After the Bauhaus, Before the Internet: A History of Graphic Design Pedagogy
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Problems with Problems: Reconsidering the Frame of Designing as Problem-Solving

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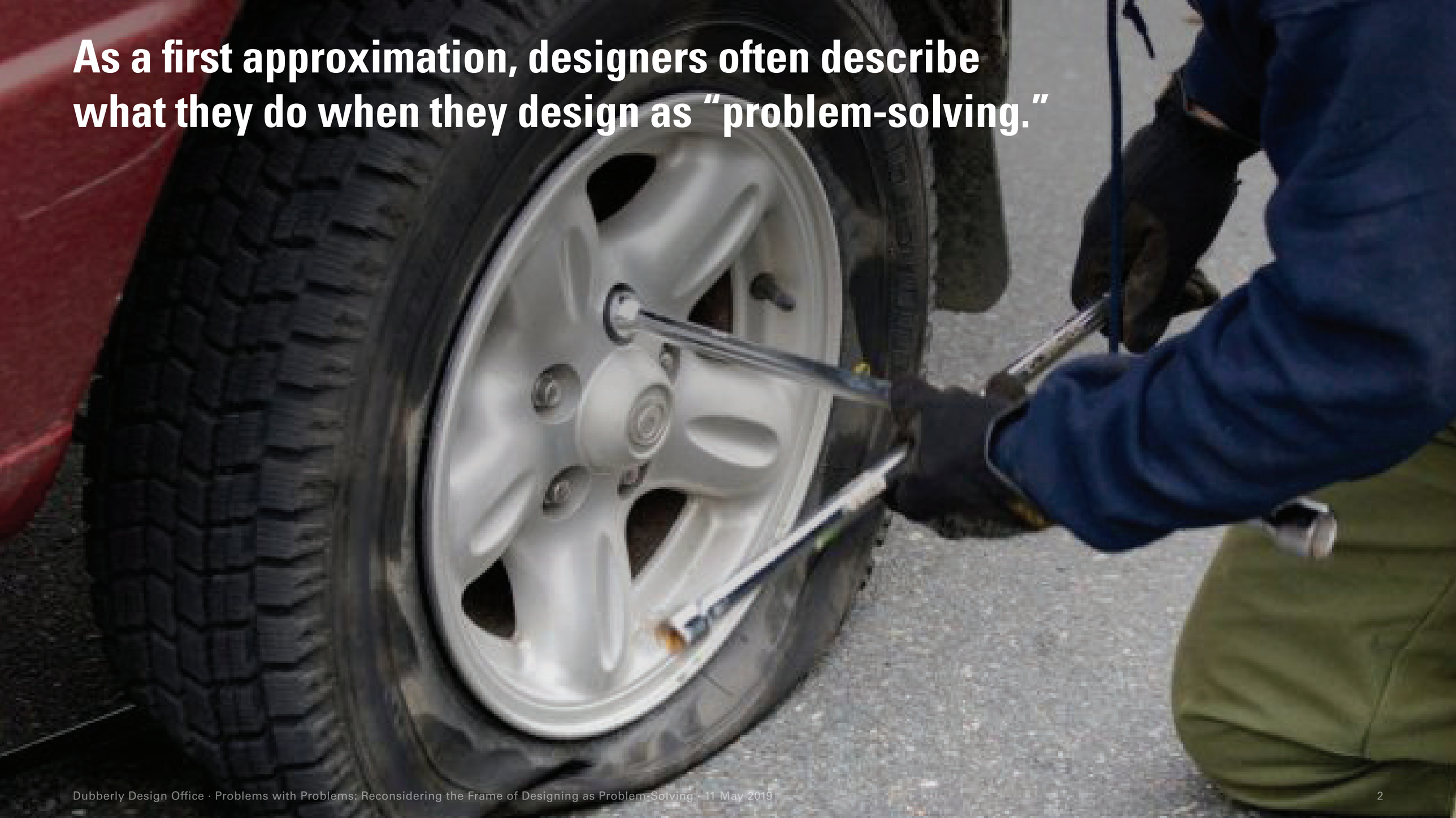
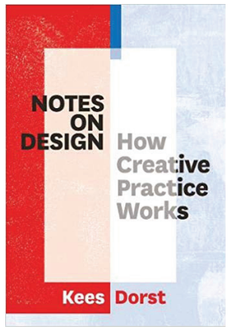
As a first approximation, designers often describe what they do when they design as “problem-solving.”



