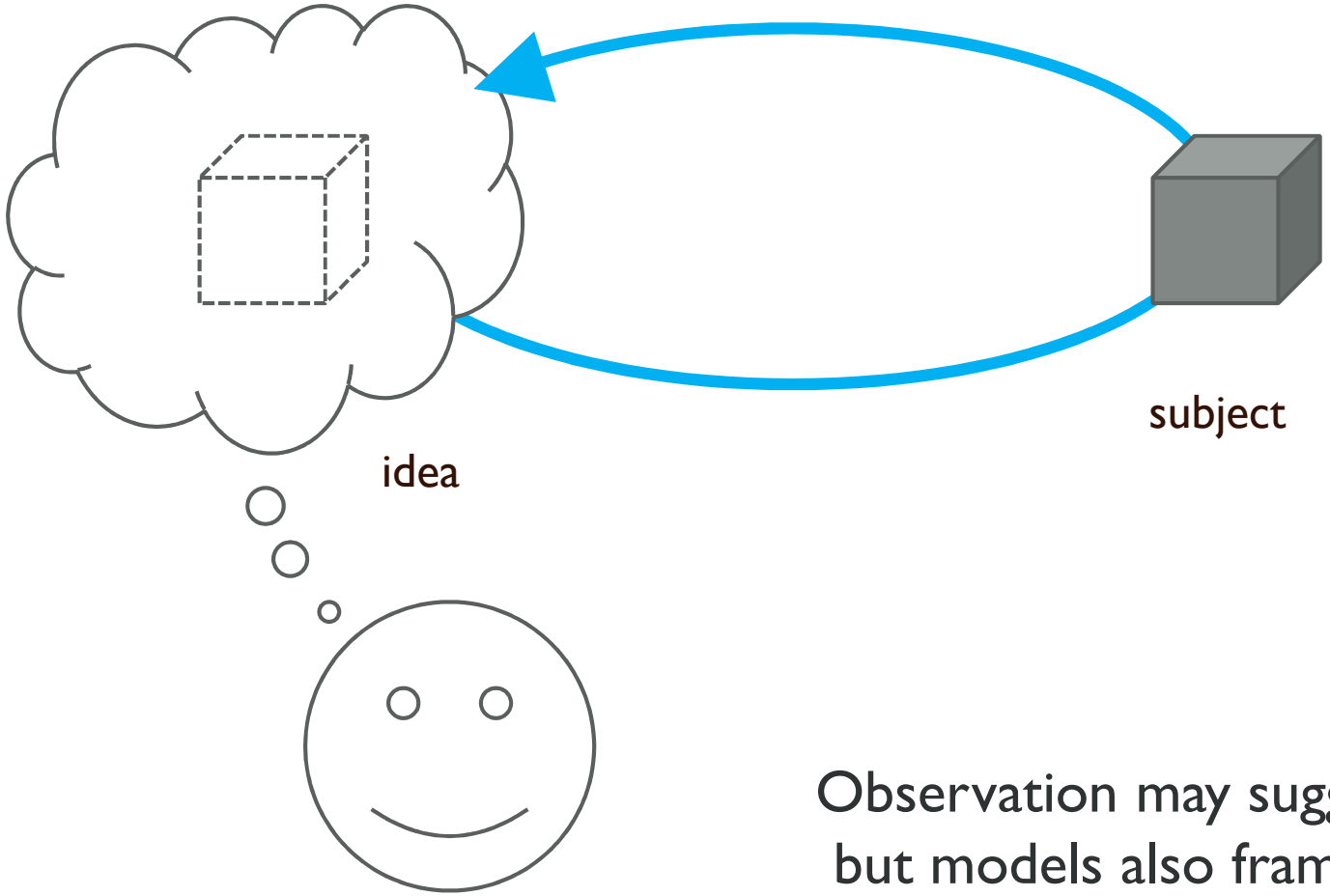
The danger is oversimplification: to make it conceptually controllable, we have to reduce reality to a conceptual skeleton—the question remaining whether, in doing so, we have not cut out vital parts of the anatomy.

The danger of oversimplification is greater, the more multifarious and complex the phenomenon is."

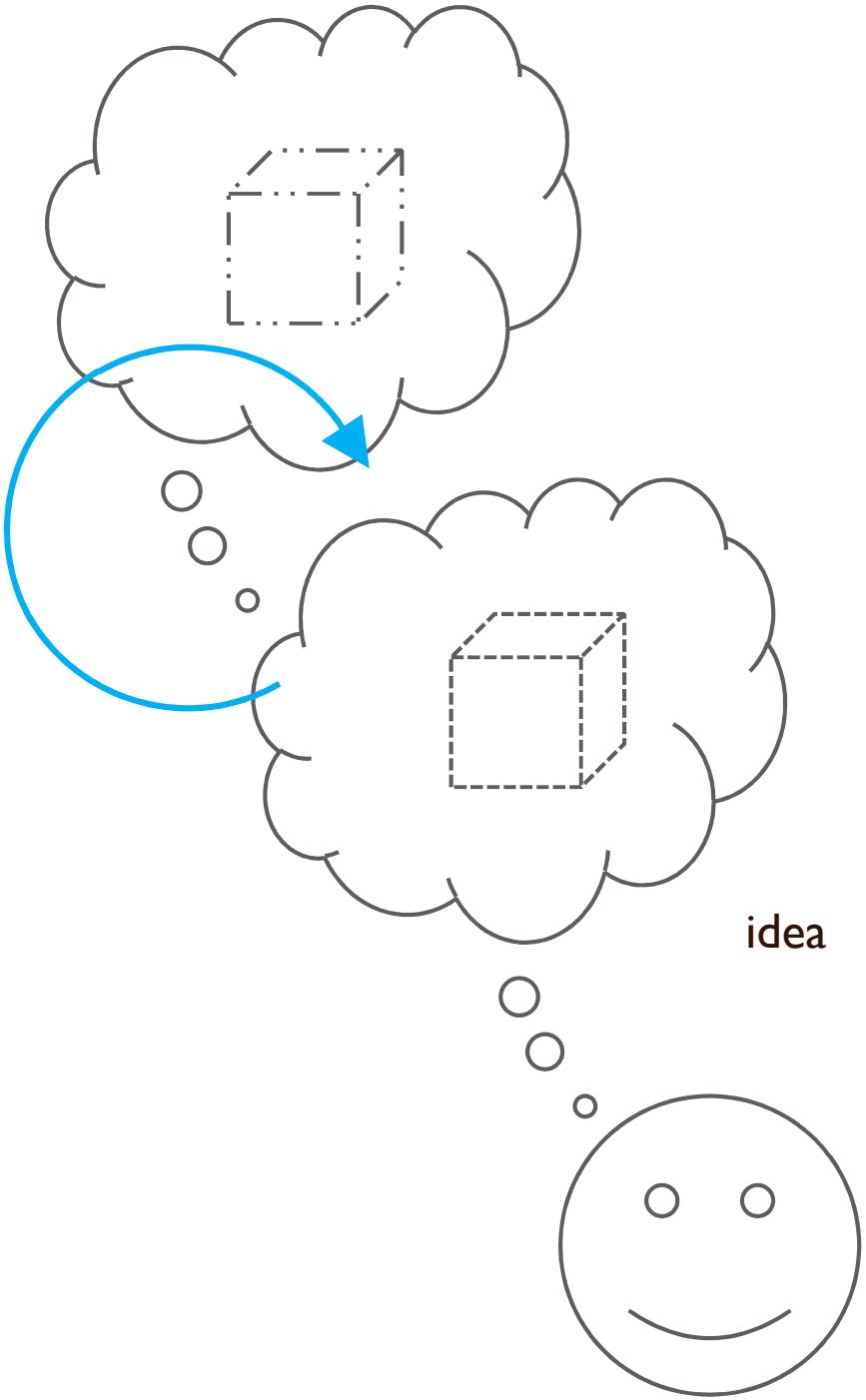
— *Von Bertalanffy*

Questions?

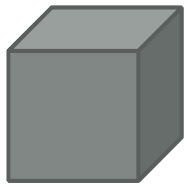
A Process of Modeling



Observation may suggest models, but models also frame and filter observations.



