Wisdom is not the product of schooling but the lifelong attempt to acquire it.
- Albert Einstein

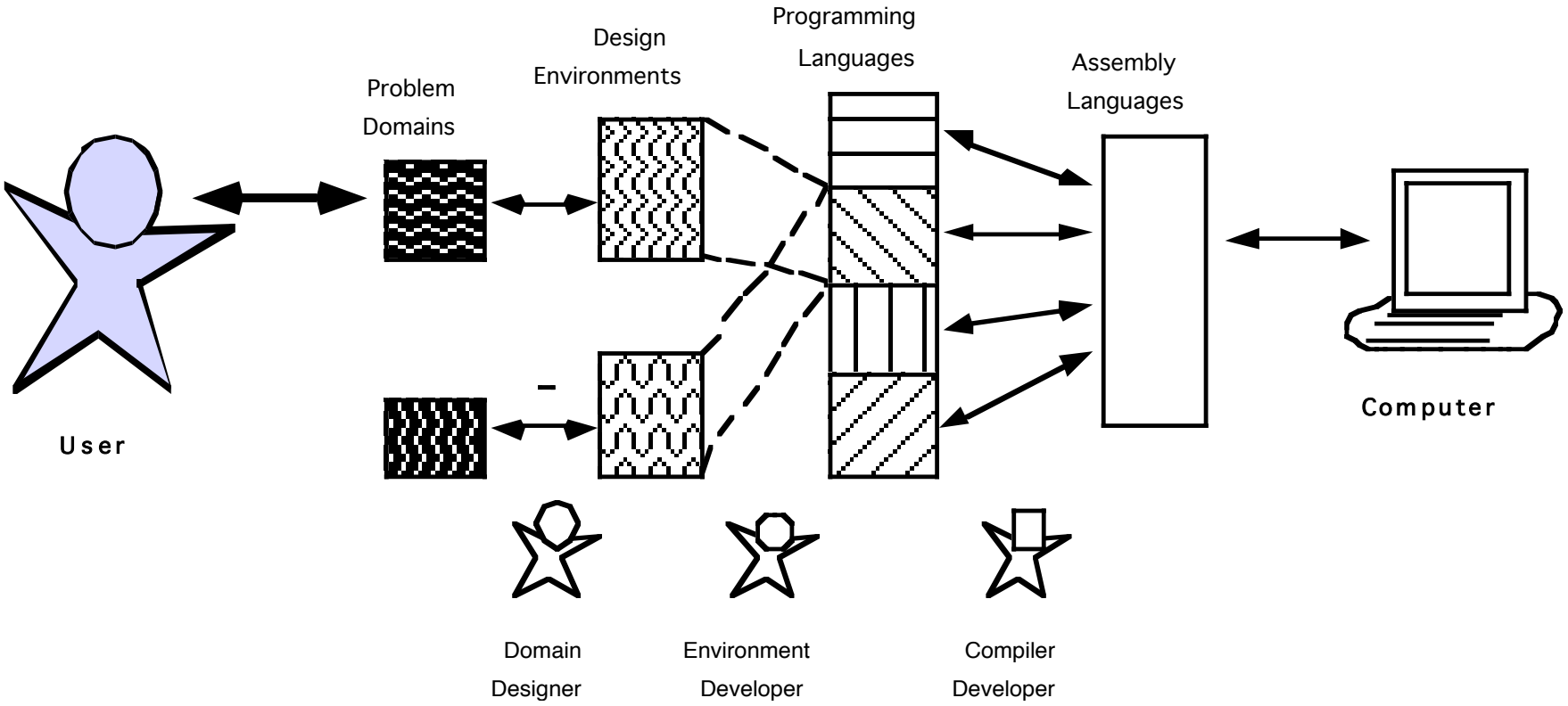
Embedding Critics into Domain-Oriented Design Environments

Gerhard Fischer and Hal Eden
Spring Semester 2004

March 4, 2004

paper: Fischer, G., Nakakoji, K., Ostwald, J., Stahl, G., & Sumner, T. (1998) "Embedding Critics in Design Environments." In M. T. Maybury & W. Wahlster (Eds.), Readings in Intelligent User Interfaces, Morgan Kaufmann, San Francisco, pp. 537-561.