"When people started trying to understand design … the first model they devised was of design as a problem solving process."



— **Kees Dorst**, *Notes on Design: How Creative Practice Works*, 2017 [19]

Walter Gropius —

"My intention is … to introduce a method of approach which allows one to tackle a problem according to its peculiar conditions." [1955]

Josef Albers —

Interaction of Color [1963] uses the word "problem" 15 times; Albers writes of "… solving our problems…" and he titles the student exercises "Problems."

Charles Eames —

"Design addresses itself to the need."

"[Constraints are] one of the few effective keys to the design problem." [1972]

Buckminster Fuller —

"When I am working on a problem, I never think about beauty. I only think about how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong."

Paul Rand —

In "Design and the Play Instinct," he discusses "the kind of problem chosen for study," and recommends "a problem with well defined limits." [1965]

Lou Danziger —

"Design is purposeful …"
"… factors of the problem should shape the solution." [2019]

Armin Hofmann —

In his preface to *Graphic Design Manual,* George Nelson writes that Hofmann believes "that if problems can be correctly stated, they can be solved." [1965]

Ken Hiebert —

"Problem-solving was embedded in every aspect of learning in the Basel Program." [2019]

"Unimark designers were the clinicians, diagnosing a client's problems and then solving them.... Design was scientific and not a messy artistic process. The white lab coat transformed us all into a well-organized team of consistent precise professionals without individuality and quirky intuitions, biases and emotions. Lab coats kept us "clean," like the "clean" design solutions we sought."

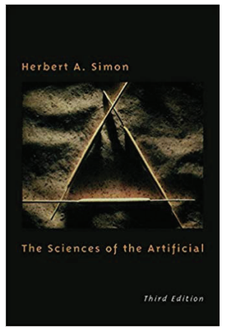
— **Katherine McCoy,** 2019

"The new art is founded not on a subjective, but on an objective basis. This, like science, can be described with precision and is by nature constructive. It unites not only pure art, but all those who stand at the frontier of the new culture. The artist is companion to the scholar, the engineer, and the worker."

— **El Lissitzky and Illya Ehrenberg**, Statement by the editors of the journal *Veshch*, 1922

"The natural sciences are concerned with how things are…. Design, on the other hand, is concerned with how things ought to be, with devising artifacts to attain goals."

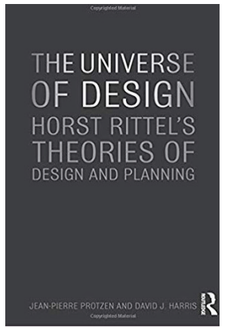
"Everyone designs who devises courses of action aimed at changing existing situations into preferred ones."



— **Herbert Simon**, *Sciences of the Artificial,* 1968 [111]

"Science and design are usually taken as polar contradictions….What do the words science and design mean and what do they have in common?…

