


Northeastern University Boston, MA
MFA ID+V, Design Theory March 21, 2020

Models of the Space of Design (Work in progress)

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Dubberly Design Office

Presentation posted at
presentations.dubberly.com/space_of_design.pdf

Models of the process of design are common.

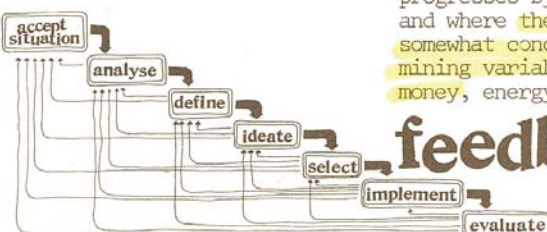


But one stage need not follow another as if on a train where one cannot proceed without passing through successive cars one at a time. It is also possible that the stages can be considered in other ways... It could be

circular... HELICAL


Others see it as a constant feedback system where you never go forward without always looping back to check on yourself; where one progresses by constant backward relationships; and where the stages of the process advance somewhat concurrently until some strong determining variable terminates the process (time, money, energy, etc.)

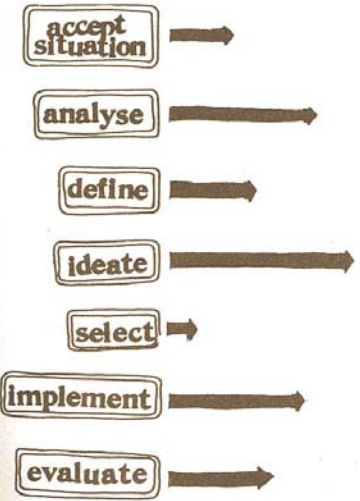
feedback CASCADE



And still others see the design process as a branching system where certain events determine more than one direction and where directional progress is achieved via a many-branched excursion.

branching






But the most NATURAL way to view process is as a totality...to see each stage progressing concurrently with all the other stages...more like a "horse-race" than as the "mule-train" of pure linearity. In this manner, each stage can be considered in relationship to all others rather than just as a connection between its foregoing and following stages. Although only one of the "horses" may be out front at any moment, the rest of them are also part of the race.

natural

With it we realize that no stage ever really stops but that like the others each stage is always "in process;" i.e., we are always in the process of accepting, analyzing, defining, ideating, deciding and acting. And even the evaluative stage works best when concurrent with all other stages and not just "at the end"...when it may be too late to improve. PROCESS NEVER ENDS...its ultimate model is the SPIRAL, a continuum of sequential round-trips that goes on ad infinitum.

The DESIGN PROCESS is a Problem-Solving JOURNEY



Gym teachers and geologists, writers and truck farmers, movie makers and motocy-clists, audiophiles and elevator operators, xylophonists and sci-fi fans are all prob-lem-solvers. Everyone is a problem-solver. Some just do it better than others, by de-sign. By generating unique and/or particu-larly satisfying solutions, a designer is said to behave creatively. Since problem-solving is intertwined with living, you are ever embarking on a problem-solving journey stand DESIGN as being closely related to the life process the better you'll be as a cre-ative problem-solver or 'designer'.

The creative problem-solving (design) process is most easily understood as a sequence of stages or stopovers on a journey to a given destination. A full round-trip itiner-ary offers experience at each of those places. Once internalized through experi-ence, design process oriented travel in-volves the conscious application of incen-tives, intentions, decisions, actions and evaluations.

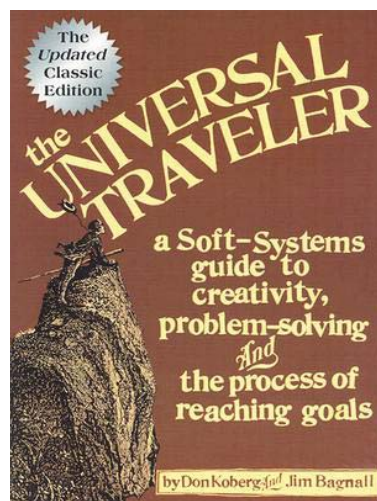
Note: The design process presented here is a design in itself; developed by extracting the essential characteristics of many spe-cific problem-solving processes, including the works of Wallas, Dewey, Rossman, Guilford, Osborn, Stanislawski, Barnes, Gordon, Kepner-Tregoe, Arnold, Churchman, Zwicky, General Electric, the Military, and PERT (Program Evaluation Review Technique).

16

A COMPLETE SYSTEMATIC PROBLEM-SOLVING JOUR-NEY includes a SEVEN STAGE ITINERARY.

- accept** GETTING STARTED
Stating initial intentions; accept the prob-lem as a challenge; allowing the problem to become the generator of process; self-moti-vation.
- analyze** GATHERING FACTS AND FEELINGS
Becoming familiar with the insides and outsides of the problem; discovering what the "world of the problem" contains.
- define** DETERMINING THE DESTINATION (ESSENTIALS FOR SUCCESS)
Determining the main issues of the problem; conceptualizing and clarifying aims, ends, and goals of problem resolution.
- ideate** GENERATING ALTERNATIVES
Identifying all possible ways of realizing the goals.
- select** CHOOSING FROM THE OPTIONS
Comparing the destination with the possible ways of getting there; determining the best match(es).
- implement** TAKING ACTION
Giving form to the selected "best ways;" "realizing" intentions.
- evaluate** MEASURING SUCCESS
Reviewing the journey to determine the de-gree of success and its overall value; what was learned? How can the experience be used to make future travel more meaningful and/or enjoyable?

1



We have collected many of them into a compendium.

How do you design?

A Compendium of Models
by Hugh Dubberly
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Design process after Tim Brennan (~1990)

At an off-site for Apple Computer's Creative Services department, Tim Brennan began a presentation of his group's work by showing this model. "Here's how we work," he said. "Something came up with a project, we do some stuff, and the money follows."

Brennan captures important aspects of the process:

- the potential for play
- its similarity to a "random walk"
- the importance of iteration
- its ineluctable "black-box" nature

Introducing process

What is a process?
Where does it begin?
Where does it end?
How much detail is enough?

We begin with simple models of the design process and look at how they might be expanded into useful frameworks.

Expanding the two-step process after Don Koberg and Jim Bagnall (1972)

In their classic book, *The Universal Traveler*, Koberg and Bagnall take flight in the College of Environmental Design at Cal Poly in San Luis Obispo to expand the archetypal two-step process to three, five, ten, and finally to seven steps.

They take "the last of design" we derive an understanding or concept that is then followed as a guideline in the rebuilding or Synthesis stage." Within the book's "problem-solving" frame, definition involves problem definition, and they never follow up on the idea of definition as concept or part.

The synthesis phase becomes "define, select, implement," while the analysis phase remains intact. Finally, they add a new phase at the beginning and another at the end.

Matching process to project complexity after Jay Dobbin (1987)

In his article, "A Short, Grandiose Theory of Design," Dobbin presents a similar series of expanding processes. Dobbin's notion of direct and indirect design advice. Alexander's 1980 model of unorthodox and self-conscious design. Dobbin's third and fourth processes correspond to Alexander's third type of design—mediated design (my title). (For more on Alexander's model, see the next page.)

System approach to the design of technical systems and products after Verein Deutscher Ingenieure (1987)

VDI stands for Verein Deutscher Ingenieure, the professional engineering society of Germany. Their guideline 2221 maps out the design process, as part of product creation, is subdivided into general working stages, naming the design approach transparent, rational and independent of a specific branch of industry."

The full process contains much more detail than the diagram below shows. In practice, the process is less linear than the diagram implies. "It is important to note that the stages do not necessarily follow righty one after the other. They are often carried out iteratively, returning to preceding ones, thus achieving a step-by-step optimization."

Design process after Gerhard Pahl and Wolfgang Beitz (1984)

Cross recommends this model as "reasonably comprehensive" but not denouncing "the general structure of the design process by expanding it in the fine detail of the numerous tasks and activities that are necessary in all practical design work." He seems to refer to Arthur's "Systematic method for designers". (See page 98.)

Mechanical engineering design process after students at UC Berkeley Institute of Design (BID)

Agapies sometimes asks her students to diagram the design process—an interesting way to begin to understand how students (and others) understand things. Below is an example from one of her classes.

New product development process after Steven D. Eppinger and Karl T. Ulrich (1995)

Alice Agapies introduced me to Eppinger and Ulrich's model of the product development process. It provides a useful outline, but does not capture the "messy" iteration typical of most product development work.

Extreme Programming (XP) Process after Don Wells (2000)

Kent Beck, founder of Extreme Programming, has described how he created XP in 1996. Chrysler asked him to put a payment system project back on track. When they called him, eighteen months into the project, the system still couldn't print a check. Three weeks later, Beck had them print their first one. "Up until then I believed better programming would solve all the world's ills. Yes, you can screw up the programming so badly you kill the project. Usually, however, the problem concerns relationships between the business people and the programmers. The budget process, poor communications—factors unrelated to the programming. The context in which the software development takes place proves as important to the project's success as the programming itself."

At its core, XP is a simple process of experimentation and improvement. Divide a project into "iterations"; in each iteration, implement a few new features called "stories"; for each story, write "acceptance tests" to demonstrate the story meets customer expectations. Alan Cooper, however, argues

XP is not a design process—because it includes no mechanism for understanding user goals. For more on Cooper, see pages 98-101.

The models below are revised. The first one shows the whole project. The second "zooms in" on iteration; the third "zooms in" on development; and the fourth on collective code ownership.

Second-order feedback loops after Pangaro (2002)

The model on the previous page assumes a constant goal. That is, it provides no mechanism for changing or refining the system's goal. Typically, such systems are mechanical (or electrical), and require humans to set their goals. For example, defining the set point for a thermostat. The human creates a second loop in which the "factor" is setting the goal of the first loop. (Like the thermostat, the human also measures the room temperature and decides whether to raise or lower the set point on the thermostat.)

As we've seen, designing involves not only achieving goals but also defining them. Thus we may improve our model of designing by nesting our original feedback loop within a second feedback loop. See the next page for an example.

Bootstrapping or improving improvement after Douglas Engelbart (1992)

In 1992, Douglas Engelbart offered "an optimized bootstrapping approach for iteratively improving on any organization's already existing improvement processes."

According to his foundation, Bootstrap.org, the process works as follows: "Referring to an organization's principal work as an Activity and to ordinary efforts at process improvement as an Activity, he describes bootstrapping as a C-activity, which is an improving of the improvement process. His paper, 'Bootstrapping Organizations: A Strategic Framework for Continuous Improvement', argues that highest payoff comes from engaging in that C-activity."

Levels A, B, and C are analogous to first-, second-, and third-order feedback loops.

Product development process: overview after Hewlett Packard (circa 2000)

Loops or circular layouts are curiously rare in design process models—with the notable exception of the IPOD cycle on the next page. Koberg and Bagnall provide another example by emptying turning their seven-step process into a circle.

Dubberly Design Office · Models of the Space of Design · 21 March 2020

3

Much less common are models of the space of design — the dimensions in which design practice occurs.

What follows is a compendium of such models.

We hope to add to it as we find new ones.

Typically models of a domain are of three types:

Timelines

- Lists of events from the domain's history
- Links between events suggesting influences

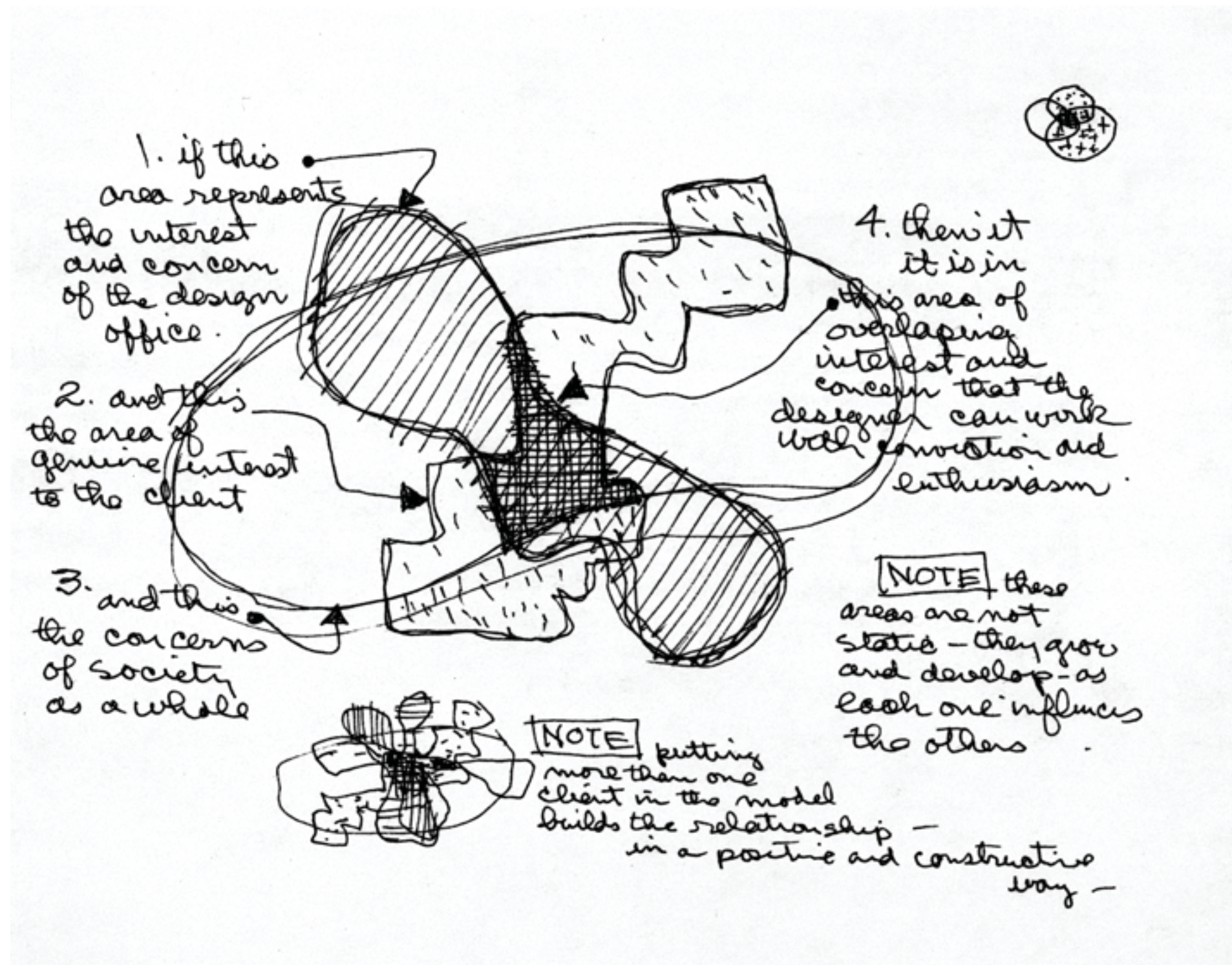
Taxonomies

- Lists of sub-domains
- Trees branching into categories and subcategories and so on

Spaces

- Venn diagrams indicating overlapping categories
- Matrices defining the dimensions of a space of possibilities or area of potential