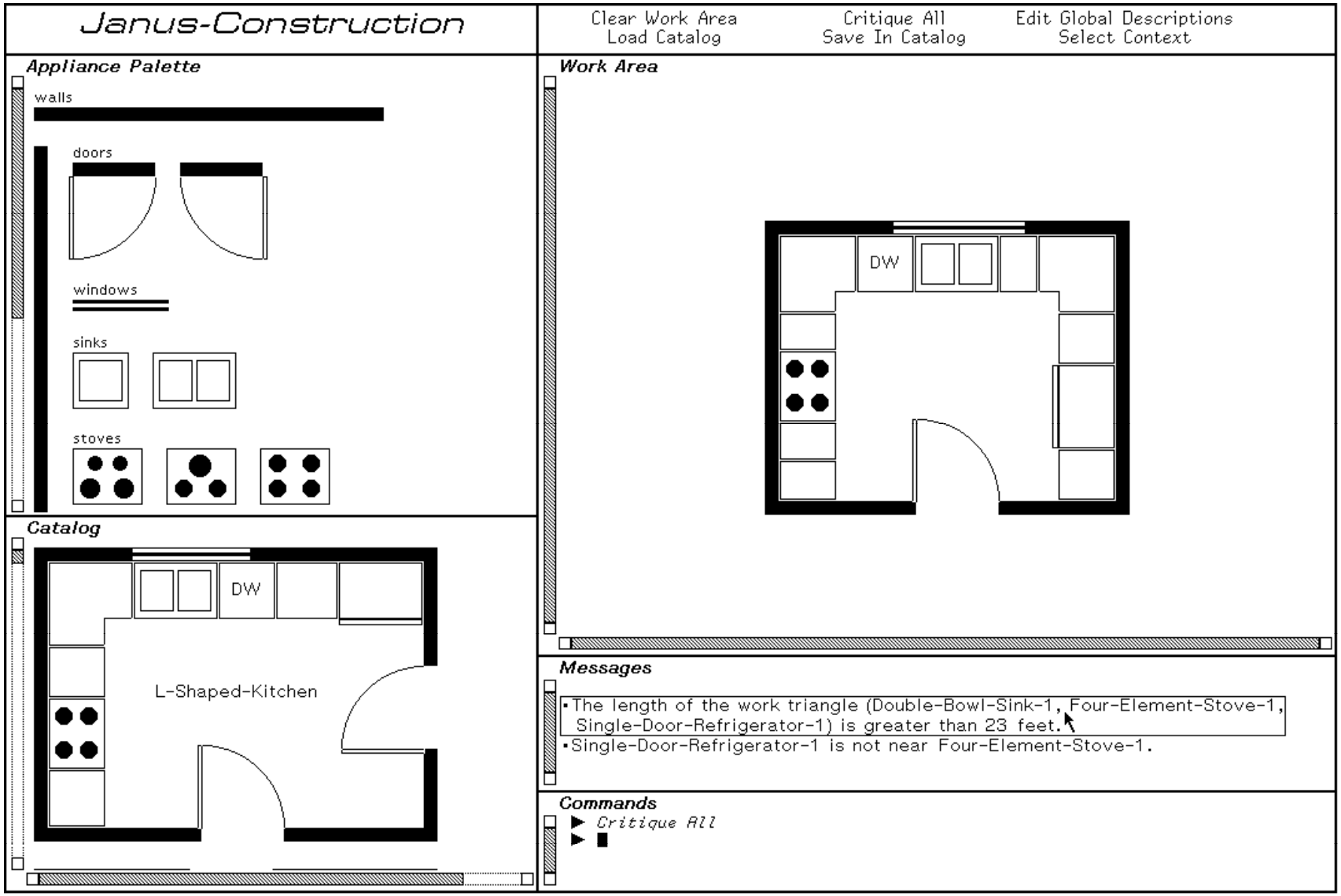
The Objectives of Domain-Oriented Design Environments
—
Supporting Human Problem-Domain Interaction



Examples of Domain-Oriented Design Environments

- kitchen design
- voice dialog design
- computer network design
- urban design and transportation planning — Envision and Discovery Collaboratory (EDC)
- multi-media design (color)
- website design

Domain-Oriented Design Environments (Janus-Construction)



Janus-Argumentation

Janus-Argumentation

Answer (Refrigerator, Sink, Stove)

The distance between sink, stove and refrigerator, the *work triangle*, should be less than 23 feet.

