University of California, Berkeley
Jacobs Institute for Design Innovation
MDes Degree Program

# Design Frameworks
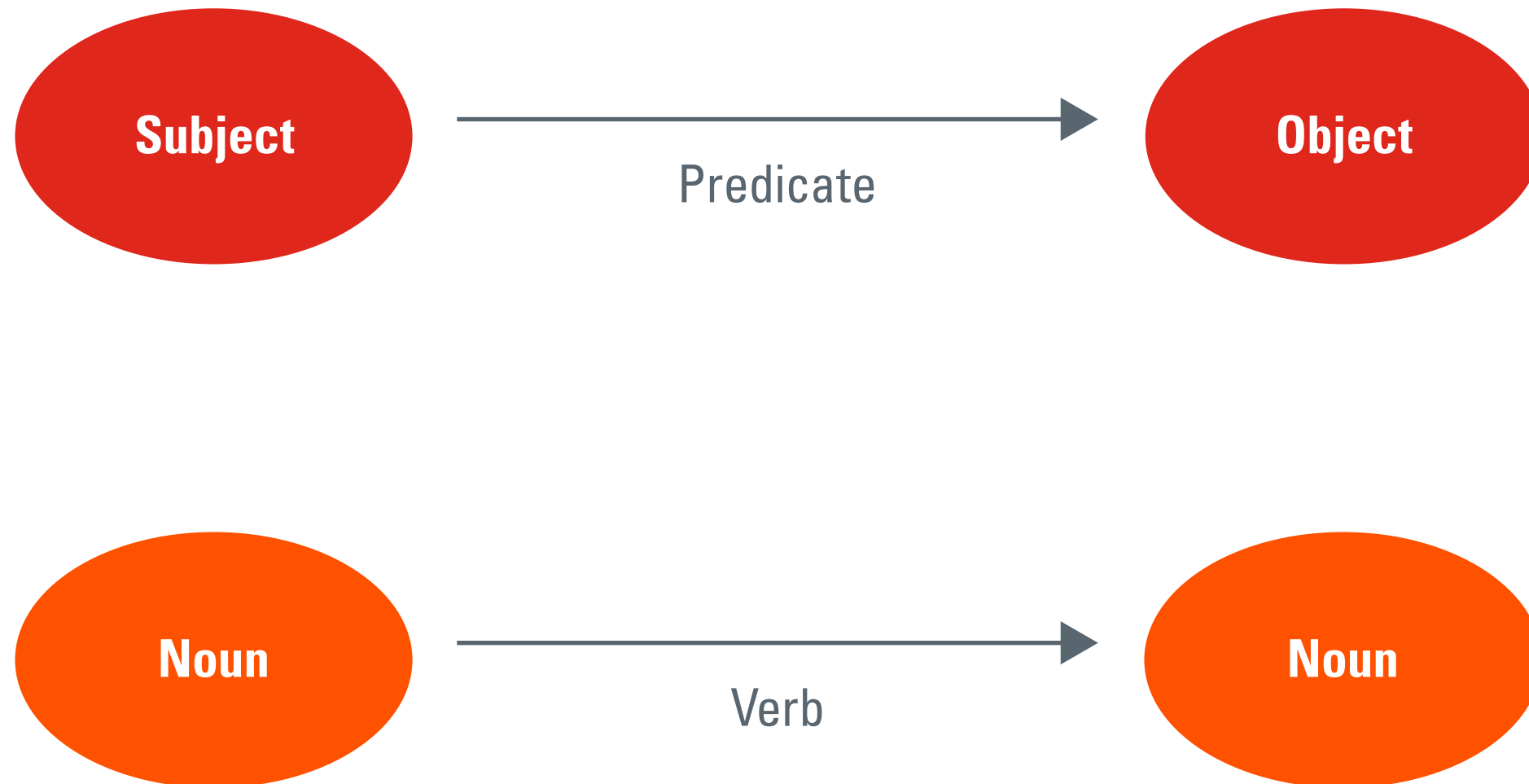# DES INV 200

Yoon Bahk, Hugh Dubberly, Kevin Ma
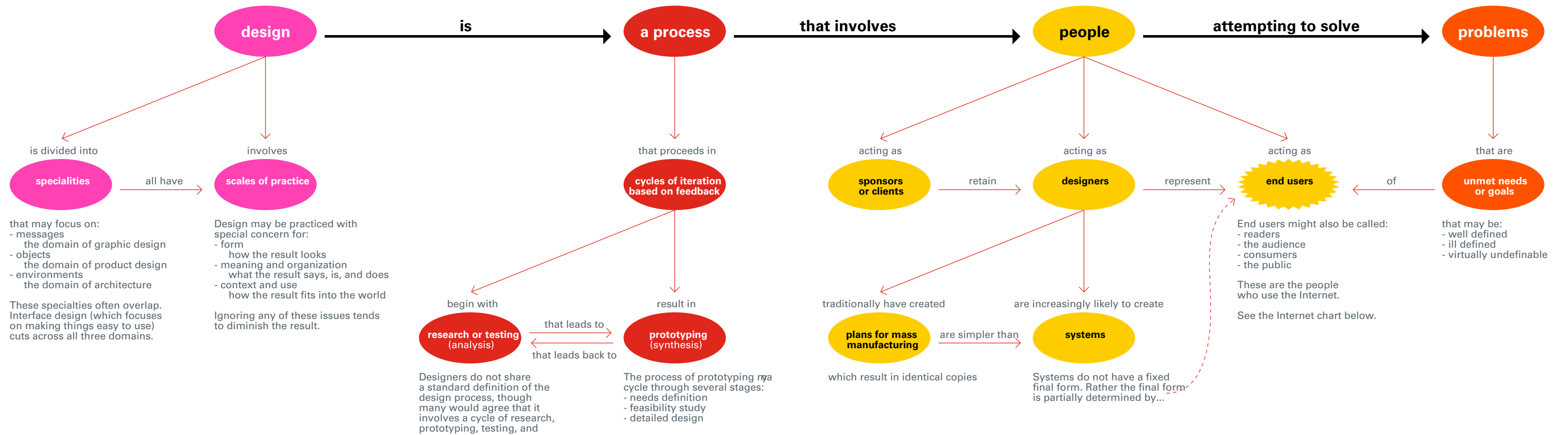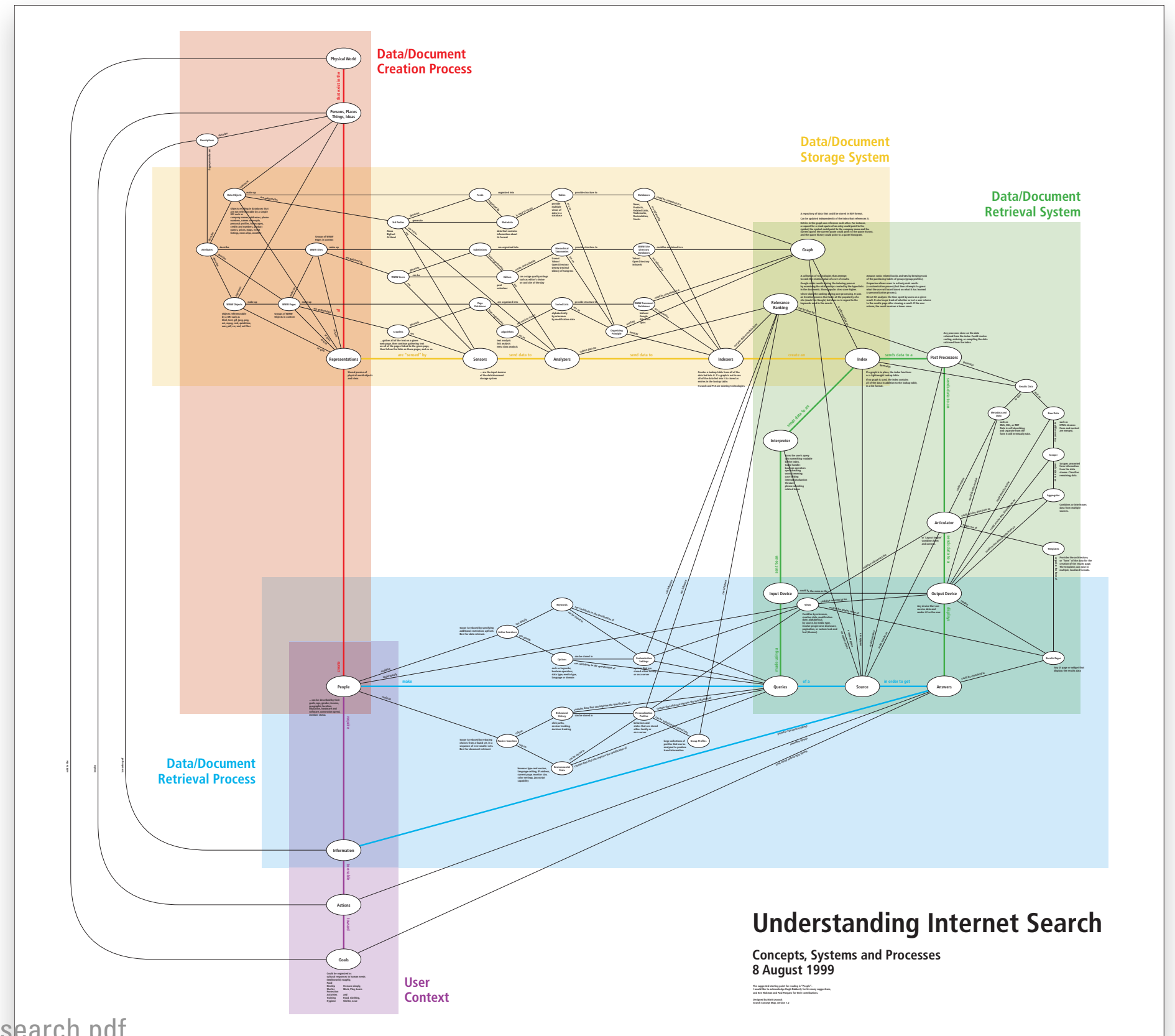Version 4 · January 11, 2024

# Concept maps

# Concept map structure

# Concept map

design **is** a process **that involves** people **attempting to solve** problems

design — **is divided into** → specialities

specialities — **all have** → scales of practice

design — **involves** → scales of practice

a process — **that proceeds in** → cycles of iteration based on feedback

cycles of iteration based on feedback — **begin with** → research or testing (analysis)

research or testing (analysis) — **that leads to** → prototyping (synthesis)

prototyping (synthesis) — **that leads back to** → research or testing (analysis)

cycles of iteration based on feedback — **result in** → prototyping (synthesis)

people — **acting as** → sponsors or clients

sponsors or clients — **retain** → designers

people — **acting as** → designers

designers — **represent** → end users

people — **acting as** → end users

problems — **that are** → unmet needs or goals

unmet needs or goals — **of** → end users

designers — **traditionally have created** → plans for mass manufacturing

designers — **are increasingly likely to create** → systems

plans for mass manufacturing — **are simpler than** → systems

## specialities
that may focus on:
- messages
    the domain of graphic design
- objects
    the domain of product design
- environments
    the domain of architecture

These specialties often overlap. Interface design (which focuses on making things easy to use) cuts across all three domains.

## scales of practice
Design may be practiced with special concern for:
- form
    how the result looks
- meaning and organization
    what the result says, is, and does
- context and use
    how the result fits into the world

Ignoring any of these issues tends to diminish the result.

## research or testing (analysis)
Designers do not share a standard definition of the design process, though many would agree that it involves a cycle of research, prototyping, testing, and

## prototyping (synthesis)
The process of prototyping may run a cycle through several stages:
- needs definition
- feasibility study
- detailed design

## plans for mass manufacturing
which result in identical copies

## systems
Systems do not have a fixed final form. Rather the final form is partially determined by...

## end users
End users might also be called:
- readers
- the audience
- consumers
- the public

These are the people who use the Internet.

See the Internet chart below.

