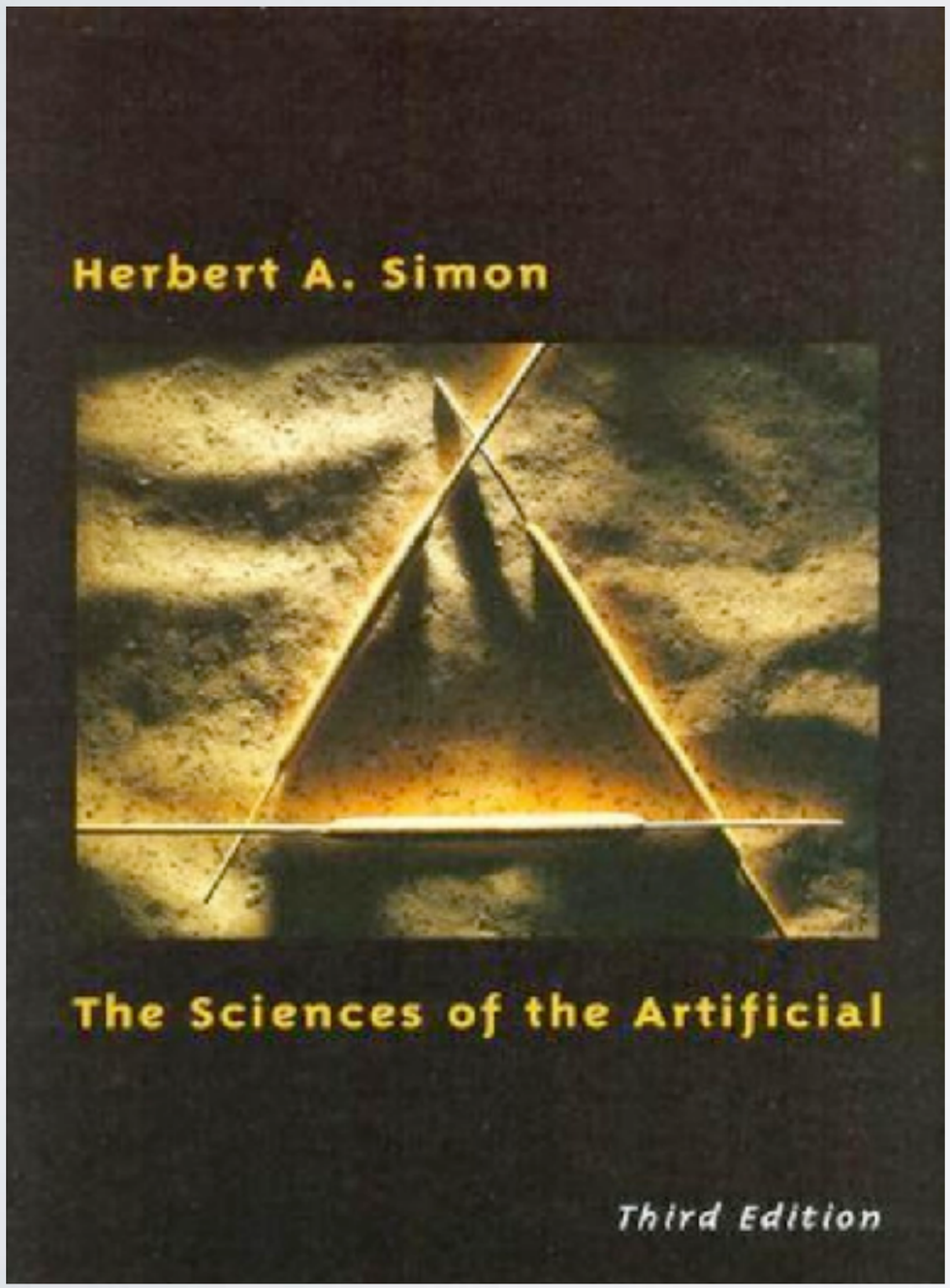
SOME FRAMINGS OF DESIGN

- **Problem-solving**
- Art & creativity
- Collaboration
- Business
- Software development
- Politics