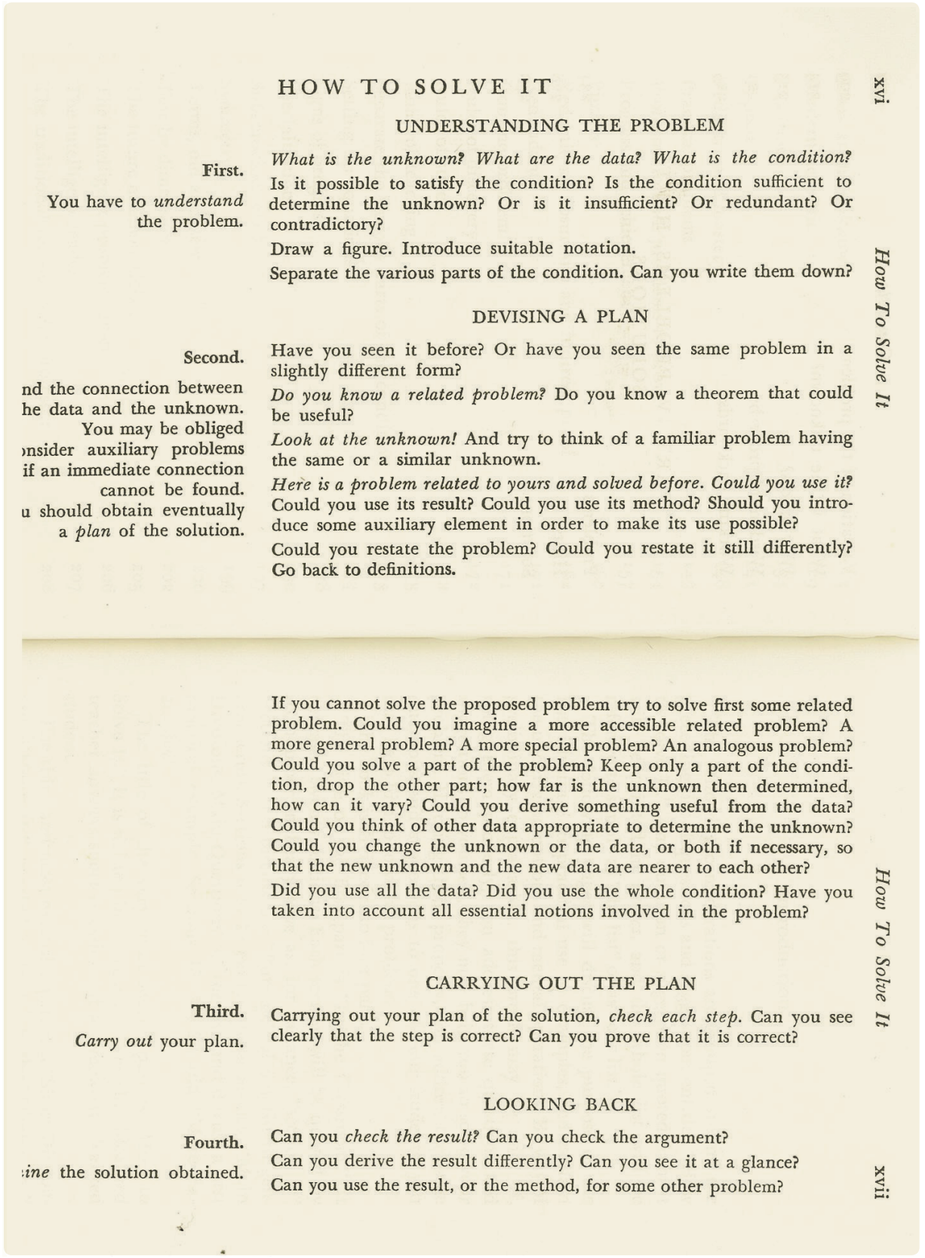
1. *activities,*
2. *names for the results of activities,*
3. *associated with social institutions…*
4. *directed to the achievement of new realities…*
5. *problem-solving activities,*
6. *… unpredictable results"*



— **Horst Rittel**, *The Universe of Design,* 1964 [48]

"In all of us [at HfG Ulm], especially myself, there was a deep dissatisfaction with a didactics (and a design activity) that had appealed only to intuition. In this context an increasing interest in disciplines ... with a heuristic function such as 'problem-solving' and 'decision-making' [showed up]. We were very curious about anything moving in the world that was concerned with scientific questions."

— **Tomás Maldonado**, "Looking Back and Forward: Interview," 2002 [241]



HOW TO SOLVE IT xvi

UNDERSTANDING THE PROBLEM

First.
You have to *understand* the problem.

What is the unknown? What are the data? What is the condition? Is it possible to satisfy the condition? Is the condition sufficient to determine the unknown? Or is it insufficient? Or redundant? Or contradictory?

Draw a figure. Introduce suitable notation.

Separate the various parts of the condition. Can you write them down?

DEVISING A PLAN

Second.
nd the connection between
he data and the unknown.
You may be obliged
nsider auxiliary problems
if an immediate connection
cannot be found.
u should obtain eventually
a *plan* of the solution.

Have you seen it before? Or have you seen the same problem in a slightly different form?

Do you know a related problem? Do you know a theorem that could be useful?

Look at the unknown! And try to think of a familiar problem having the same or a similar unknown.

Here is a problem related to yours and solved before. Could you use it? Could you use its result? Could you use its method? Should you introduce some auxiliary element in order to make its use possible?

Could you restate the problem? Could you restate it still differently? Go back to definitions.

How To Solve It

If you cannot solve the proposed problem try to solve first some related problem. Could you imagine a more accessible related problem? A more general problem? A more special problem? An analogous problem? Could you solve a part of the problem? Keep only a part of the condition, drop the other part; how far is the unknown then determined, how can it vary? Could you derive something useful from the data? Could you think of other data appropriate to determine the unknown? Could you change the unknown or the data, or both if necessary, so that the new unknown and the new data are nearer to each other?