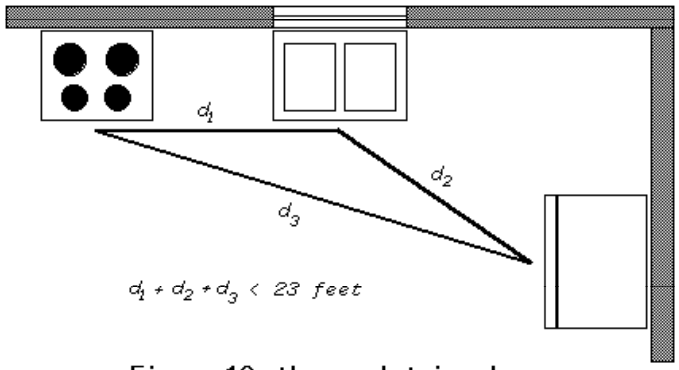


Figure 10: the work triangle

Argument (Walking Distance)

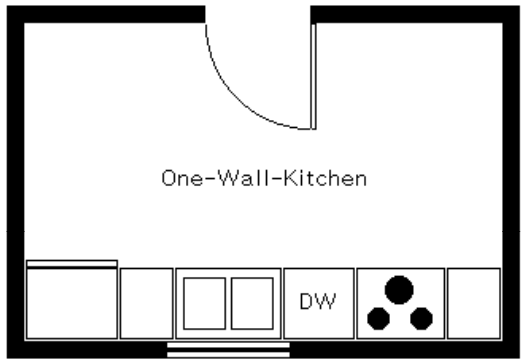
The work triangle is an important concept in kitchen design. The work triangle denotes the center front distance between the three main appliances: *sink*, *stove* and *refrigerator*. This length should be less than 23 feet to avoid unnecessary walking and to ensure an efficient work flow in the kitchen!

Argument (Small Room)

In small kitchens where the work triangle is less than 16 feet,

Viewer: Default Viewer

Catalog Example



The length of the work triangle (Stove, Refrigerator, Sink) is less than 23 feet.