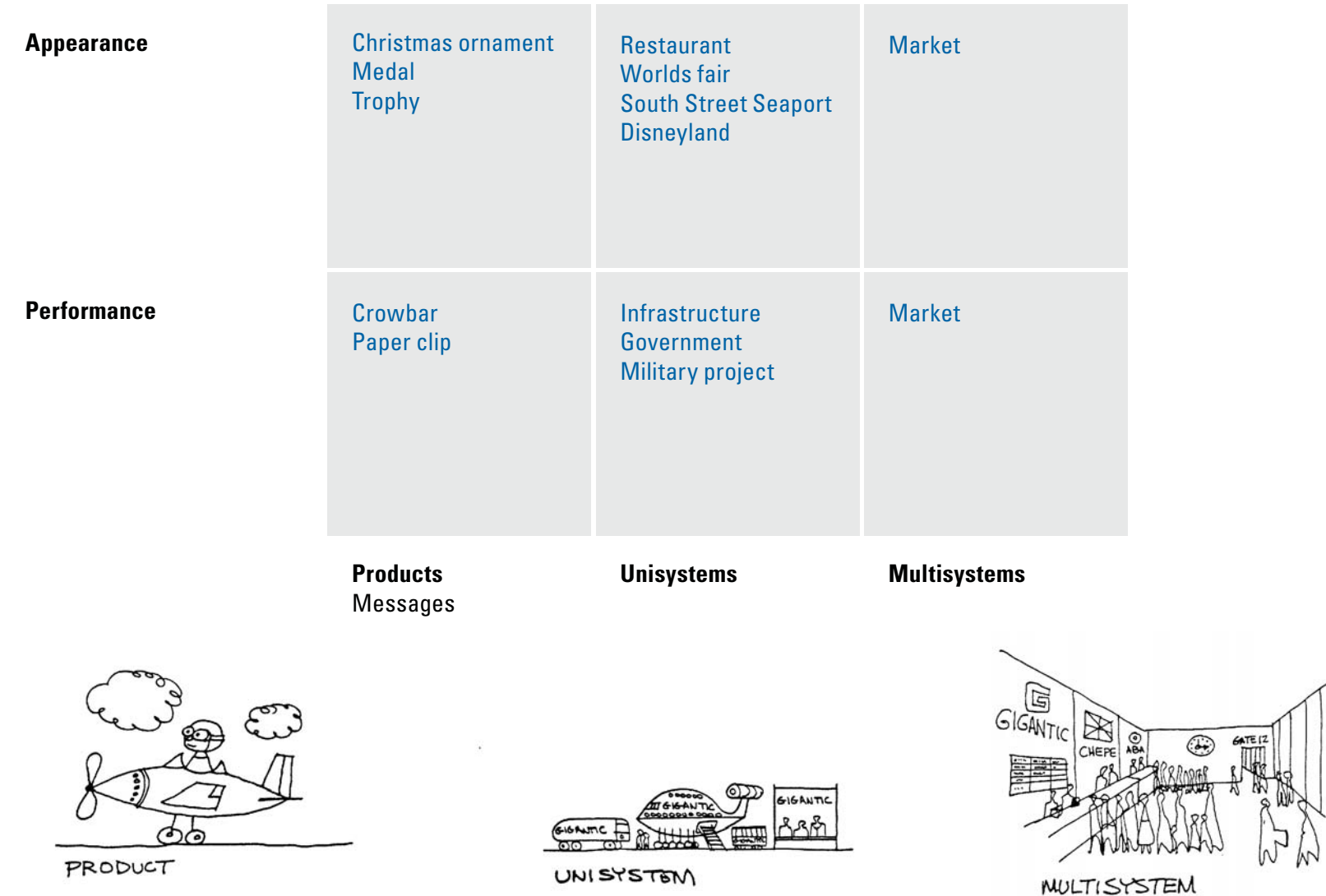
Diagram for "What is Design?" exhibit, Charles Eames, 1969



<https://www.eamesoffice.com/blog/why-did-charles-and-ray-eames-make-models/>

Matrix of Design Types, Jay Doblin, 1987

from “A Short, Grandiose Theory of Design”



<https://doblin.com/dist/images/uploads/A-Short-Grandiose-Theory-of-Design-J.-Doblin.pdf>

Space of design + examples — crossing Charles Morris with Jay Doblin

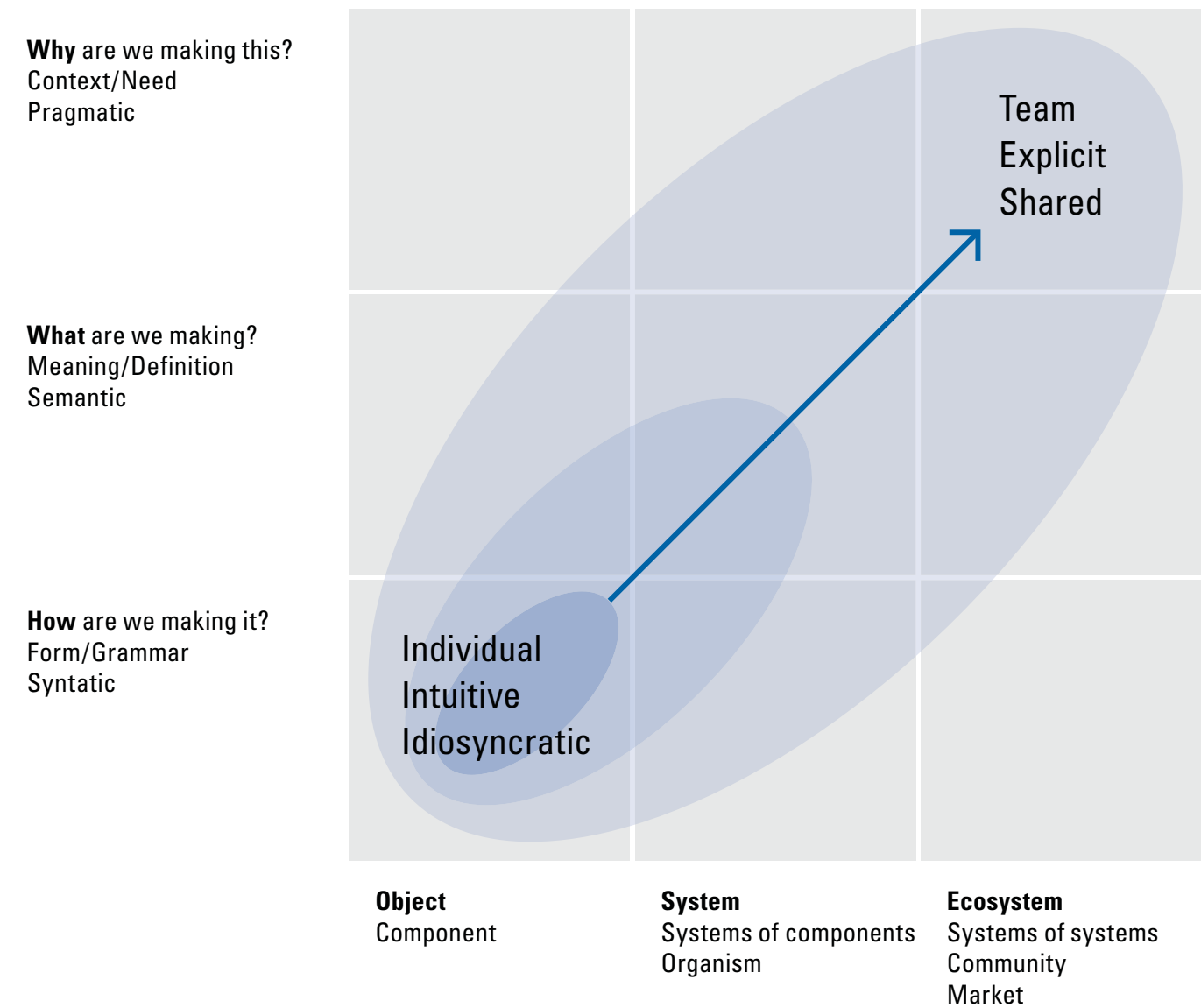
Hugh Dubberly, 2010

Why are we making this? Context/Need Pragmatic	Event + methods of attracting an audience	Website business/user/ technology models	Developer community and its drivers
What are we making? Meaning/Definition Semantic	Poster headline + imagery	Website information architecture + content + CMS	APIs—rules for communicating between systems
How are we making it? Form/Grammar Syntactic	Poster typography + layout	Website style sheet (CSS)	Cross media coordination of identity system
	Object Component	System Systems of components Organism	Ecosystem Systems of systems Community Market

http://www.dubberly.com/wp-content/uploads/2013/06/Dubberly_Space-of-design.pdf

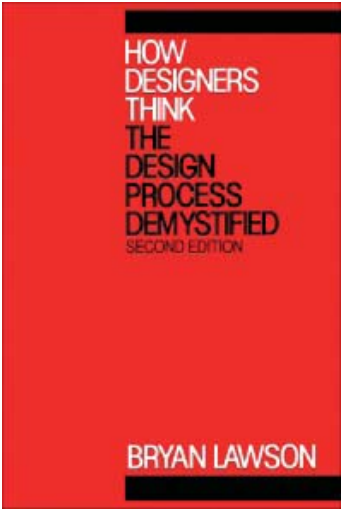
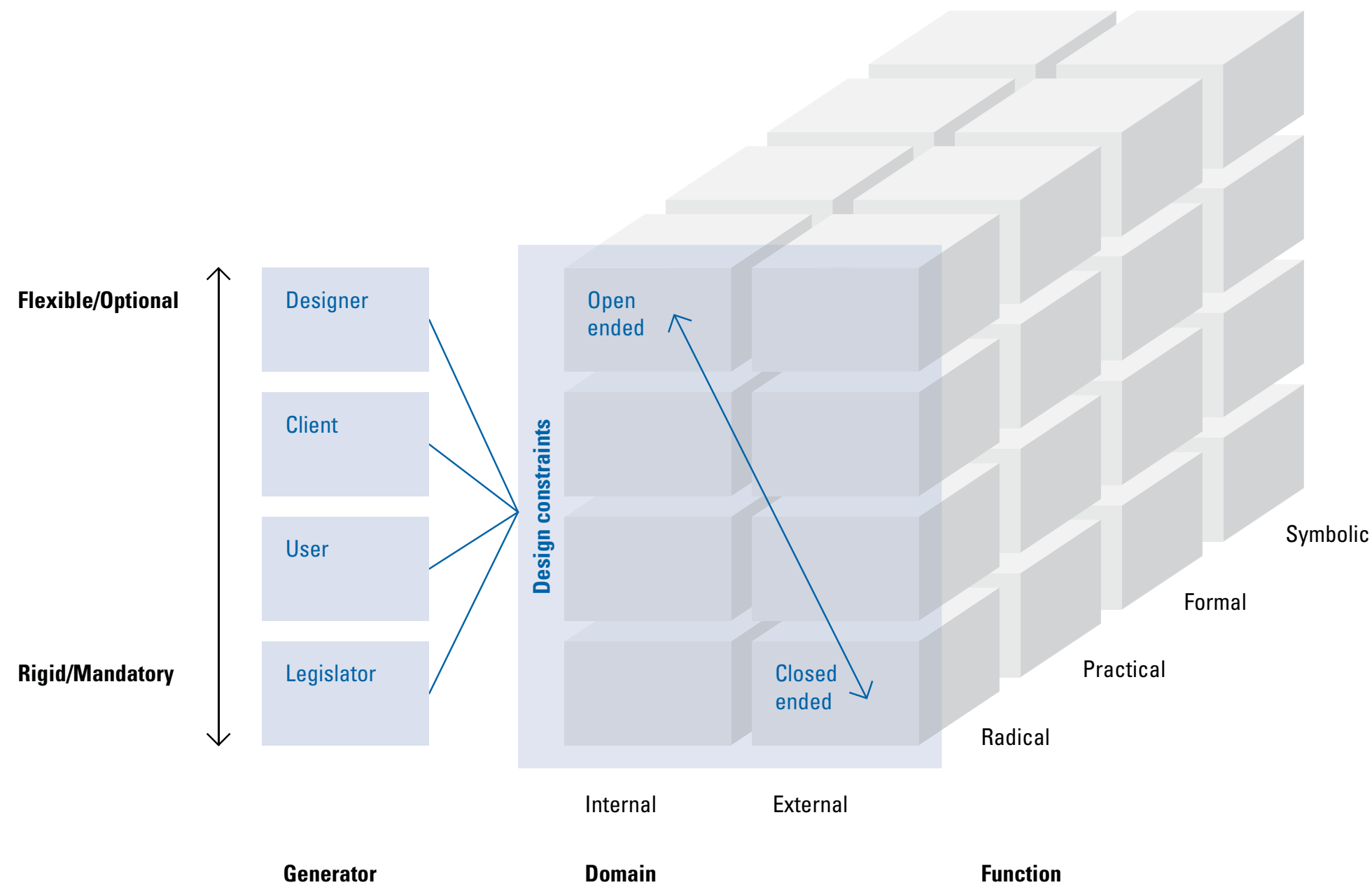
Direction of change in design practice — after Morris + Doblin