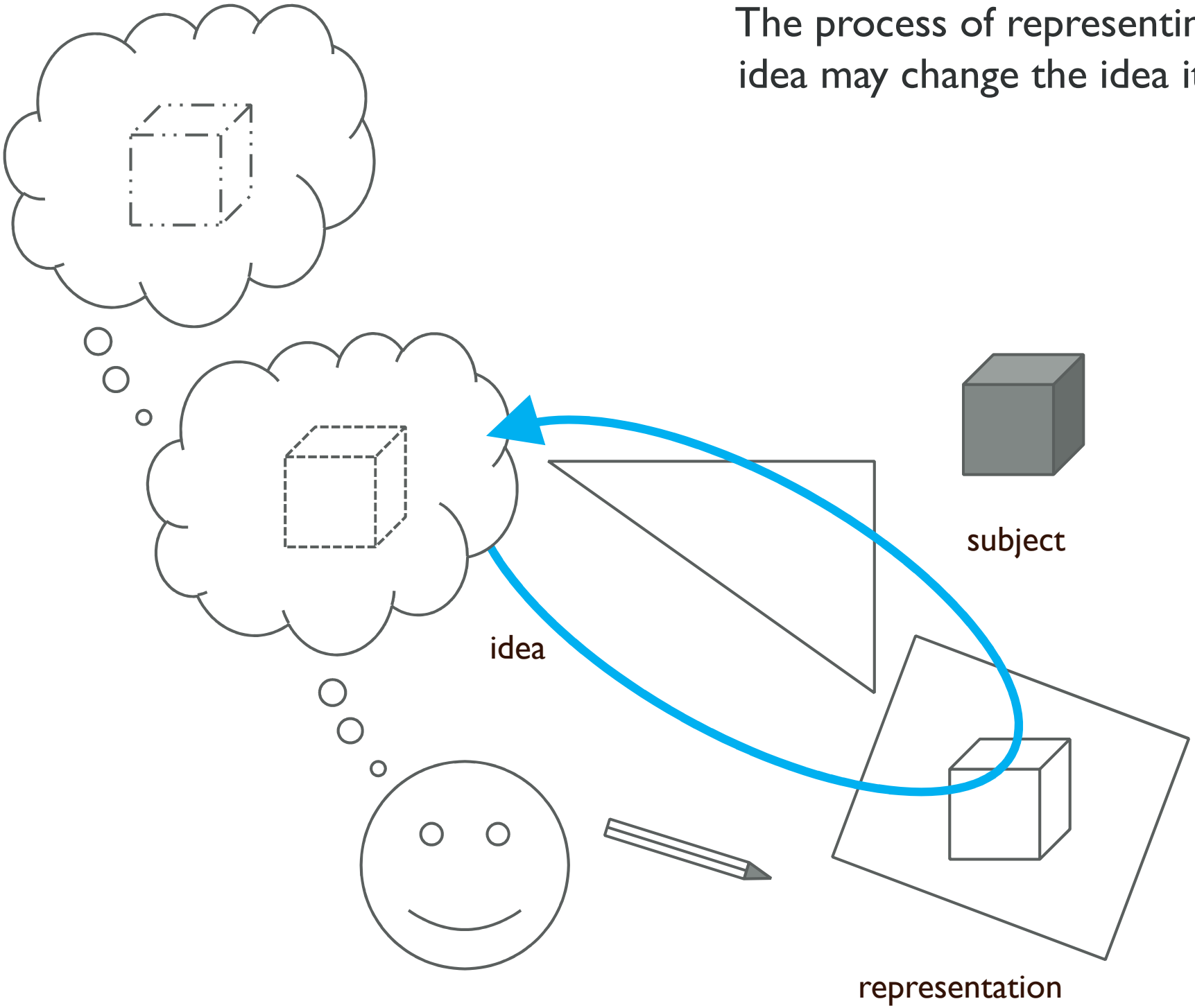
idea



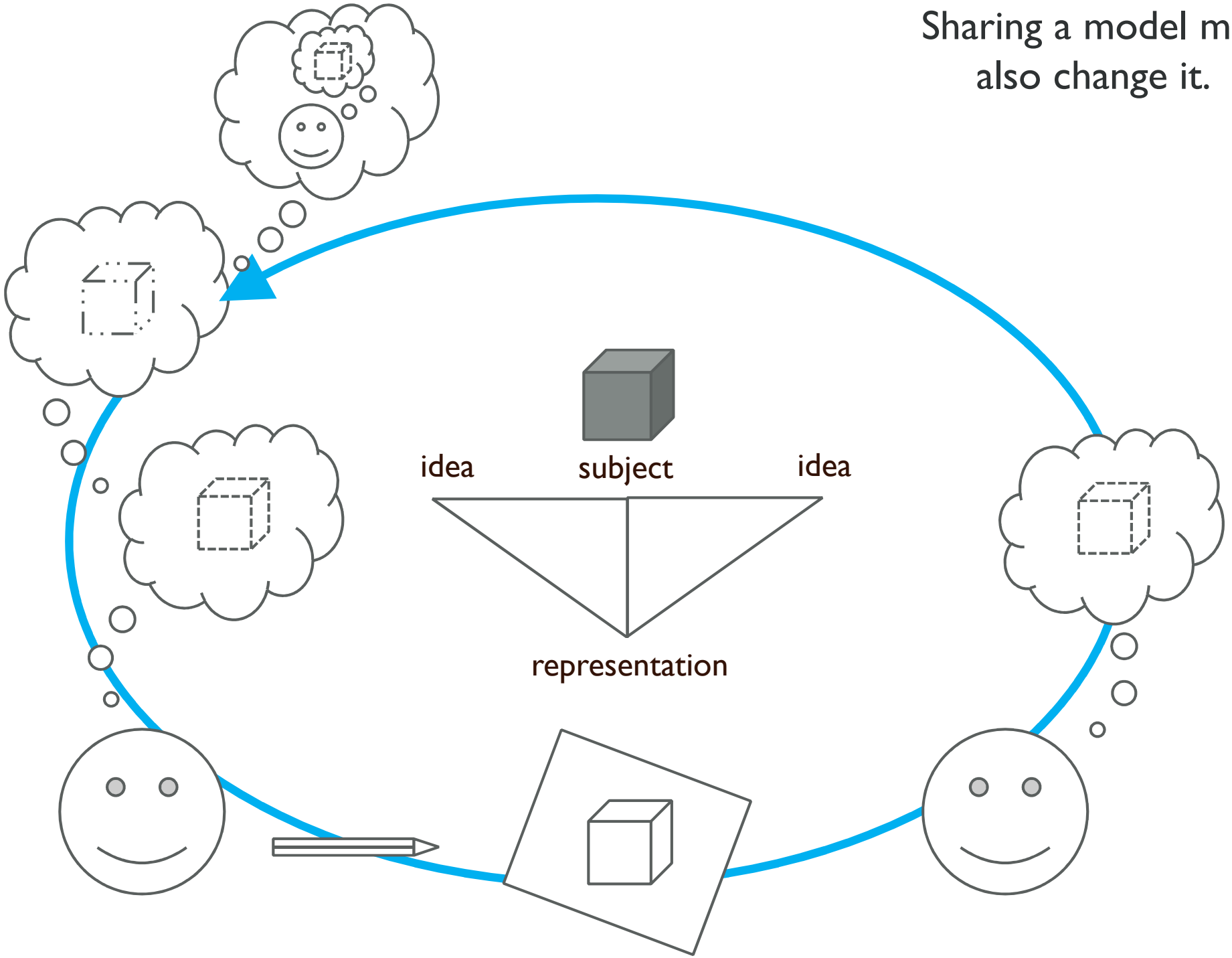
subject

Thinking about how to explain our observations may lead us to think of alternatives or related ideas.

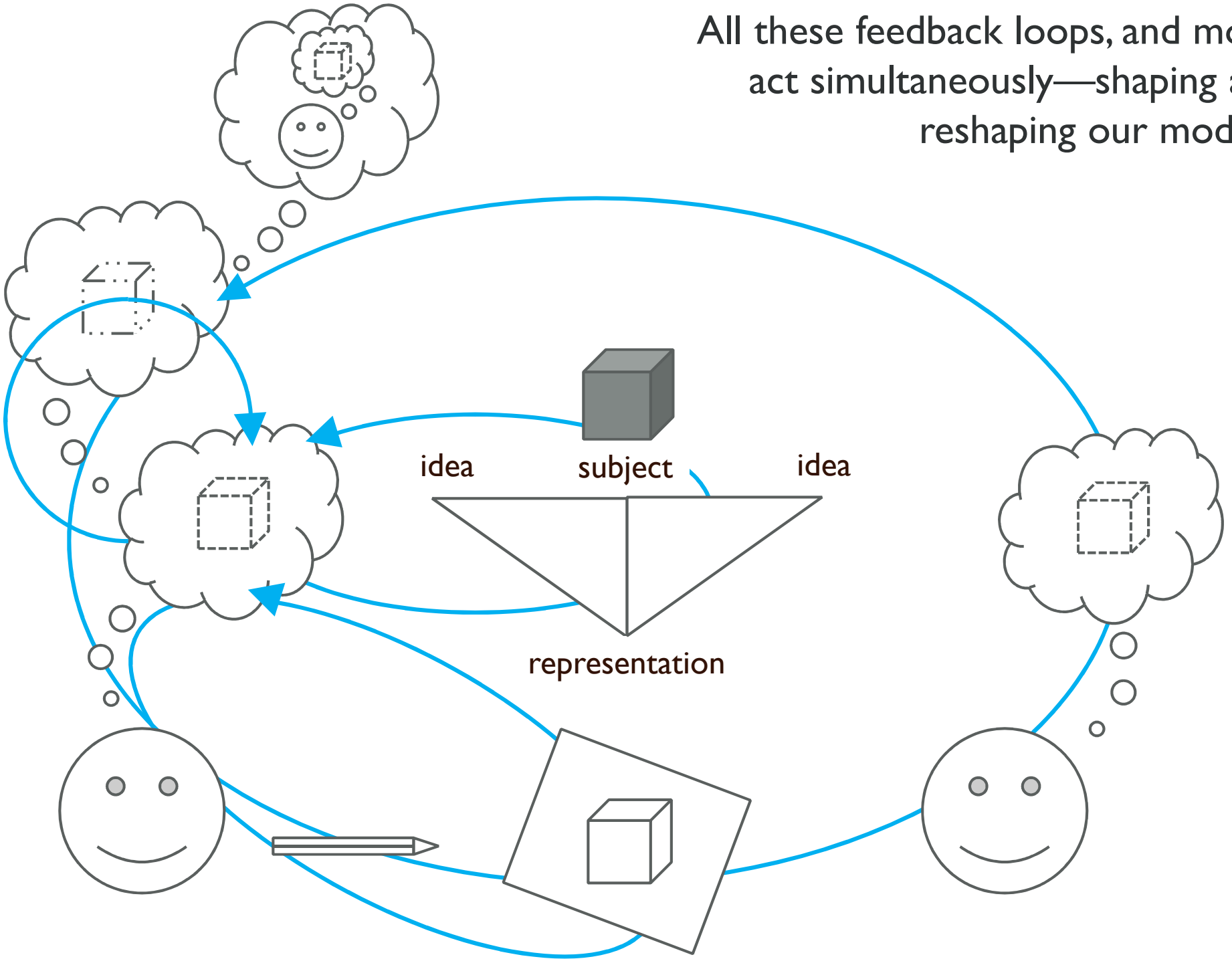
The process of representing an idea may change the idea itself.



Sharing a model may also change it.



All these feedback loops, and more, act simultaneously—shaping and reshaping our models.



Questions?

How do you judge a model?

Criteria for Judging

Fit

Least means

Consistency

Hierarchy

Predictive value

Final test with audience

Fit

How does the model fit the evidence?

Is our evidence relevant?

Is it reliable?

Is it sufficiently granular? — sufficiently deep?

Do we have enough evidence to draw meaningful conclusions? Does it have sufficient breadth?

Are the elements of the model necessary and sufficient?

Least Means

Is there a simpler way to explain the evidence?

Given two models explaining the same evidence, prefer the simpler.

Are the elements of the model "MECE"— mutually exclusive and collectively exhaustive?

Consistency

Is the model internally consistent?

Is it free from contradiction?

Predictive Value

What predictions does the model make?

Are our model's predictions consistent with later observations?

Do the model's predictions help us make decisions that might have been more difficult without them?

Hierarchy

How do the elements of the system appear to fit together?

Is the structure of the system clearly visible?

Do we know where to look first?

Can we find a clear path through the model?

Final Test With Audience

Does the audience understand it?

Do they agree with it?

Do they agree that they agree?

Will they act on it?