Visited Nodes

⇒ Answer (Refrigerator, Sink, Stove) Section

Commands

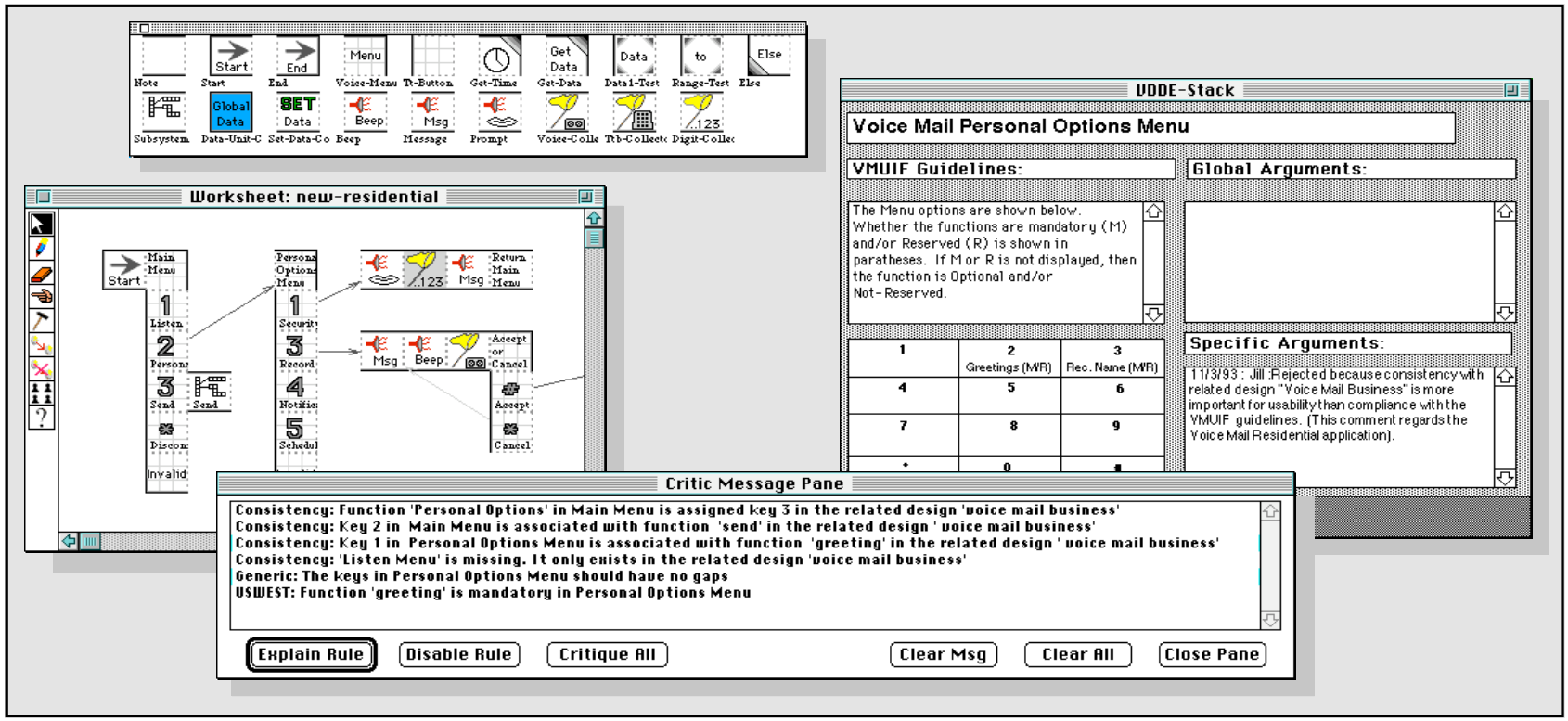
Show Example: "Answer (Refrigerator, Sink, Stove)"