## unmet needs or goals
that may be:
- well defined
- ill defined
- virtually undefinable

# Leacock's model of Search



**Understanding Internet Search**

Concepts, Systems and Processes
8 August 1999

https://www.dubberly.com/wp-content/uploads/2008/06/ddo_search.pdf

# Information primitives

**Primitive 1**
**Point**

**Primitive 2**
**Line**

**Primitive 3**
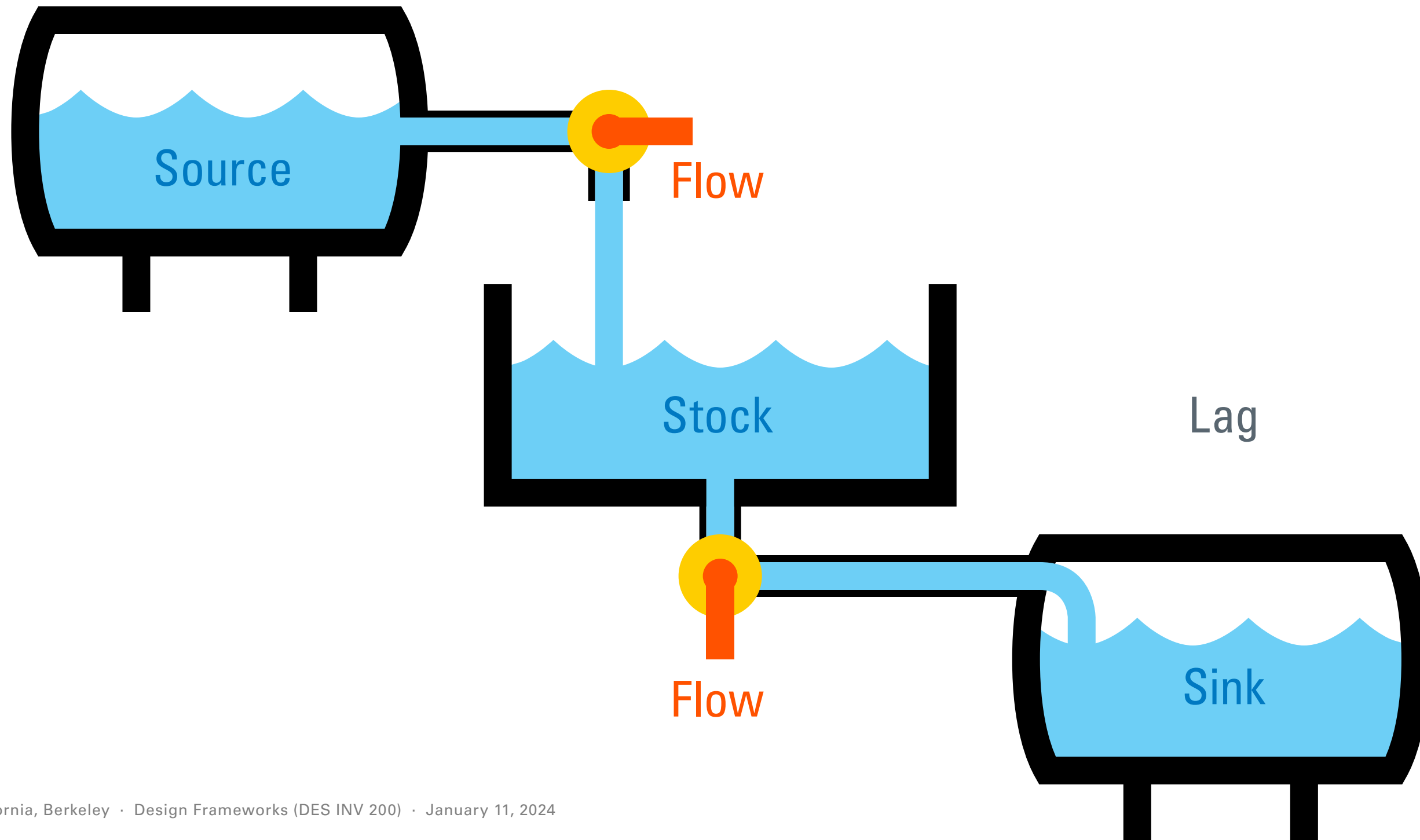**Matrix**

**Primitive 4**
**Tree**

**Primitive 5**
**Web**

# Causal-Loop Diagrams (CLDs)

# Stocks and flows

Dynamic Equilibrium



Source

Flow

Stock

Lag

Flow

Sink

# Feedback
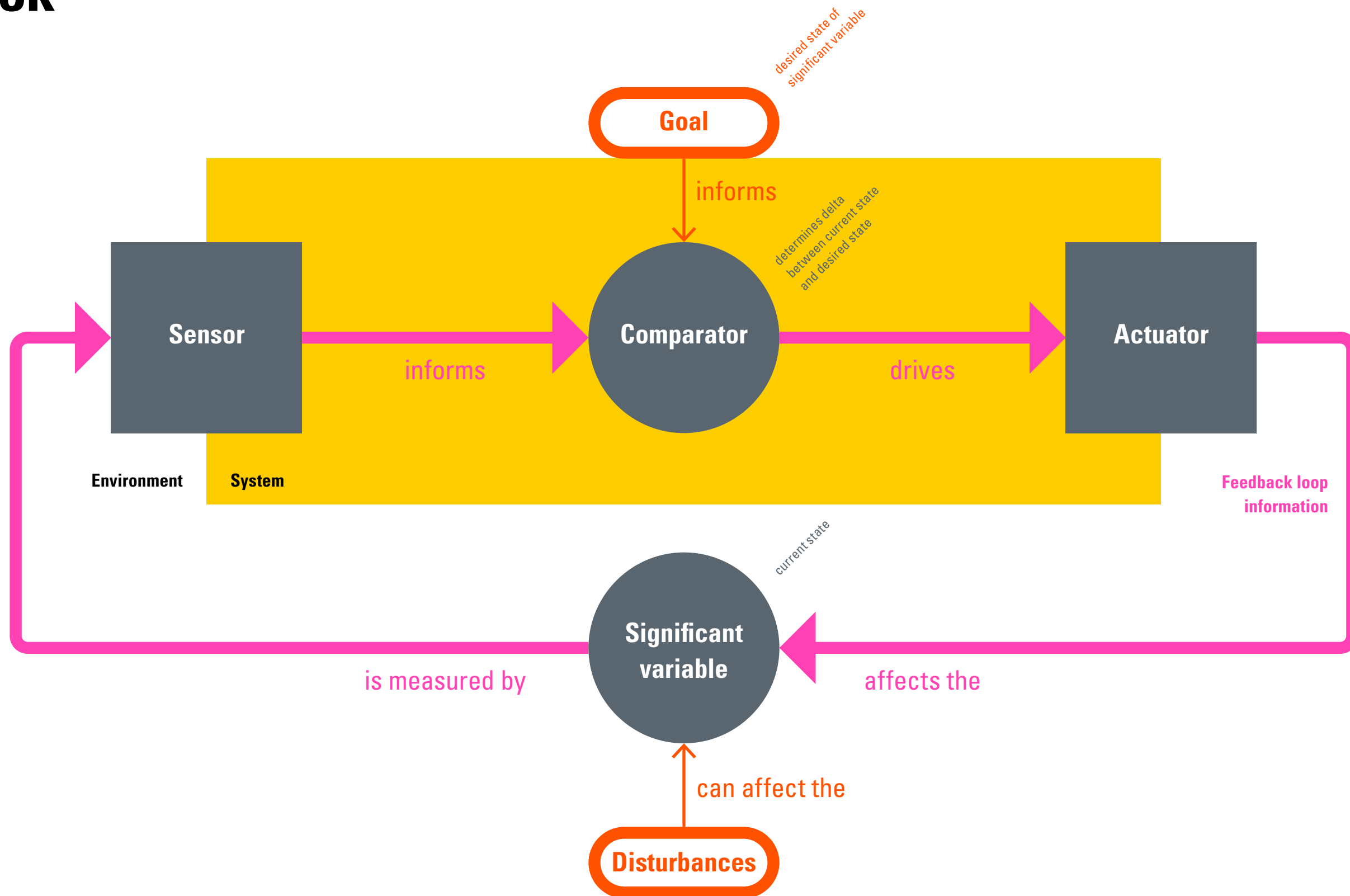
# **Desireable, Viable, Feasible** (DVF), and its variants

# Successful products balance desirability, viability, and feasibility.
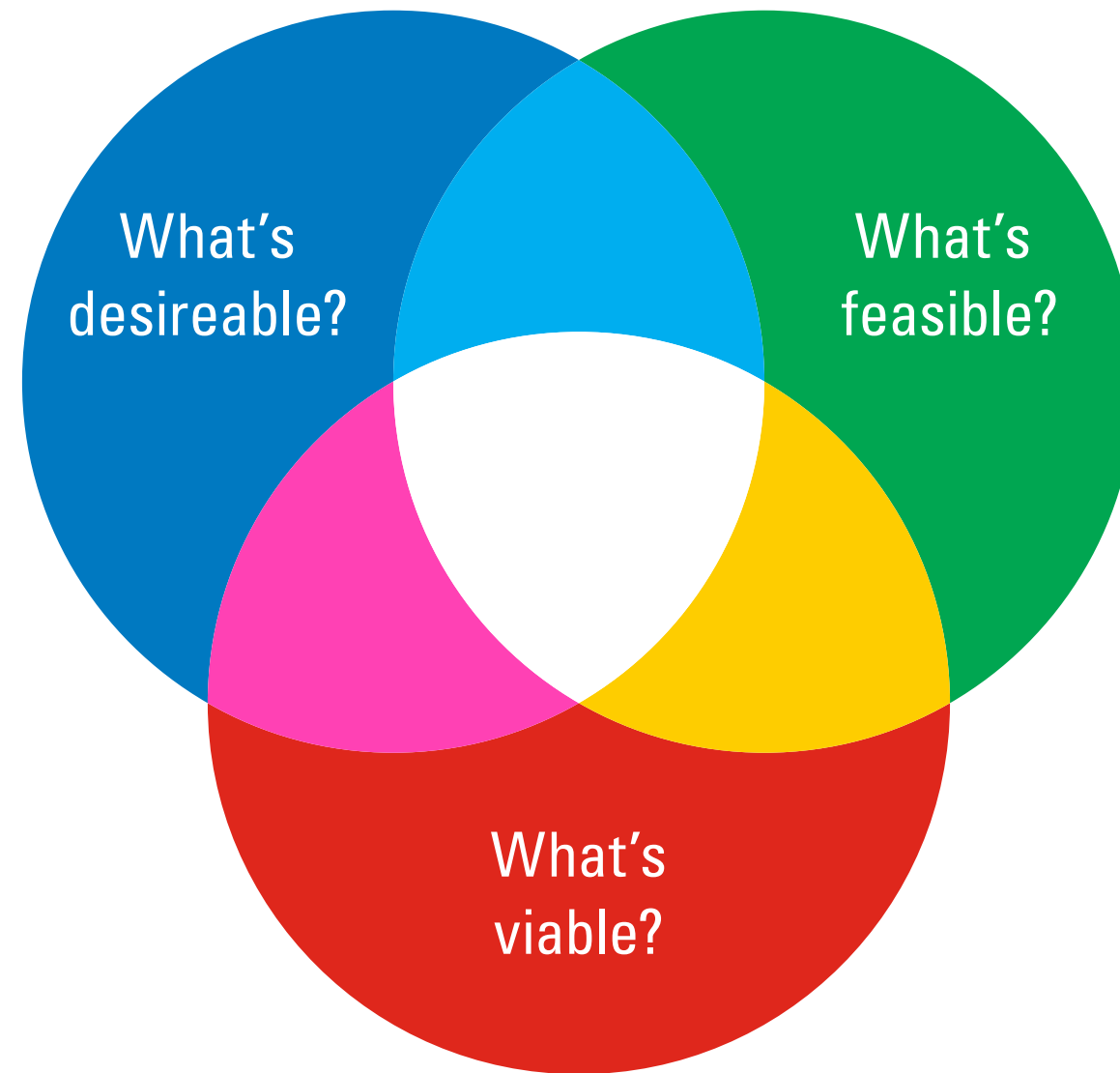
# Vitruvius asserted that a building or other structure must exhibit three qualities: Firmitas (solidity), utilitas (commodity), venustas (beauty)



**Firmitas**
Solidity

**Utilitas**
Commodity

**Venustas**
Beauty
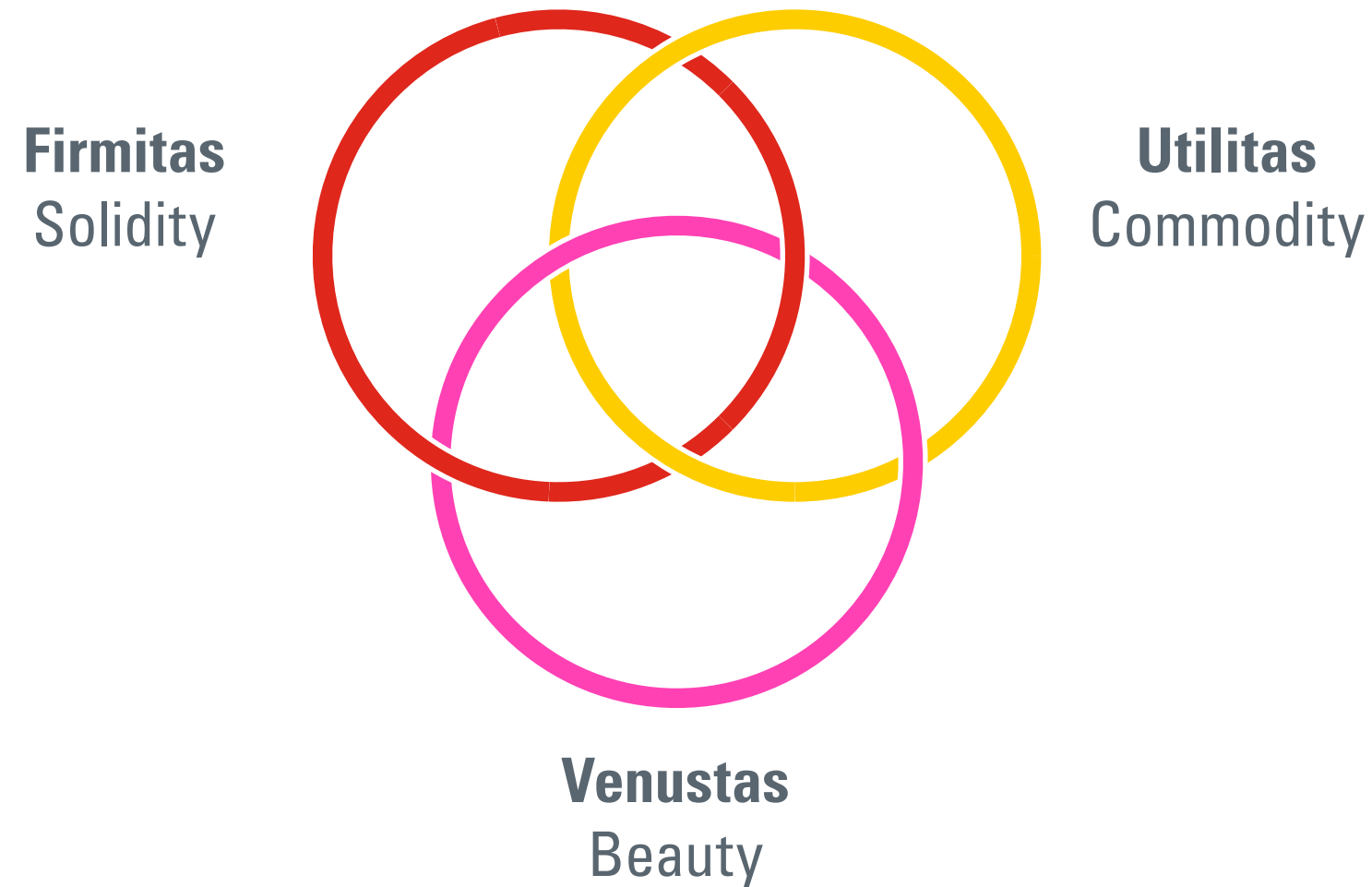
The ISO 9241 defines usability as
**"the extent to which a product can be used ... with effectiveness, efficiency, and satisfaction"**

Effectiveness

Efficiency

**Usability**

Satisfaction
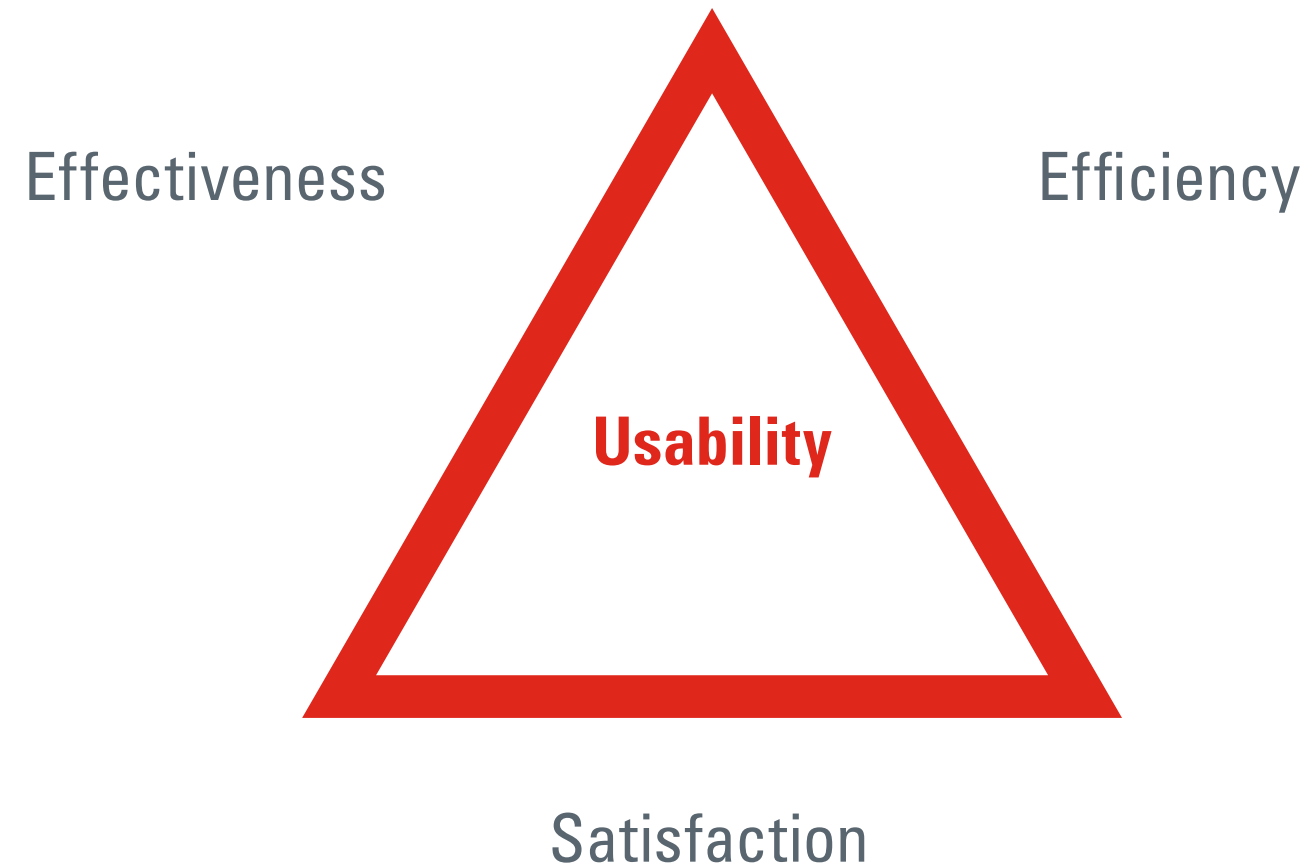
# Venns

**Row 1: Comb Curves**
after John Venn (1880) and Charles Sanders Peirce (1896)
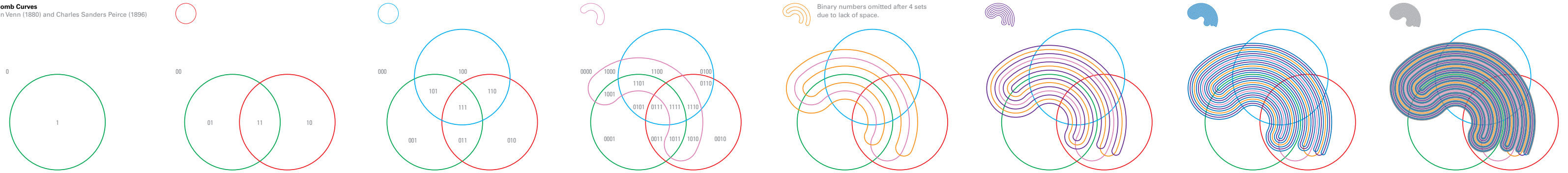
Binary numbers omitted after 4 sets due to lack of space.