THE SCIENCES OF THE ARTIFICIAL



→ Design Methodology

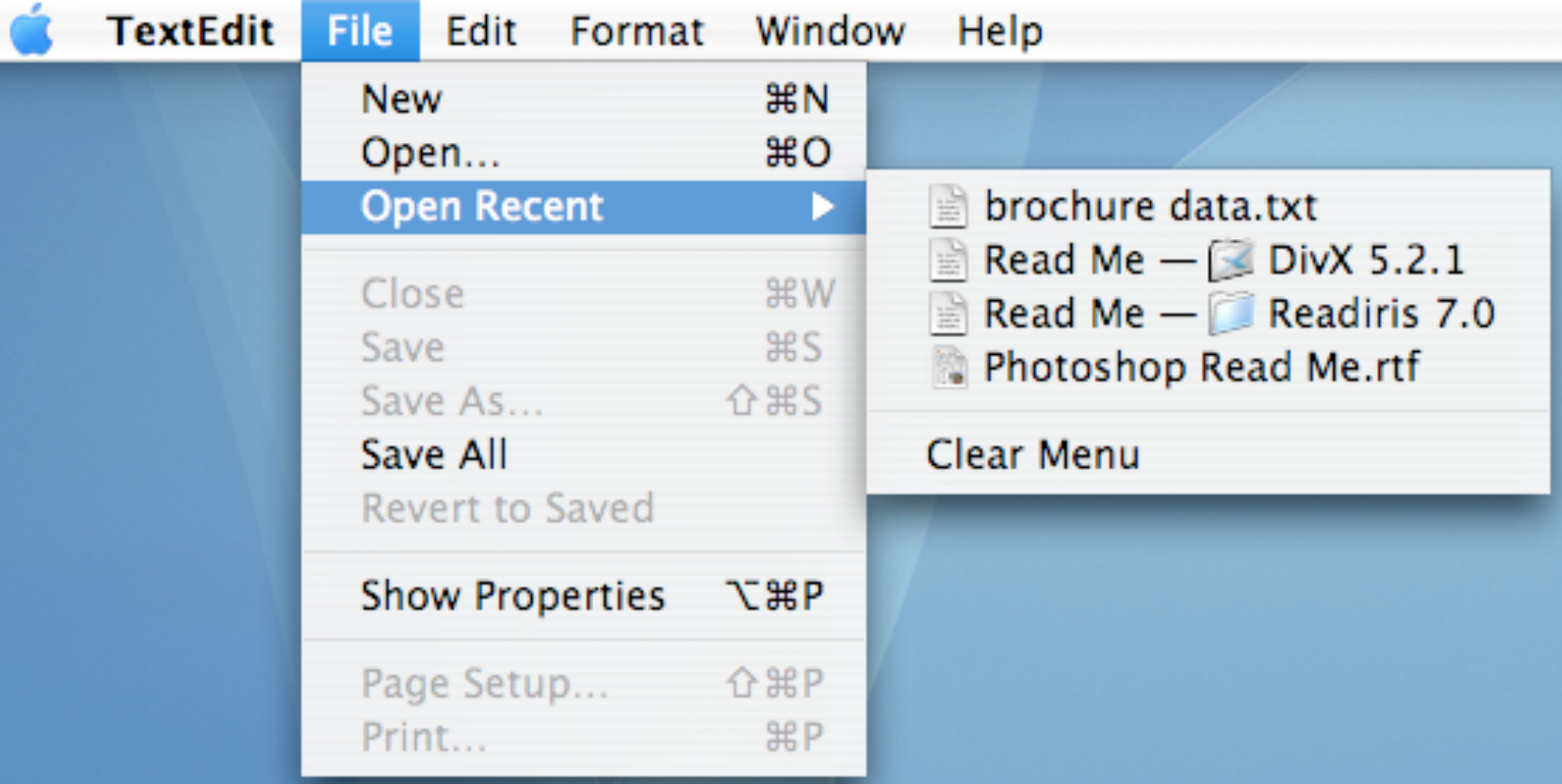
→ Cognitive Science

→ Computer Science

DEFINITION

DESIGN AS PROBLEM-SOLVING

Design = Search in a design space for candidate designs with desired qualities



Heads up: A task will follow