Hugh Dubberly, 2010

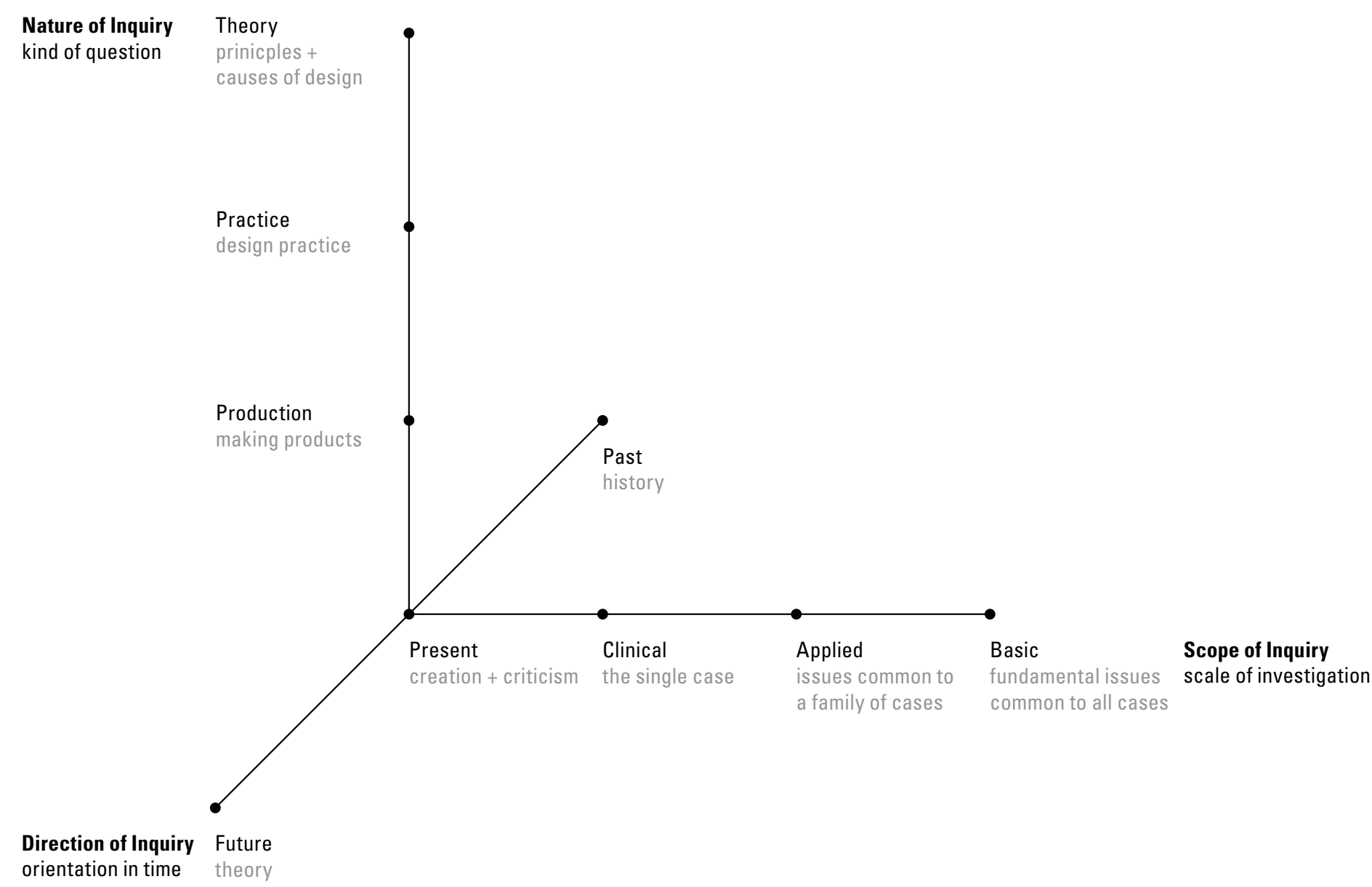


http://www.dubberly.com/wp-content/uploads/2013/06/Dubberly_Space-of-design.pdf

Model of the space of design constraints, Brian Lawson, 1990

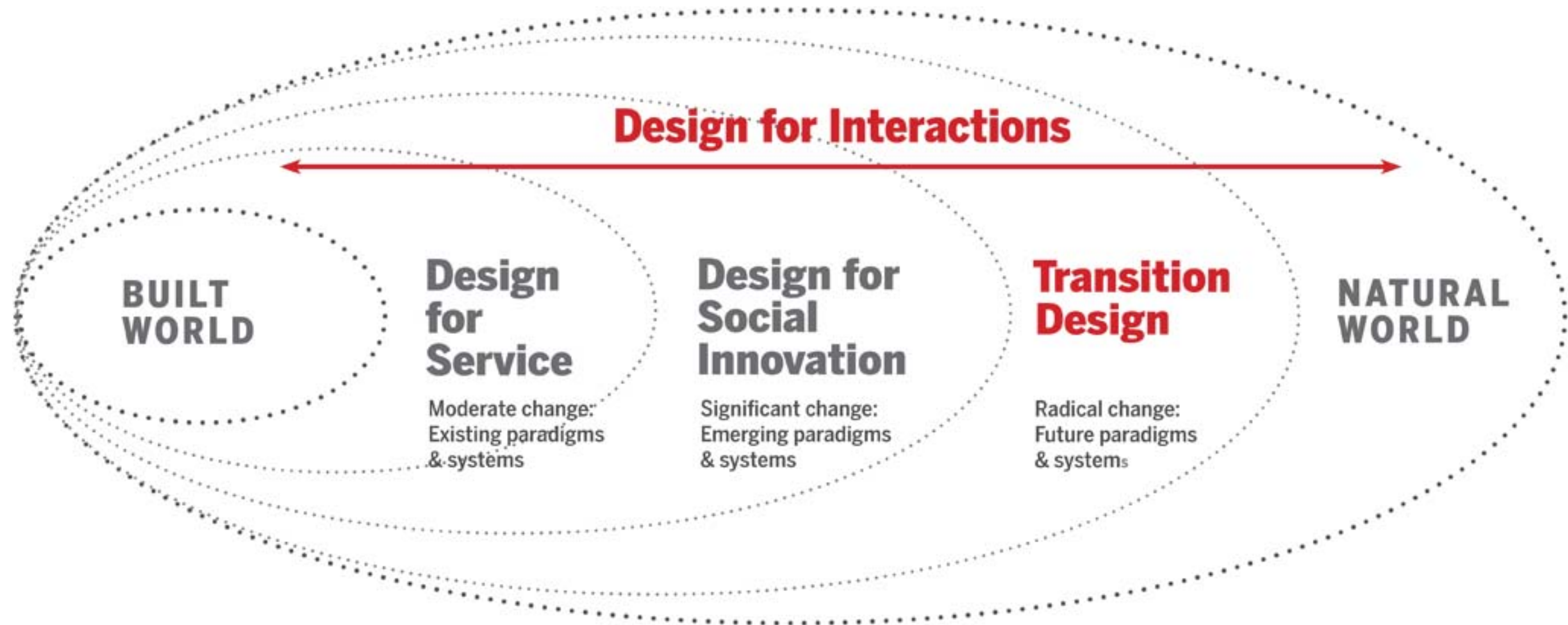


The matrix of inquiry, Richard Buchanan, 2005



http://www.dubberly.com/wp-content/uploads/2013/06/Dubberly_Space-of-design.pdf

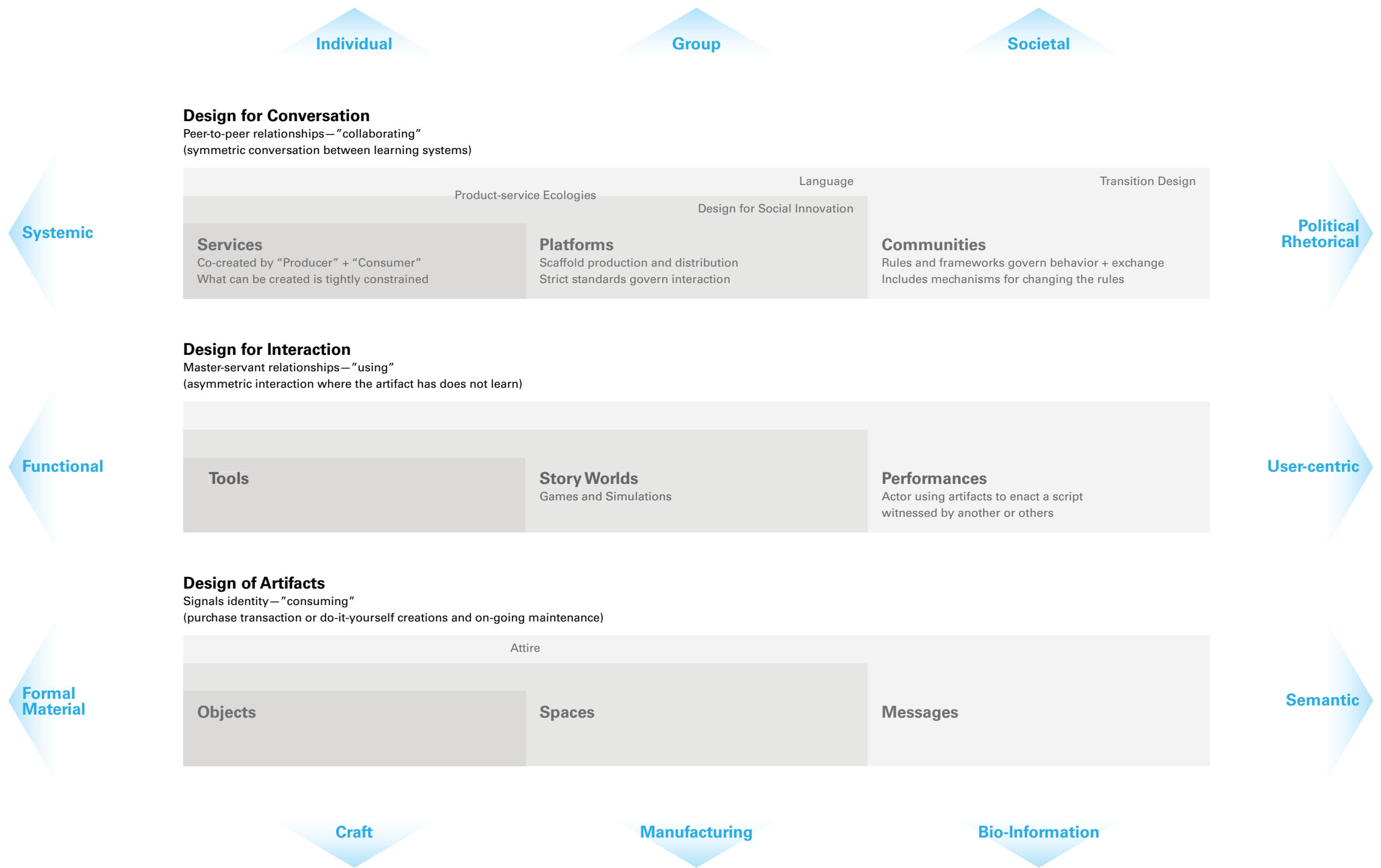
Design for interactions, Terry Irwin, 2013



© School of Design, Carnegie Mellon University, 2013

https://design.cmu.edu/sites/default/files/users/user10/CircleDiagram_TransitionDesign.png

Space of design + Lenses on design, Hugh Dubberly, 2014

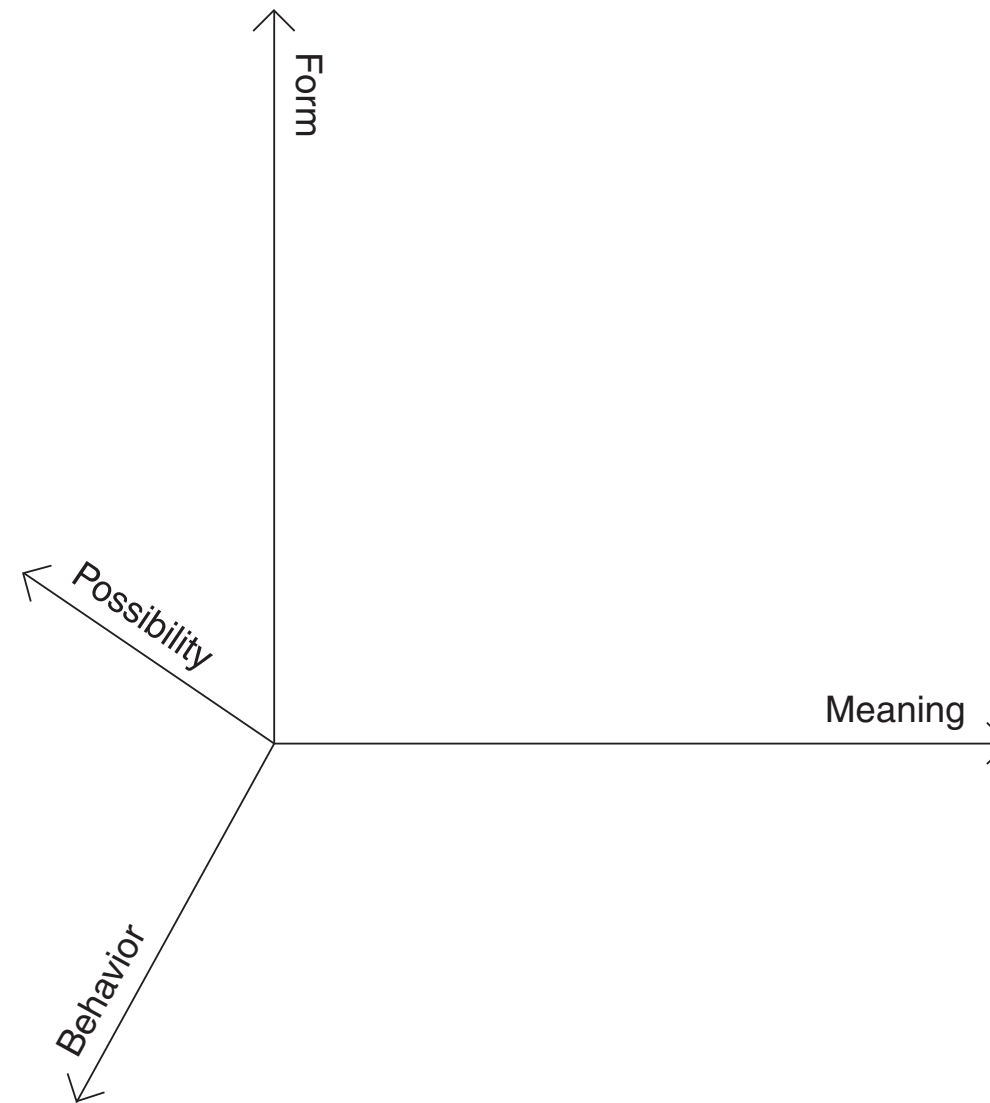


http://presentations.dubberly.com/Space_of_Design.pdf

The space of design conversations, Hugh Dubberly, 2014

	First-order Design: Design of Completed Artifacts, e.g., objects, buildings, and messages i.e., traditional product design, architecture, and graphic design		Second-order Design: Design for the Incomplete—for the Emergence of Evolving Systems or Situations for Conversation, e.g., languages, platforms, and product-service ecologies i.e., interaction design and service design	
	Design conversation about the situation at hand	Design conversation about the process of designing being used	Design conversation about the situation at hand	Design conversation about the process of designing being used
Meta Conversation to maintain the conversation	Is the conversation on track? Do the others understand me? Do we agree? Do we have the right frame? Shall we continue? Why are we doing this? our goals Are we making things better? no harm	Is the process working? Do the participants understand the process? Do they agree to it? Do we need a different process? How can we improve our process? What can we learn from what we've already done?	In addition to first-order questions: What systems affect this one? What systems does this one affect? How is the system maintained? By whom? Is this system still needed? Should it be re-thought?	In addition to first-order questions: What are the rules for modifying the rules?
The Conversation Itself (per se)	What is the context? Who are the constituents? What do they value? What are their specific goals? How shall we frame the situation?	What process are we using? Where are we in the process? Who is involved? What are their roles? Do the participants have sufficient variety? Do we need others?	In addition to first-order questions: What items are fixed? variable? What rules govern variation? What disturbances are likely? How does the system counter them?	In addition to first-order questions: Who can modify “fixed” items? Who can modify the rules? How does the system “learn”?
The Sub-strata of the Conversation	What do we share? - “Space” of the conversation? - Experiences - Languages - Artifacts (Boundary Objects)	What variety do participants have? - Special knowledge or skills - Familiarity with the situation - Experience with similar situations - Experience with designing	In addition to first-order questions: What data should be collected? How does the system react to data? What data should be exposed? How is data collected? Where is it stored? How is it kept secure?	In addition to first-order questions: How does the system represent knowledge?
Dubberly Design Office Paul Pangaro Ranulph Glanville November 16, 2014				

Four orders of design, Richard Buchanan, circa 1997 (interpreted)



http://www.dubberly.com/wp-content/uploads/2008/06/ddo_article_cooper.pdf

Four orders of design, Richard Buchanan, 2015

		Fields of Design Problems			
		Communication Symbols	Construction Things	Interaction Action	Integration Thought
Arts of Design Thinking	Inventing Symbols	Symbols: Words & Images			
	Judging Things		Physical Objects		
	Connecting Action			Activities, Services, Processes	
	Integrating Thought				Systems, Organizations, Environments

<https://www.sciencedirect.com/science/article/pii/S2405872615000039>

Four fields framework, Staphanie Tharp and Bruce Tharp, 2019

(as interpreted by John Cain)

from *Discursive Design: Critical, Speculative, and Alternative Things*

Commercial Design

Its dominant context, industrial design, assumes commerce and transaction / buyer-seller, growth mindsets and more.