**Row 2: Similarly Shaped Sets**
1-to-4-sets after John Venn (1880)
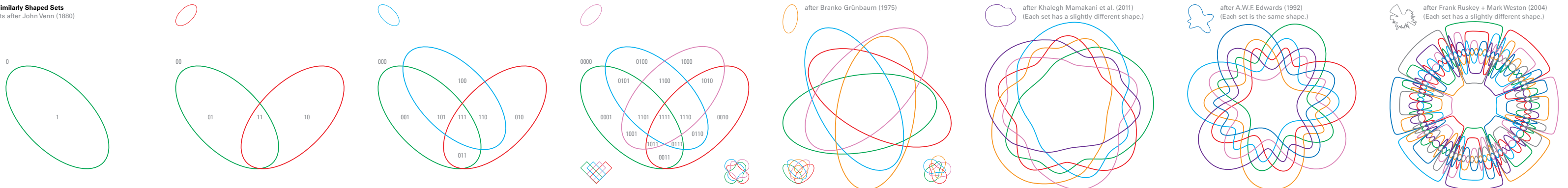
after Branko Grünbaum (1975)

after Khalegh Mamakani et al. (2011)
(Each set has a slightly different shape.)

after A.W.F Edwards (1992)
(Each set is the same shape.)

after Frank Ruskey + Mark Weston (2004)
(Each set has a slightly different shape.)

**Row 3: Edwards-Venn**
after A.W.F. Edwards (1988)
and Branko Grünbaum (1992)
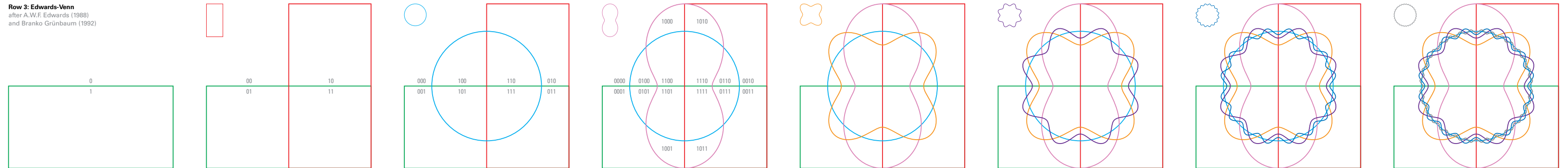
# Venns



**Row 4: Sine Waves as Venns**
after Martin Gardner (1971), C.A.B. Smith and A.W.F. Edwards (1989)
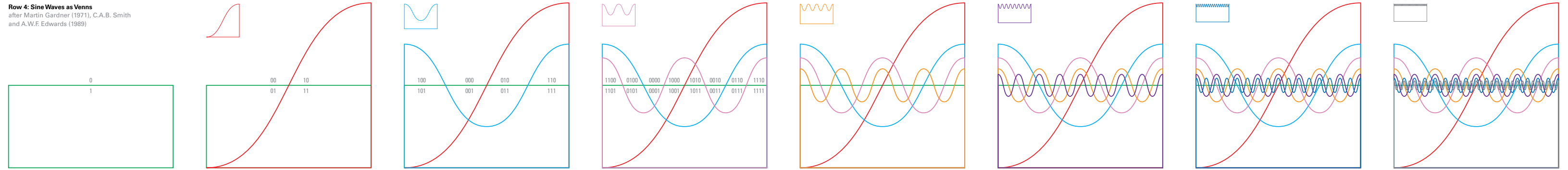
**Row 5: Boxes**
after Charles Dodgson (a.k.a. Lewis Carroll) (1896)
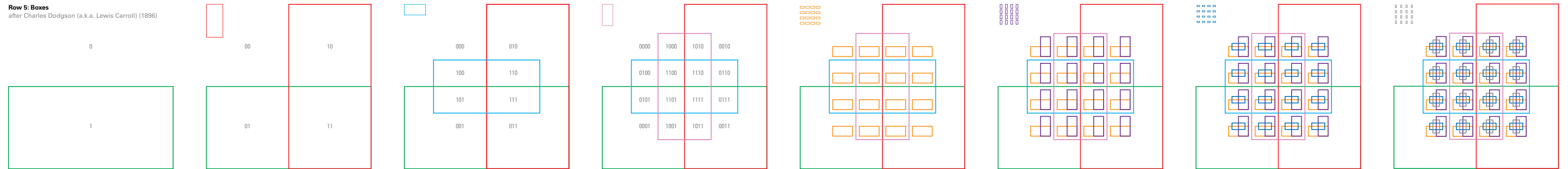
**Row 6: Boxes and Combs**
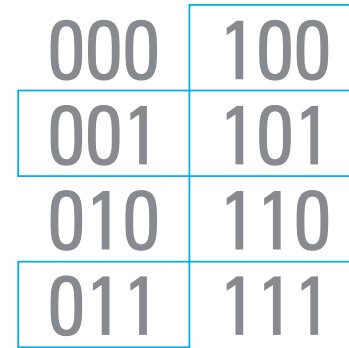after Arnaud Bannier and N. Bodin (2017)
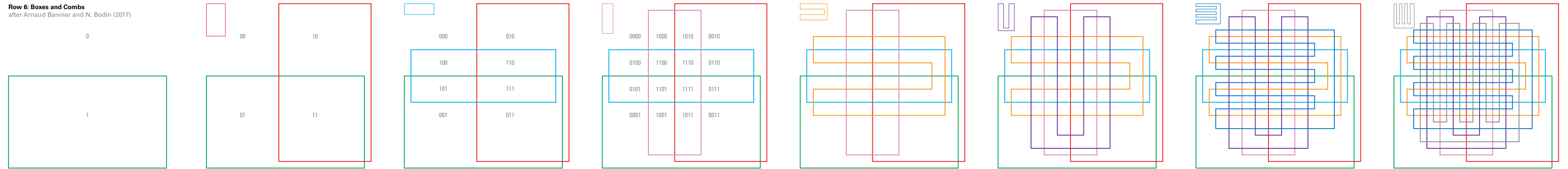
# Venns

**Row 7: Binary Counting in Grids**
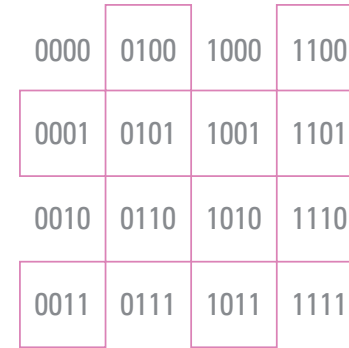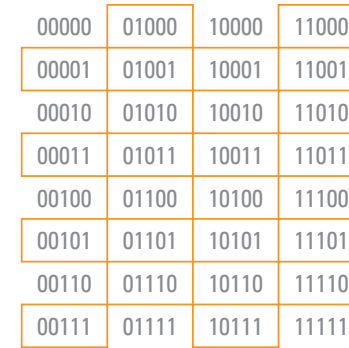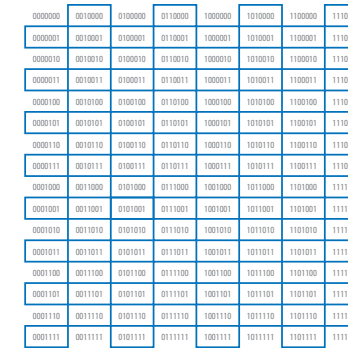(N sets have 2^N possible unique regions, e.g. 2^1 = 2.)
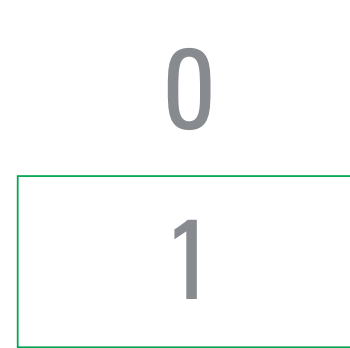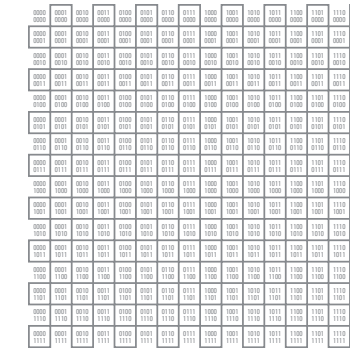
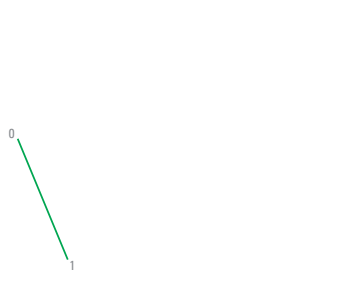2^2 = 4 · 2^3 = 8 · 2^4 = 16 · 2^5 = 32 · 2^6 = 64 · 2^7 = 128 · 2^8 = 256
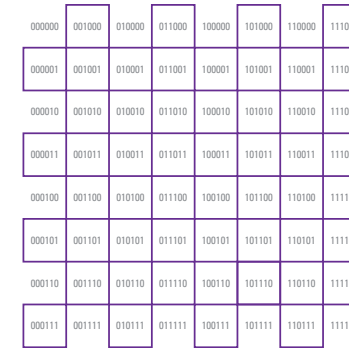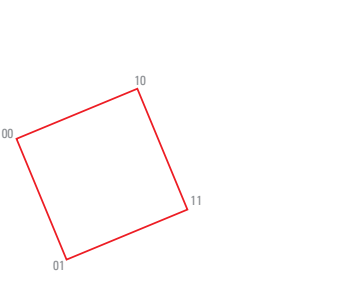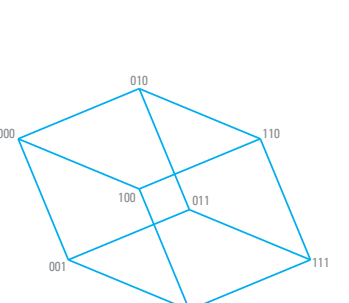


**Row 8: Hypercubes in 1-to-8 Dimensions**
Set intersections map to corners in hypercubes.
1D, a line

2D, a square · 3D, a cube · 4D, a tesseract · 5D · 6D · 7D · 8D
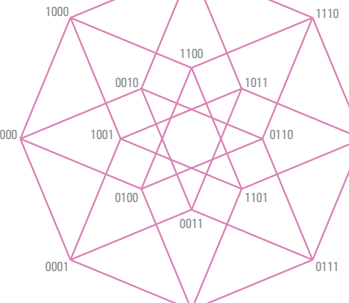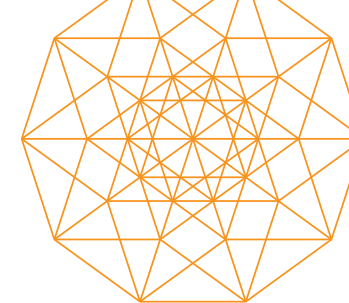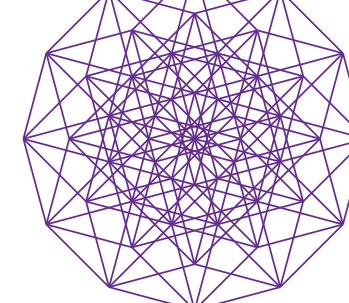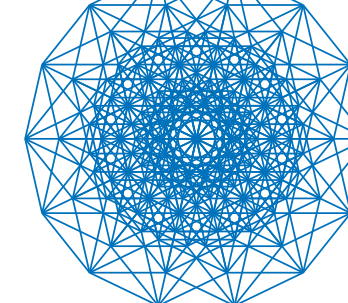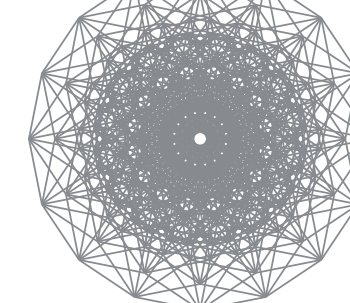


**Row 9: Overlapping Circles (Incomplete Venns)**
0's and 1's as shown in Row 1, can also be substituted with letters and dashes for easier identification of missing combinations. 2 shown + 0 missing = 2.
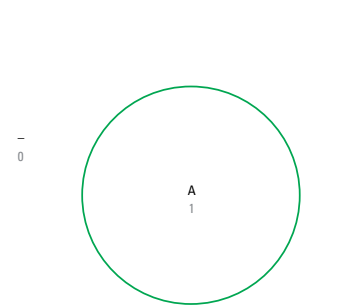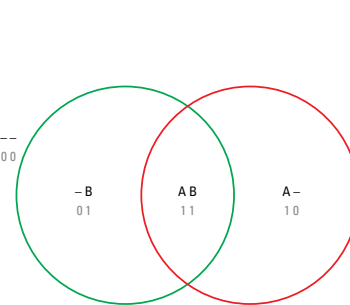
4 shown + 0 missing = 4 · 8 shown + 0 missing = 8 · 14 shown + 2 missing = 16 · 22 shown + 10 missing = 32 · 32 shown + 32 missing = 64 · 44 shown + 84 missing = 128 · 58 shown + 198 missing = 256
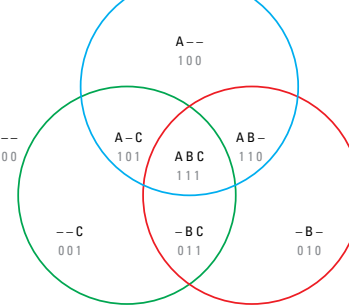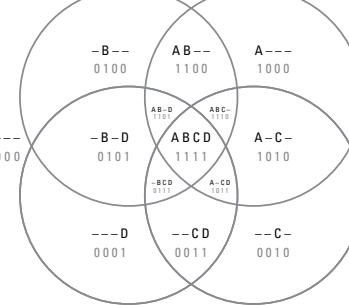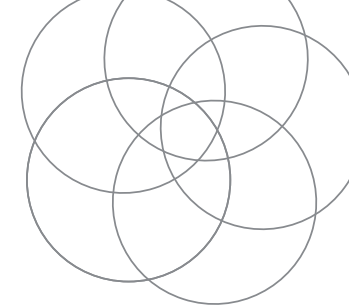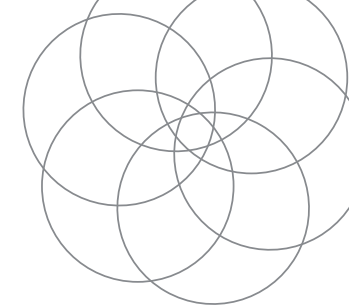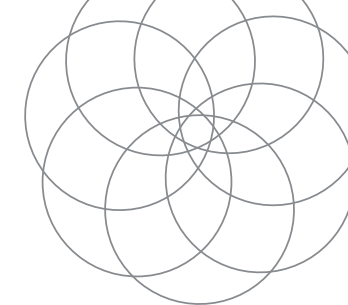
# Venns