Example Models

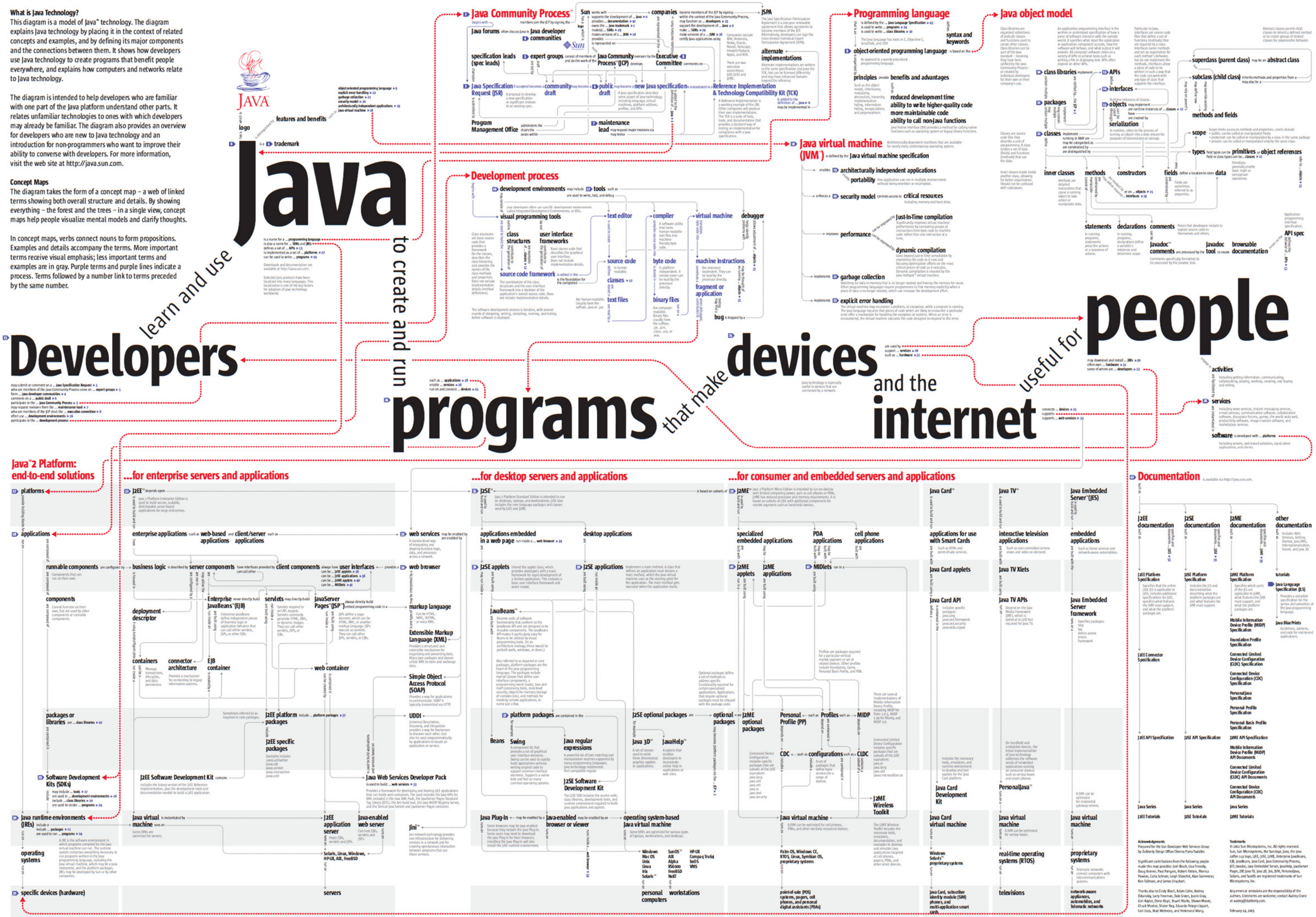
Java™ Technology Concept Map

What is Java Technology?
This diagram is a model of Java™ technology. The diagram explains Java technology by placing it in the context of related concepts and examples, and by defining its major components and the connections between them. It shows how developers use Java technology to create programs that benefit people everywhere, and explains how computers and networks relate to Java technology.

The diagram is intended to help developers who are familiar with one part of the Java platform understand other parts. It relates unfamiliar technologies to ones with which developers may already be familiar. The diagram also provides an overview for developers who are new to Java technology and an introduction for non-programmers who want to improve their ability to converse with developers. For more information, visit the web site at http://java.sun.com.

Concept Maps
The diagram takes the form of a concept map – a web of linked terms showing both overall structure and details. By showing everything – the forest and the trees – in a single view, concept maps help people visualize mental models and clarify thoughts.

In concept maps, verbs connect nouns to form propositions. Examples and details accompany the terms. More important terms receive visual emphasis; less important terms and examples are in gray. Purple terms and purple lines indicate a process. Terms followed by a number link to terms preceded by the same number.



exists within

may revise

specification.

Development process

begins with

16 development environments may include **17 tools** such as

are used to write, test, and debug

may consist of

Java developers often use specific development environments called Integrated Development Environments, or IDEs.

visual programming tools

are used to build the

outline

lay out

class structures

contribute to the generation of

are examples of ... **classes** ▸12

Class structures are basic source code that provides a framework for the classes, describes the class hierarchy, and provides the names of the class methods and properties. Does not include implementation details (method definitions).

user interface frameworks

contribute to the generation of

Basic source code that describes the graphical user interface. Does not include implementation details.

source code framework

is edited in the

is the foundation for the completed

The combination of the class structures and the user interface framework into a skeleton of the application's overall source code. Does not include implementation details.

The software development process is iterative, with several rounds of designing, writing, compiling, running, and testing before software is deployed.

text editor

is used to create

source code

Is human readable.

defines

classes ▸12

are stored in

text files

Are human-readable. Usually have the suffixes .java or .jav.

are read by a

compiler

A software utility that turns human-readable text files into machine-friendly byte code.

compiles source code into

byte code

Is platform independent. It almost never can be read by the processor directly.

is stored in

binary files

Are computer-readable. Binary files usually have the suffixes .jar, .jcm, .class, .ear, or .war.

run on a

virtual machine

translates byte code into

machine instructions

Are processor dependent. They can be read by the processor directly.

may be thought of as running ... **objects** ▸15

constitute a

fragment or application

when debugged, contributes to

testing may find a

bug

is trapped by a

debugger

helps identify problems with

allows adjustment of ... **objects** ▸15

▸25

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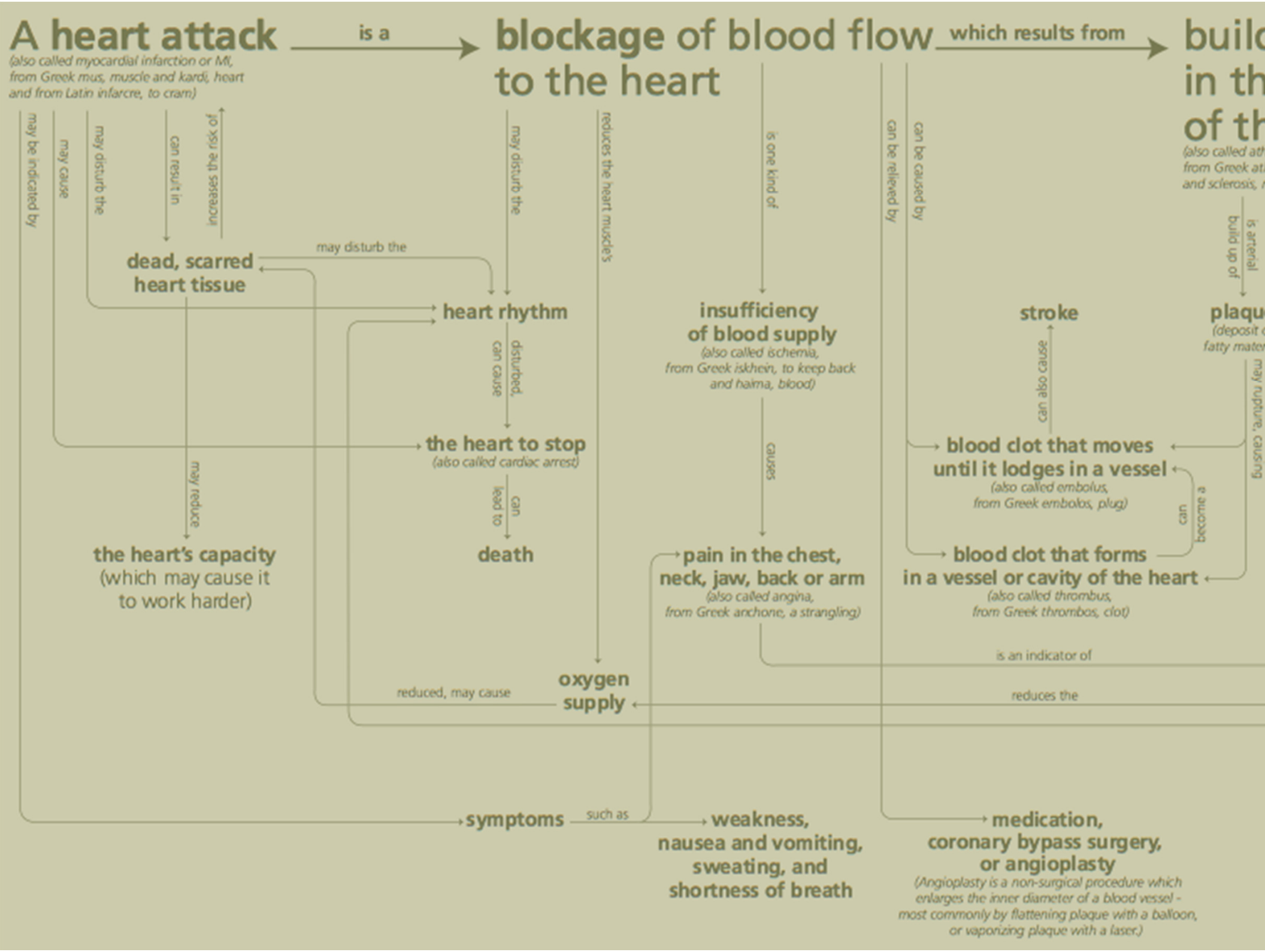
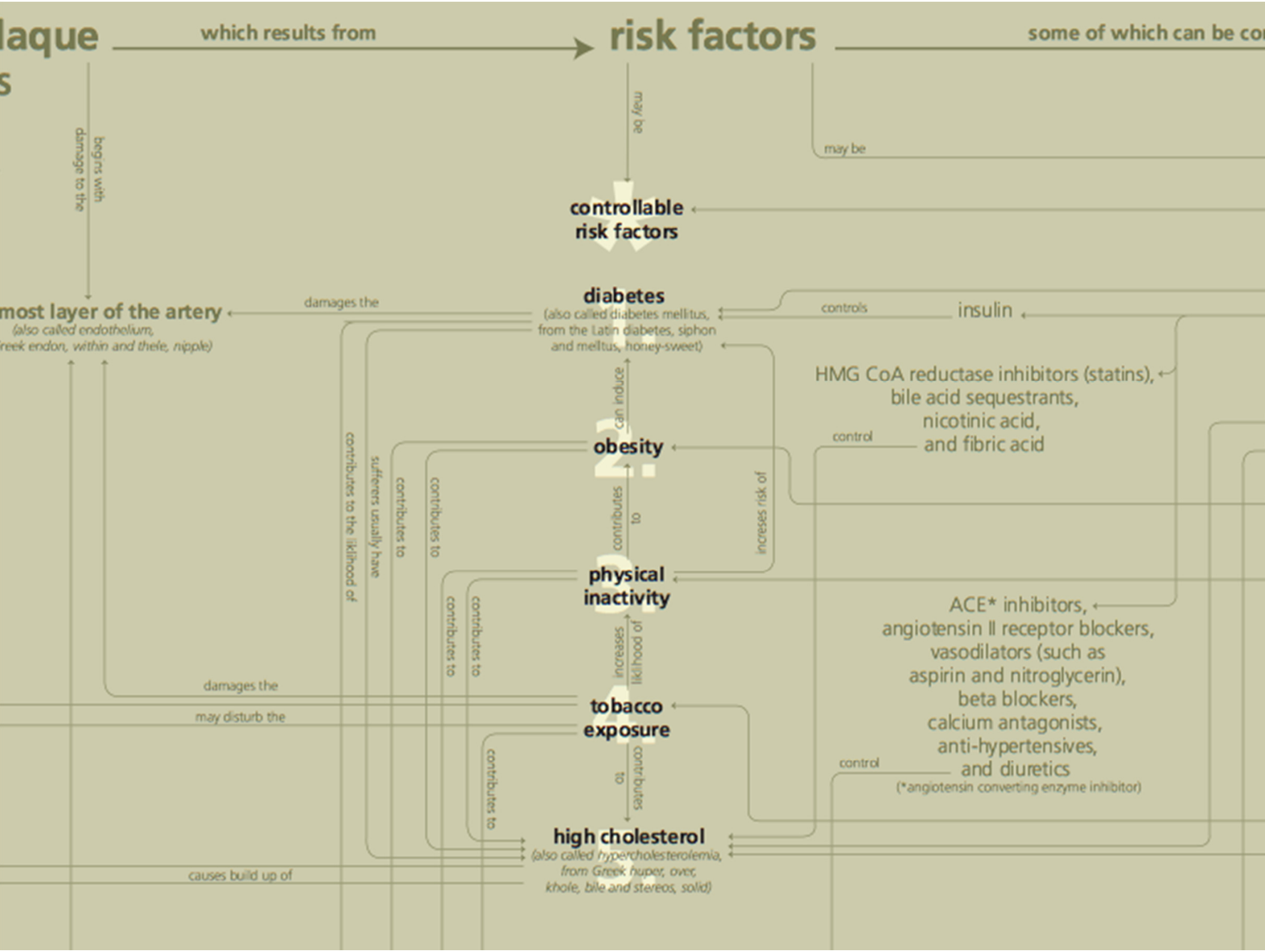
ke