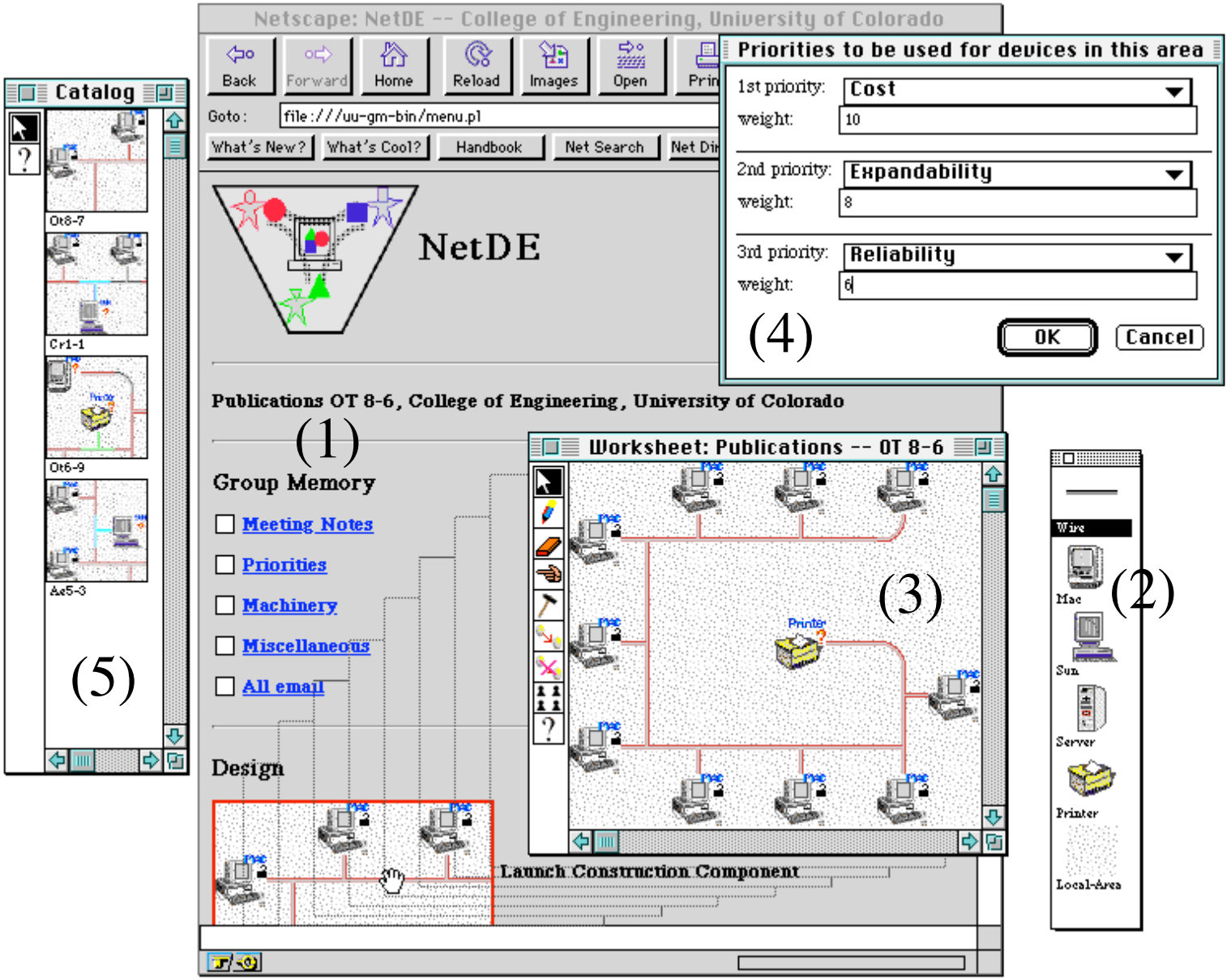
Show Example Answer (Refrigerator, Sink, Stove)