Visualizing
1-to-8-set
Venn Diagrams

# Hasse diagrams

# User Conceptual Models

# User conceptual model structure

Application ——— includes ————————→ Main Data Object 1 ——— includes ————→ Sub-object 1 ——— must be ————→ Data Type

can be

Created

Read                                                                    Sub-object 2 ——— can be ————→ Numeric Value

Updated

Displayed                                                               Sub-object 3 ——— is ————→ Text String

includes ————————→ Main Data Object 2

can be

Created

Read

Updated

Displayed

Black = Entities (data type)
Red = Relation between entities
Pink = Action user can take on entity

# UCM of email

**Accounts**
such as
- AOL
- Exchange
- Gmail
- Hotmail
- iCloud
- Ymail

*include →* **Mail Boxes**
can be
Added
Deleted
Logged in to
Logged out of

*can be accessed by →* **Kindle Email Client**
Access includes
- Fetch and Push
- Auto and Manual

or
Other Clients

*sends and receives →* **Messages**
can be
Created
- New
- - Manually
- - From short cuts
- Reply
- Reply All
- Forward
- Sent
- Sent Again
Read (opened)
- As preview
- Full text
Read
- Text-to-speech
Updated (draft)
Deleted
- Locally
- Globally
- Singly
- En Masse
- Undo
Saved
- Locally
- To Cloud
Filtered
Sorted
Searched
- Locally
- Globally
- Within Filter
Moved
- Singly
- En masse
Flagged
Marked (read/not)
- Singly
- En masse

*contain →* **Text**
- Original
- Quoted
can be
Created
- By Virtual Keyboard
- By Microphone
   (voice-to-text)
Deleted
Formatted
Annotated
Spell-checked
Enlarged / Reduced

*has →* **Format**
*could be →* **Plain Text**
can be
Viewed + Created

**Hot Strings**
- URLs (Auto-formed links)
- Dates (Calendar events)
- Names (Contacts)
- Phone numbers
- Addresses
can be
Auto-recognized

→ **RichText**
can be
Viewed only

**Annotations**
- Highlights
- Notes
can be
Created / Deleted
Displayed / Hidden

→ **HTML Text**
can be
Viewed only

*includes →* **Images**
can be
Attached / Deleted
Displayed / Hidden
Saved
Loaded from remote source

*sent to / uploaded from →*
Local memory
Cloud
Gallery
Quick Office
Documents to Go
Social network sites (later)

**Attachments**
can be
Attached
Deleted
Opened / Closed
Saved

*sent to / uploaded from →*

**Meta-data**
can be
Created / Deleted
- Automatic
- Manual
Displayed / Hidden
Used to Filter
Used to Sort

*includes →* **Recipients**
- Main
- CC
- BCC
Sender
Subject
Preview
Time Stamp (year, month, day, hour, minute)
Flag (on or off, depends on service)
Tags
Status (unread or read)
Response (none, reply, or forward)
Priority (low, normal, or high)
Routing Information

*are stored in →* **Contacts List**

*are →* **Primary (Default)**
or
**Secondary**
can be
Designated

*are associated with →*
**Account Name**
User Name
Email Address
User Name
Password
Server

Protocols
- SMTP for sending
- IMAP or POP for retrieving
- Exchange

*for IMAP / POP* **Port**
Secure Connection
- Auto
- SSL/TLS
- STARTTLS

*for Exchange* **Domain**
Secure Connection (yes or no)
can be
Configured

*includes →* **Kindle email address**
e.g., ron@kindle.com
is
Included w/Kindle purchase
Receives and converts docs
Automatically added to Contacts

**Preferences**
- Primary Account
- Notification
- - Sound
- - By Account
- - By Sender
- Preview Length
- Meta-data View
- Auto Download
- - Yes / No
- - Up to file size
- Number of Messages Stored
- Number of Days  Saved
- Signature (default from Amazon)
- Auto-response (out-of-the-office)
can be
Configured

*are organized in →* **Folders**
can be
Created / Deleted
Opened / Closed
Moved

*such as →*
All (unified in-box, default if multiple services)
Account (1 to n; mean = 6)
Inbox (Default, if only one service)
Drafts (Depends on service)
Sent (Depends on service)
Junk (Spam, depends on service)
Trash (Depends on service)
Archive (Depends on service)

**Threads (Conversations)**
can be
Displayed / Hidden

*may include →* **Related Features**
- Contacts
- Calendar
- Bookmarks
- Reminders (To-do's)
- Documents (Files)
- Media (e.g., books, music, video)

Black = Entities (data type)
Gray = Entity to be added later
Red = Relation between entities
Pink = Action user can take on entity
Yellow = Action to be added later

# Scheiner's Digital Machine
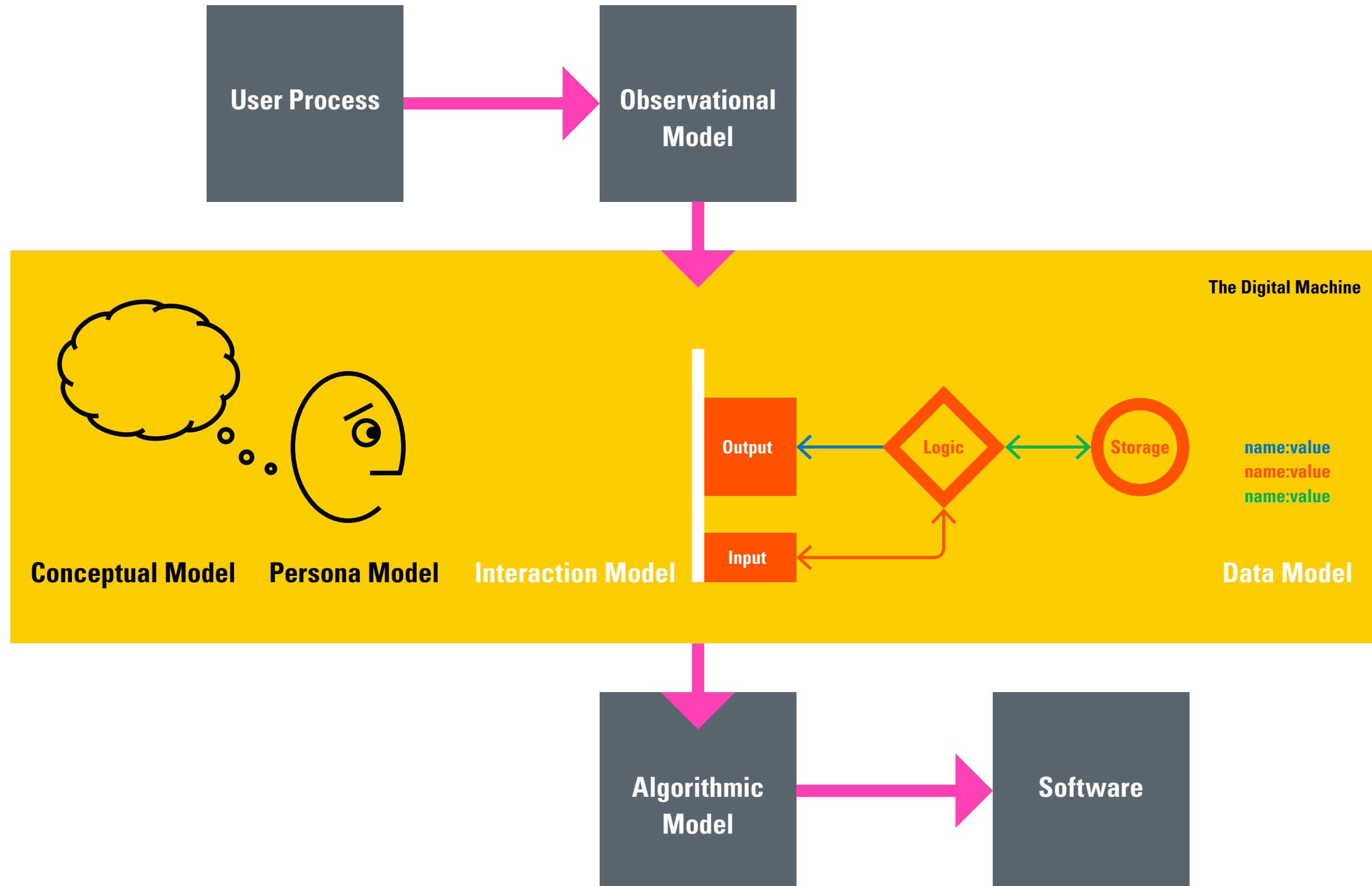
# 2-by-2's

# Strength-Weakness-Opportunity-Threat
## (SWOT)

|  | Present | Future |
|---|---|---|
| **Positive** | Strengths | Opportunities |
| **Negative** | Weaknesses | Threats |

# Strength-Weakness-Opportunity-Threat (SWOT)

|  | Past | Present | Future |
|---|---|---|---|
| **Positive** | Successes | Strengths | Opportunities |
| **Negative** | Failures | Weaknesses | Threats |
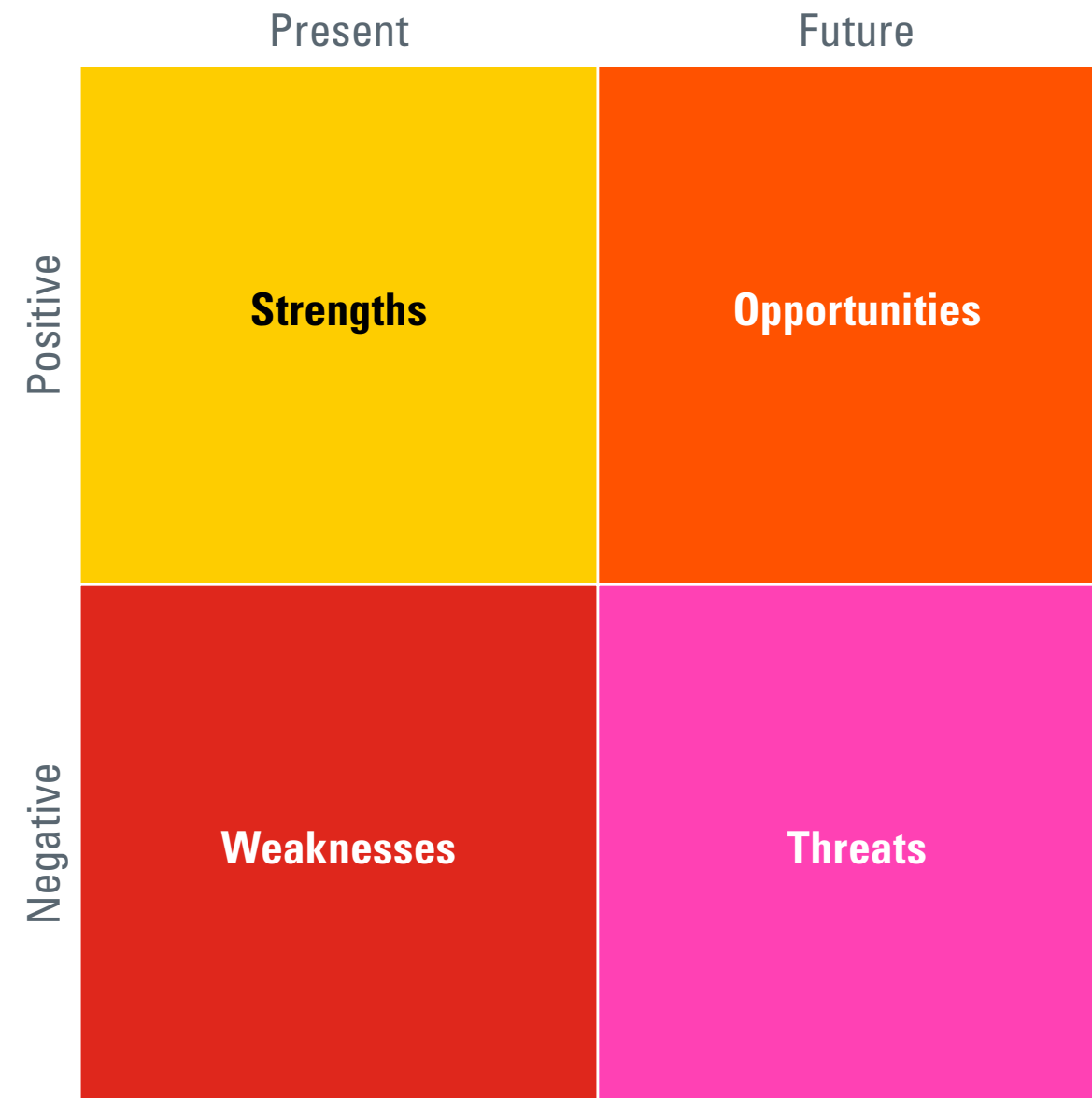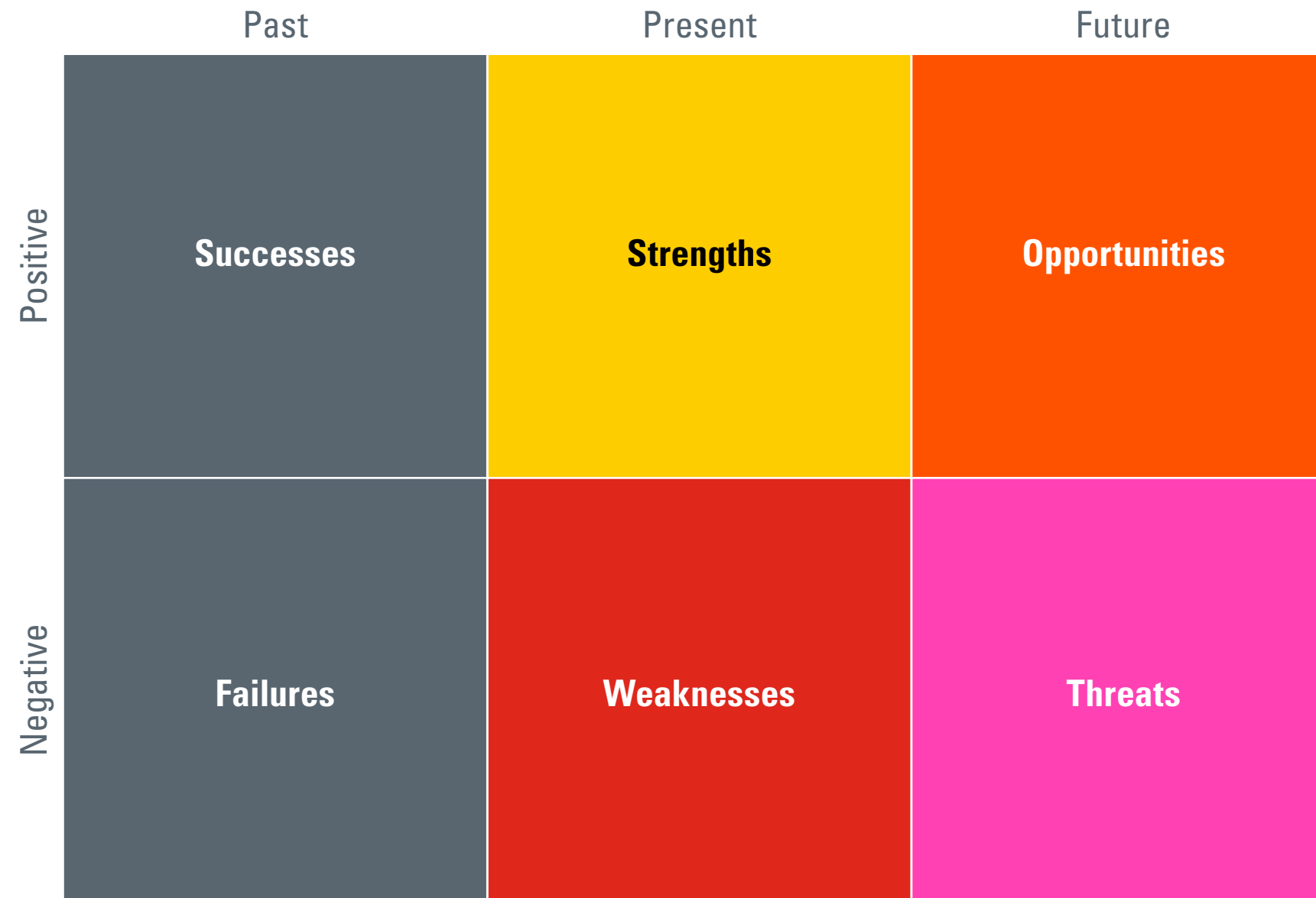
# Controlling
## Manager tells designer what to do and how to do it