uch as ... **applications** ▸28

nable ... **services** ▸26


A heart attack
(also called myocardial infarction or MI, from Greek mus, muscle and kardi, heart and from Latin infarcre, to cram)
is a
blockage of blood flow to the heart
which results from
buil
in th
of th
(also called ath
from Greek at
and sclerosis,
may be indicated by
may cause
may disturb the
can result in
increases the risk of
may disturb the
reduces the heart muscle's
is one kind of
can be relieved by
can be caused by
is arterial build up of
dead, scarred heart tissue
may disturb the
heart rhythm
disturbed, can cause
insufficiency of blood supply
(also called ischemia, from Greek iskhein, to keep back and haima, blood)
stroke
can also cause
plaqu
(deposit
fatty mate
may rupture, causing
the heart to stop
(also called cardiac arrest)
causes
blood clot that moves until it lodges in a vessel
(also called embolus, from Greek embolos, plug)
can become a
may reduce
can lead to
the heart's capacity (which may cause it to work harder)
death
pain in the chest, neck, jaw, back or arm
(also called angina, from Greek anchone, a strangling)
blood clot that forms in a vessel or cavity of the heart
(also called thrombus, from Greek thrombos, clot)
is an indicator of
reduced, may cause
oxygen supply
reduces the
symptoms
such as
weakness, nausea and vomiting, sweating, and shortness of breath
medication, coronary bypass surgery, or angioplasty
(Angioplasty is a non-surgical procedure which enlarges the inner diameter of a blood vessel - most commonly by flattening plaque with a balloon, or vaporizing plaque with a laser.)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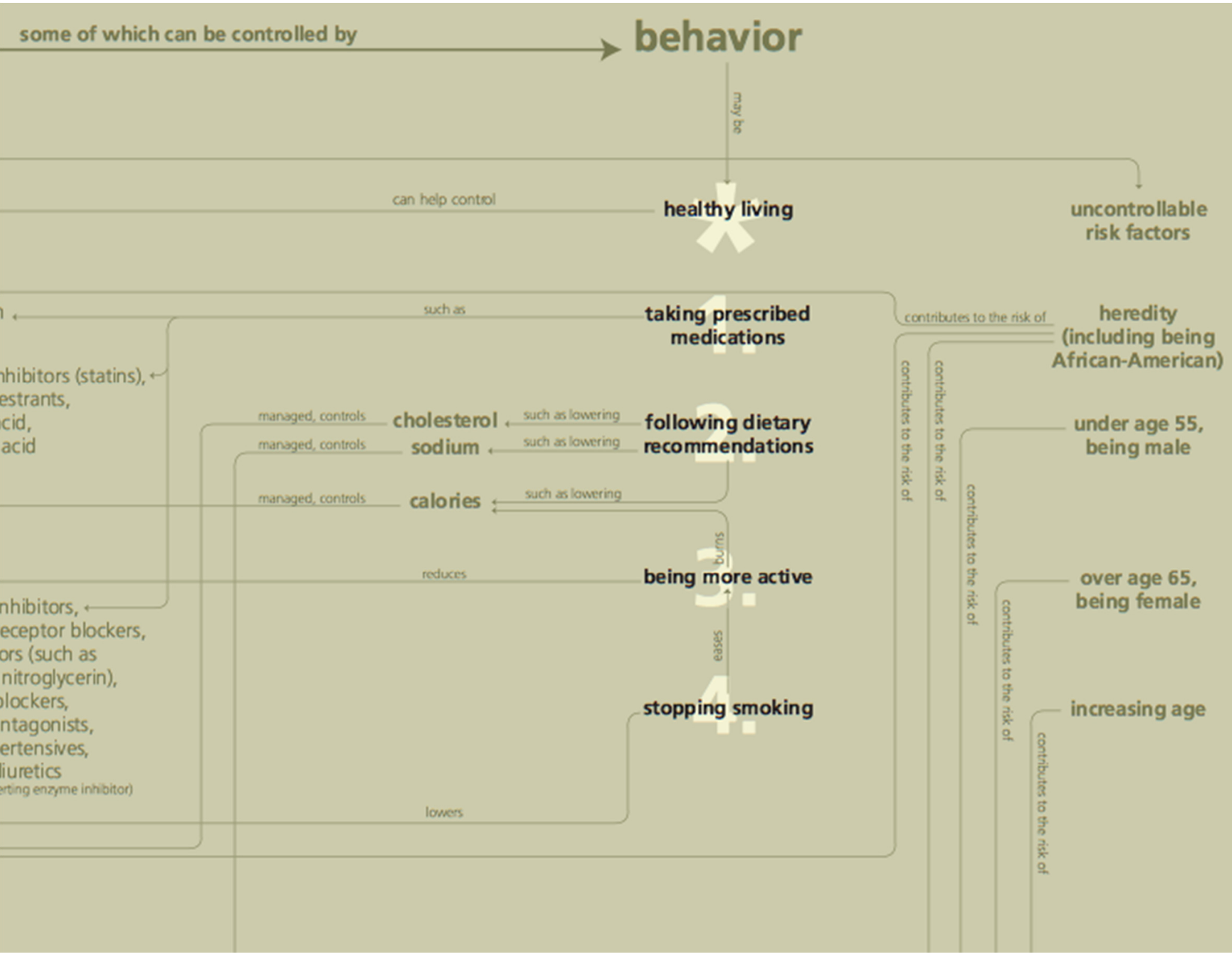
s
which results from
risk factors
some of which can be co
may be
may be
begins with damage to the
controllable risk factors
most layer of the artery
(also called endothelium, reek endon, within and thele, nipple)
damages the
diabetes
(also called diabetes mellitus, from the Latin diabetes, siphon and melitus, honey-sweet)
controls
insulin
HMG CoA reductase inhibitors (statins), bile acid sequestrants, nicotinic acid, and fibric acid
control
can induce
obesity
contributes to
physical inactivity
increases risk of
contributes to the likelihood of
sufferers usually have
contributes to
contributes to
contributes to
contributes to
increases likelihood of
ACE* inhibitors, angiotensin II receptor blockers, vasodilators (such as aspirin and nitroglycerin), beta blockers, calcium antagonists, anti-hypertensives, and diuretics
(*angiotensin converting enzyme inhibitor)
control
damages the
may disturb the
tobacco exposure
contributes to
contributes to
high cholesterol
(also called hypercholesterolemia, from Greek huper, over, khole, bile and stereos, solid)
causes build up of


some of which can be controlled by
behavior
may be
can help control
healthy living
uncontrollable risk factors
such as
taking prescribed medications
1.
contributes to the risk of
heredity (including being African-American)
nhibitors (statins),
estrants,
cid,
acid
managed, controls
cholesterol
such as lowering
following dietary recommendations
2.
managed, controls
sodium
such as lowering
under age 55, being male
managed, controls
calories
such as lowering
burns
reduces
being more active
3.
over age 65, being female
nhibitors,
eceptor blockers,
ors (such as
nitroglycerin),
blockers,
ntagonists,
ertensives,
liuretics
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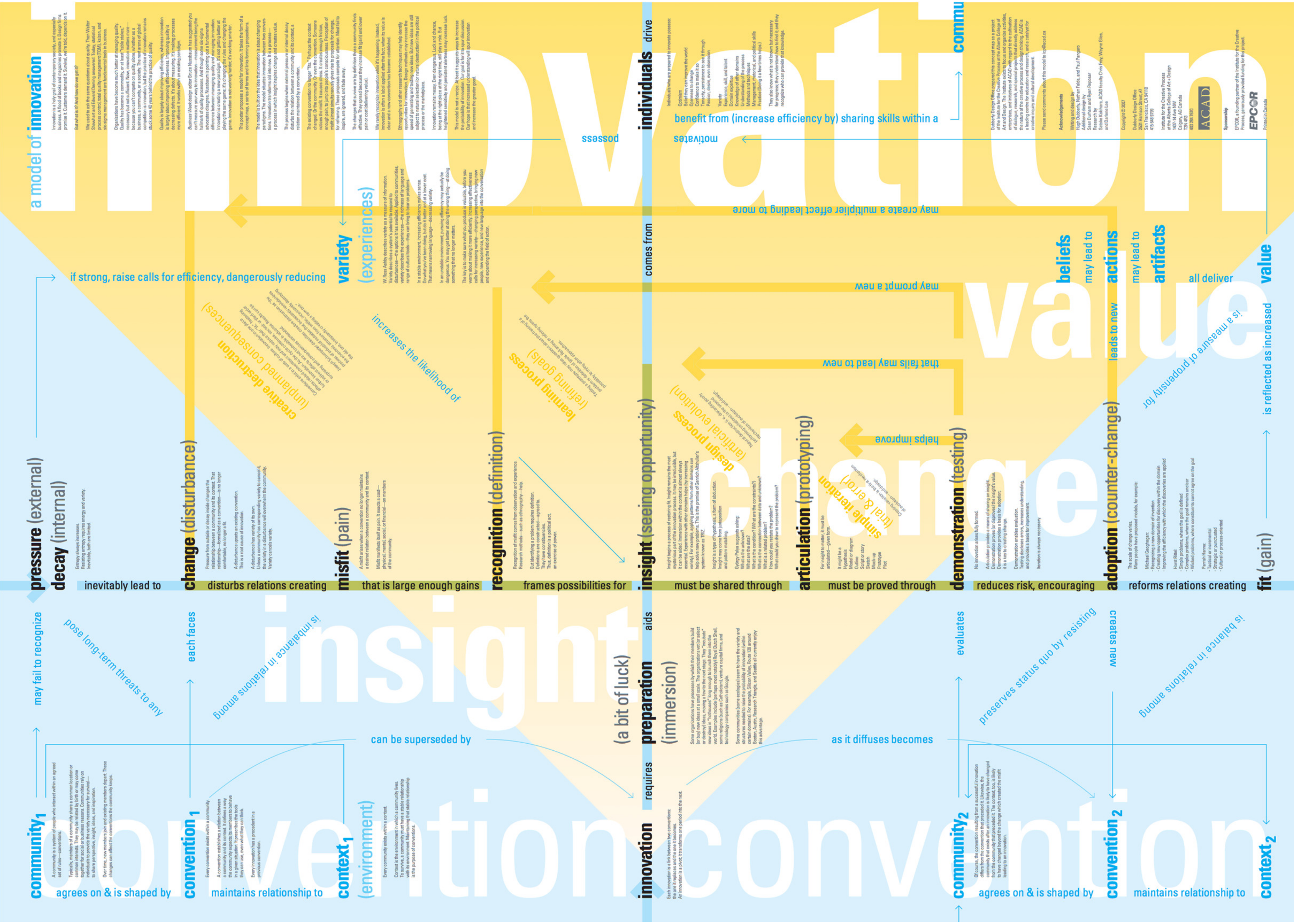
eases
stopping smoking
4.
increasing age
lowers
contributes to the risk of