DESIGN AS PROBLEM-SOLVING

=

DESIGN SPACE

+

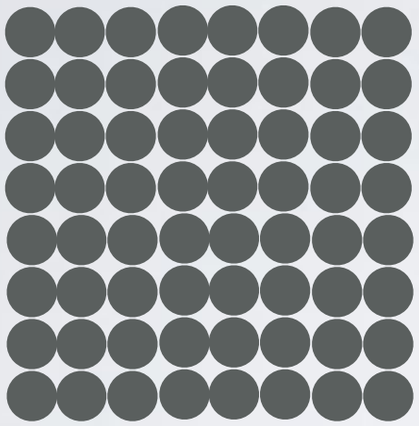
OBJECTIVES

+

SEARCH METHOD

1. DESIGN SPACE

Design space = The set of candidate designs



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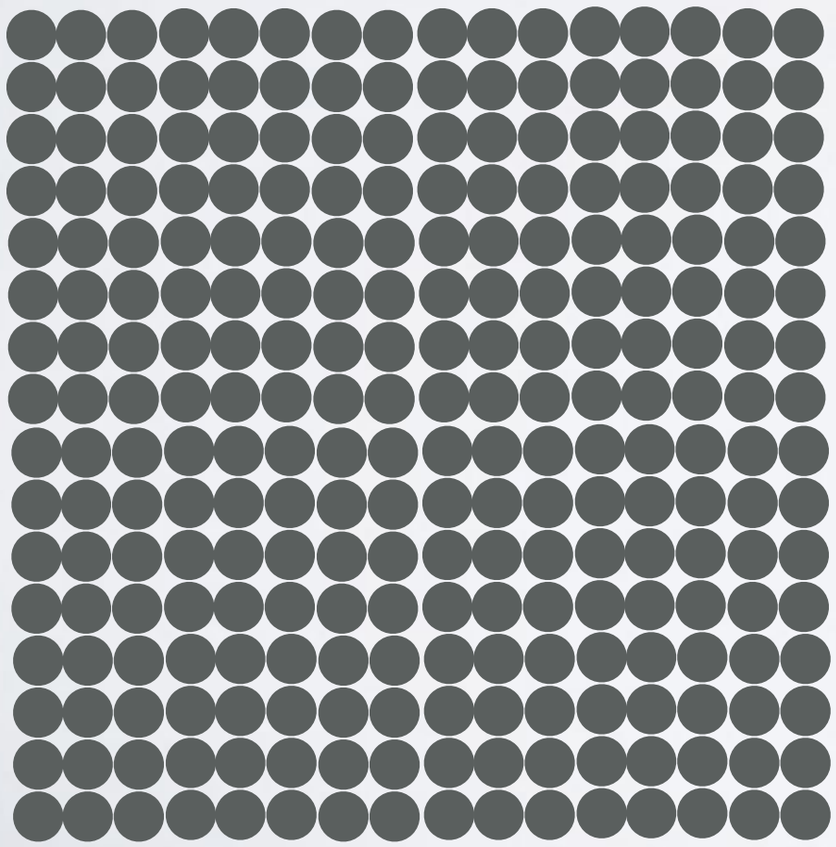