Show Outline
Search For Topics
Show Argumentation
Show Context

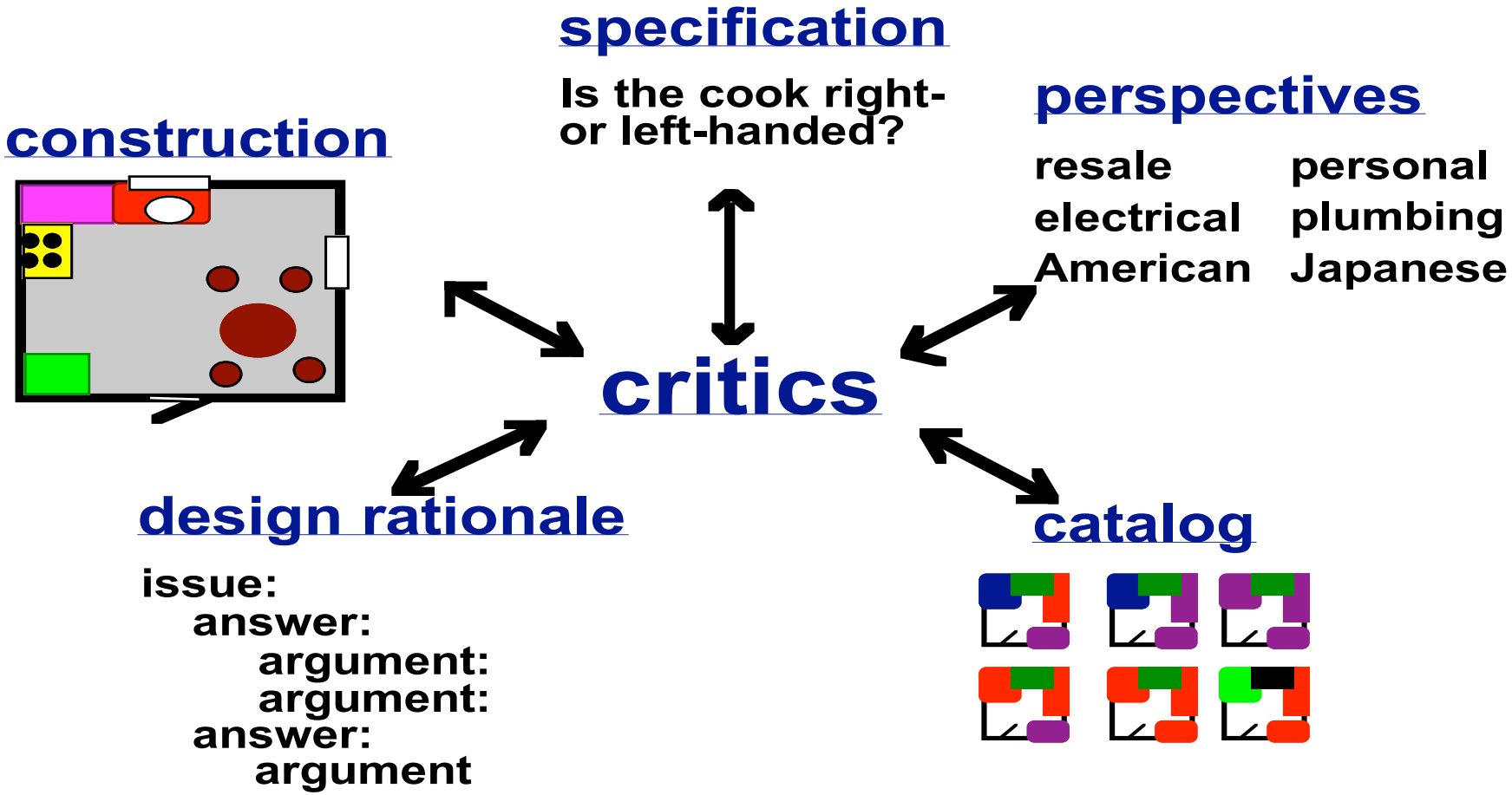
Resume Construction
Show Construction
Show Example
Show Counter Example