Did you use all the data? Did you use the whole condition? Have you taken into account all essential notions involved in the problem?

How To Solve It

CARRYING OUT THE PLAN

Third.
Carry out your plan.

Carrying out your plan of the solution, *check each step*. Can you see clearly that the step is correct? Can you prove that it is correct?

LOOKING BACK

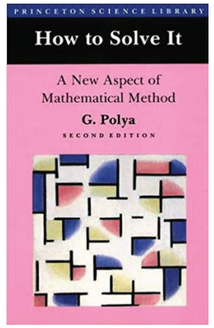
Fourth.
ine the solution obtained.

Can you *check the result?* Can you check the argument?

Can you derive the result differently? Can you see it at a glance?

Can you use the result, or the method, for some other problem?

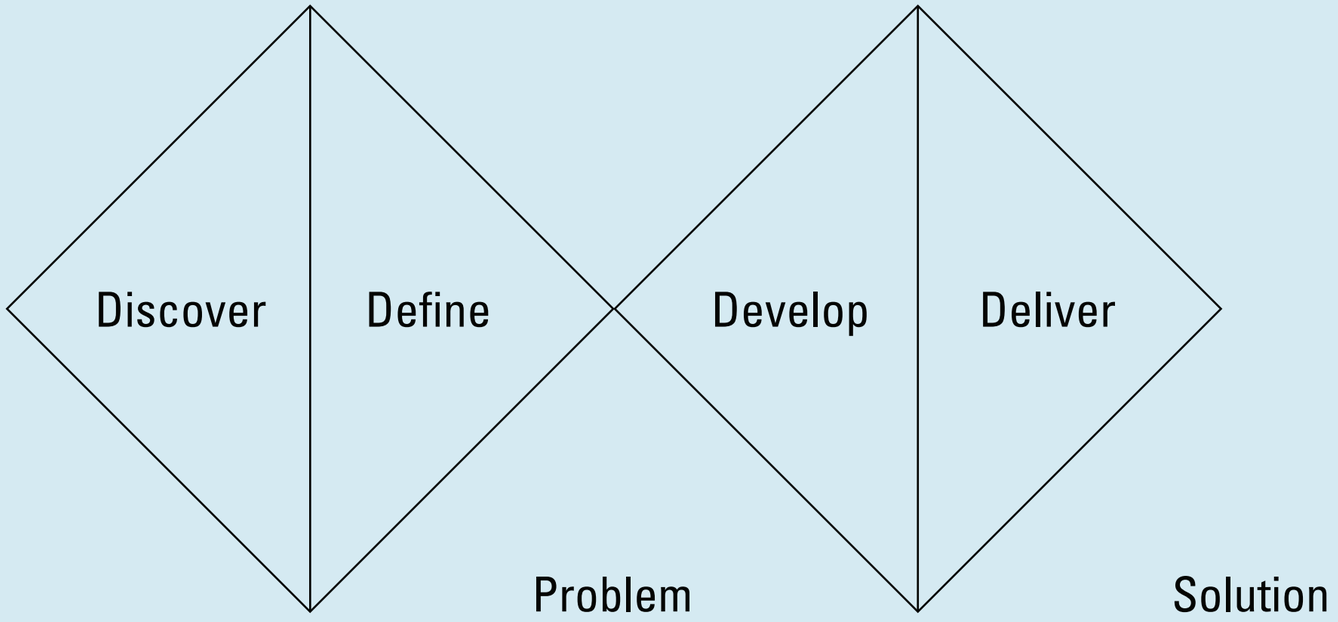
xvii



— **George Polya**, *How to Solve It,* 1945 [xvi-xvii]

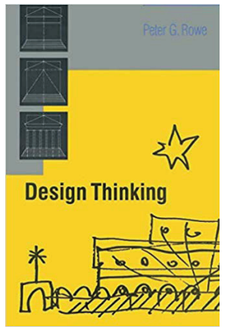
The concept of designing as “problem-solving” is a foundation for design practice, design education, and writing about design.

So much so, that the “design problem” is the basic “unit of work.”
That is, “design project” is almost synonymous with “design problem.”