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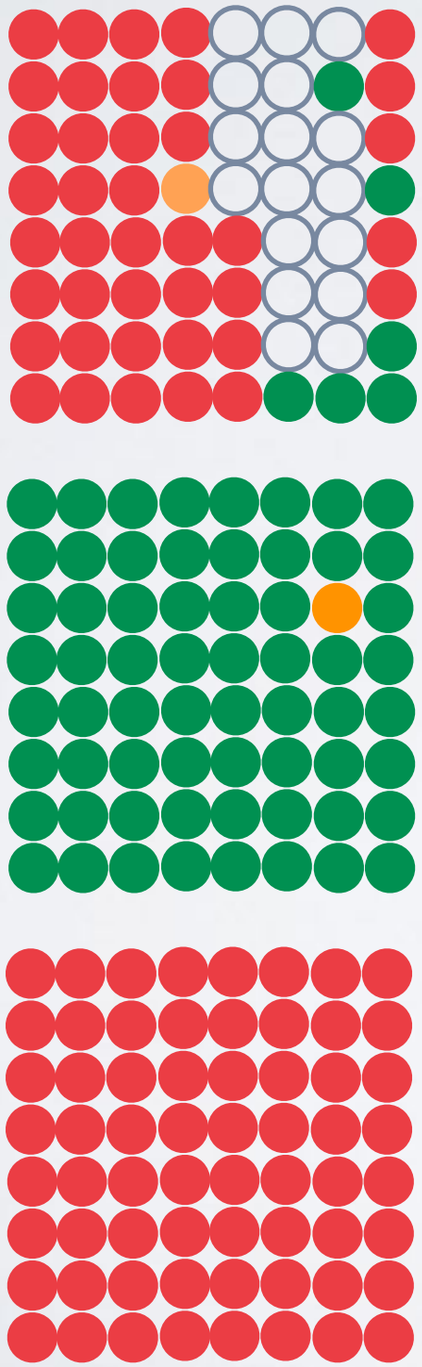
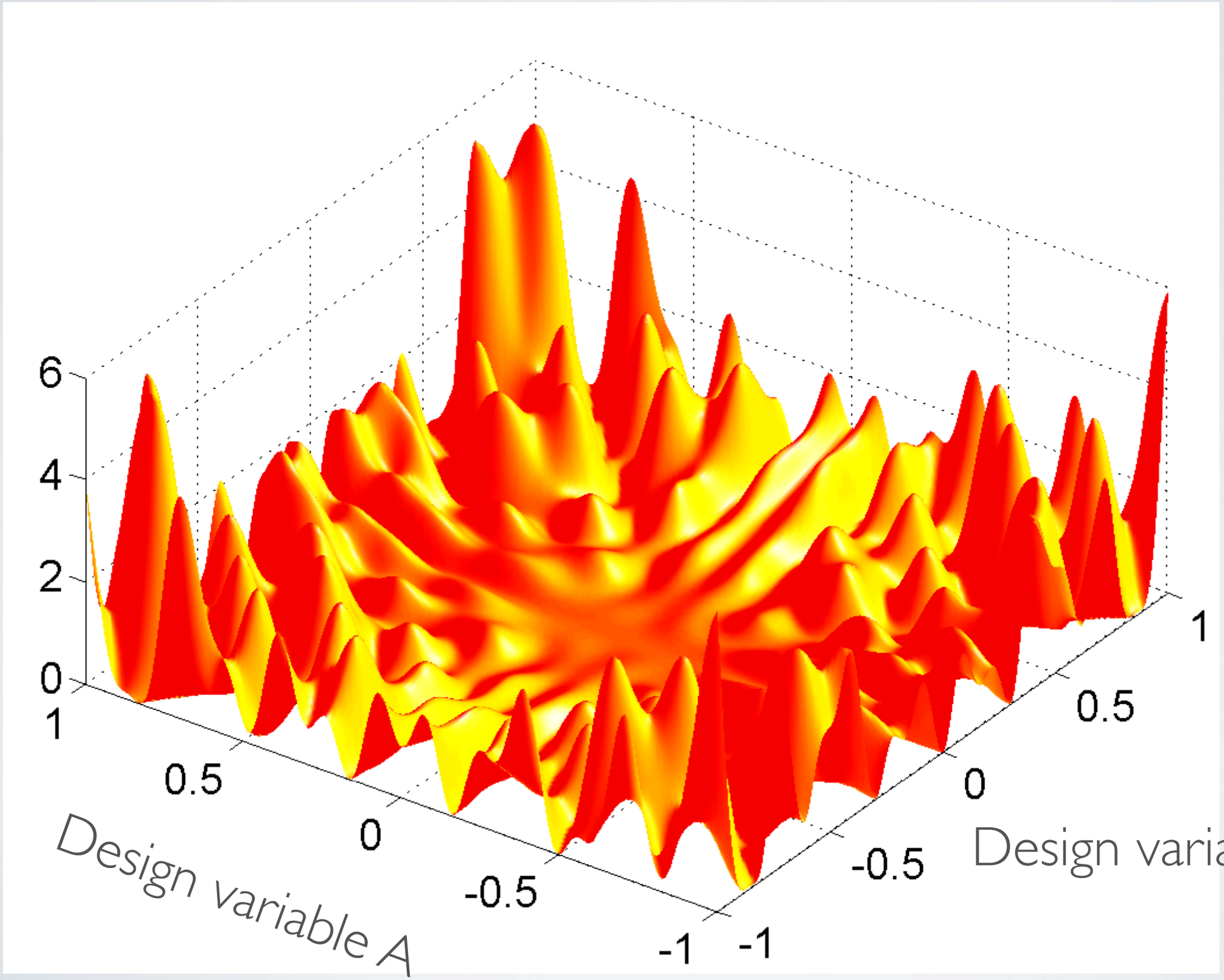
2. OBJECTIVES

Objective = Criteria for an acceptable design



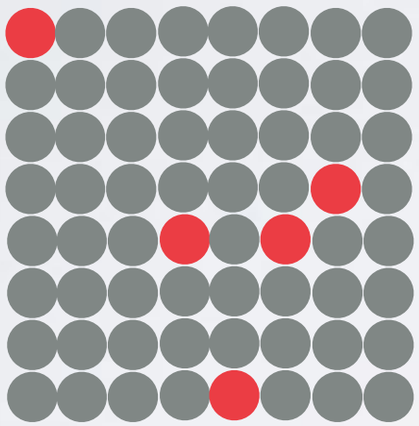
Infeasible designs
Poor designs
Acceptable designs
Optimum design