Responsible Design

Considers the marginalized, those outside the normative bounds of 'commercial' design.

Experimental Design

Explores; does not assume a 'solution'; make-to-think, make-to-know.

Discursive Design

Covers speculative design and "futuring", is likely political in that sense.



Discursive designing: nine facets, Staphanie + Bruce Tharp, 2019

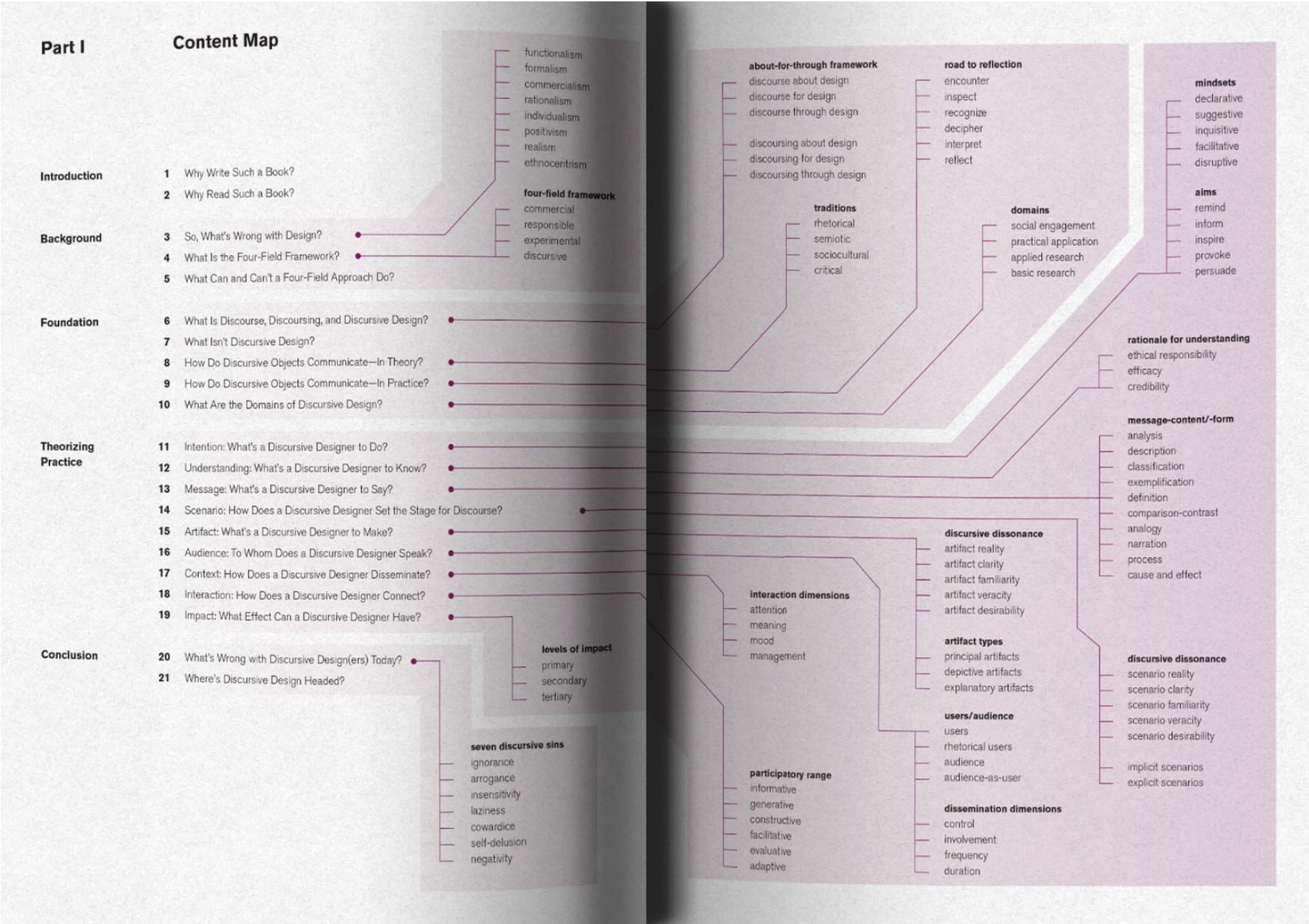
from *Discursive Design: Critical, Speculative, and Alternative Things*

- Intention
- Understanding
- Message
- Scenario
- Artifact
- Audience
- Context
- Interaction
- Impact

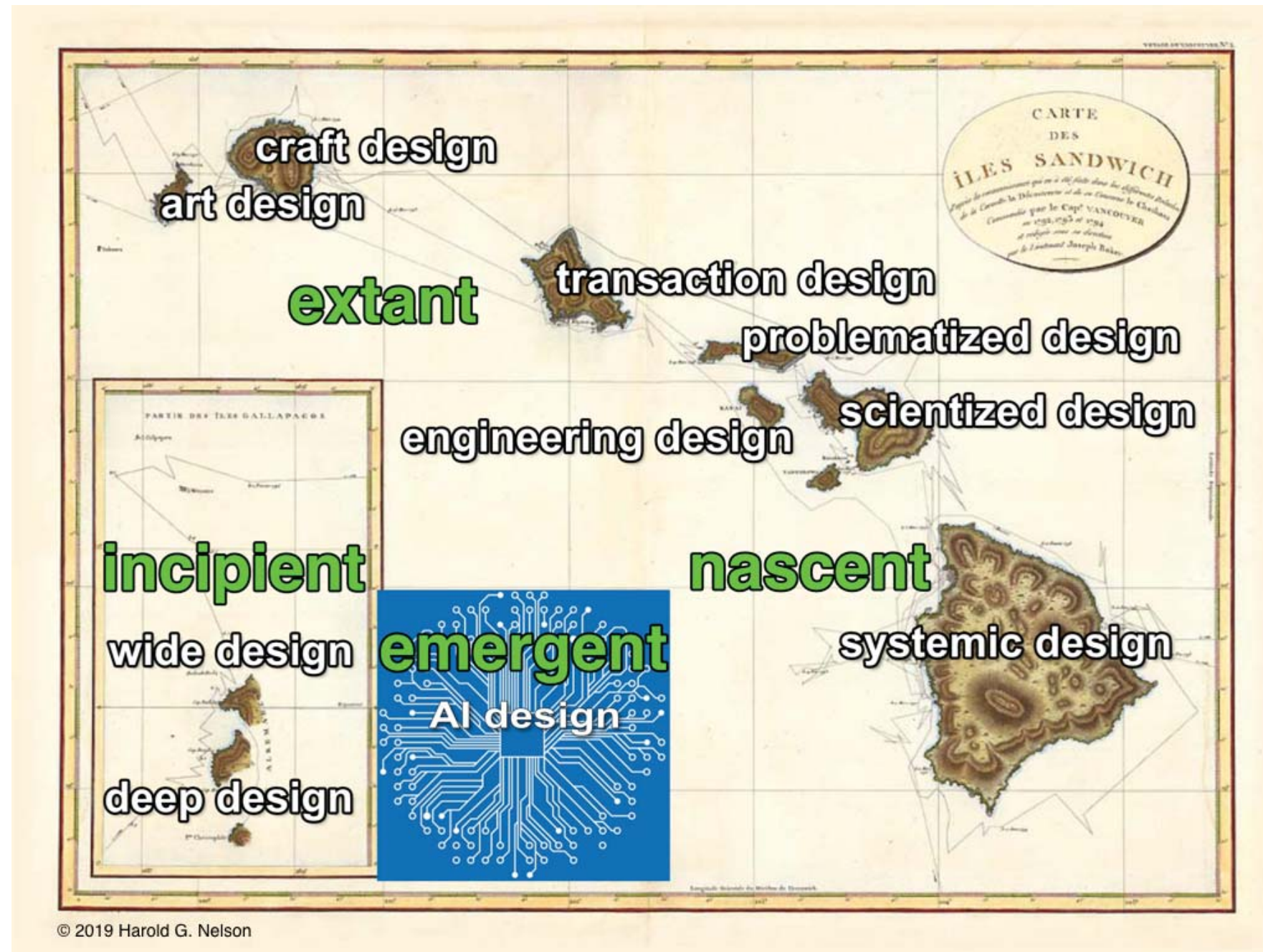


Discursive designing: nine facets, Staphanie + Bruce Tharp, 2019

from *Discursive Design: Critical, Speculative, and Alternative Things*

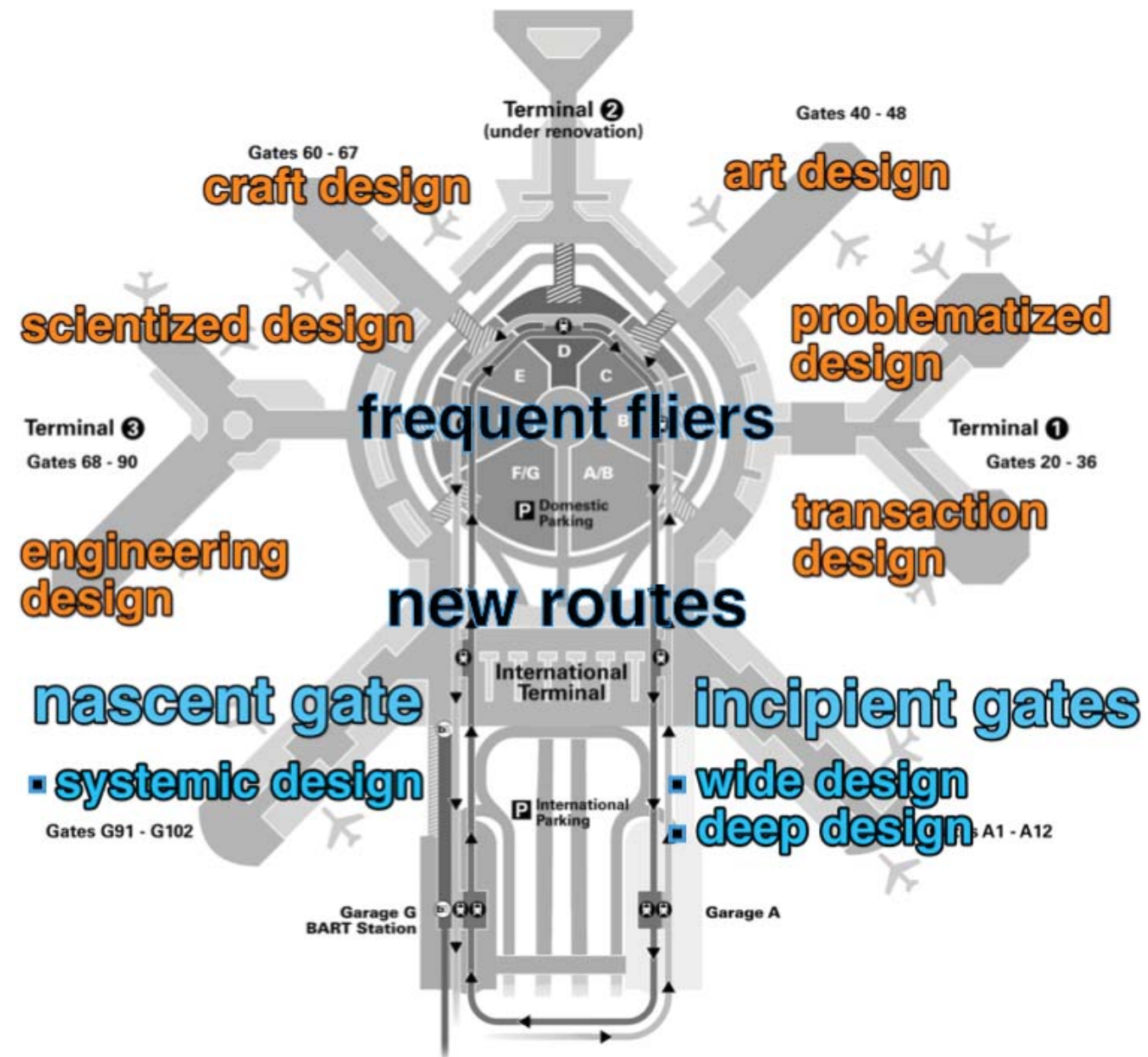


Design archipelago, Harold Nelson, 2019



<http://accidentalvagrant.blogspot.com/2019/12/design-mind-slides-from-presentation.html>

Design departure gates, Harold Nelson, 2019



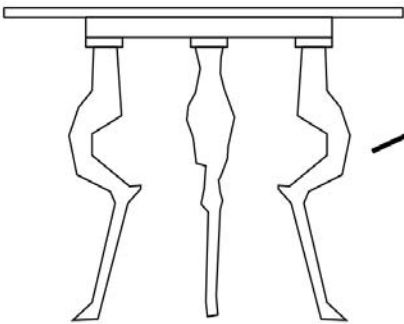
<http://accidentalvagrant.blogspot.com/2019/12/design-mind-slides-from-presentation.html>