Hallmark of a traditional
industrial-age organization;
may be appropriate for new
or under-performing employees

e.g., "Make the logo bigger."



**Manager**

Goals

Goals

Means
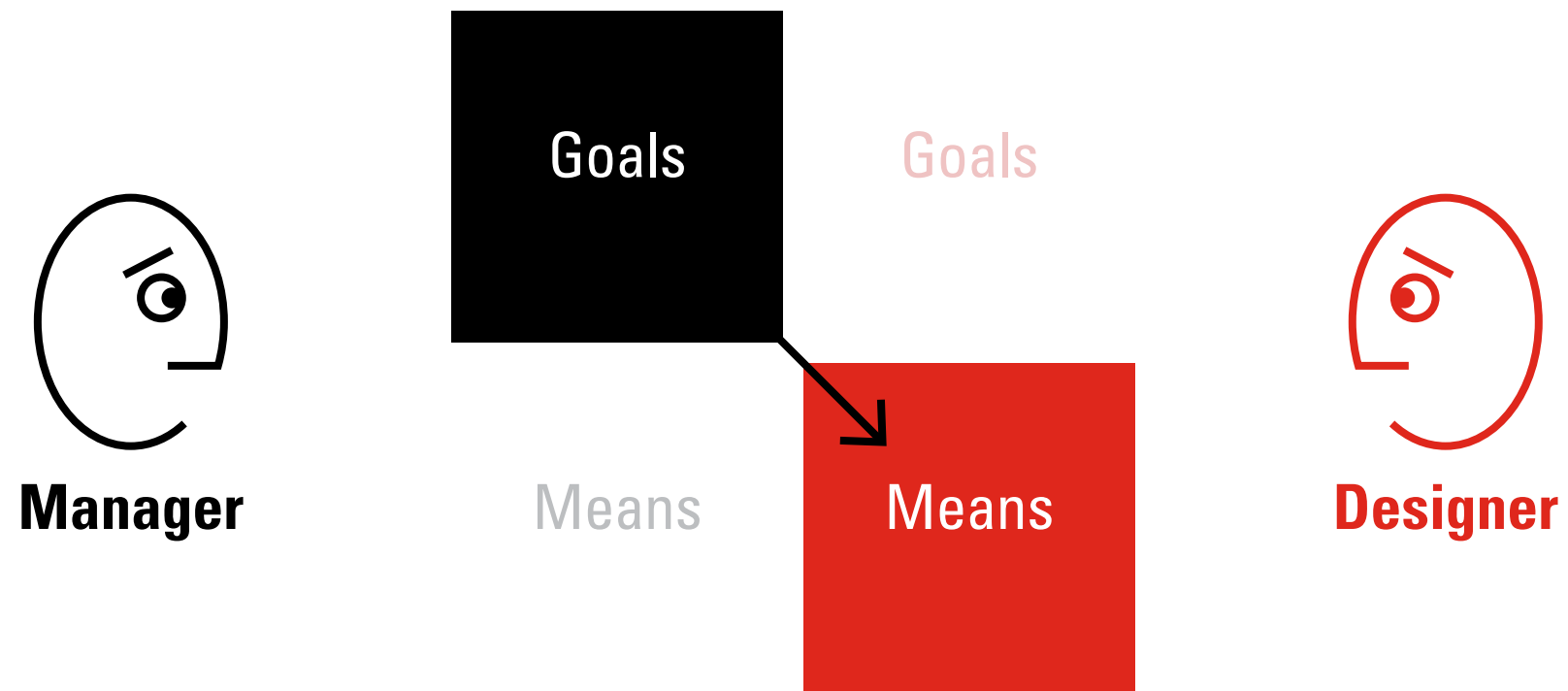
Means

**Designer**

# Mentoring
## Manager sets goals and discusses means with designer

Enlightened managers realize
that teaching is a key responsibility

e.g., "What's the best way
to make sure our name really pops?"

Goals    Goals

**Manager**    Means → Means    **Designer**
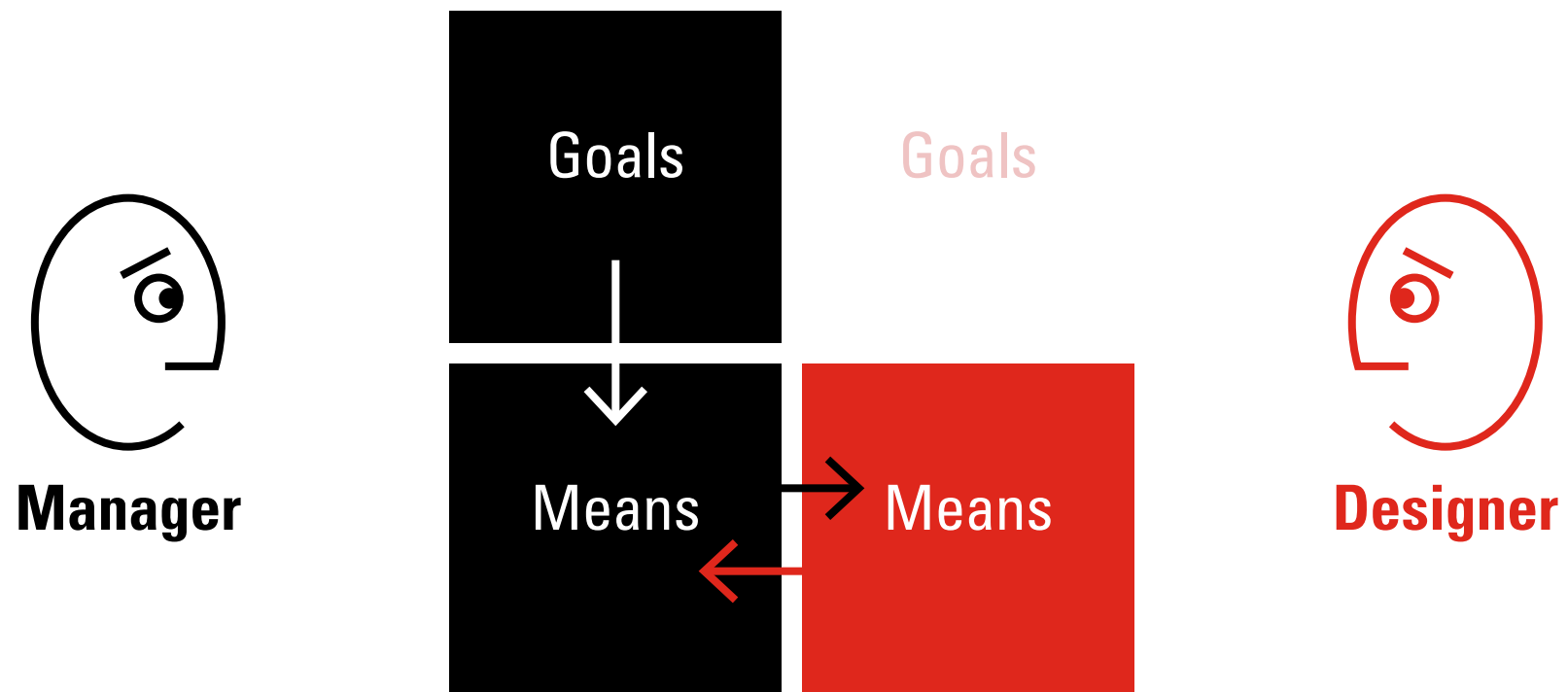
# Delegating
## Manager sets goal and leaves means to the designer

Good managers get out of the way
of good employees
and let them to do their jobs

e.g., "Make sure this ad gets noticed."

**Manager**

Goals → Goals

Means

Means
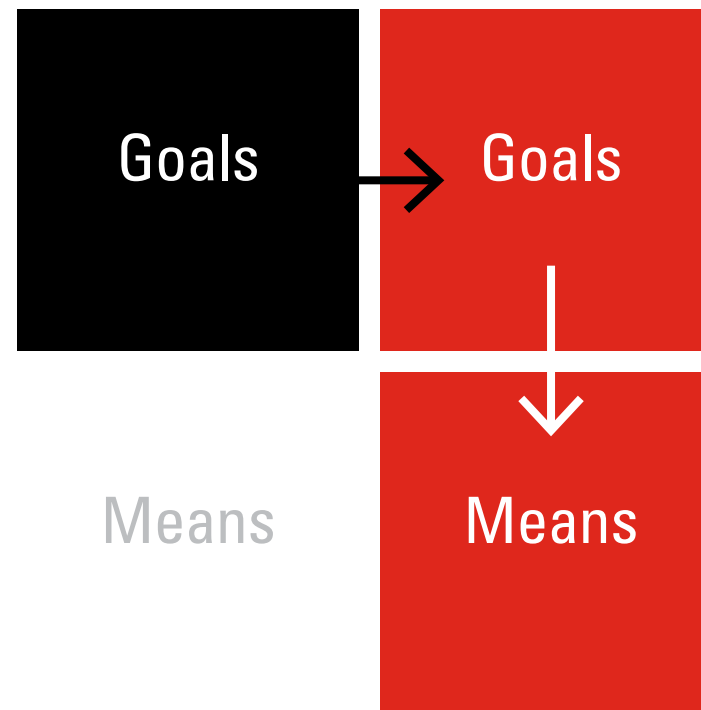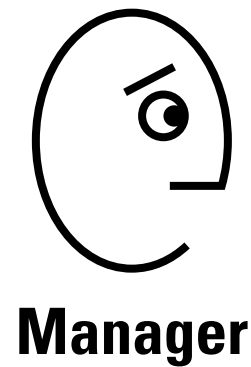
**Designer**

# Collaborating
## Manager and designer set goals together

Information-age management
is less hierarchical
and more collegial

e.g., "Which methods
of engaging customers
are right for us?"

**Manager**

Goals → Goals

Means

Means

**Designer**
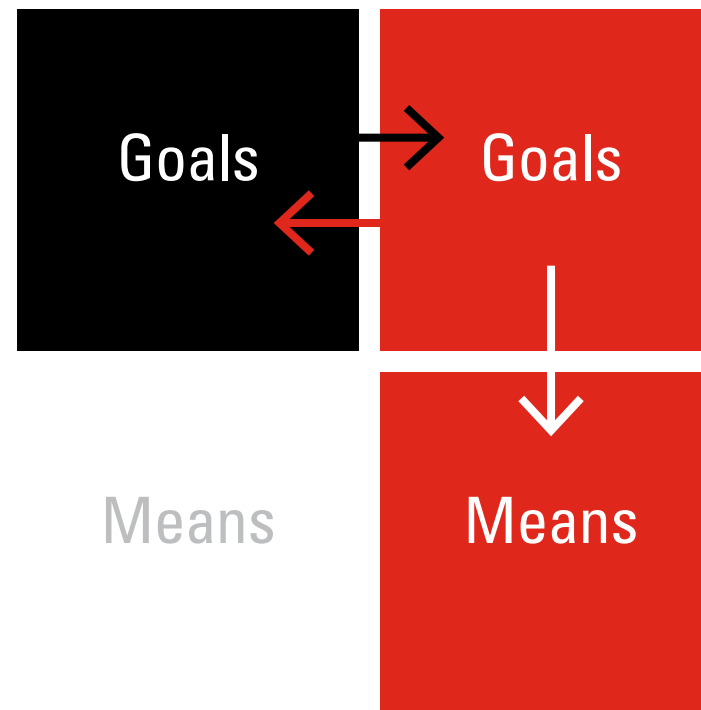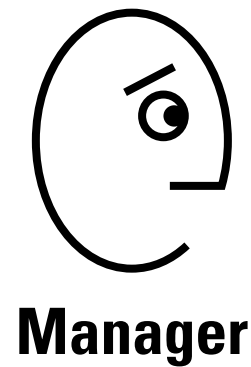
# True Positive/True Negative (TP/TN) vs. False Positive/False Negative (FP/FN)
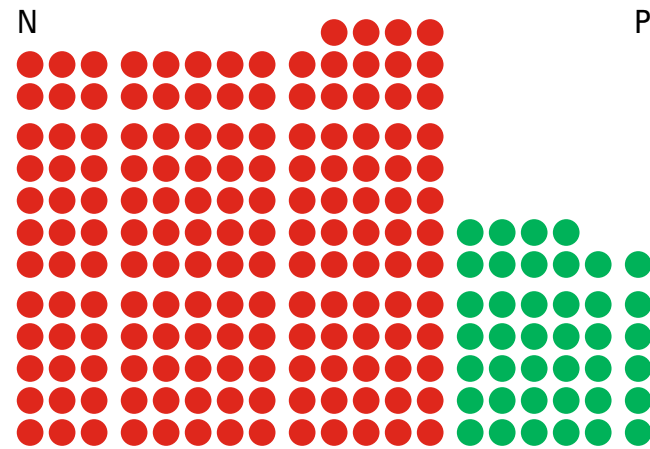