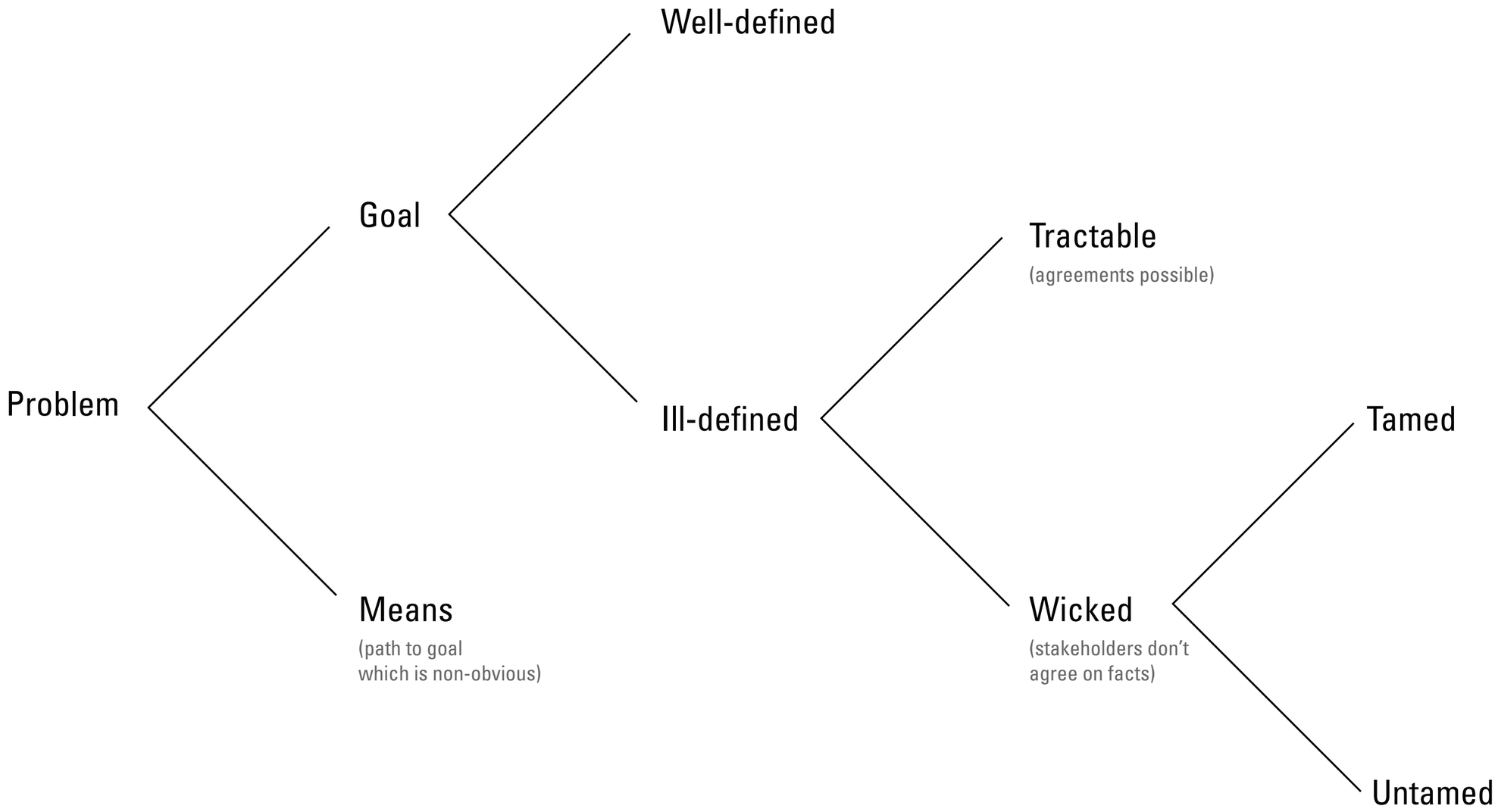
“Double diamond,” after Papanek, one of many linear design process models.

"To paraphrase Thorndike's venerable definition, a problem can be said to exist if an organism wants something but the actions necessary to obtain it are not immediately obvious…."