Aristotle's Four Causes, 350 BCE

Material Cause:
Wood



Final Cause:
Dining

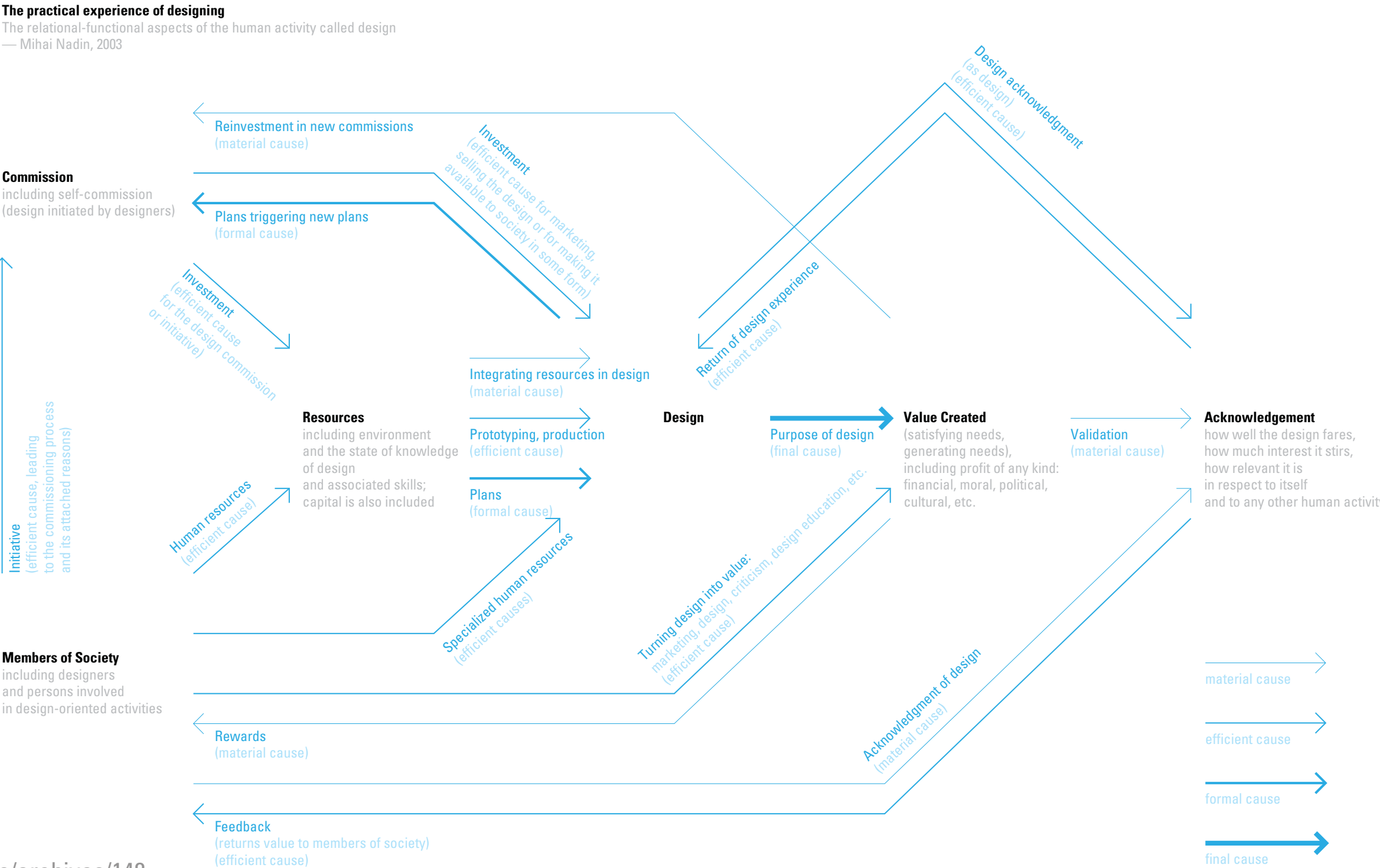


Formal Cause:
Design



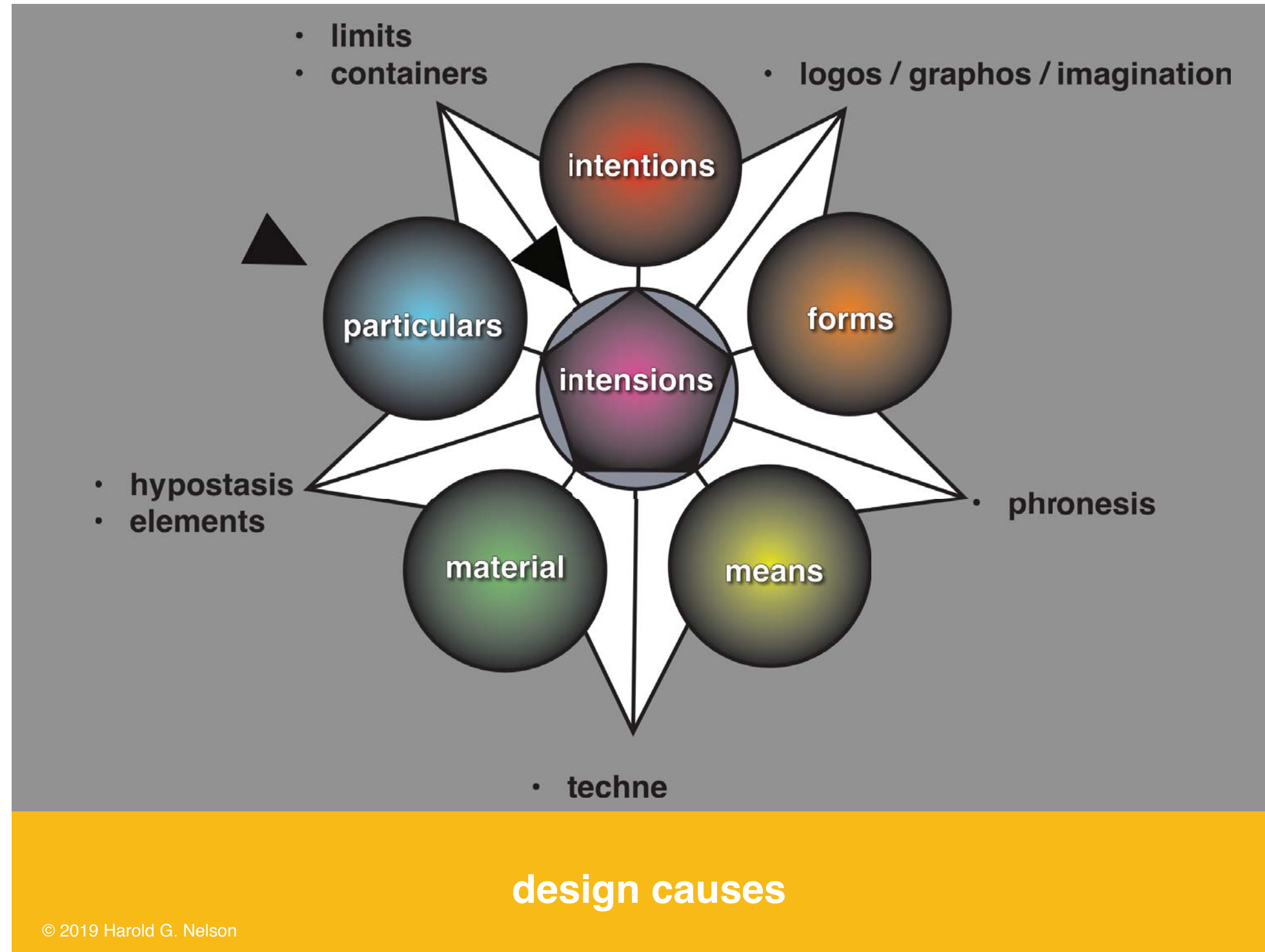
Efficient Cause:
Carpentry

The practical experiences of designing, Mihai Nadin, 2003



<https://www.nadin.ws/archives/148>

Design causes, Harold Nelson, 2019



List of design types, Harold Nelson, 2019

design disciplines (Wikipedia)

- Applied arts
- Architecture
- Automotive design
- Biological design
- Communication design
- Configuration design
- Design management
- Engineering design
- Experience design
- Fashion design
- Game design
- Graphic design
- Information architecture
- Information design
- Industrial design
- Instructional design
- Interaction design
- Interior design
- Landscape architecture
- Lighting design
- Modular design
- Motion graphic design
- Organization design
- Product design
- Process design
- Service design
- Software design
- Sound design
- Spatial design
- Strategic design
- Systems architecture
- Systems design
- Systems modeling
- Urban design
- User experience design
- Visual design
- Web design

fruits of the tree

today's harvest

- **biophilic design**
- **computational design**
- **design thinking design**
- **design science**
- **operational design**
- **curriculum design**
- **post-modern design**
- **critical design**
- **subverted design**
- **transitional design**
- **intelligent design**
- **sustainable design**
- **resilient design**
- **decorative design**
- **creative design**
- **evidence based design**
- **systems design**
- **performance based design**
- **human centered design**
- **aerospace design**
- **responsive design**
- **adaptive design**
- **interface design**
- **user design**
- **transportation system design**
- **acoustics design**
- **furniture design**

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<http://accidentalvagrant.blogspot.com/2019/12/design-mind-slides-from-presentation.html>

Multicultural inquiry, Harold Nelson, 2019

what is **true**? (scientific research)
what is **real**? (systems science research)

what is **good**? (humanities inquiry)
what is **right**? (humanities inquiry)
what is **aesthetic**? (arts inquiry)

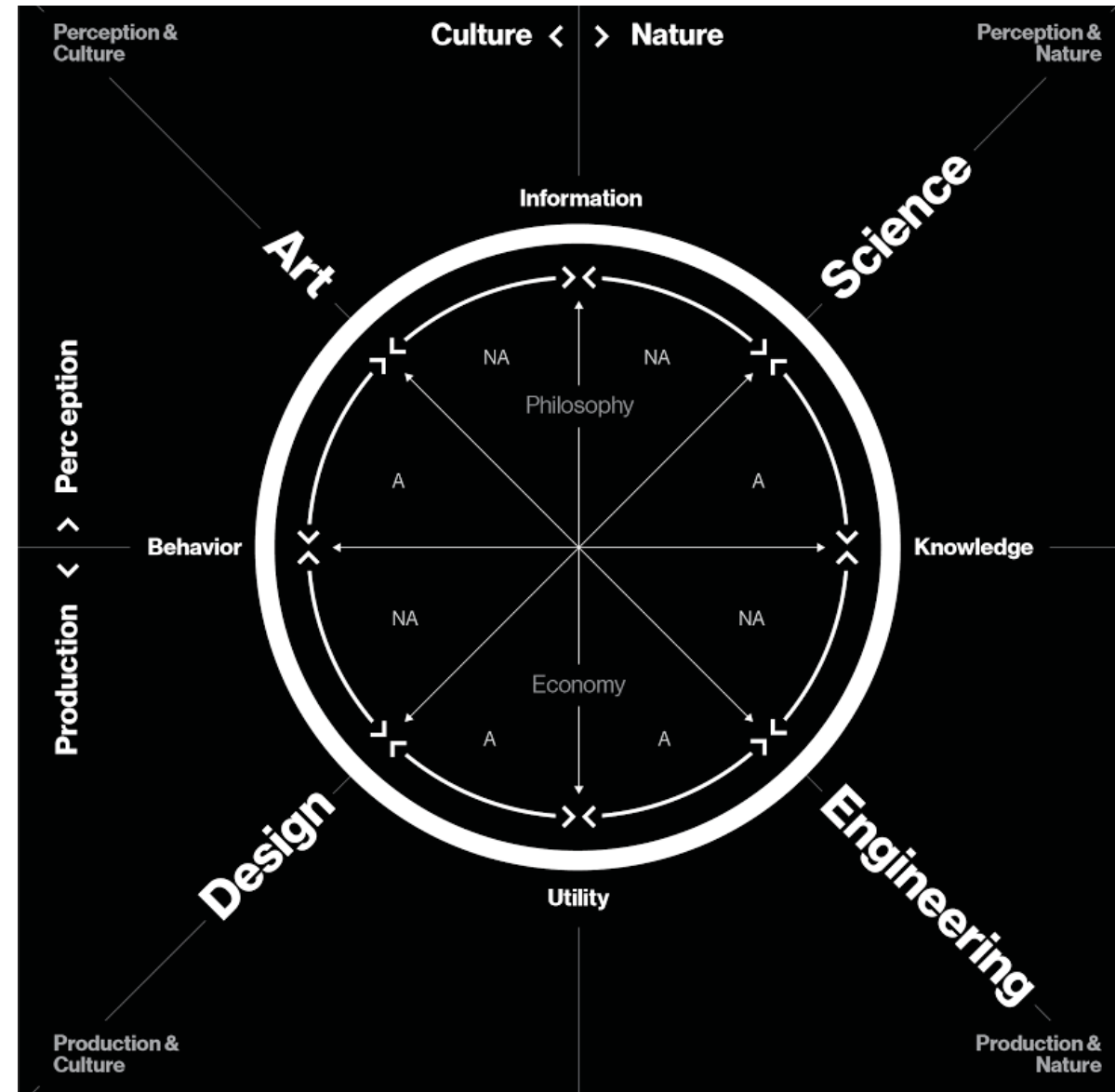
what would be **ideal**? (design inquiry)
what would be **prudent**? (design inquiry)
what would be **desirable**? (design inquiry)
what ought to be **made real**? (design inquiry)

multicultural inquiry

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<http://accidentavagrant.blogspot.com/2019/12/design-mind-slides-from-presentation.html>

Krebs cycle of creativity, Neri Oxman + Joi Ito, 2016

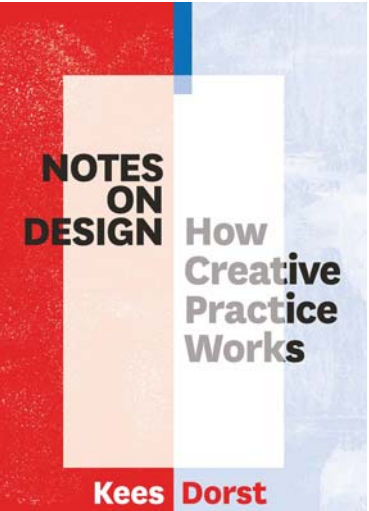


<https://jods.mitpress.mit.edu/pub/designandscience>

Logic of creation, Kees Dorst, 2017

from *Notes on Design: How Creative Practice Works*

Reasoning	WHAT (elements)	+	HOW (patterns of relationships)	→	OUTCOME (observed phenomenon)
Deduction	WHAT	+	HOW (model)	→	??? (prediction)
Induction	WHAT	+	??? (hypothesis)	→	OUTCOME
Normal abduction	???	+	HOW	→	OUTCOME (the desired ?)
Design abduction	???	+	???	→	OUTCOME



Hierarchy of change, Harold Nelson + Erik Stolterman, 2012

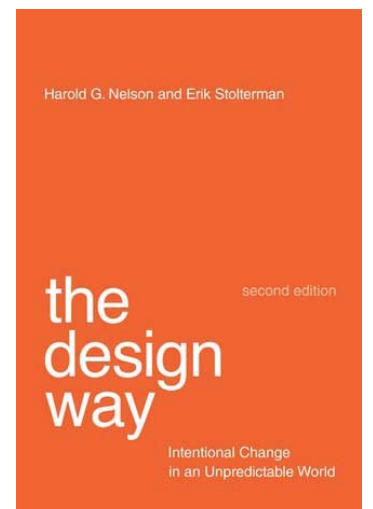
from *The Design Way: Intentional Change in an Unpredictable World*