200 patients present with symptoms / month,
with a prevalence of 20% (x 200 = 40)
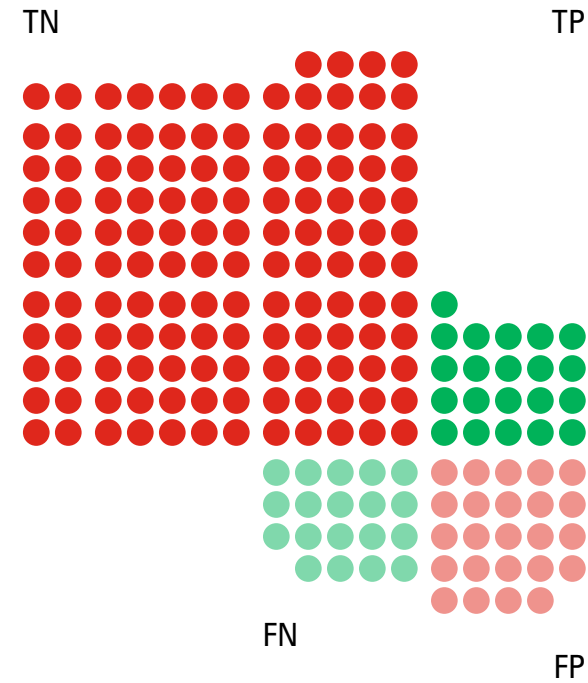
Current technology A
correctly identifies 21 of the 40 (TP = 52%)
and 136 of the 160 (TN = 85%),
missing 19 of the 40 (FN = 47%)
and mis-idenitifying 24 of the 160 (FP = 15%)
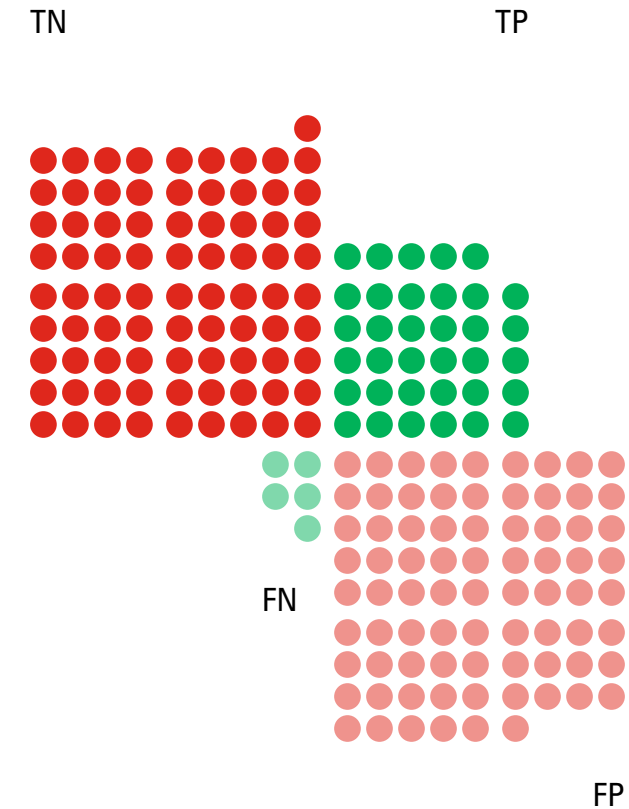
New technology B
correctly identifies 35 of the 40 (TP = 87%)
and 82 of the 160 (TN = 51%),
missing only 5 of the 40 (FN = 12%)
and mis-idenitifying 78 of the 160 (FP = 48%)

# Shannon's Model of Communication

# Shannon's Model of Communication

**Info Source** → Message → **Transmitter** → Signal → **Channel** ● → Received Signal → **Receiver** → Message → **Destination**

**Noise Source** (arrow pointing up to Channel)
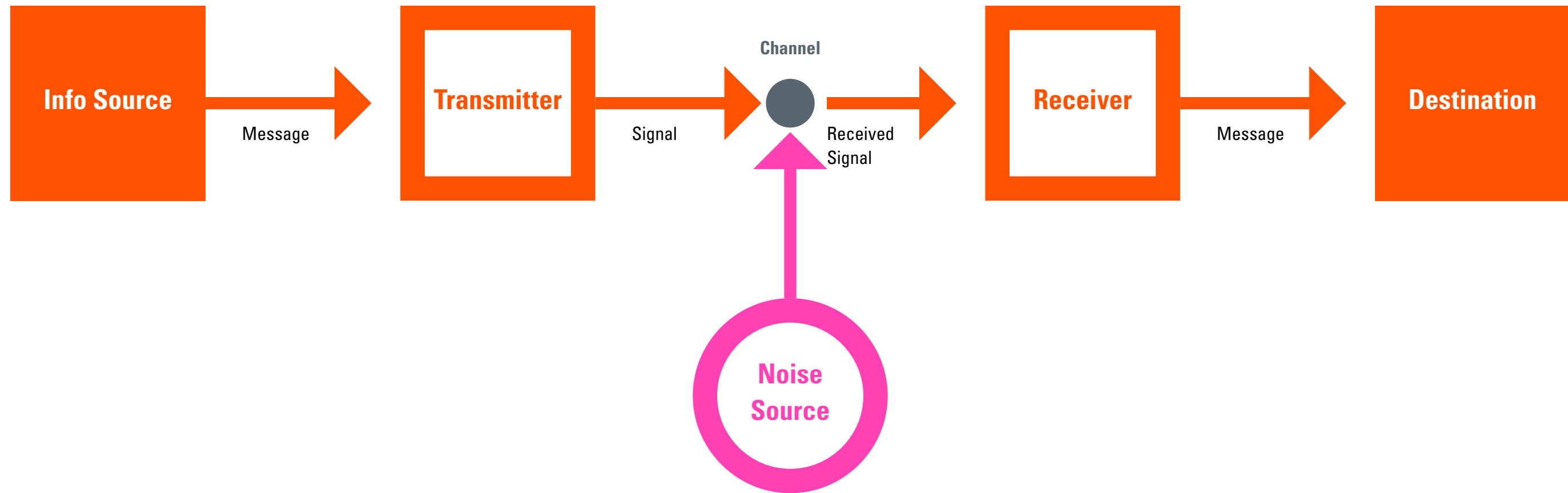
# Open Systems Interconnection (OSI)

| | | |
|---|---|---|
| **7** | **Application** | Allows applications to request network services. |
| **6** | **Presentation** | Converts data so that systems that use different data formats can exchange information. |
| **5** | **Session** | Establishes sessions between network applications. |
| **4** | **Transport** | Provides reliable delivery of packets. |
| **3** | **Network** | Handles routing of data across network segments. |
| **2** | **Data Link** | Provides MAC addresses to uniquely identify network nodes and a means for data to be sent over the Physical layer. |
| **1** | **Physical** | Governs the layout of cables and devices, such as repeaters and hubs. |

# Open Systems Interconnection (OSI)
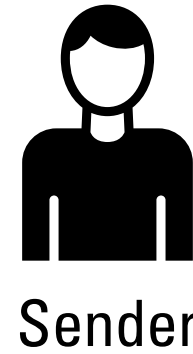
Sender   Device                Device   Receiver

| 7 | **Application** | | |
| 6 | **Presentation** | | |
| 5 | **Session** | | |
| 4 | **Transport** | | |
| 3 | **Network** | Local Router | Local Router |
| 2 | **Data Link** | Local Switch | Local Switch |
| 1 | **Physical** | | |

Network Routers
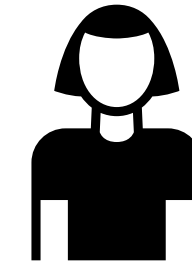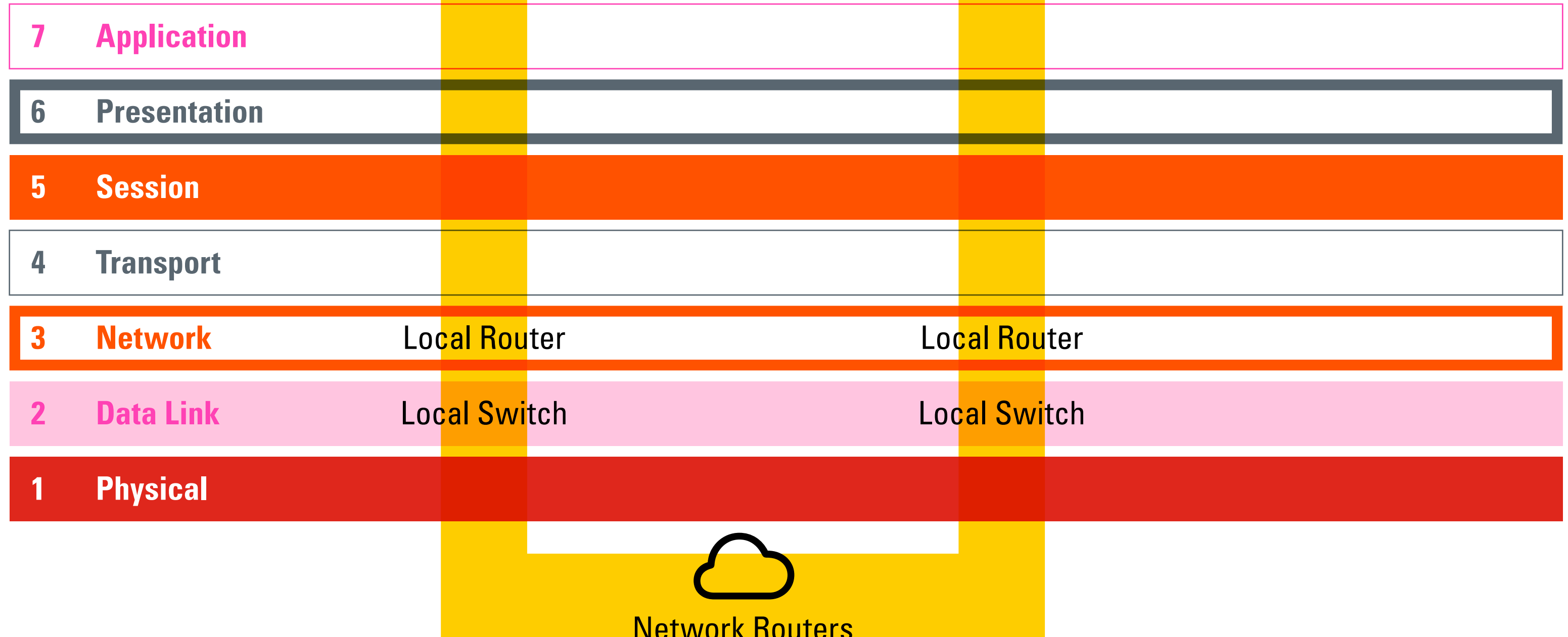
# Stacks

| | |
|---|---|
| **Local Documents** | .doc, .xls, .ppt, etc. |
| **PC Apps** | Word, Excel, PowerPoint, etc. |
| **Operating System (OS)** | Windows |
| **Processor** | 8086, 80286, 80386, etc. |

# A platform is a service on which others can build.

**App L2**

**Platform L1**

# Applications rely on platforms;
# **but an app may itself be a platform**
# for another higher level app.

App L3

App L2

Platform L2

Platform L1

# Maslow's hierarchy of needs



Self-fulfillment needs

**Self-actualization**
achieving one's full potential,
including creative activities

**Esteem**
prestige and feeling of accomplishment

Psychological needs

**Belonging + Love**
intimate relationships, friends

**Safety**
security, safety

Basic needs

**Physiological**
food, water, warmth, rest
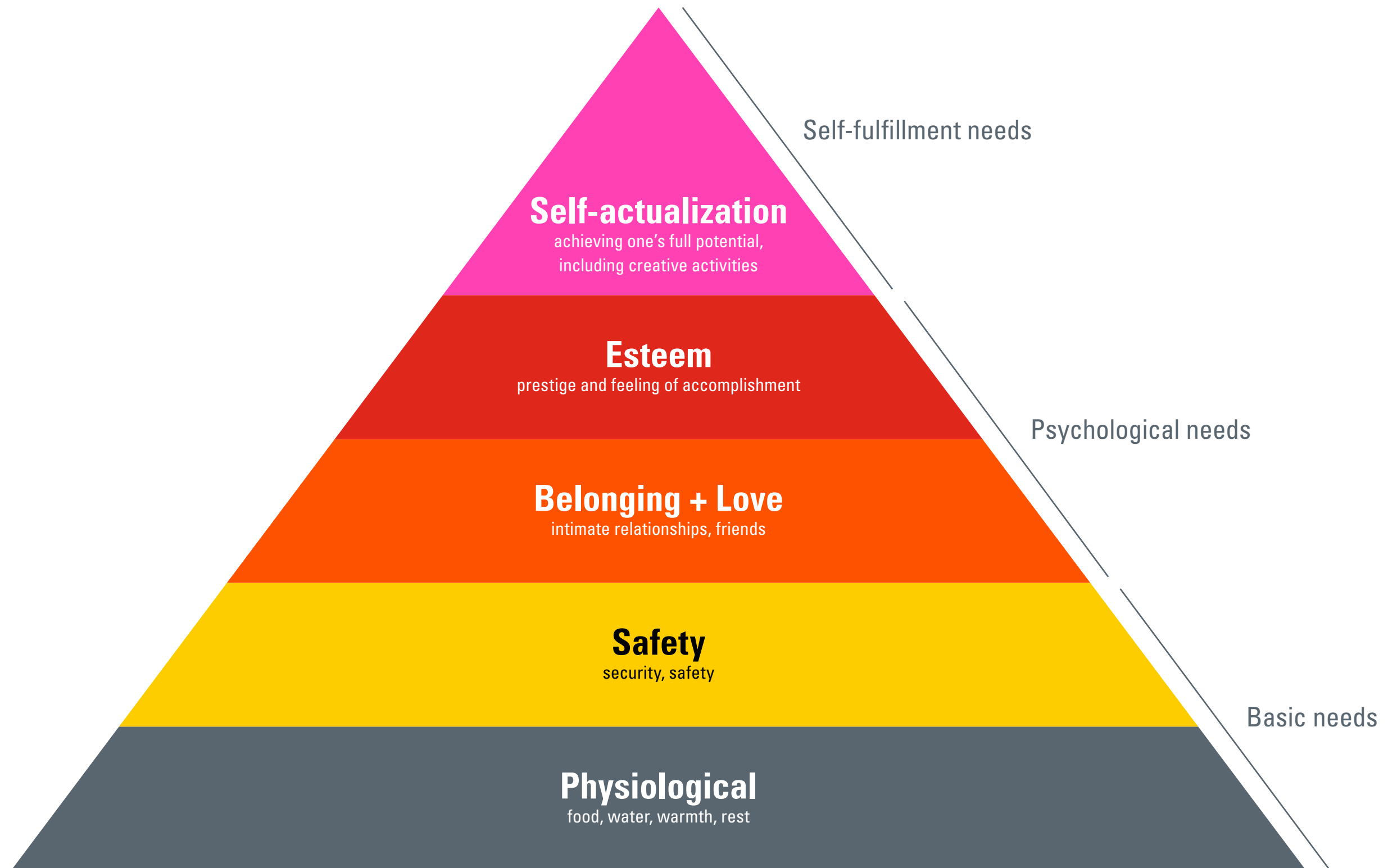
# Iceberg



**Events** ——————————————————— **React**

What just happened?
Catching a cold.

**Patterns/Trends** ——————————————— **Anticipate**

What trends have there been over time?
I've been catching more colds when sleeping less.

**Underlying Structures** ———————————— **Design**

What has influenced the patterns?
What are the relationships between the parts?
More stress at work, not eating well,
difficulty accessing healthy food near home or work.