— **Peter Rowe**, *Design Thinking*, 1987 [39]

Rowe's taxonomy of problems



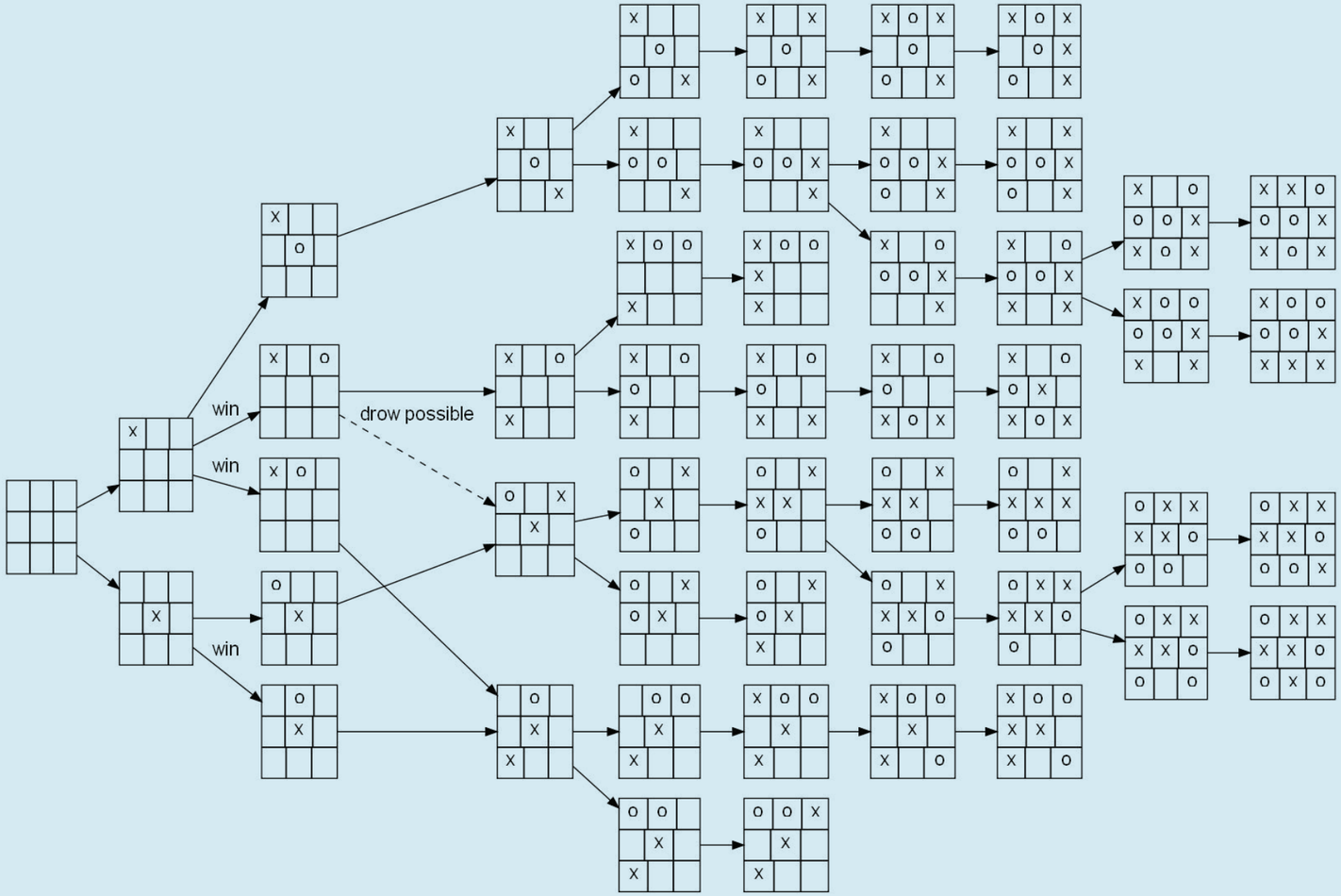
Rittel's criteria for identifying wicked problems:

1. No definitive formulation
2. No stopping rule
3. Solutions are not true-or-false but good-or-bad
4. No immediate and no ultimate test of a solution
5. Every solution is a "one-shot operation"
6. The set of potential solutions cannot be enumerated
7. Essentially unique
8. A symptom of another problem
9. Choice of explanation determines the resolution
10. The planner has no right to be wrong

— **Horst Rittel & Melvin Webber**, *Dilemmas in a General Theory of Planning,* 1972

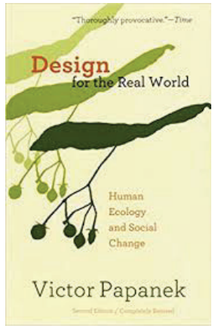
Wicked problems differ from math problems, which may be tautologies

2 + 2 = ?, proofs of the Pythagorean Theorem, tic-tac-toe, chess, and go



Tic-tac-toe as a “solution space” or “decision tree.”