VDDE: Voice Dialog Design Environment

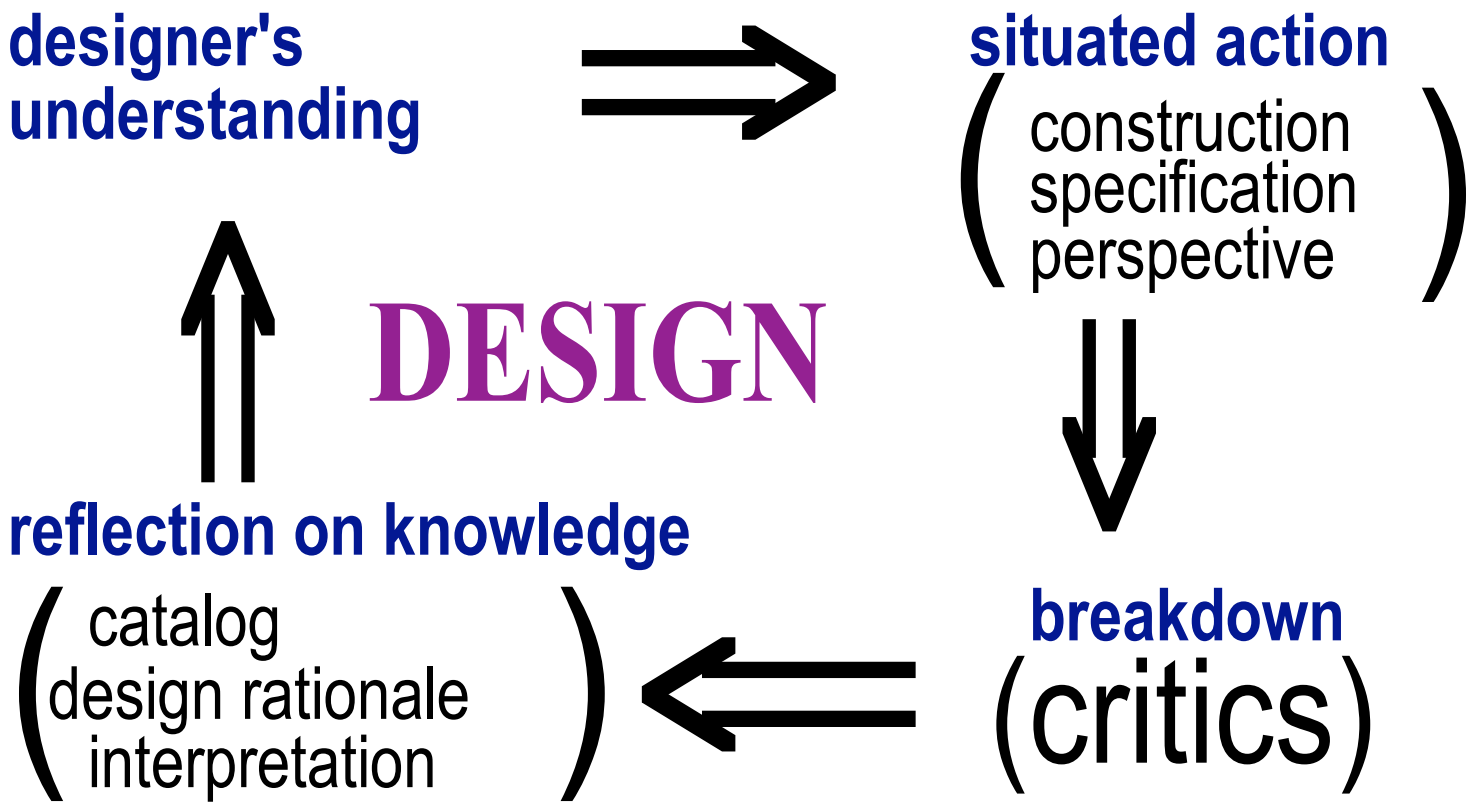



Netscape: NetDE -- College of Engineering, University of Colorado
Back
Forward
Home
Reload
Images
Open
Goto:
file:///uu-gm-bin/menu.pl
What's New?
What's Cool?
Handbook
Net Search
NetDE
Publications OT 8-6, College of Engineering, University of Colorado
(1)
Group Memory
Meeting Notes
Priorities
Machinery
Miscellaneous
All email
Design
Launch Construction Component
Catalog
Ot8-7
Cr1-1
Ot6-9
Ae5-3
(5)
Worksheet: Publications -- OT 8-6
Printer
(3)
Priorities to be used for devices in this area
1st priority:
Cost
weight:
10
2nd priority:
Expandability
weight:
8
3rd priority:
Reliability
weight:
6
(4)
OK
Cancel
Wire
Mac
Sun
Server
Printer
Local-Area
(2)

Domain-Oriented Design Environments (DODEs)



Reflection-in-Action as a Problem Solving Theory



Computational Critics (= “Virtual Human Critics”)

- **spelling correctors** — example of a “simple” critiquing system
  - simple: a “correct” answer exists
  - passive ←→ active
  - suggestions for corrections ←→ “auto-correct” in MS-Word

- **unlimited opportunities for application**: grammar checkers, color critics, graphs critics, webpage critics

- **webpage critics and universal access**
  http://bobby.watchfire.com/bobby/html/en/index.jsp
  This free service will allow you to test web pages and help expose and repair barriers to accessibility and encourage compliance with existing accessibility guidelines, such as Section 508 and the W3C's WCAG. To learn about products to test websites of all sizes for accessibility issues, please visit the accessibility section on www.watchfire.com.