change is **difference**

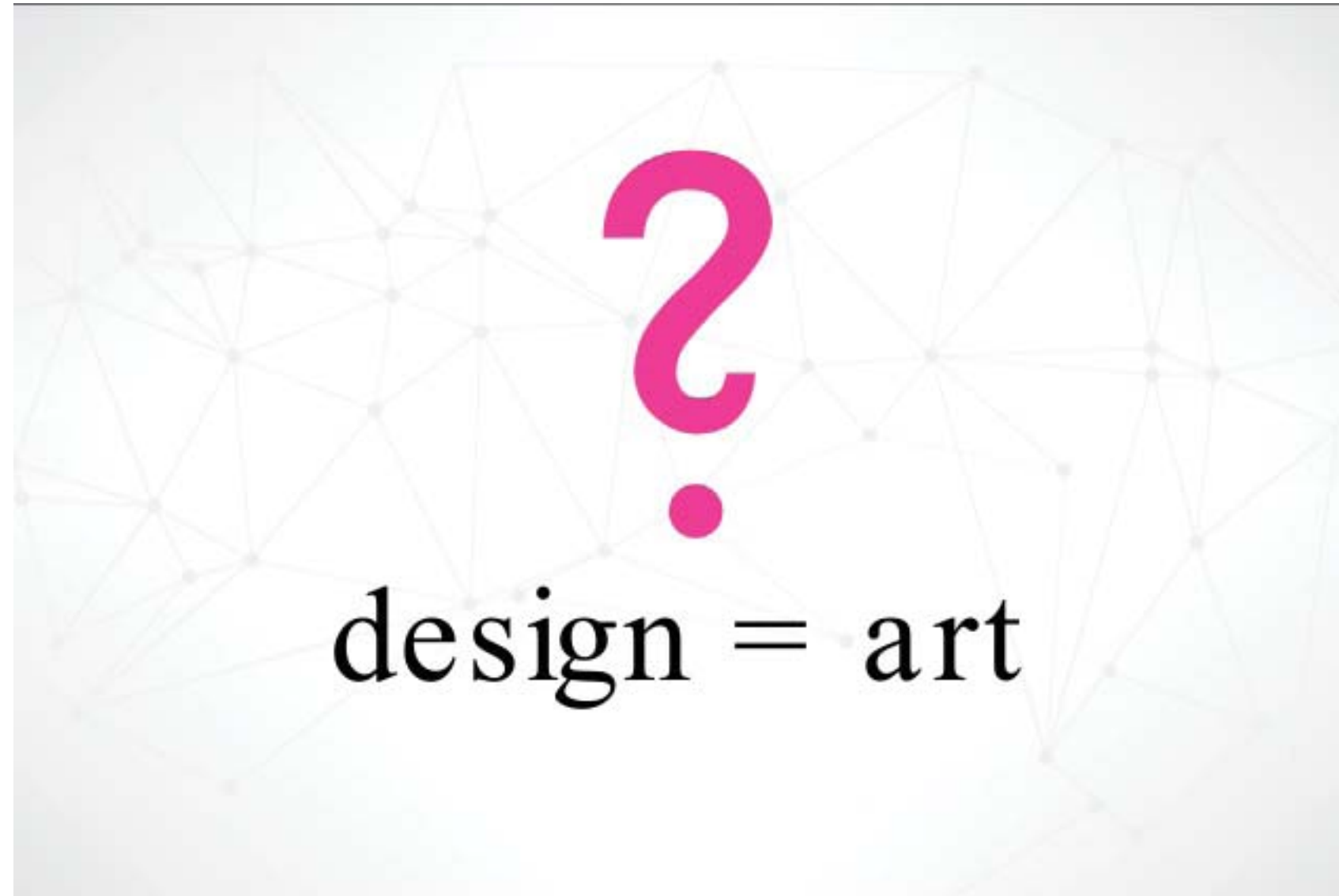
change of *difference* is **process**

change of *process* is **evolution**

change of *evolution* is **design**



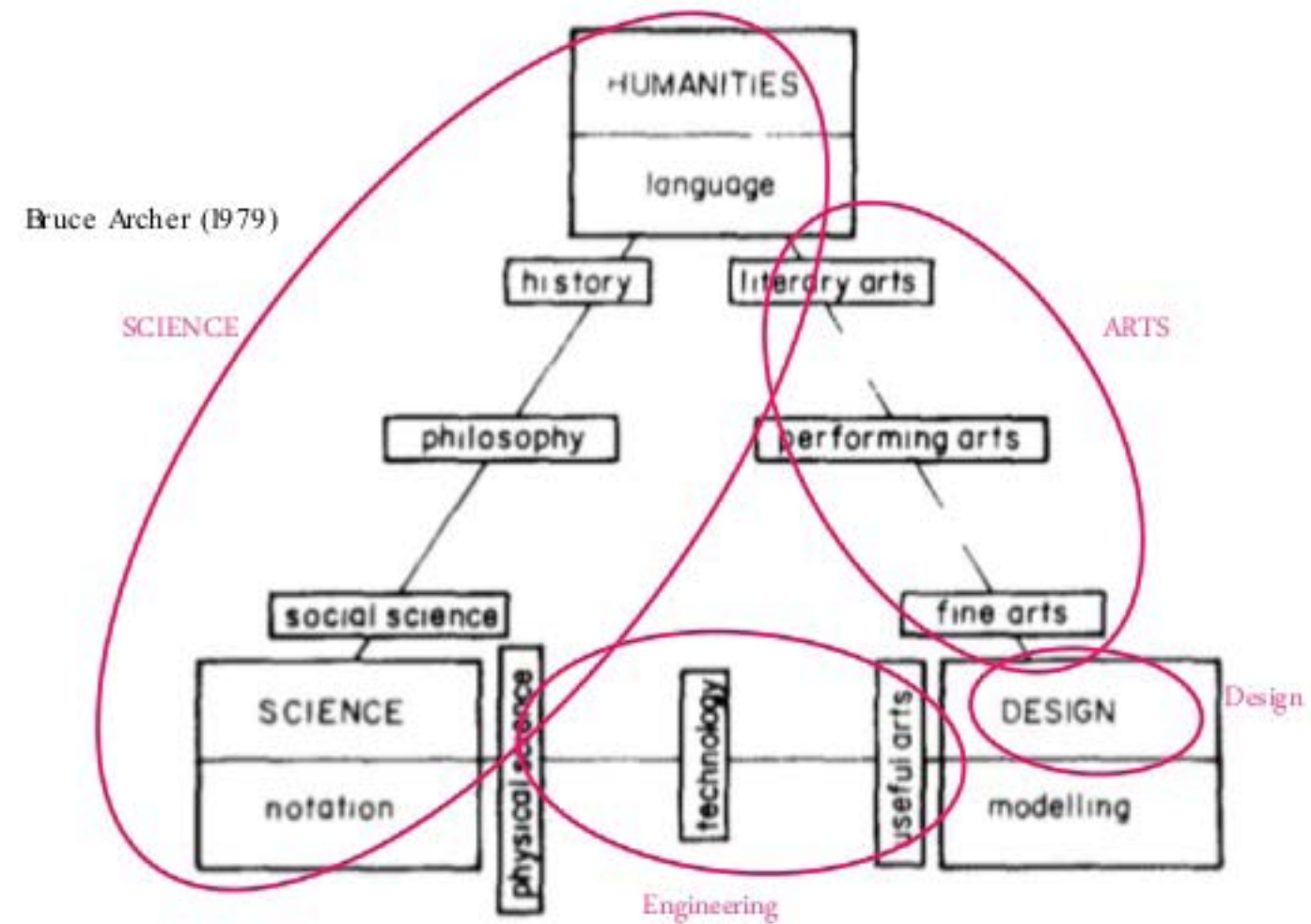
Design Thinking, Jy Lee, 2015



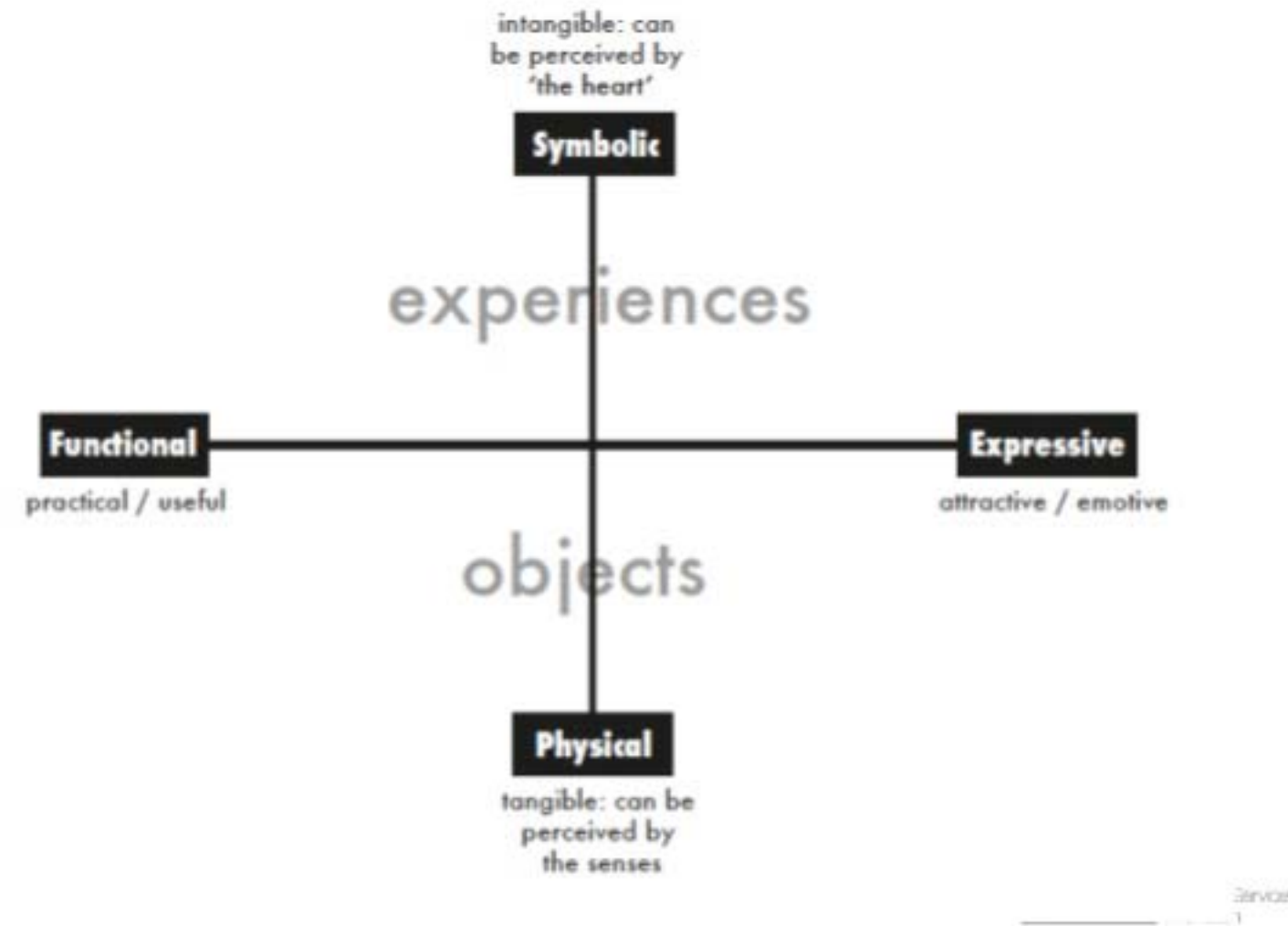
sidlab Social & Service
Innovation

https://www.slideshare.net/jylee_sidlab/dt2015-class02

Design Thinking, Jy Lee, 2015

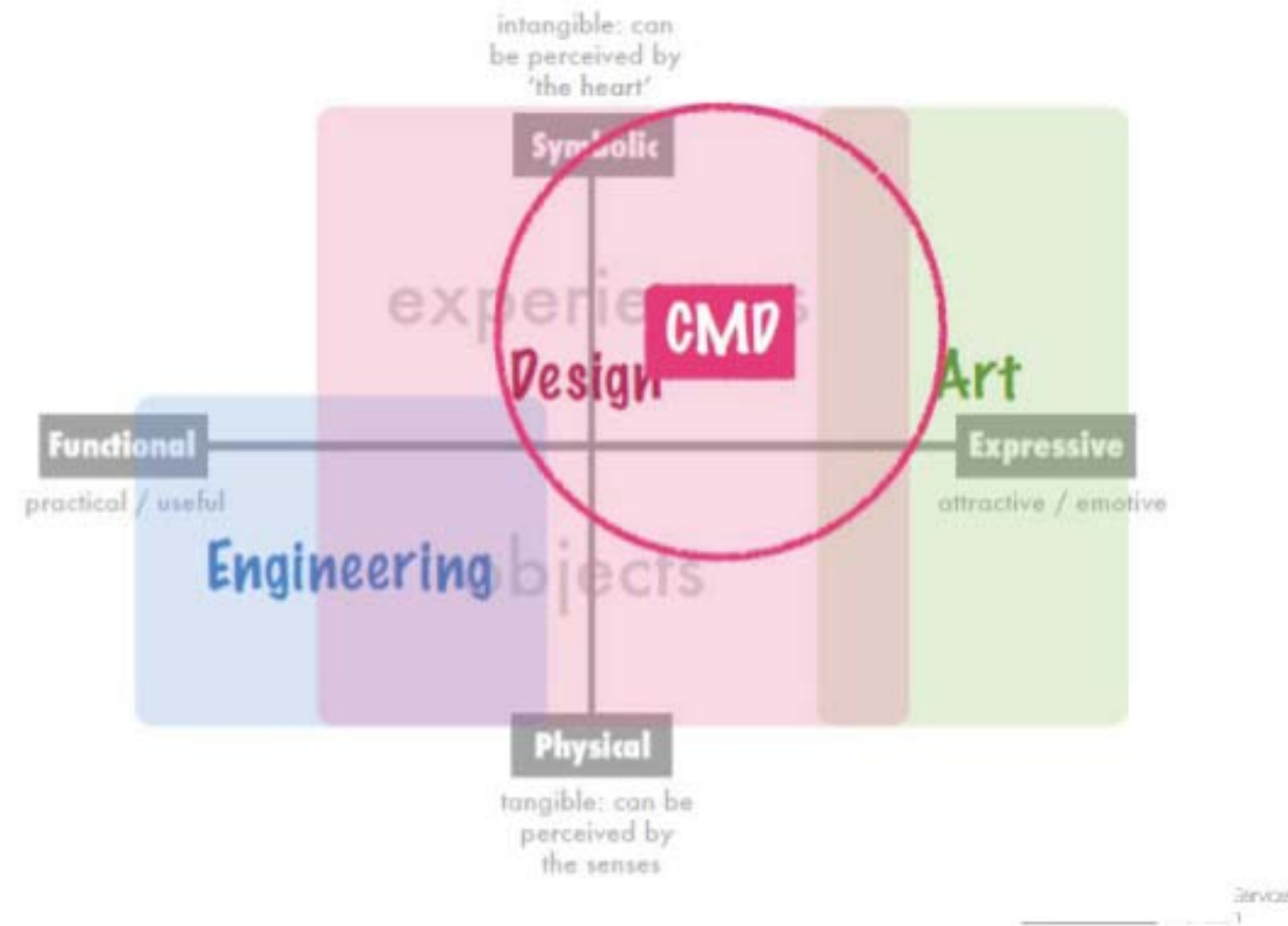


Design Thinking, Jy Lee, 2015



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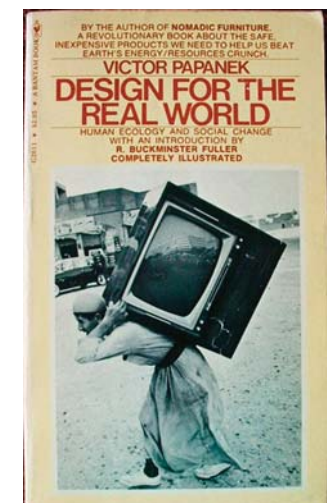
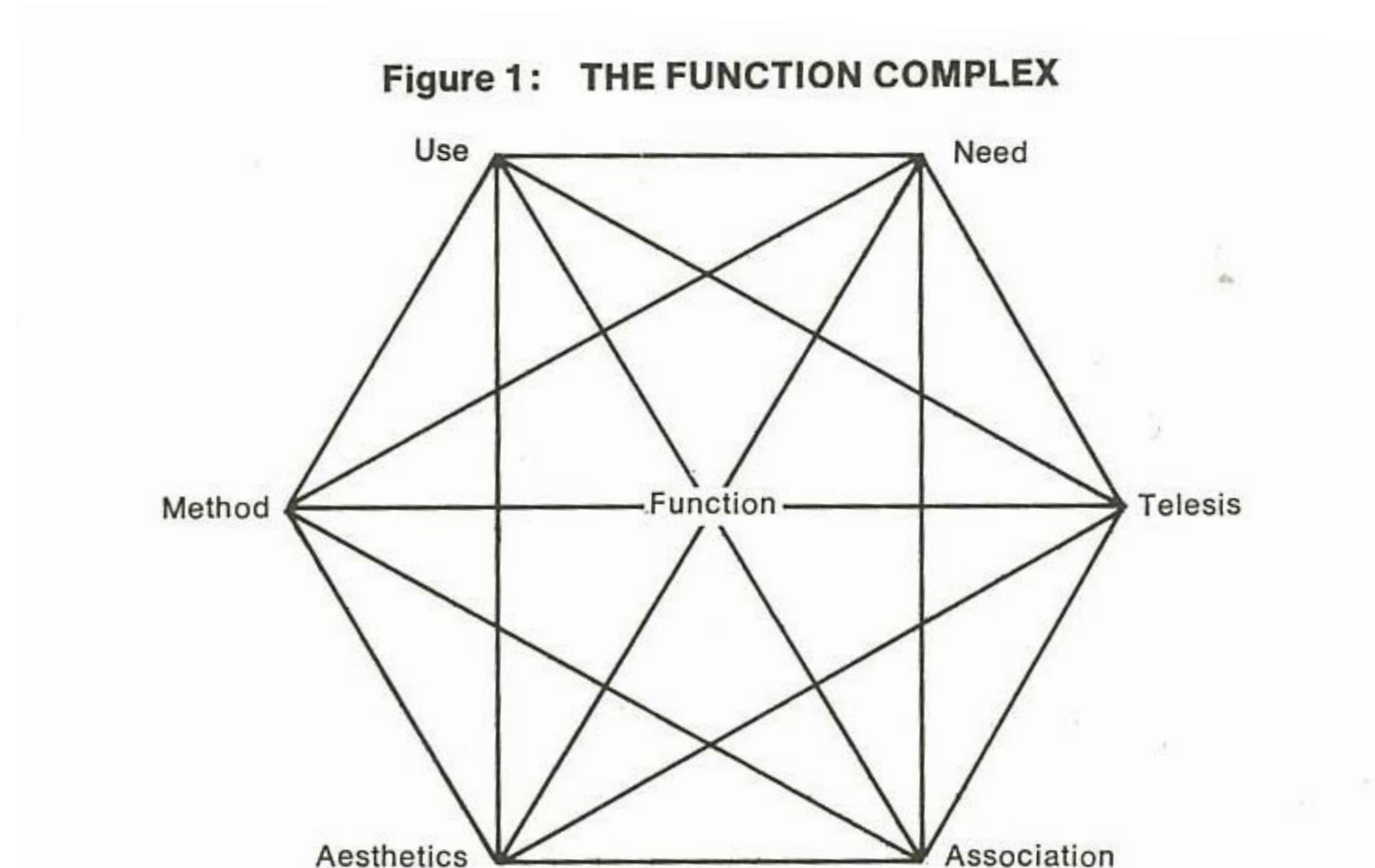
Design Thinking, Jy Lee, 2015



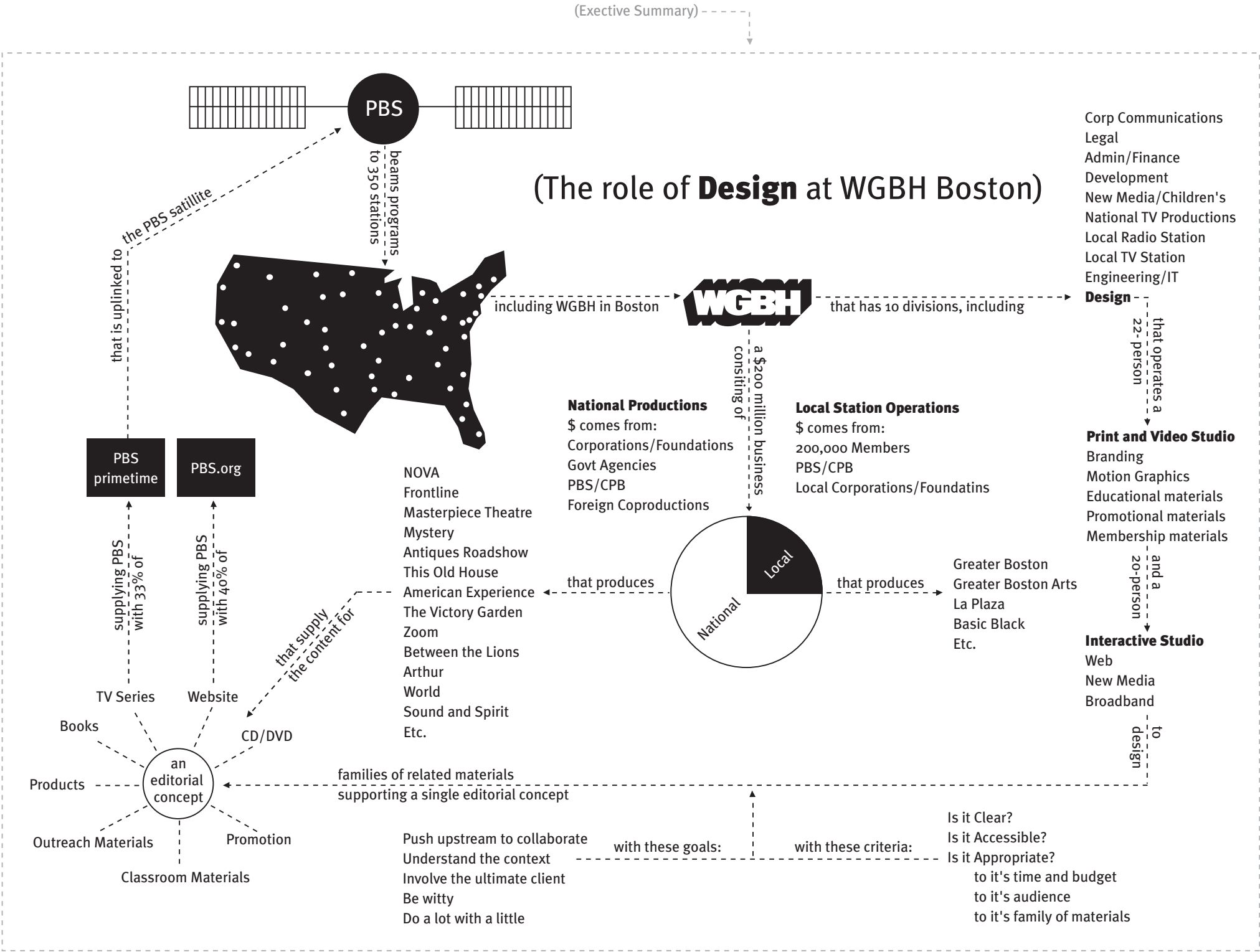
https://www.slideshare.net/jylee_sidlab/dt2015-class02