SEARCH LANDSCAPE



3. SEARCH METHOD

Search method = The principle of searching the space



Random search

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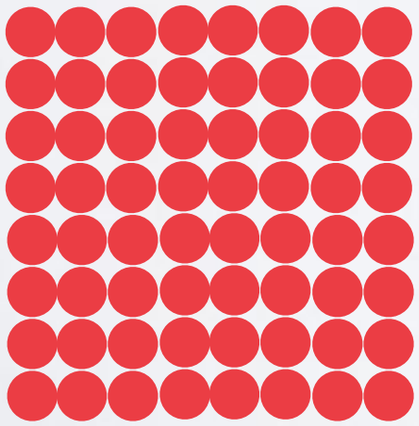
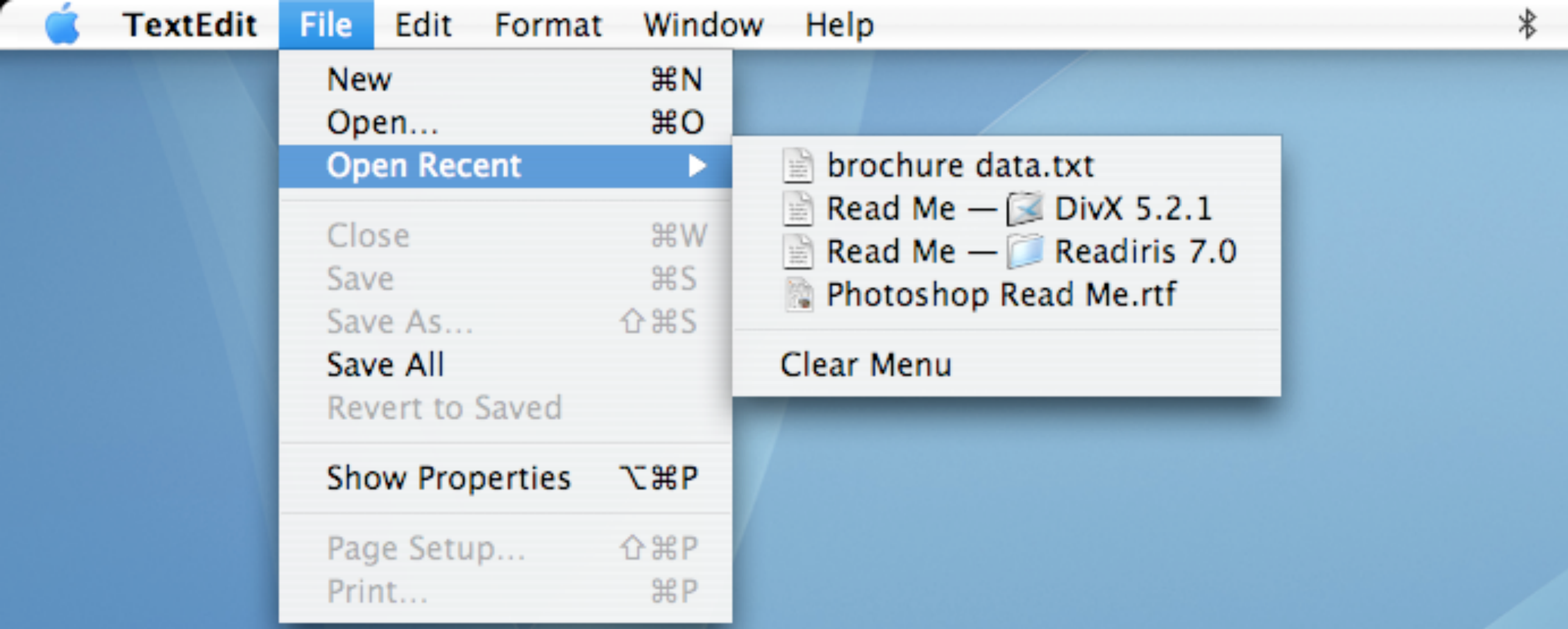