"… design as a problem-solving activity can never, by definition, yield the one right answer: it will always produce an infinite number of answers, some 'righter' and some 'wronger.'"



— **Victor Papanek**, *Design for the Real World*, 1971 [5]

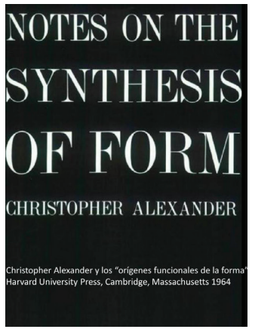
"You stop for any planning problem, because you have run out of time, money, or patience; but that has nothing to do with the logic of the problem, and you can always try to do better."

On the Planning Crisis:
Systems Analysis of the 'First and Second Generations'

By Professor H. Rittel

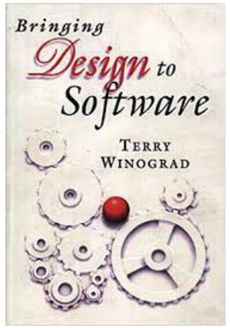
— **Horst Rittel**, *"On the Planning Crisis: Systems Analysis of the 'First and Second Generations,'"* 1972

"… every design problem begins with an effort to achieve fitness between two entities: the form in question and its context. The form is the solution to the problem; context defines the problem. In other words, when we speak of design, the real object of discussion is not the form alone, but the ensemble comprising the form and its context."



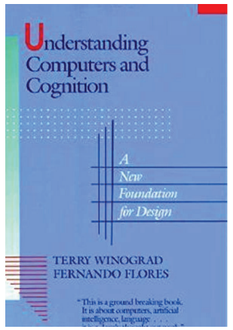
— **Christopher Alexander,** *Notes on Synthesis of Form,* 1964 [15-16]

"There is no direct path between the designer's intention and the outcome. As you work a problem, you are continually in the process of developing a path into it, forming new appreciations and understandings as you make new moves."



— **Terry Winograd**, *Bringing Design to Software*, 1996 [5]

"The critical part of problem-solving lies in formulating the problem.… A problem is created by the linguistic acts in which it is identified and categorized. Of course, some situation is previous to the formulation, but its existence as a particular problem (which constrains the space of possible solutions) is generated by the commitment in language of those who talk about it. This conversation in turn exists within their shared background in a tradition."



— **Terry Winograd & Fernando Flores,** *Understanding Computers and Cognition,* 1986 [147]

Simon's "Problem Solving" vs Winograd's + Flores' "Deliberation / Conversation"

Problem frame => solution space / criteria => determining values + probabilities / selecting

vs

A "breakdown" results in a "situation of irresolution" (conflict over "What needs to be done?"), "in which the course of activity is interrupted by some kind of 'unreadiness.'"

Moving "from irresolution to resolution is 'deliberation.' The principle characteristic of deliberation is that it is a kind of conversation (in which one or many actors may participate)…"

Deliberations may include:

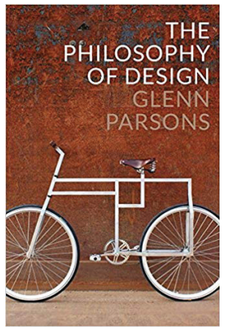
- Selecting from a space of possibilities defined by the original frame
- Generating new possibilities (changing the dimensions of the [existing] space)
- Changing the frame (creating a new space of possibilities)
- Rejecting the frame (deciding there really isn't a problem after all)

In summary, “problem solving” as a frame for designing has several issues, including:

1. Not all “problems” have solutions.
2. Not everything in need of designing is a “problem.”
3. Designing involves agreeing on stakeholders and goals.
4. “Problems” are inherently subjective.
5. “Problems” change as we examine them and begin to craft solutions.
6. Stopping conditions are mostly external.
7. The context of design, its ethos or paradigm, has changed.

“Problem-solving” as a frame for designing remains in current use.

“Design is the intentional solution of a problem, by the creation of plans for a new sort of thing, where the plans would not be immediately seen, by a reasonable person, as an inadequate solution.”



— **Glenn Parsons**, *The Philosophy of Design,* 2016 [10]

“Problem solving” is also promised in promotion of “design thinking.”