**Mental Models** ——————————————— **Transform**

What assumptions, beliefs, and values do people hold about the system?
What beliefs keep the system in place?
Career is the most important piece of our identity,
healthy food is too expensive, rest is for the unmotivated.

Source: https://ecochallenge.org/iceberg-model/

# Problem spaces (latent spaces)

# Double Diamond design process model
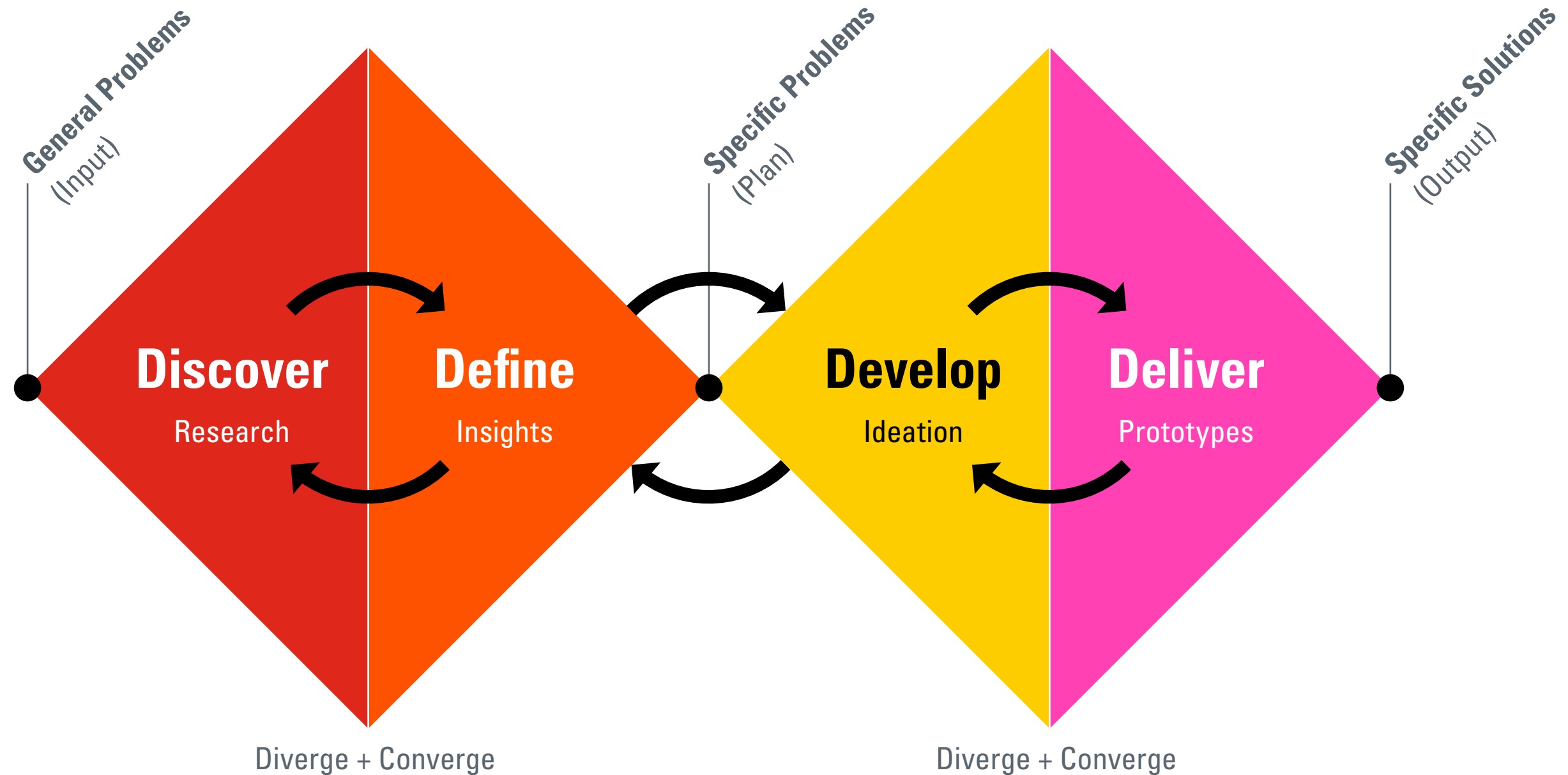
# Analysis-Synthesis Bridge Model of designing

# Frutiger's Univers grid



Expanded    Normal    Condensed    Ultra Condensed

Thin

Light

Regular

Bold

Black

Extra Black

Oblique

Roman
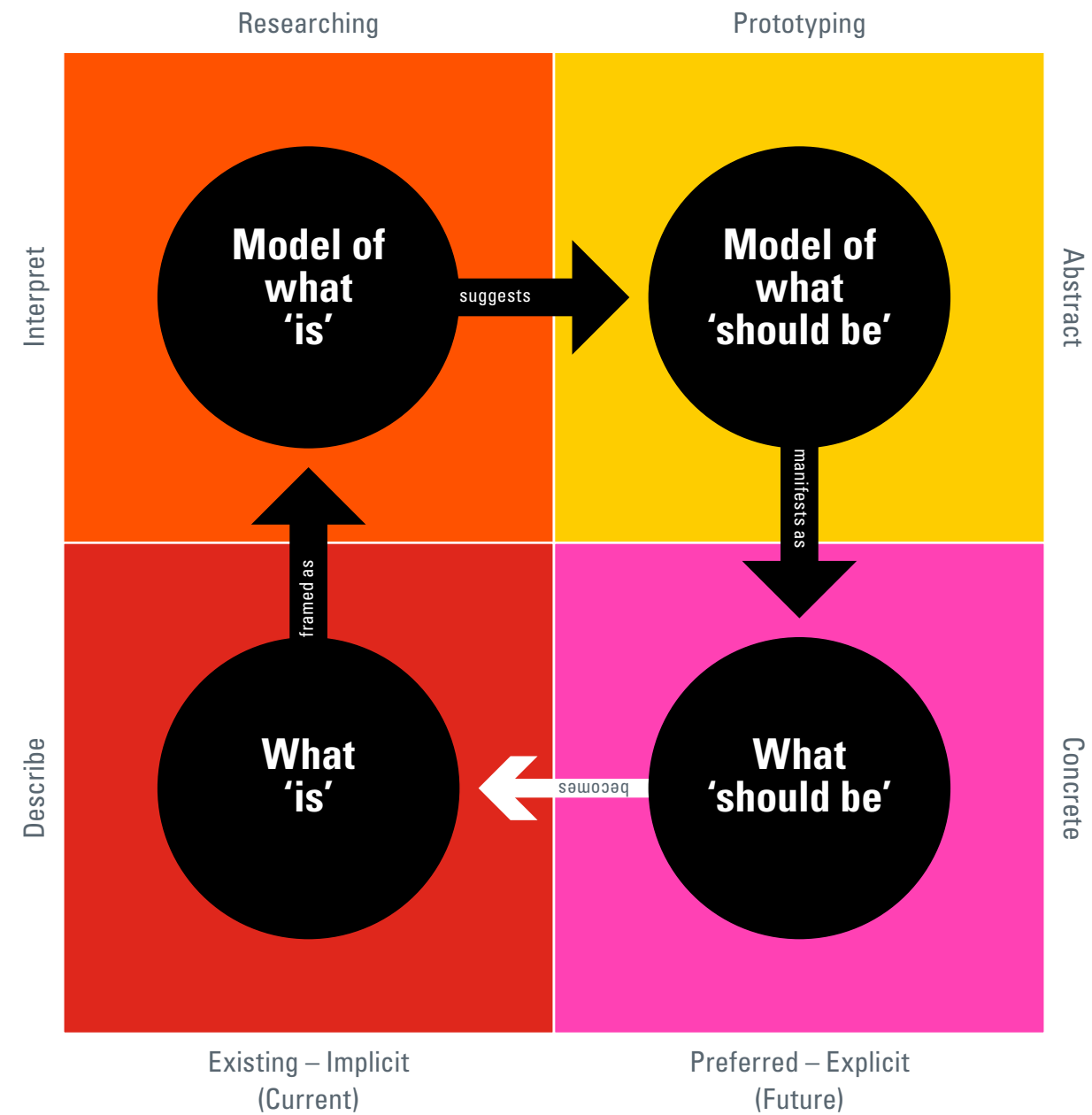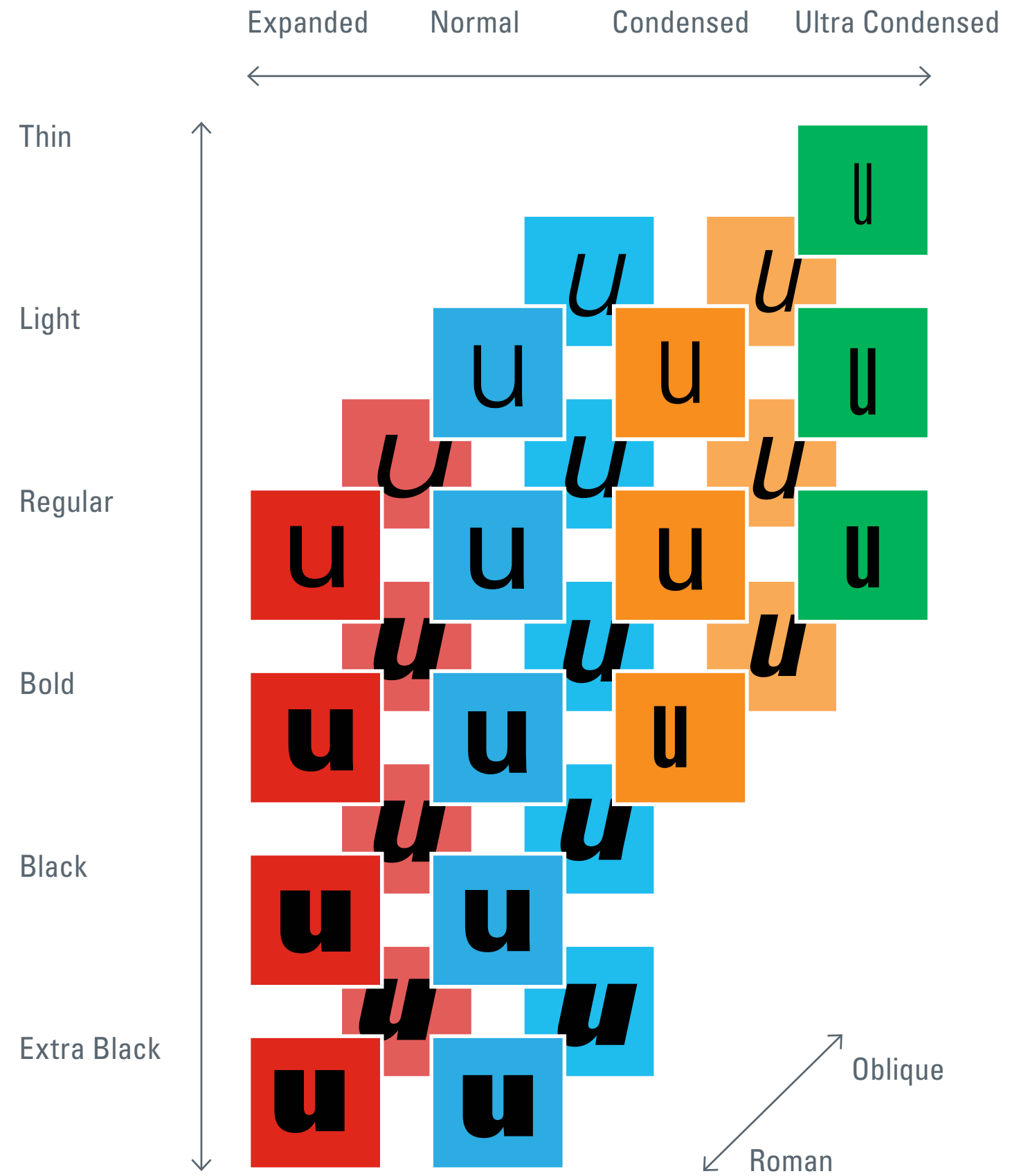
# Transfer functions

# Csikszentmihalyi's flow



Challenges (y-axis) · Skills (x-axis)

Anxiety

Flow State

Boredom
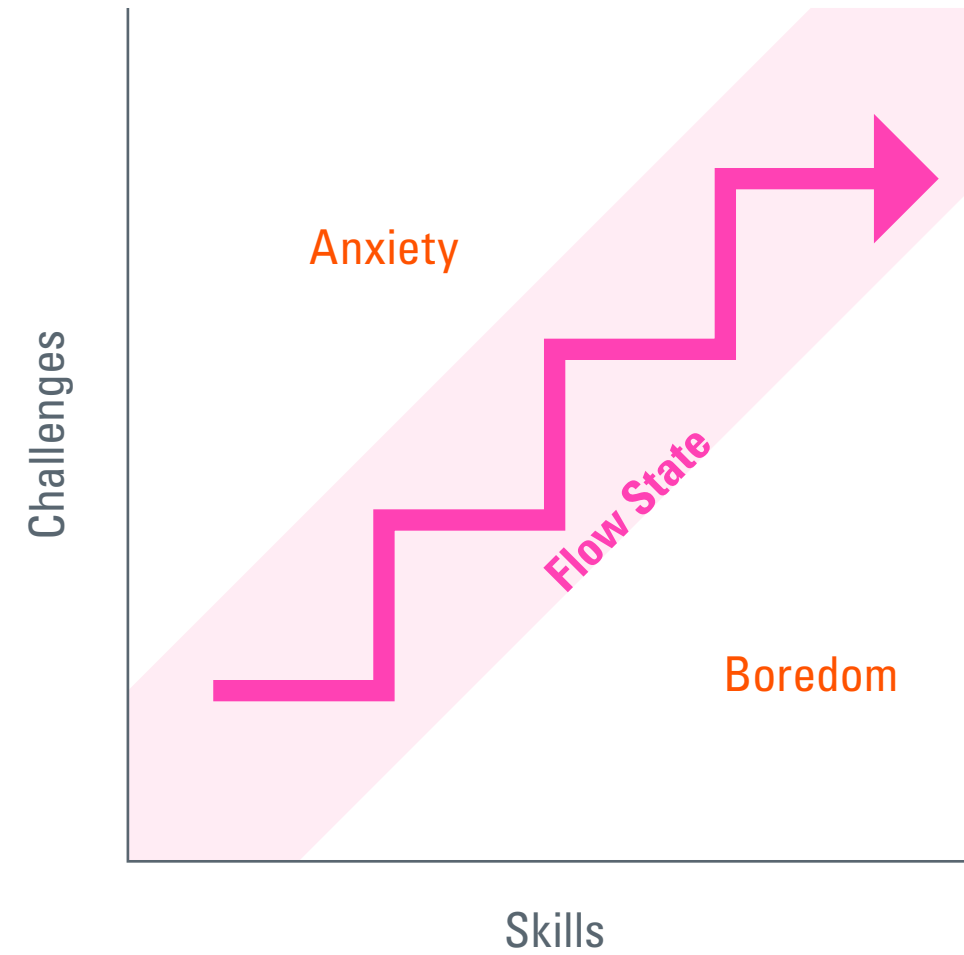
# Tension between responsiveness and coherence (2 dimensions).