The function complex, Victor Papanek, 1971

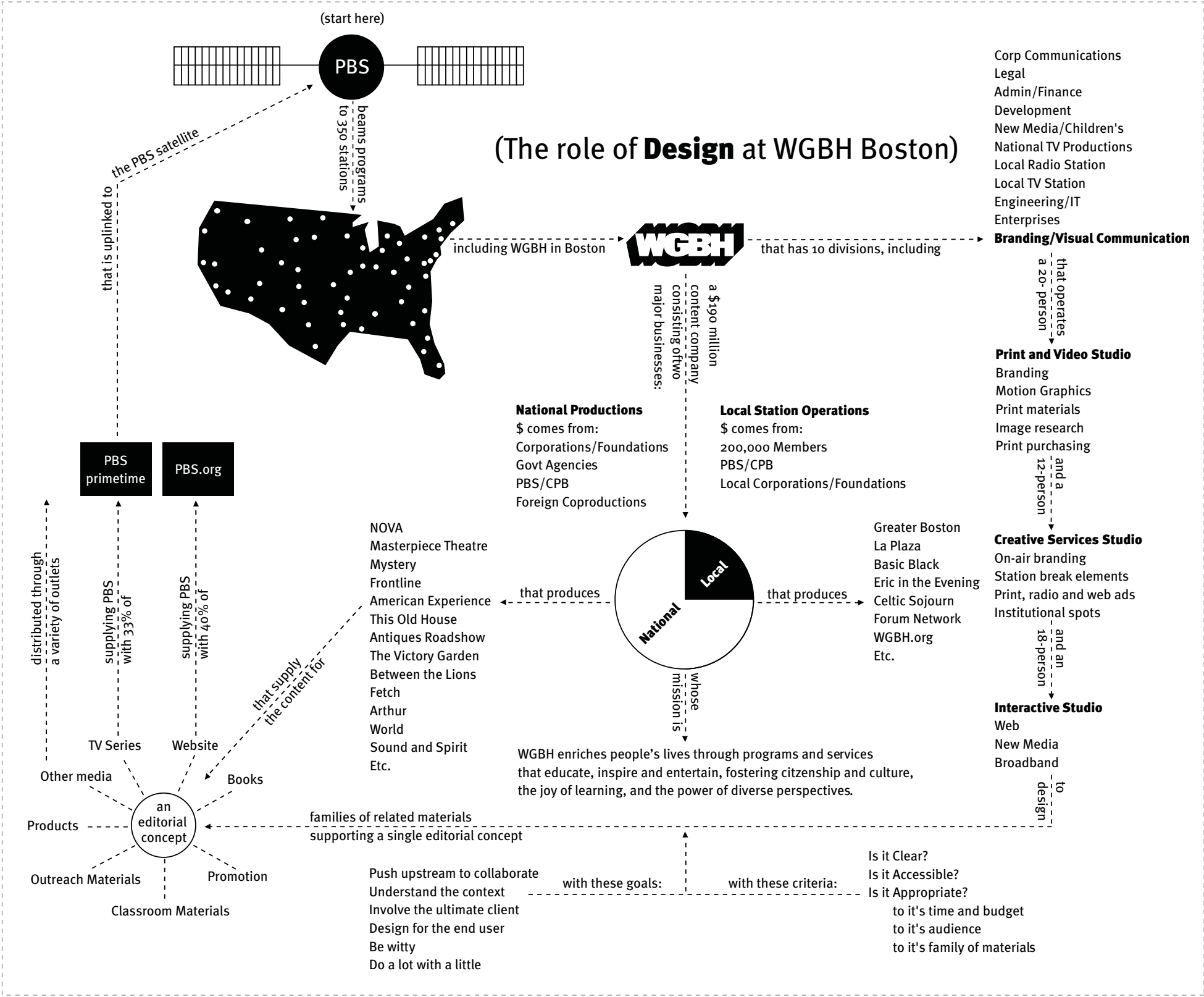
from *Design for the Real World*



The role of Design at WGBH Boston, Chris Pullman, 2002



The role of Design at WGBH Boston, Chris Pullman, 2006



10 lessons I learned (or at least had confirmed) at WGBH,

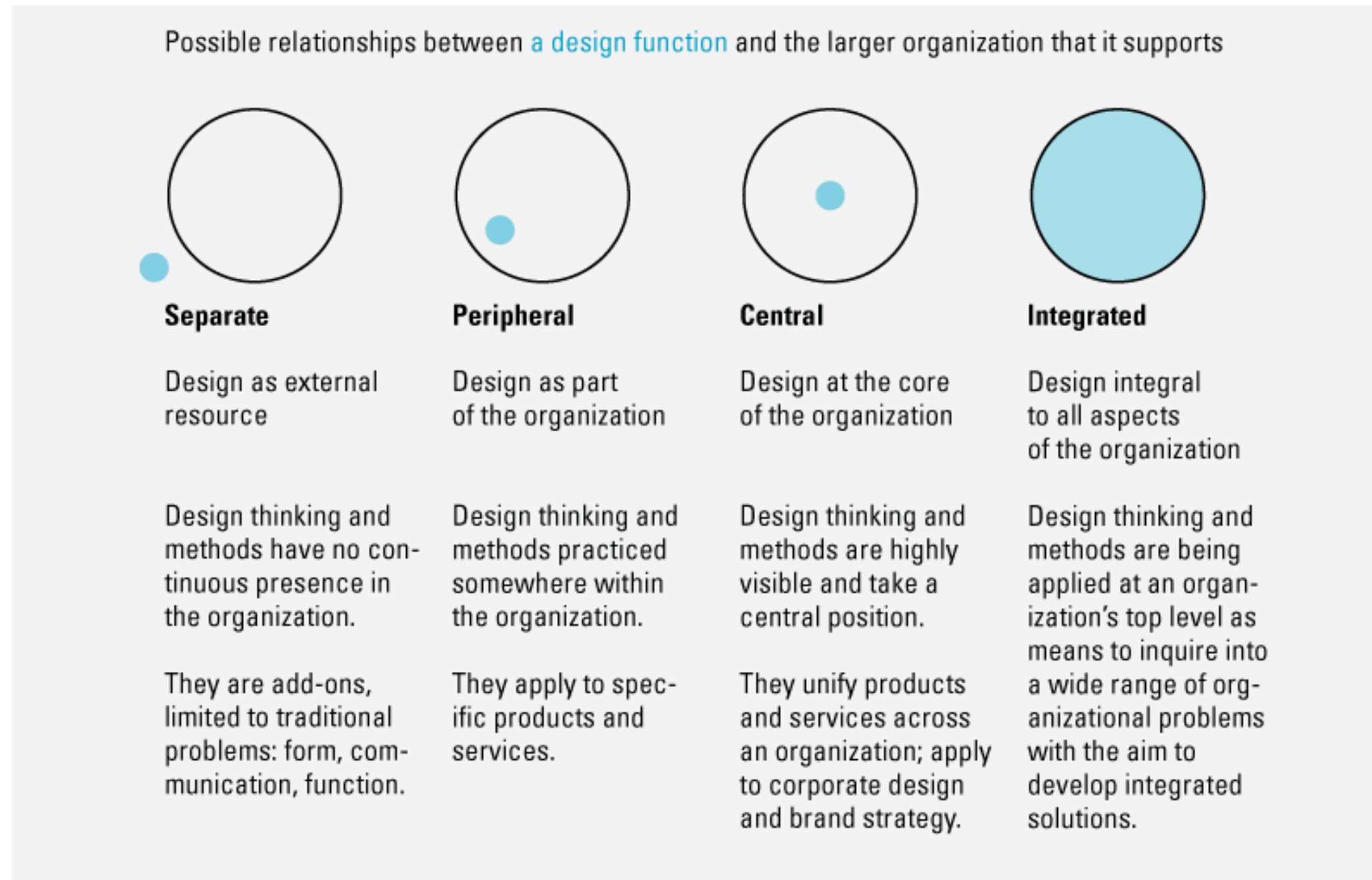
Chris Pullman, 2008

1. Work on things that matter
2. Work with people you like and respect
3. Be nice
4. Have high standards
5. Have a sense of humor
6. Design is not the narrow application of formal skills, it's a way of thinking
7. Variety is the spice of life
8. Institutions have a character, just like people do
9. We're all in the "understanding business"
10. You are what you eat

Dimensions of design practice

[to come]