Exhaustive search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Save All
Revert to Saved
Show Properties ⌥⌘P
Page Setup... ⇧⌘P
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brochure data.txt
Read Me — DivX 5.2.1
Read Me — Readiris 7.0
Photoshop Read Me.rtf
Clear Menu

1 2 3

DIMENSIONS OF DESIGN PROBLEMS

- Ill-defined problems vs. well-defined
- Single- vs. multi-objective problems
- Small vs. large problems
- Wicked problems

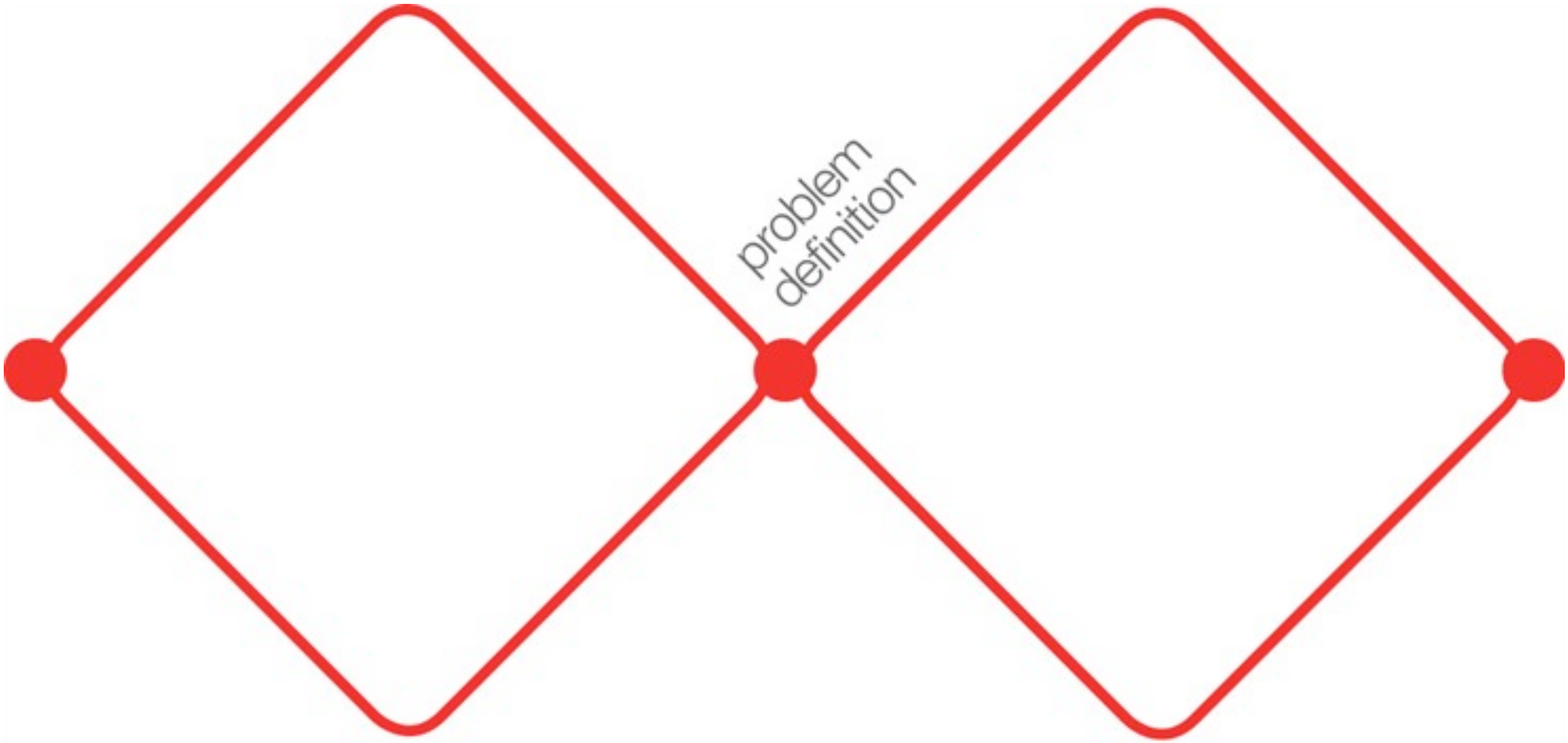
PROBLEM TYPES

Ill-structured **Well-structured**

Unknown	**Number of candidates**	Limited
Undefined	**Objectives**	Defined
Not known	**Good designs**	At least one
Undefined	**Search method**	Systematic

Real design problems are a mixture of the two

“Double Diamond”