a model of innovation
innovation
value
change
insight
convention
convention
individuals
drive
possess
motivations
benefit from (increase efficiency by) sharing skills within a
commu
comes from
may create a multiplier effect leading to more
may prompt a new
that fails may lead to new
helps improve
variety
(experiences)
if strong, raise calls for efficiency, dangerously reducing
increases the likelihood of
creative destruction
(unplanned consequences)
learning process
(refining goals)
design process
(artificial evolution)
simple iteration
(trial & error)
beliefs
may lead to
actions
may lead to
artifacts
all deliver
value
leads to new
is a measure of propensity for
is reflected as increased
pressure (external)
decay (internal)
inevitably lead to
change (disturbance)
disturbs relations creating
misfit (pain)
that is large enough gains
recognition (definition)
frames possibilities for
insight (seeing opportunity)
must be shared through
articulation (prototyping)
must be proved through
demonstration (testing)
reduces risk, encouraging
adoption (counter-change)
reforms relations creating
fit (gain)
may fail to recognize
pose long-term threats to any
each faces
is imbalance in relations among
aids
(a bit of luck)
preparation
(immersion)
requires
evaluates
preserves status quo by resisting
creates new
is balance in relations among
can be superseded by
as it diffuses becomes
community₁
agrees on & is shaped by
convention₁
maintains relationship to
context₁
(environment)
innovation
community₂
agrees on & is shaped by
convention₂
maintains relationship to
context₂
ACAD
EPCOR

innovation

eded by

ugh gains

frames possibilities for

must be shared through

mus

as

innovation requires preparation (immersion) aids insight (seeing opportunity)

(a bit of luck)

Each innovation is a link between two conventions:
the one it replaces and the one it becomes.
An innovation is a pivot; it transforms one period into the next.

Some organizations have processes by which their members build (or buy) new ideas at a small scale. The organizations vet (or select or destroy) ideas, moving a few to the next stage. They "incubate" new ideas in "hothouses" long enough to launch them into the world. Examples include (perhaps most notably) Royal Dutch Shell, some religions (such as Catholicism), venture capital firms, and technology companies such as Google.

Some communities (some ecologies) seem to have the variety and structures needed to raise the probability of innovation (within certain domains). For example, Silicon Valley, Route 128 around Boston, Austin, Research Triangle, and Seattle all currently enjoy this advantage.

recognition (definition)

Recognition of misfit comes from observation and experience.
Research methods—such as ethnography—help.

But identifying a problem requires definition.
Definitions are constructed—agreed to.
They have constituencies.
Thus, definition is a political act,
an exercise of power.

hood of

learning proce
(refining go

Testing a prototype may
problem or definition
possibility to tryin

Insight begins a process of restoring fit. Insight remains the most mysterious part of the innovation process. It may be irreducible, but it can be aided. Immersion within the context is almost always essential. Experience with other domains helps (by increasing variety). For example, applying patterns from other domains can help solve new problems. This is the promise of Genrich Altshuller's system known as TRIZ.

Insight is a type of hypothesis, a form of abduction.
Insight may come from juxtaposition
and pattern matching.

György Polya suggests asking:
What is the unknown?
What are the data?
What is the condition? (What are the constraints?)
What is the connection between data and unknown?
What is a related problem?
How could you restate the problem?
What could you draw to represent the problem?

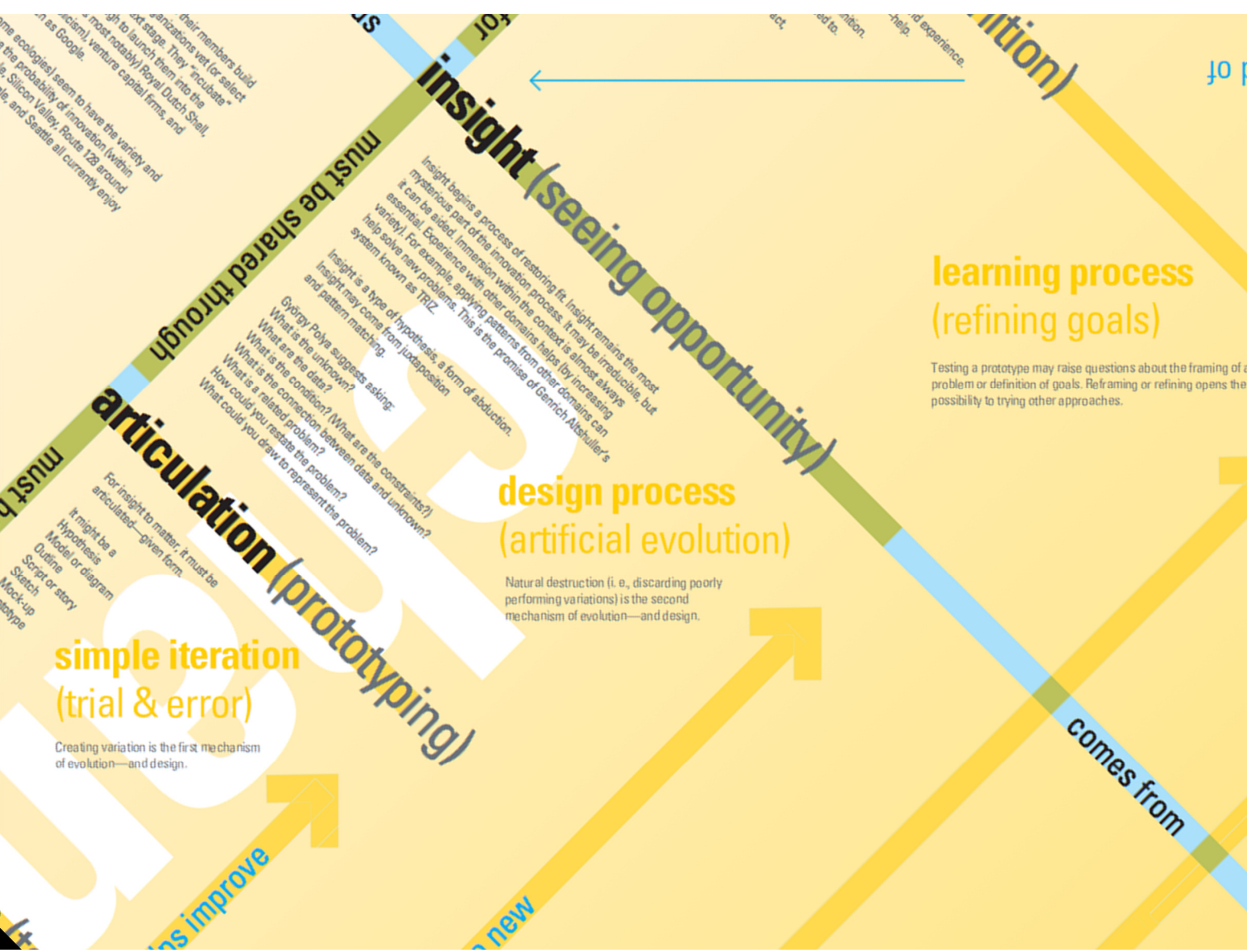
design process
(artificial evolution)

Natural destruction (i. e., discarding poorly performing variations) is the second mechanism of evolution—and design.

articulation (prototyping)

For insight to matter, it must be articulated—given form.

It might be a
Hypothesis


their members build
anizations vet (or select
ext stage. They "incubate"
gh to launch them into the
most notably) Royal Dutch Shell,
cism), venture capital firms, and
n as Google.
me ecologies) seem to have the variety and
e the probability of innovation (within
, Silicon Valley, Route 128 around
e, and Seattle all currently enjoy
must be shared through
insight (seeing opportunity)
Insight begins a process of restoring fit. Insight remains the most
mysterious part of the innovation process. It may be irreducible, but
it can be aided. Immersion within the context is almost always
essential. Experience with other domains helps (by increasing
variety). For example, applying patterns from other domains can
help solve new problems. This is the promise of Genrich Altshuller's
system known as TRIZ.
Insight is a type of hypothesis, a form of abduction.
Insight may come from juxtaposition
and pattern matching.
György Polya suggests asking:
What is the unknown?
What are the data?
What is the condition? (What are the constraints?)
What is the connection between data and unknown?
What is a related problem?
How could you restate the problem?
What could you draw to represent the problem?
must b
articulation (prototyping)
For insight to matter, it must be
articulated—given form.
It might be a
Hypothesis
Model or diagram
Outline
Script or story
Sketch
Mock-up
otype
design process
(artificial evolution)
Natural destruction (i. e., discarding poorly
performing variations) is the second
mechanism of evolution—and design.
simple iteration
(trial & error)
Creating variation is the first mechanism
of evolution—and design.
learning process
(refining goals)
Testing a prototype may raise questions about the framing of a
problem or definition of goals. Reframing or refining opens the
possibility to trying other approaches.
comes from
ns improve
new

the creative process

The creative process is classically described (Wallas, 1926) as
preparation → incubation → illumination → verification

Businesses often describe the process as
research → development → execution

These models suggest a tidy, linear structure
beginning → middle → end

Simple sequences sound manageable, even predictable. They promise tasks we can schedule and budget. That makes them appealing to people who run organizations and worry about minimizing uncertainty and risk. But the creative process resists planning; it's not a recipe, script, or formula. (How could it be?) In practice, the process is messy, iterative, and recursive.