Sabine Junginger, 2009



Junginger, S. Design in the organization: Parts and wholes. *Design Research Journal*, 2, 9 (2009)

http://www.dubberly.com/wp-content/uploads/2012/04/Junginger_model.png

Design Triples

Vitruvius

- solidity, commodity, delight

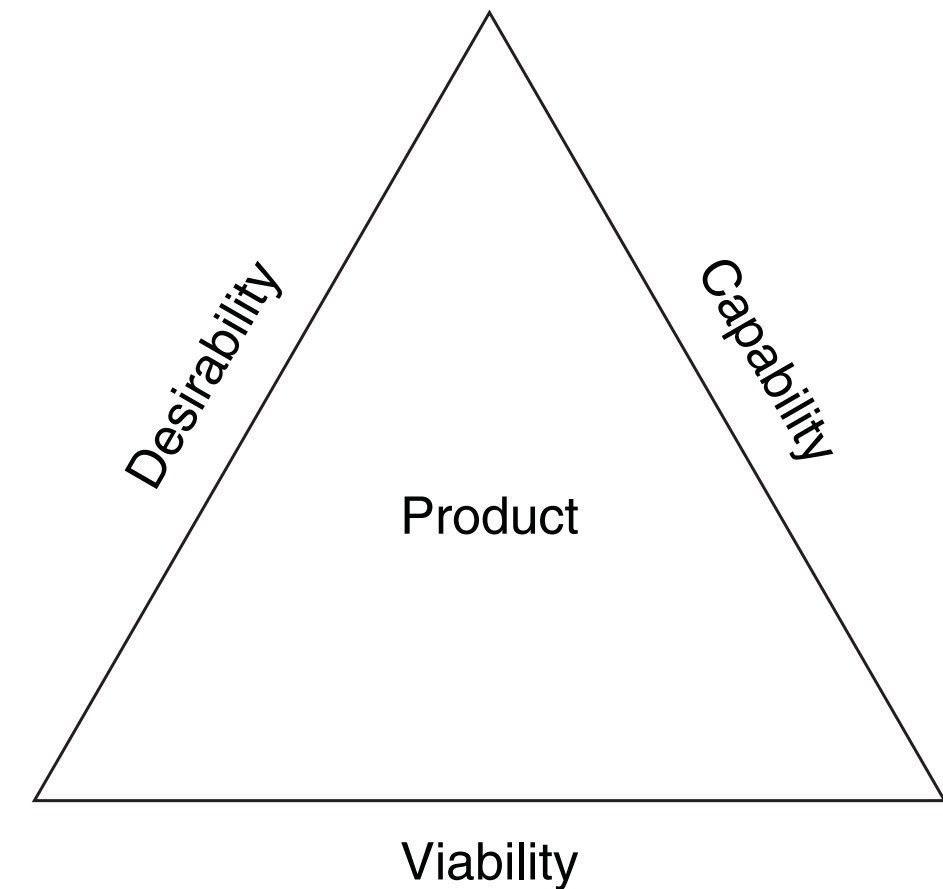
ISO 9241

- efficiency, effectiveness, satisfaction

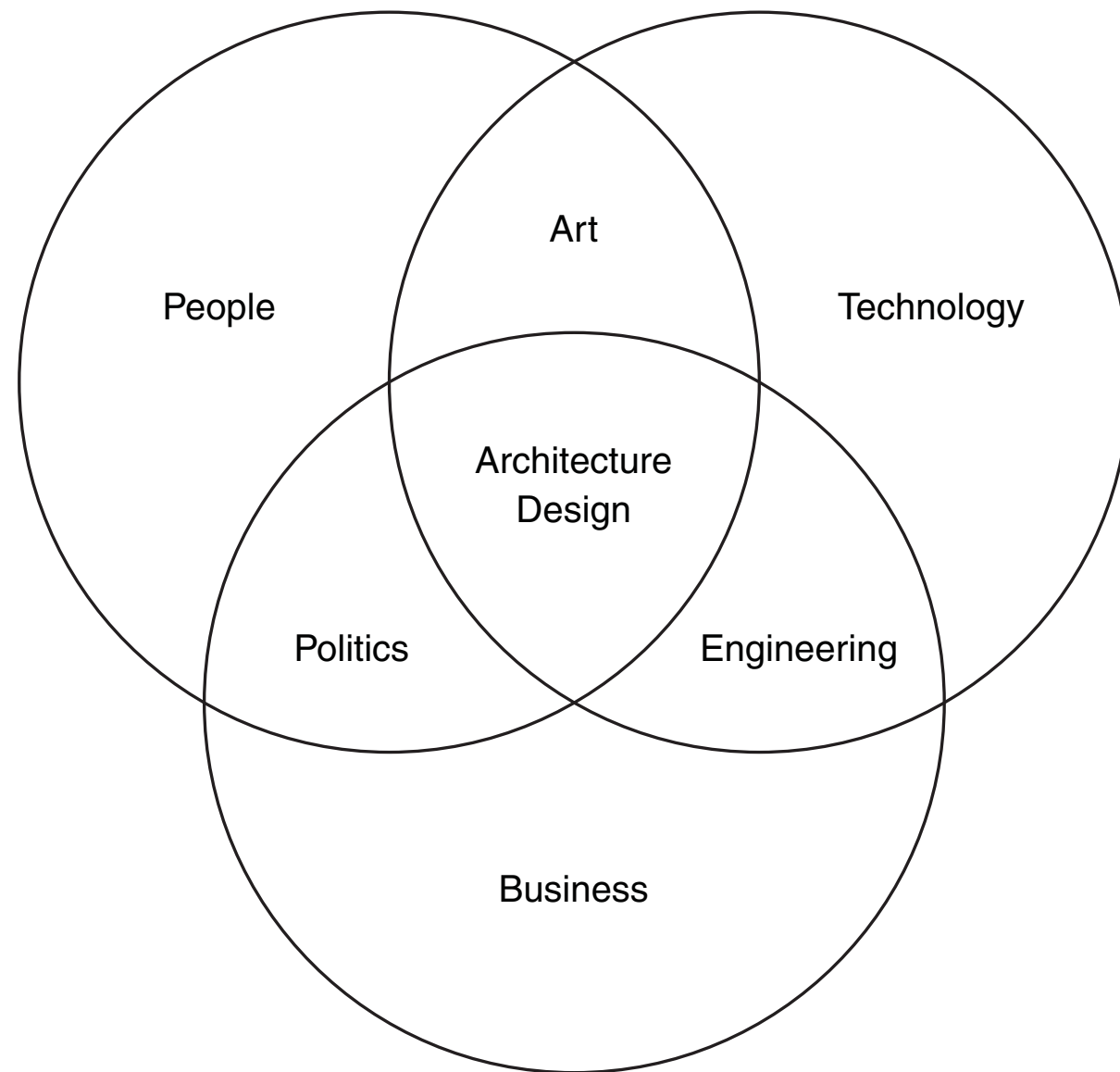
Cooper

- hot, simple, deep

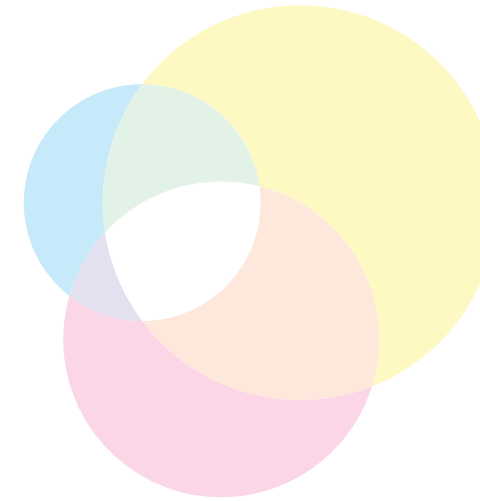
and of course: fast, cheap, good



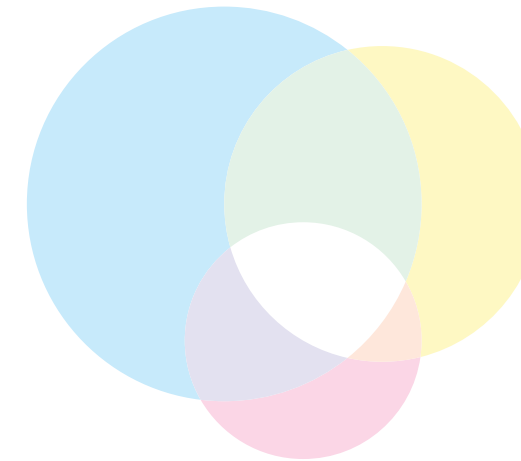
http://www.dubberly.com/wp-content/uploads/2008/06/ddo_article_cooper.pdf



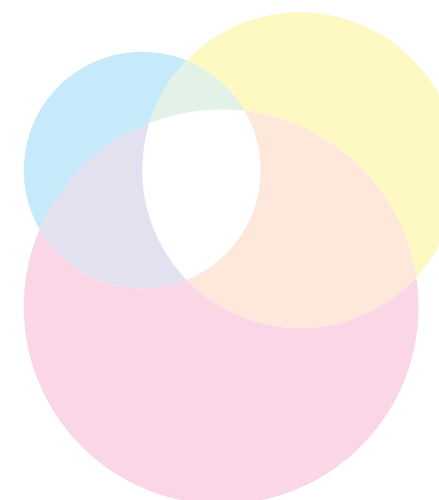
http://www.dubberly.com/wp-content/uploads/2008/06/ddo_article_cooper.pdf



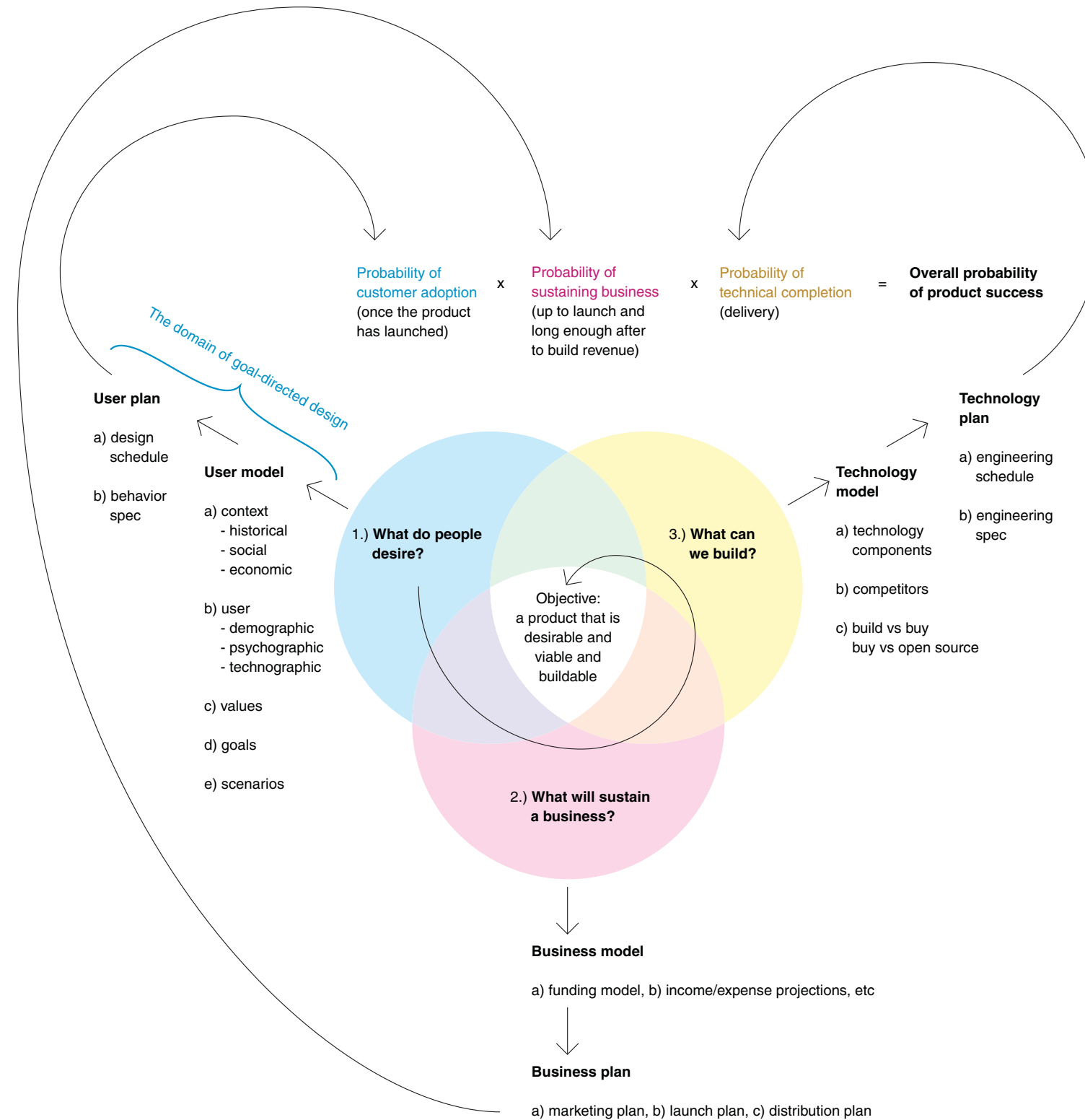
Novell emphasized technology and gave little attention to desirability. This made it vulnerable to competition.



Apple emphasized desirability but has made many business blunders. Never-the-less, it is sustained by the loyalty its attention to users creates.



Microsoft is one of the best run businesses ever, but it has not been able to create highly desirable products. This provides an opening for competitors.



http://www.dubberly.com/wp-content/uploads/2008/06/ddo_article_cooper.pdf

10 Principles of Good Design, Dieter Rams, 1970's

1. Good design is innovative
2. Good design makes a product useful
3. Good design is aesthetic
4. Good design makes a product understandable
5. Good design is unobtrusive
6. Good design is honest
7. Good design is long lasting
8. Good design is thorough down to the last detail
9. Good design is environmentally friendly
10. Good design is as little design as possible

Levels of systems, Kenneth Boulding, 1956

1. the level of Frameworks	Only the geography and anatomy of the subject is described and analyzed; a kind of system of static relations [Most architecture and graphic design systems are of this type.]
2. the level of Clockworks	Machines that are determined
3. the level of Thermostats	The level of control in mechanical and cybernetical [sic] systems
4. the level of the Cell	As an open and self-maintaining system, having a through-put that transforms unpredicted inputs into outputs [what Maturana, Varela, and Uribe later called an “autopoetic” system]
5. the Genetic and Societal level	Of plants and accumulated cells
6. the level of the Animal	Specialized receptors, a nervous system, and an “image”
7. the Human level	All of the previous six—plus self-consciousness. The system knows that it knows, and knows that it dies
8. the level of the Social Organism	The unit at this level is a role, rather than a state; messages with content and meaning exist, and value systems are developed
9. the level of Transcendental Systems	The “ultimates” and “absolutes” and the “inescapables” with systematic structure

—Kenneth Boulding [14]

Classification of systems, Stafford Beer, 1959

222 :: CHAPTER SIX

SYSTEMS	<i>Simple</i>	<i>Complex</i>	<i>Exceedingly complex</i>
Deterministic	Window catch	Electronic digital computer	EMPTY
	Billiards	Planetary system	
	Machine-shop lay-out	Automation	
Probabilistic	Penny tossing	Stockholding	The economy
	Jellyfish movements	Conditioned reflexes	The brain
	Statistical quality control	Industrial profitability	THE COMPANY

Figure 6.3. Beer's classification of systems. Source: S. Beer, *Cybernetics and Management* (London: English Universities Press, 1959), 18.

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