# A family of trade-off curves.

Coherence

**More coherence; less responsiveness**
e.g., Mainframe

**Less coherence; more responsiveness**
e.g., Internet

Responsiveness

Coherence

Responsiveness
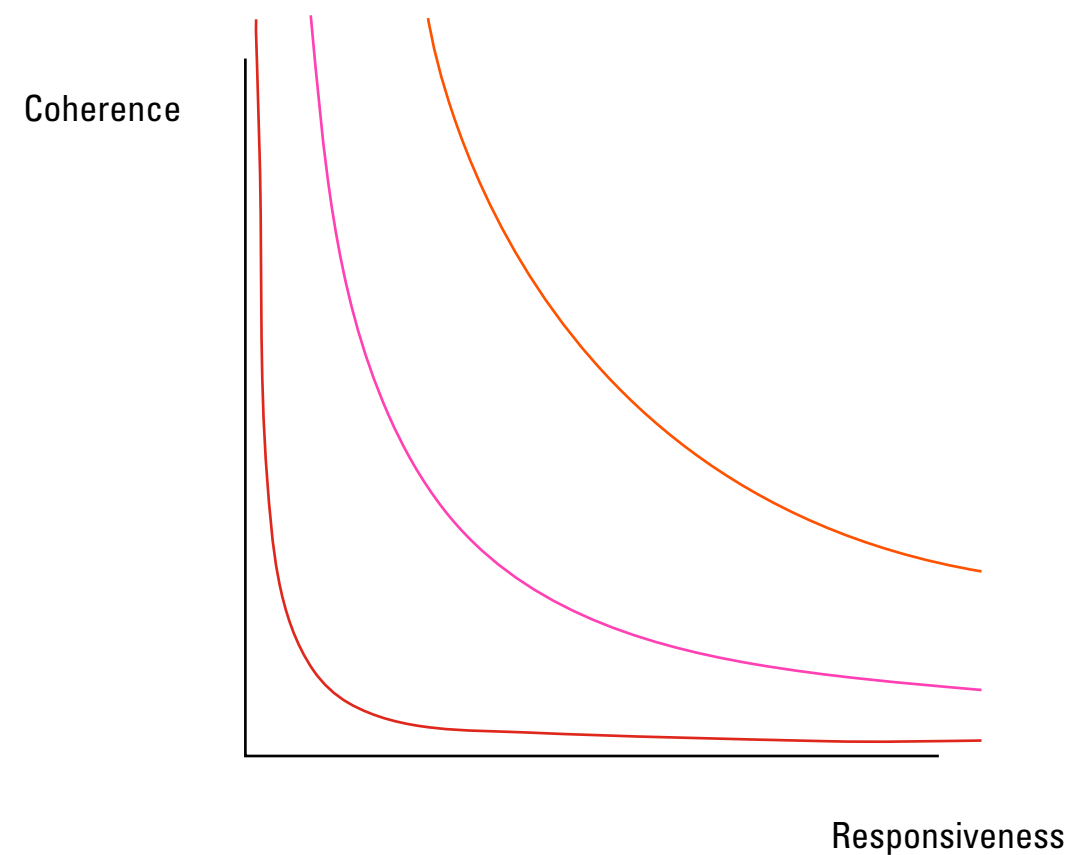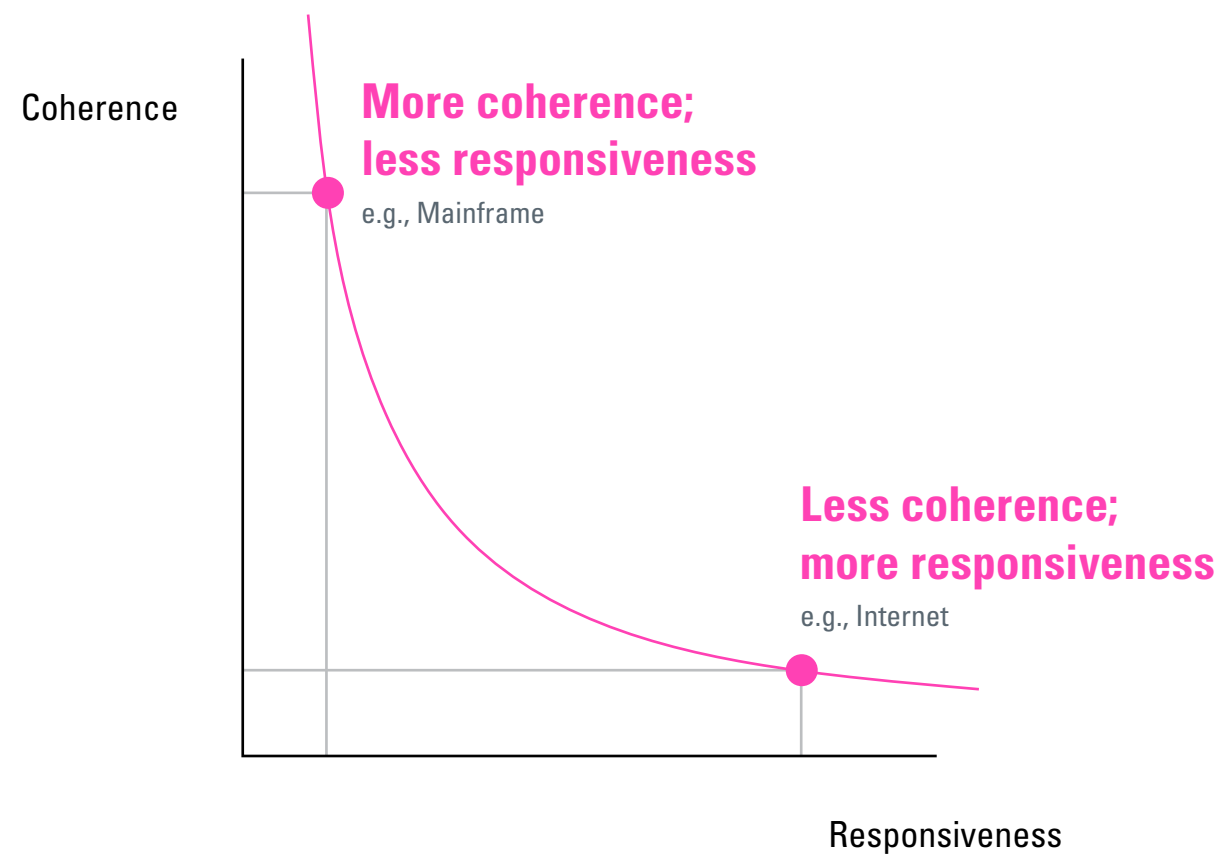
# Moving to a less desirable trade-off curve.

## e.g., as organizations grow, getting things done may become more difficult and take longer.



Coherence

Increasing scale

Responsiveness



Coherence

**Less coherence; less responsiveness**

e.g., Large conglomerates

Responsiveness
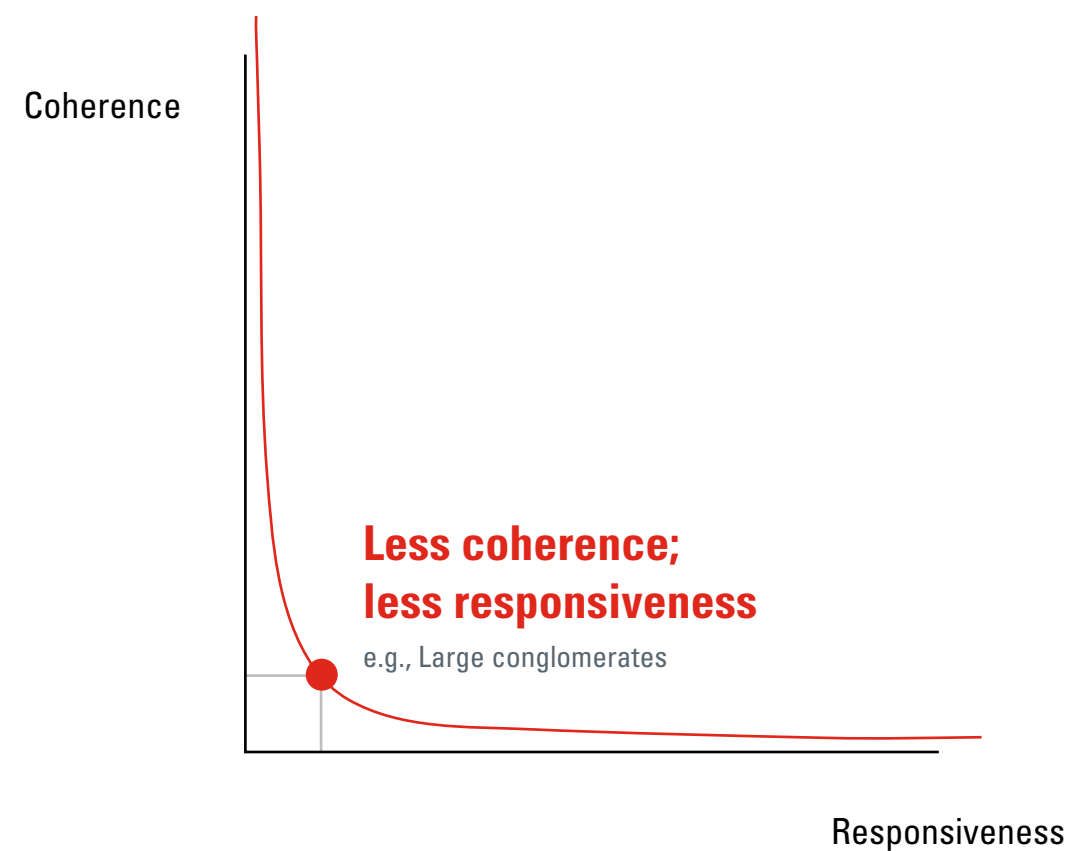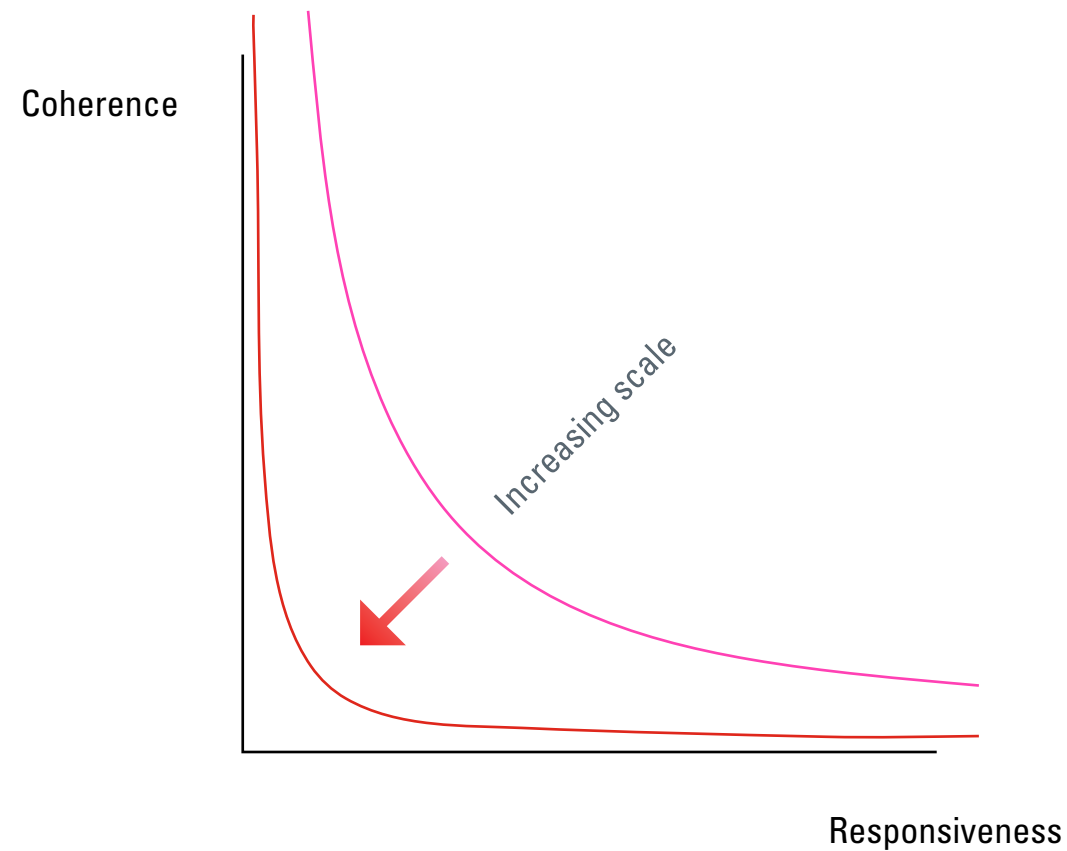
# Moving to a more desirable trade-off curve.

e.g., Google's PageRank search algorithm sits on a higher trade-off curve than early Internet navigation systems such as Yahoo's original directory.



Coherence

Better ways for large groups to work together.

Responsiveness



Coherence

**More coherence; more responsiveness**
e.g., English

Responsiveness

# Photoshop's curves

# Learning curves

# Learning curves



Quality

PRODUCT QUALITY

SERVICES

DATA + AI

Best

World Class

National Class

Average

Time (Investment)

# Porter's value chain



**Support activities**

**Firm infrastructure**
These are a company's support systems, and the functions that allow it to maintain daily operations.
Accounting, legal, administrative, and general management are examples of necessary infrastructure that businesses can use to their advantage.

**Human resource management**
This is how well a company recruits, hires, trains, motivates, rewards, and retains its workers.
People are a significant source of value, so businesses can create a clear advantage with good HR practices.

**Technological development**
These activities relate to managing and processing information, as well as protecting a company's knowledge base.
Minimizing information technology costs, staying current with technological advances, and maintaining technical excellence are sources of value creation.

**Procurement**
This is what the organization does to get the resources it needs to operate.
This includes finding vendors and negotiating best prices.

**Primary activities**

**Inbound logistics**
Processes related to receiving, storing, and distributing inputs internally.

**Operations**
Transformation activities that change inputs into outputs that are sold to customers.

**Outbound logistics**
These activities deliver your product or service to your customer.
These are things like collection, storage, and distribution systems, and they may be internal or external to your organization.

**Marketing + sales**
Processes used to persuade clients to purchase from you instead of your competitors. The benefits offered, and how well they are communicated, are sources of value here.

**Service**
These are the activities related to maintaining the value of your product or service to your customers, once it's been purchased.

**Margin**

Value Created and Captured – Cost of Creating that Value = Margin

# Futures cone



Possible

Plausible

Probable

Forecast

Foresight

Preferable

Wild Card

Now

Future

# Pace Layers and time

# Duffy's shearing layers



**Stuff** — Days / Weeks

**Space Plan** — 3 Years

**Services** — 7 – 15 Years

**Skin** — 20 Years

**Structure** — 30 – 300 Years

**Site** — Semi-permanent

# Brand's pace layers



Fashion

Commerce

Infrastructure

Governance

Culture

Nature

**Faster layer**
learns
proposes
absorbs shocks
discontinuous
innovates

**Slower layer**
remembers
disposes
integrates shocks
continuous
stabilizes

# Lifecycles



The cycle diagram shows four product life cycle stages:

- **Introduction** (yellow): Seek to build product awareness and develop a market for the product
- **Growth** (pink): Seek to build brand preference and increase market share
- **Maturity** (orange): Defend market share while maximizing profit
- **Decline** (red): Add new features, Reduce costs, Discontinue

Source: https://www.smartdraw.com/cycle-diagrams/examples/cycle-diagram-example-product-life-cycle/

**Special thanks to**
**Ryan Reposar**