Framed as a sequence, it's a plan for achieving a goal
ready → aim → fire

Yet a first shot doesn't always hit the target. Achieving a goal may require a few tries; it may require iteration. Iteration is a looping process, using feedback from earlier attempts to converge on a goal. Iteration enables participants to calibrate, correct mistakes, build on accidents, add and remove detail, and improve skills through practice.

The creative process is less like a line and more like a loop:
observe → reflect → make → observe → reflect → make → . . .

The process need not begin with observing; it may begin with any step. Boundaries between the steps are not rigid. Each activity continues throughout the process, e.g., making also involves reflecting and observing.
observe ——→ observe ——→
——→ reflect ——→ reflect ——→
——→ make ——→ make →

If the goal is clear—if we have agreed on how we define a problem, as in a math problem—then solutions may be implied. And we know when to stop. If the goal is less clear, deciding when to stop requires judgment.

But some problems are "wicked" (Rittel, 1969). Their definition depends on point of view; participants can always broaden or deepen their understanding and improve their solutions. For such problems, starting and stopping are arbitrary and external to the process. It ends only when we "run out of time, money, or patience" (energy, will, or gumption).

Sometimes the goal is not clear. Participants don't always agree on how to define the problem. Such cases require a new frame, a new generative metaphor (Schön, 1990), or a new articulation of the essential question.

Agreeing on goals may require iteration—may involve a feedback loop. Several levels of loops may be nested:
- a listing of assumptions and a first approximation of a solution
- a primary process for refining the solution
- a process for agreeing on the goal of the primary process
- a process for improving the process of agreeing on the goal

This "boot-strapping" process (Engelbart, 1962) is a sign of learning systems and organizations (Argyis + Schön, 1978).

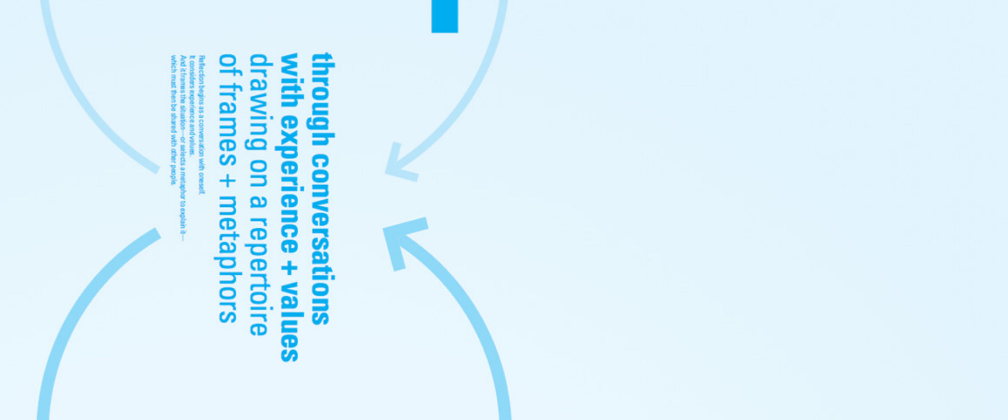
The creative process is not just iterative; it's also recursive. It plays out "in the large" and "in the small"—in defining the broadest goals and concepts and refining the smallest details. It branches like a tree, and each choice has ramifications, which may not be known in advance. Recursion also suggests a procedure that "calls" or includes itself. Many engineers define the design process as a recursive function:
discover → define → design → develop → deploy

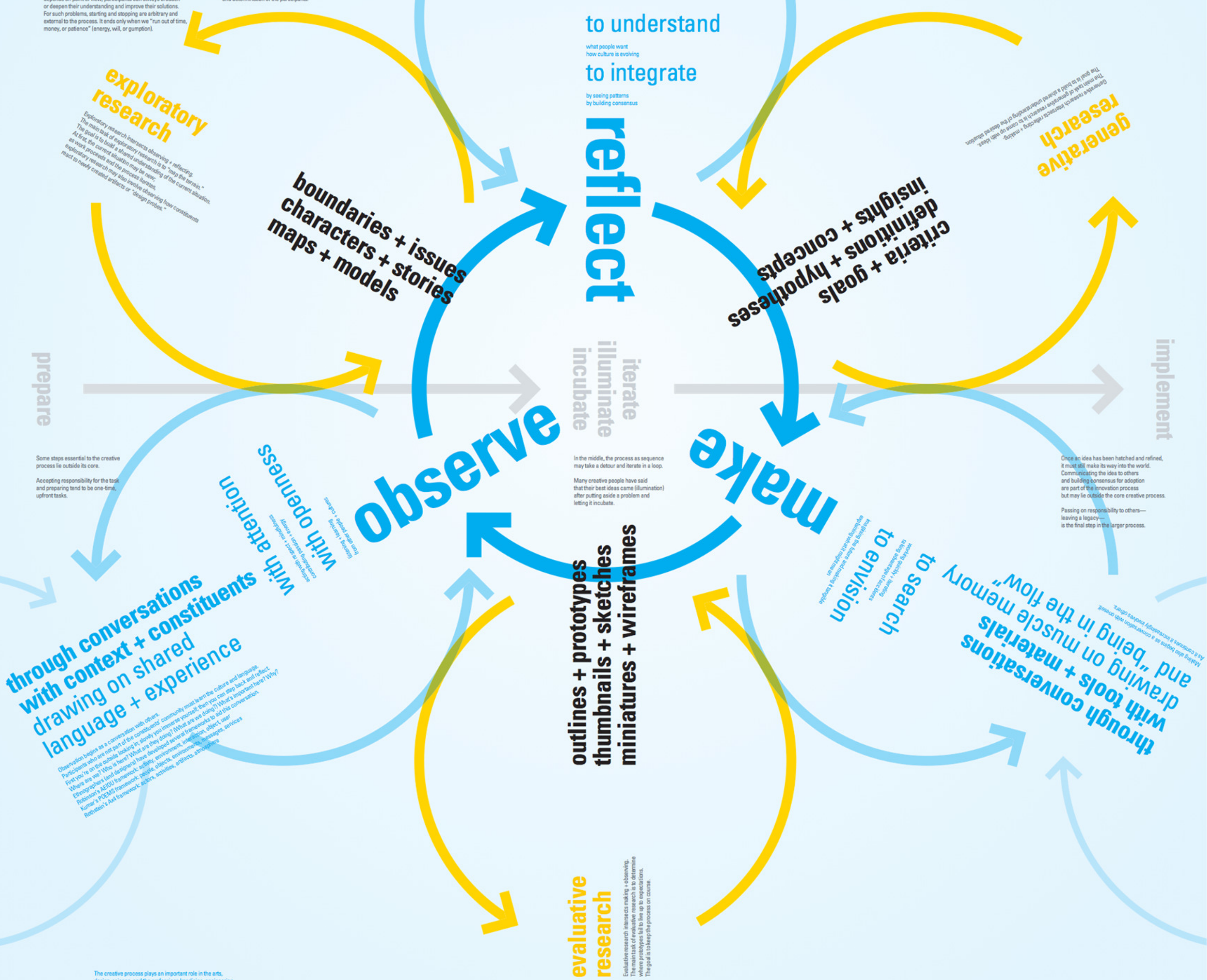
The creative process involves many conversations—about goals and actions to achieve them—conversations with co-creators and colleagues, conversations with oneself. The participants and their language, experience, and values affect the conversations.

Conversations about wicked problems especially benefit from—and may require—a variety of views. Some of these views form a habit of engaging (or observing, reflecting, and making) often called "design thinking." It might be thought of more accurately as a set of lenses on design conversations or creative conversations. These lenses provide perspective beyond the immediate focus of the conversation or process:

- attention	- understanding	- searching
- openness	- integration	- envisioning

The quality of the conversations is largely responsible for the outcome of the process. The quality of the resulting product reflects the quality of the creative process—and the curiosity and determination of the participants.




to understand
what people want
how culture is evolving
to integrate
by seeing patterns
by building consensus
reflect
criteria + goals
definitions + hypotheses
insights + concepts
generative
research
exploratory
research
Exploratory research intersects observing + reflecting.
The main task of exploratory research is to "map the terrain."
The goal is to build a shared understanding of the current situation.
At first, the current situation may be new;
as work proceeds and the process iterates,
exploratory research may also involve observing how constituents
react to newly created artifacts or "design probes."
boundaries + issues
characters + stories
maps + models
prepare
iterate
illuminate
incubate
implement
observe
with openness
with attention
make
to search
to envision
outlines + prototypes
thumbnails + sketches
miniatures + wireframes
In the middle, the process as sequence
may take a detour and iterate in a loop.
Many creative people have said
that their best ideas came (illumination)
after putting aside a problem and
letting it incubate.
Some steps essential to the creative
process lie outside its core.
Accepting responsibility for the task
and preparing tend to be one-time,
upfront tasks.
Communicating the idea to others
and building consensus for adoption
are part of the innovation process
but may lie outside the core creative process.
Passing on responsibility to others—
leaving a legacy—
is the final step in the larger process.
through conversations
with context + constituents
drawing on shared
language + experience
Observation begins as a conversation with others.
Participants who are not part of the constituents' community must learn the culture and language.
First you're on the outside looking in; slowly you immerse yourself; then you can step back and reflect.
Where are we? Who is here? What are they doing? (What are we doing?) What's important here? Why?
Ethnographers (and designers) have developed several frameworks to aid this conversation.
Robinson's AEIOU framework: activity, environment, interaction, object, user
Kumar's POEMS framework: people, objects, environments, messages, services
Rothstein's Ax4 framework: actors, activities, artifacts, atmosphere
through conversations
with tools + materials
drawing on muscle memory
and "being in the flow"
evaluative
research
Evaluative research intersects making + observing.
where prototypes fail to live up to expectations.
The goal is to keep the process on course.

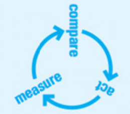
The creative process plays an important role in the arts, design, science, and the professions (medicine, engineering, law, and business). It has many analogues and synonyms.

quality cycle

The creative process is startlingly similar to the quality cycle (Shewart, 1939), popularized in business circles by the quality management movement (Deming, 1982).

self-regulating system

Like a self-regulating system, the creative process is a classic feedback loop. Measure an essential variable; compare it to a goal; and act to eliminate any difference.



scientific method

Forming a hypothesis is a special type of creative act. Framing the creative process as "experimenting" shows the close tie it has with the domain of science.

clinical process

When physicians meet patients, they begin by taking a history and examining the patient; tests may be indicated, which contribute to a diagnosis, which indicates therapy.

design process

The design process viewed as "problem solving" (Jones, 1976), "problem seeking" (Peña, 1987) or "turning existing situations into preferred" (Simon, 1969) is a variation on the creative process.

interaction loop

Interaction (with computers or the wider world) answers three questions: What do you sense? (feel?) How do you learn + plan? (know?) How do you change things? (do?) (Verplank, 2000).