Discover
Behaviour-led design research

Define
Creative work shops and idea generation

Develop
Review ideas through culture thinking and design

Deliver
Prototyping, selection and mentoring

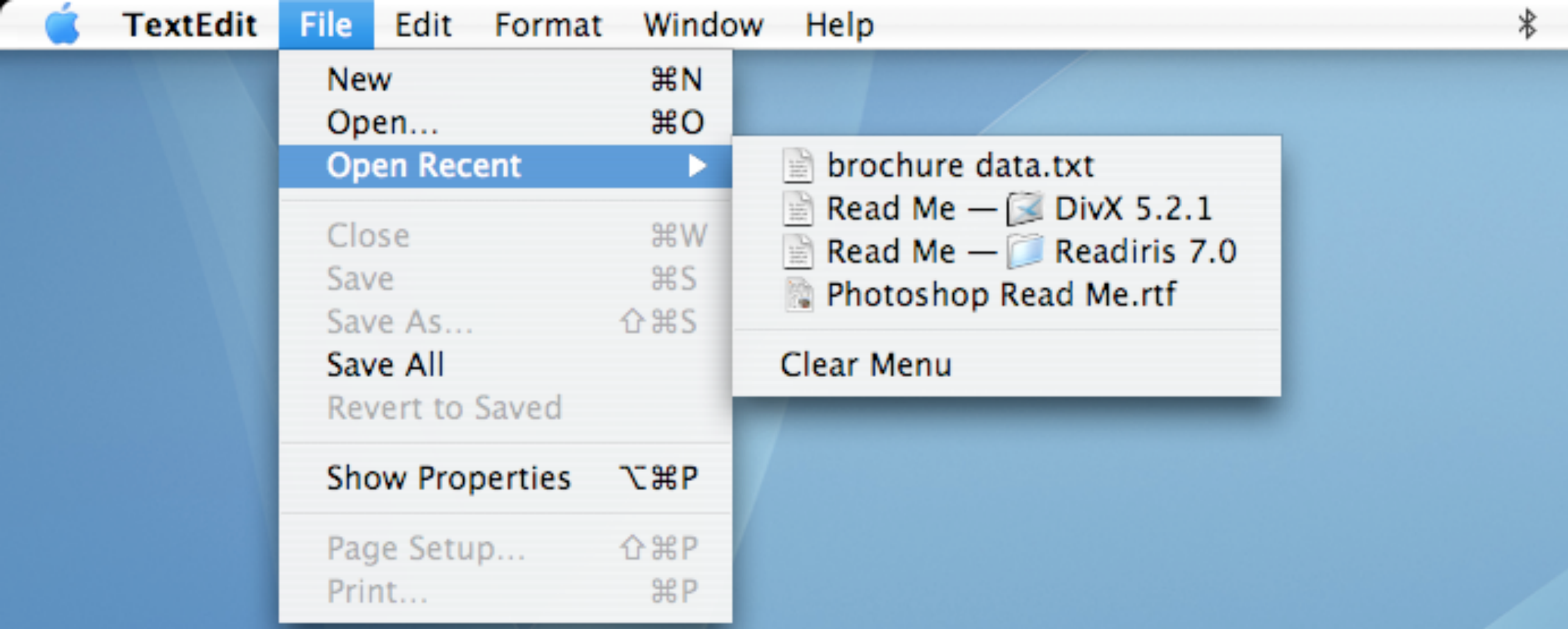
ESSENTIAL IN DESIGN

- Realizing which aspects are ill-defined and which are well-defined
- Restructuring and refining problems
- Approaching each aspect with the appropriate method

WHY DESIGN IS SO HARD

…THIS IS WHY

- Design spaces are immense
- Conflicting, ill-defined objectives
- Interlocking constraints
- Designers' search methods are often not much better than trial and error