> *“Design thinking is a process by which designers approach problem solving.”*

— **Interaction Design Foundation**, 2016

https://www.interaction-design.org/literature/article/design-thinking-essential-problem-solving-101-it-s-more-than-scientific

A new challenge to the “problem-solving” frame is technology change —disruption to the environment, materials, and tools of design.

from	to
analog artifacts (things)	digital platforms (experiences)
stand-alone products	connected product-service ecologies
mass production of an edition	continuous deployment of updates
sampling as feedback/forward	continuous monitoring (now with AI)

This disruption posits a re-alignment of values.

from	to
hierarchical + closed	distributed + open
seeking simplicity	embracing complexity
making perfect	evolving (launch with just enough, MVP)
objective observer	subjective participant (therefore: responsible)

Technology is also disrupting how designers work.

from	to
graphic design / product design	interaction design / service design
expert / decider	facilitator / convener
decision trees	webs of conversations
one-offs	reusable modules, systems, models

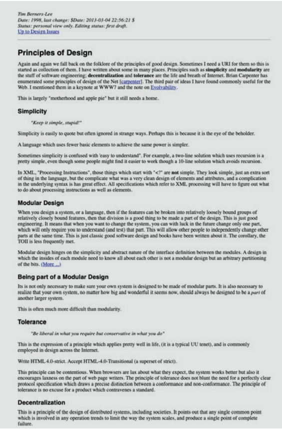
Reusable modular systems have a long history in design; while peripheral to the mainstream, they flourished mid-century.

Penguin Books typographic system, Jan Tschichold, 1950
Univers font family, Adrian Frutiger, 1957
Chase Manhattan Bank identity, Tom Geismar, 1960
Designing Programmes, Karl Gersterner, 1964

Milan Metro signage system, Franco Albini & Bob Noorda, 1964
Tokyo Olympics signage system, Yoshiro Yamashita & Masura Katzumie, 1964
New York subway map, Massimo Vignelli, 1972
Grid Systems, Josef Müller-Brockmann, 1981

With the rise of software, designers again focused on modular systems.

"Principles such as simplicity and modularity are the stuff of software engineering; ... It means that when you want to change the system, you can with luck in the future change only one part, which will only require you to understand (and test) that part. This will allow other people to independently change other parts at the same time."



— **Tim Berners-Lee**, "Principles of Design," 1993

https://www.w3.org/DesignIssues/Principles.html

Reusable modular systems (and models that describe them) have become the new basic “unit of work” in design practice.

Apple Human Interface Guidelines, Bruce Tognazzini et al. 1978.
Making It Macintosh, Lauralee Alben, Jim Faris, & Harry Saddler, 1993.

Yahoo! User Interface Library (YUI), Thomas Sha, 2006.
JQuery UI, John Resig, 2007.

Bootstrap, CSS framework, Mark Otto & Jacob Thorton, 2011.
Atomic Design, Brad Frost, 2013.
React, JS library, Jordan Walke, 2013.
Google Material Design System, Matias Duarte et al., 2014.

These design systems have become an integral part of software development.

Cloud hosting, e.g., Amazon Web Services (AWS), 2006 (NB Bezos 2002 memo)
Libraries, e.g., Ruby on Rails, 2004; Node.js, 2009
Version Control, e.g., GitHub, 2008 (NB Torvalds, 2005)

Package Managers, e.g., NPM, 2010
Containerization, e.g., Docker, 2013
AI platforms, e.g., Google, Microsoft, 2019

With reusable modular systems, designing becomes “meta” — our frame of designing shifts to stewardship and scaffolding.

First-order design

=

Correcting an error

=

Solving your problem

- prescriptive (here’s what to do)
- presumptive (I / we know what you need)

Second-order design

=

Learning what matters

=

Creating conditions for systems to emerge, in which others can design [for] themselves

- generative (allowing the “seeing” [defining] of what we will do)
- generous (let us see what we decide we need)

"[Winograd and Flores] go to the heart of the matter concerning design: 'We encounter the deep questions of design when we recognize that in designing tools we are designing ways of being'.... 'We create and give meaning to the world we live in and share with others.... we design ourselves (and the social and technological networks in which our lives have meaning) in language.'"

— **Gui Bonsiepe**, *Interface an Approach to Design,* 1994 [115]
(quoting from *Understanding Computers and Cognition,* 1986)

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