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ACAD

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Please send comments about this model to icp@acad.ca.

Design and writing by Hugh Dubberly and Shelley Evenson
Research by ACAD faculty Vera Gartley, Wayne Giles, Walter May, and Justin Waddell
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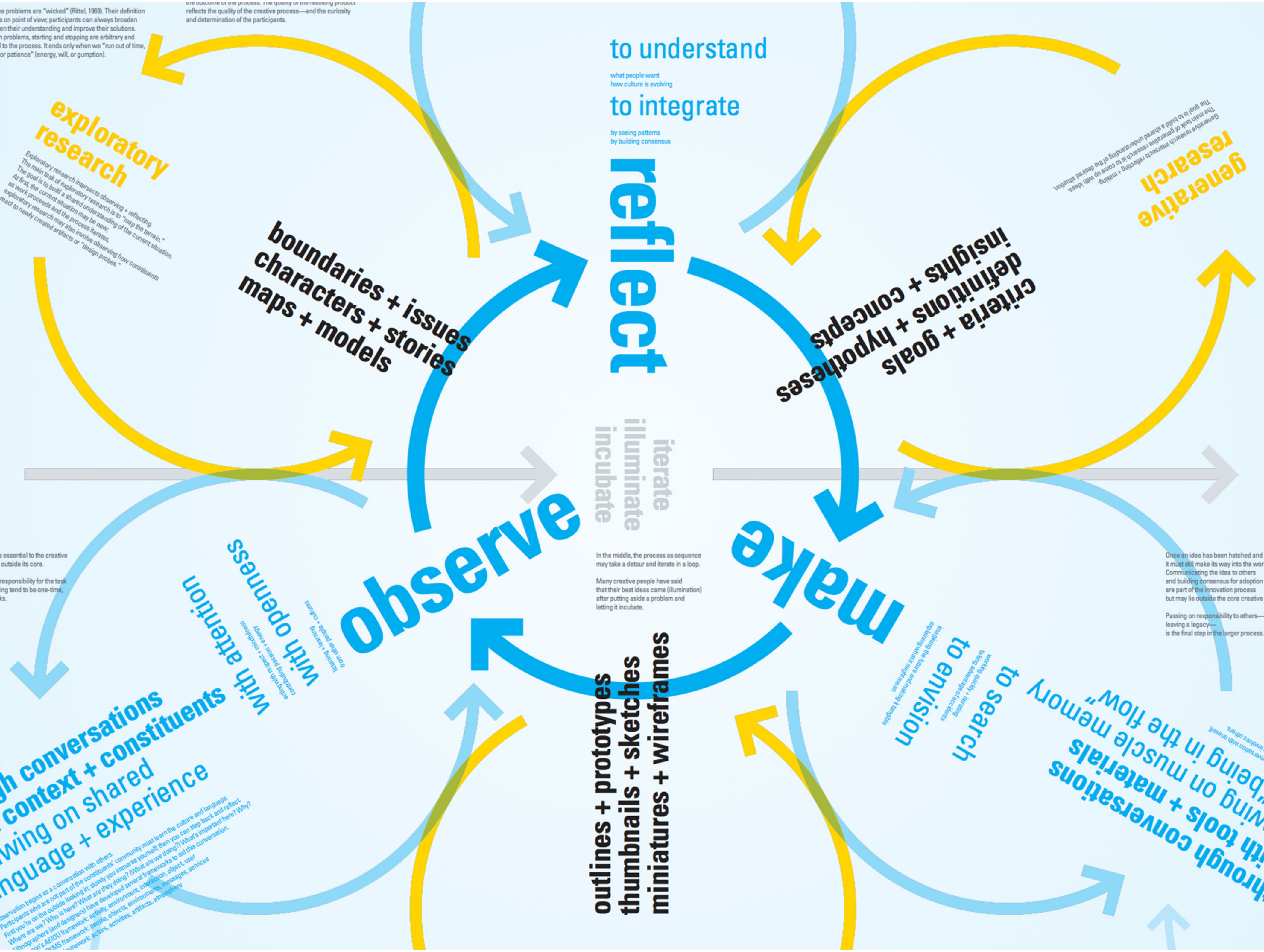

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to envision
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Once an idea has been hatched and
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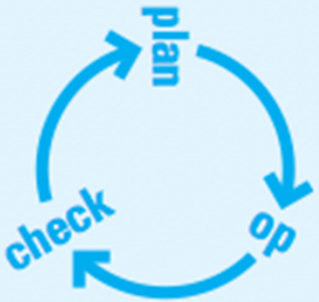

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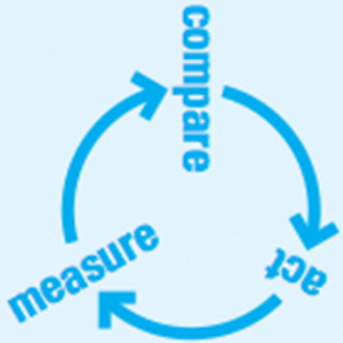

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How to Play Baseball

10546 Diagram Development Spring 2000 Pralina Chayutsahakij Yu Guo Brian Hershfeldt Mike LaManna

Baseball is a game played by **2 teams** of nine players that alternate between **offense** and **defense**. The **objective** is to score more runs than the opposition after 9 innings. A **run** is scored when a batter hits the ball and becomes a **base runner** who touches 1st, 2nd, 3rd and Home Plate. The game is officiated by an **umpire**.

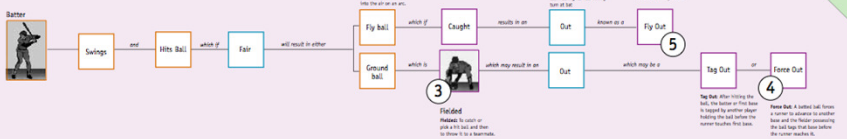
Play Ball!

The game begins when...

the pitcher *throws* a pitch to the batter. Once this happens, any number of events can occur. Here are two scenarios: one defensive and one offensive you should know about.

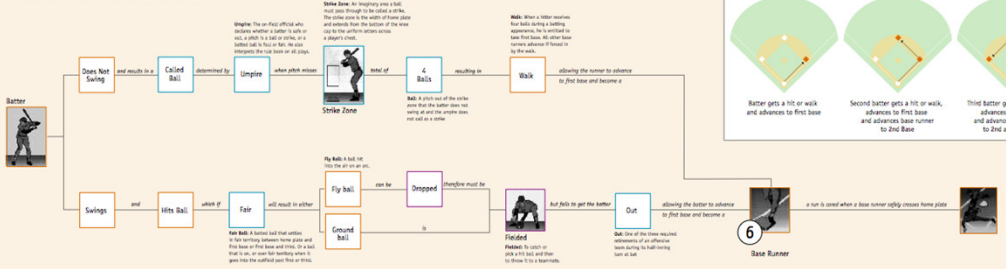
Making an out

The goal of the defensive team is to prevent runs from being scored. This is done by registering 3 outs before one or more offensive players crosses home plate.



Getting on base and scoring

The goal of the offensive team is to score runs. This is done by hitting the ball and safely advancing one or more runners around all four bases.



Officiating the game

Baseball is structured into 9 units of play called innings.

The switching of the sides after 3 outs is a half-inning. A cycle of 3 outs for each team (two half-innings) is called an inning.

Inning	1	2	3	4	5	6	7	8	9	total
HOME	0	1	0	0						
VISITORS	1	0	1							

Strikes Balls Outs

The team playing offense continues to bat until 3 outs are made against them by the defense.

Each time 3 outs are made the teams switch with the offensive (batting) team becoming the defensive team in the field.

The team whose field the game is being played on is known as the home team. The team that has come to play them is known as the visiting team.

Play begins with the visiting team on offense (batting) and the home team playing defense on the field.

Win!

The game ends when...

nine innings have been played. The team with the most runs after wins. If the game is tied after nine innings, extra innings are played until one team has more runs at the end of a complete inning.

Making an out

The goal of the defensive team is to prevent runs from being scored. This is done by registering 3 outs before one or more offensive players crosses home plate.

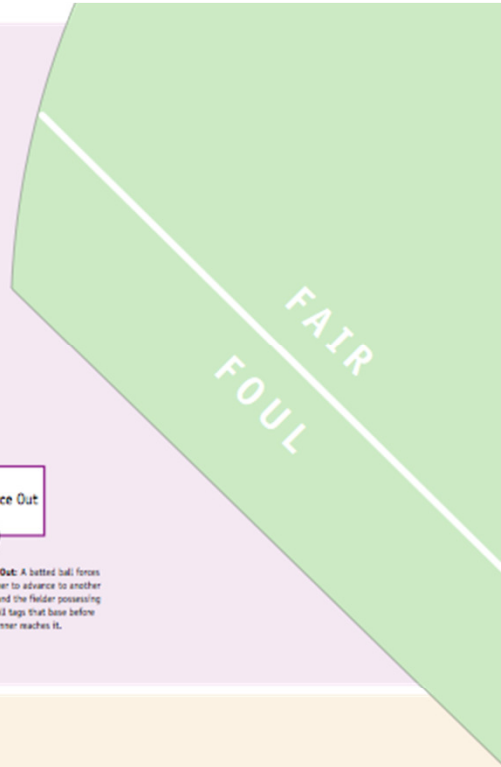
Batter → Swings → and → Hits Ball → which if → Fair → will result in either

- **Fly ball** (Fly Ball: A ball hit into the air on an arc.) → which if → Caught → results in an → **Out** (Out: One of the three required retirements of an offensive team during its half-inning turn at bat) → known as a → **Fly Out** (Fly Out: A fielder catches your fair or foul ball before it touches the ground.) — 5
- **Ground ball** → which is →  (3) → which may result in an → **Out** → which may be a → **Tag Out** or **Force Out** (4)

Fielded
Fielded: To catch or pick a hit ball and then to throw it to a teammate.

Tag Out: After hitting the ball, the batter or first base is tagged by another player holding the ball before the runner touches first base.

Force Out: A batted ball forces a runner to advance to another base and the fielder possessing the ball tags that base before the runner reaches it.



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The goal of the offensive team is to score runs. This is done by hitting the ball and safely advancing one or more runners around all four bases.

Batter

- Does Not Swing → and results in a → Called Ball → determined by → Umpire → when pitch misses →  → total of → 4 Balls → resulting in → Walk → allowing the runner to advance to first base and become a
- Swings → and → Hits Ball → which if → Fair → will result in either
  - Fly ball → can be → Dropped → therefore must be
  - Ground ball → is

Umpire: The on-field official who declares whether a batter is safe or out, a pitch is a ball or strike, or a batted ball is foul or fair. He also interprets the rule book on all plays.

Strike Zone: An imaginary area a ball must pass through to be called a strike. The strike zone is the width of home plate and extends from the bottom of the knee cap to the uniform letters across a player's chest.

Strike Zone

Ball: A pitch out of the strike zone that the batter does not swing at and the umpire does not call as a strike

Walk: When a hitter receives four balls during a batting appearance, he is entitled to take first base. All other base runners advance if forced in by the walk.