A hierarchical menu with 50 items can be ordered in 10^{158} ways

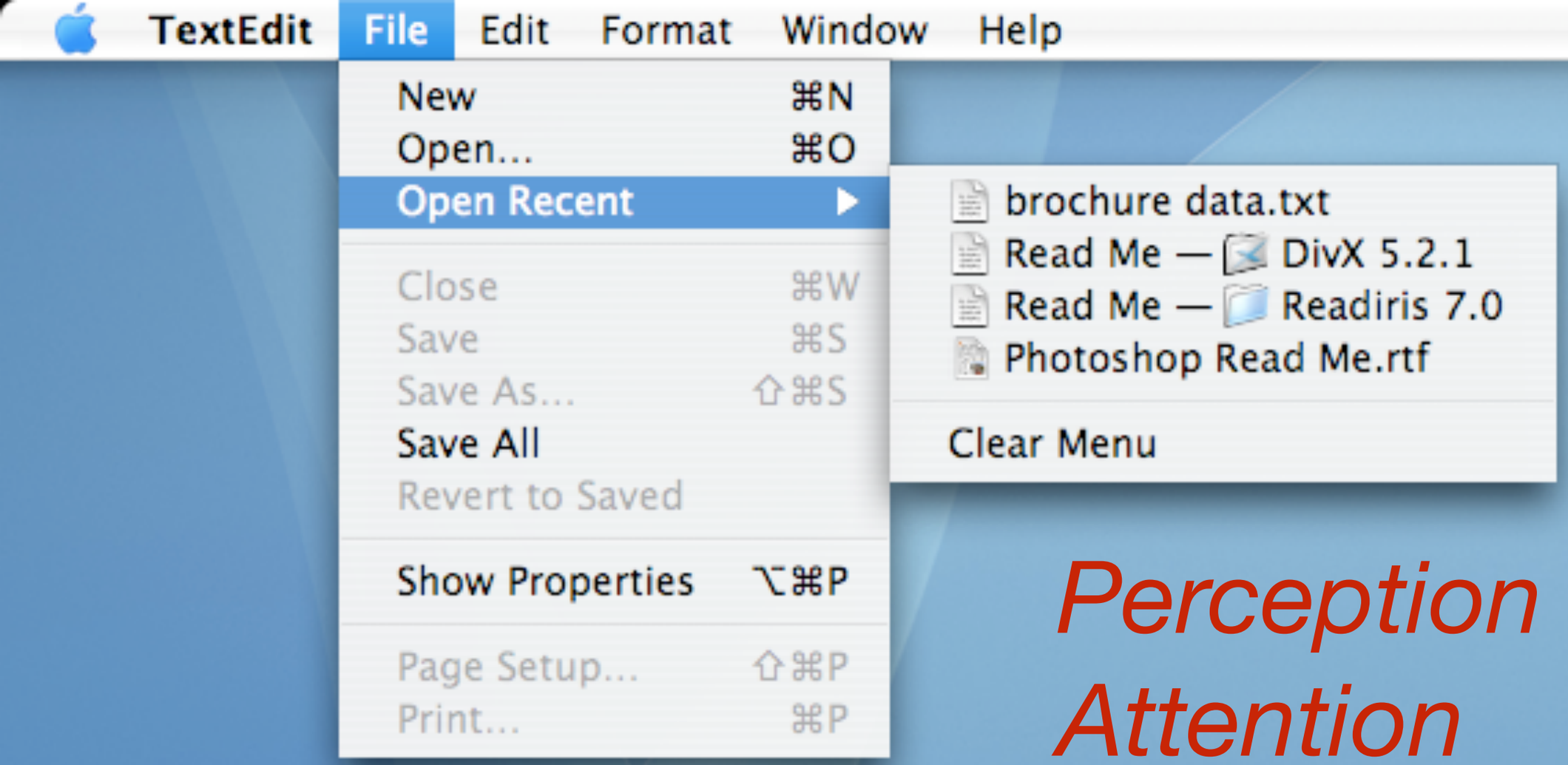
LAYOUT DESIGN

UI element →

For 1 element, 10^{11} possible designs

For 8 elements, 10^{80} possible designs

10^{82} atoms exist



Perception
Attention
Memory, learning
Motor control

Mathematical model of gaze and selection time in linear menus

$$T(\theta) = \frac{1}{R} \sum_{i=0}^{i=l} G_s(i,\theta) + G_d(i,\theta) + G_p(i,\theta)$$

$$G_s(i,\theta) = \begin{cases} a_s \times \exp(-b_s \times p_i) + c_s & \text{if } i \leq t \\ 0 & \text{otherwise} \end{cases}$$

$$G_d(i,\theta) = \psi_{t,\sigma_d^2}(i) \times (a_d \times \exp(-b_d \times p_i) + c_d)$$

$$G_p(i,\theta) = a_p + b_p \times \log(1 + \alpha \times t) \times \psi_{t,1.1}(i)$$

[Bailly et al. CHI'14]

Multiple user groups and tasks

*** Hard to determine the “least worst” compromise**