Fly Ball: A ball hit into the air on an arc.

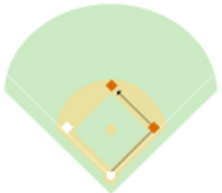
Fair Ball: A batted ball that settles in fair territory between home plate and first base or first base and third. Or a ball that is on, or over fair territory when it goes into the outfield past first or third.

Fielded
Fielded: To catch or pick a hit ball and then to throw it to a teammate.

but fails to get the batter → **Out** (Out: One of the three required retirements of an offensive team during its half-inning turn at bat) → allowing the batter to advance to first base and become a →  (6) Base Runner → a run is cored when a base runner safely crosses home plate → 

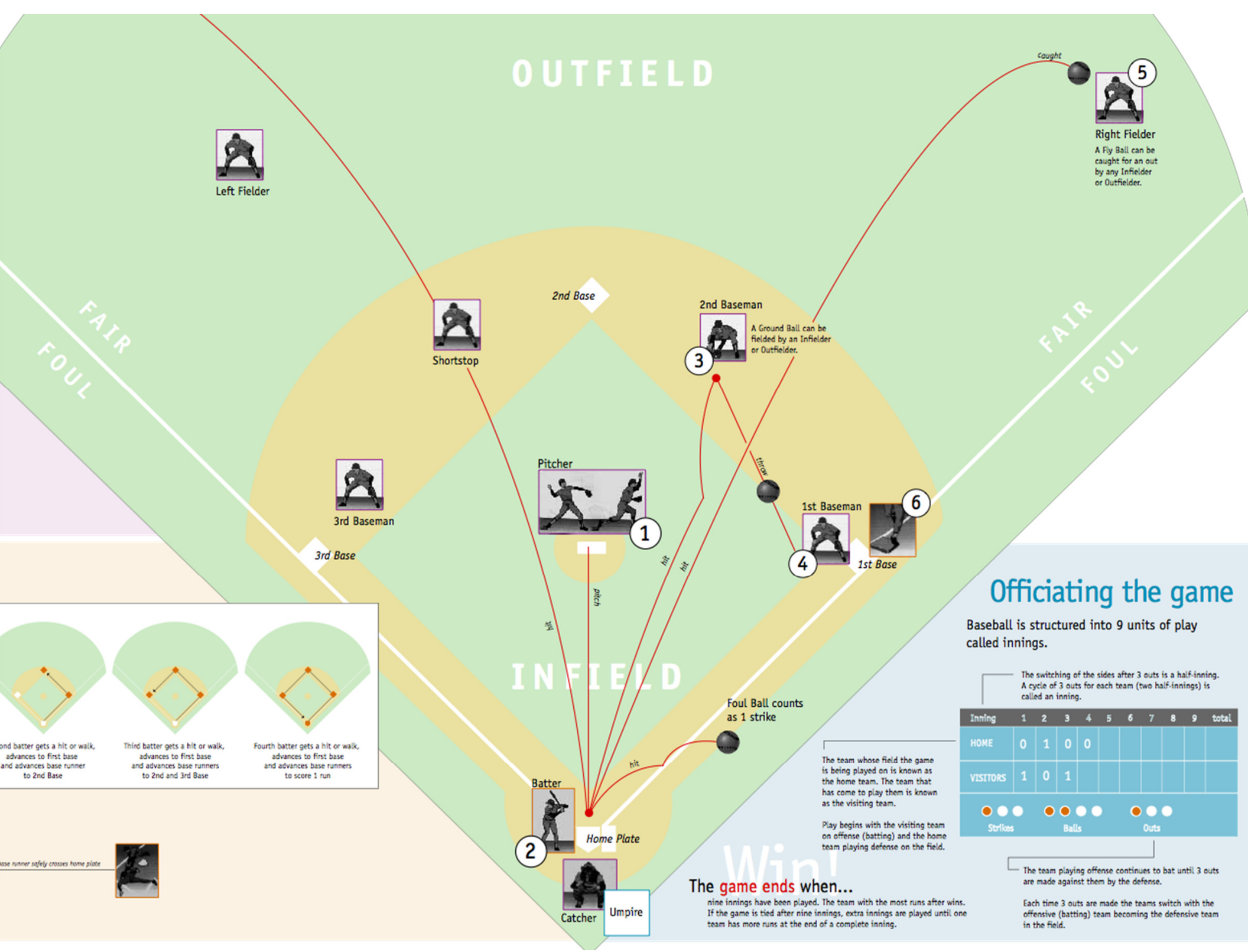
Basic concept of scoring a run

Batter gets a hit or walk and advances to first base



Second batter gets a hit or walk, advances to first base and advances base runner to 2nd Base

Third batter gets a hit or advances to first bas and advances base run to 2nd and 3rd Base


OUTFIELD
FAIR
FOUL
FAIR
FOUL
caught
5
Right Fielder
A Fly Ball can be caught for an out by any Infielder or Outfielder.
Left Fielder
2nd Base
Shortstop
2nd Baseman
A Ground Ball can be fielded by an Infielder or Outfielder.
3
throw
Pitcher
1
3rd Baseman
1st Baseman
6
4
1st Base
3rd Base
hit
hit
pitch
hit
INFIELD
Foul Ball counts as 1 strike
hit
Batter
2
Home Plate
Catcher
Umpire
ond batter gets a hit or walk, advances to first base and advances base runner to 2nd Base
Third batter gets a hit or walk, advances to first base and advances base runners to 2nd and 3rd Base
Fourth batter gets a hit or walk, advances to first base and advances base runners to score 1 run
ase runner safely crosses home plate
Officiating the game
Baseball is structured into 9 units of play called innings.
The switching of the sides after 3 outs is a half-inning. A cycle of 3 outs for each team (two half-innings) is called an inning.
Inning 1 2 3 4 5 6 7 8 9 total
HOME 0 1 0 0
VISITORS 1 0 1
Strikes
Balls
Outs
The team whose field the game is being played on is known as the home team. The team that has come to play them is known as the visiting team.
Play begins with the visiting team on offense (batting) and the home team playing defense on the field.
The team playing offense continues to bat until 3 outs are made against them by the defense.
Each time 3 outs are made the teams switch with the offensive (batting) team becoming the defensive team in the field.
Win!
The game ends when...
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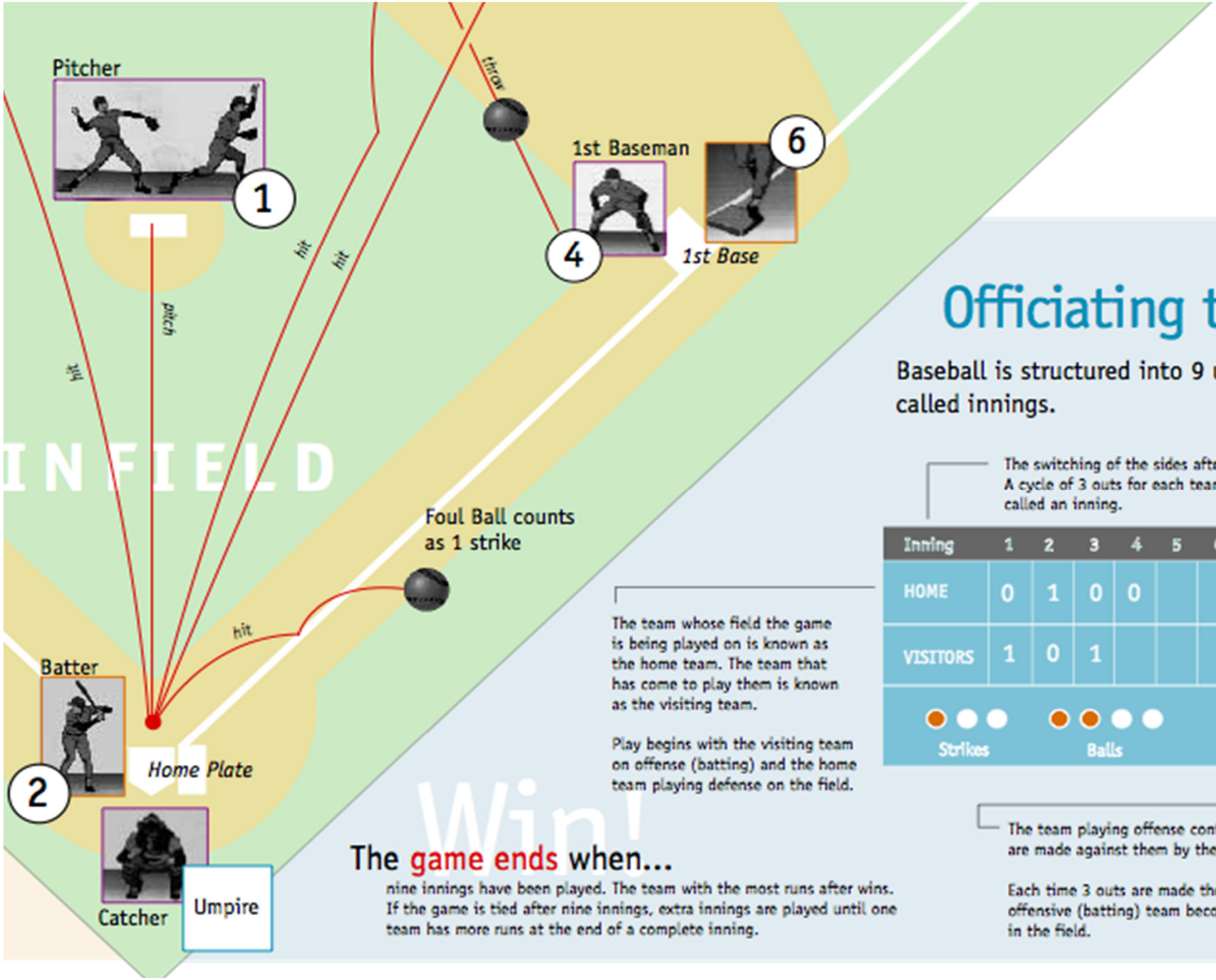

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Questions?

How to Build Models

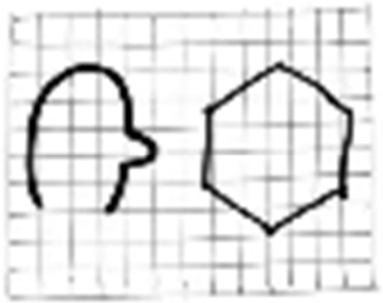
A Talk by Dan Roam, "The Back of the Napkin Guy."

Video

SEE:

SHOW:

Who / What → Qualitative representation = Portrait



How much → Quantitative representation = Chart

Where → Position in space = Map

When → Position in time = Timeline

How → Cause + effect = Flowchart

Why → deduction + prediction = Multiple-variable plot

Questions?

TopHat Question

Thanks!

Irene Rae
Computer Sciences
University of Wisconsin–Madison

CS-570 Introduction to Human-Computer Interaction