The Rationale / Need for Critiquing

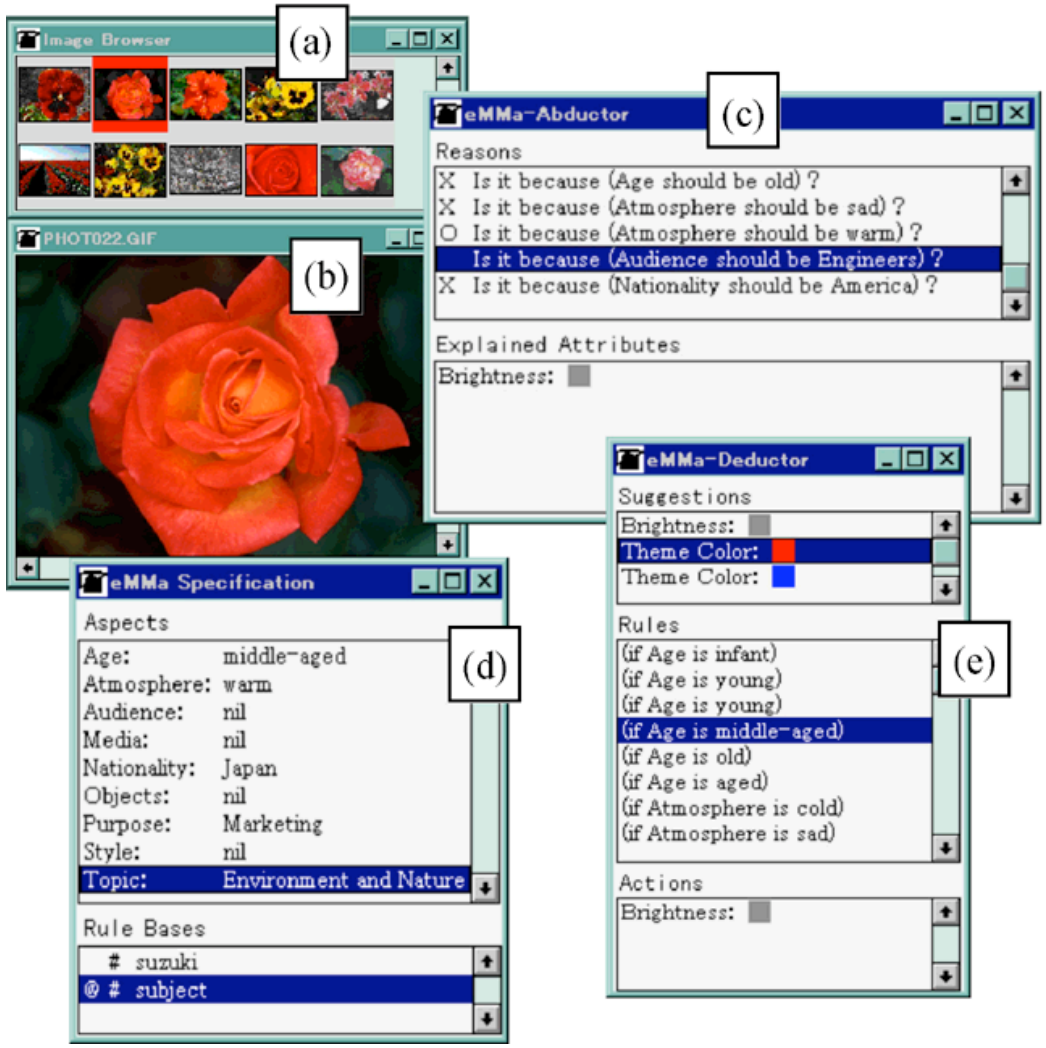
- **color** →Travis, D. (1991) *Effective Color Displays—Theory and Practice,* Academic Press, London:

  "but when color is used inappropriately it can be very counter productive and few software designers have much experience with the use of color; the aim of this book is to synthesize our current knowledge in the area and specify guidelines so that programmers, engineers, and psychologist can use color."

- **graphs** → Kosslyn, S. M. (1994) Elements of Graph Design, W.H. Freeman and Company, New York

  "one reason for the abundance of bad graphs is the proliferation of low-cost microcomputers and 'business graphics' packages which often seduce the user into producing flashy but muddled displays; many graphs are designed without consideration of principles of human perception and cognition"

EMMA (Environment for MultiMedia Authoring) and Color Critiquing

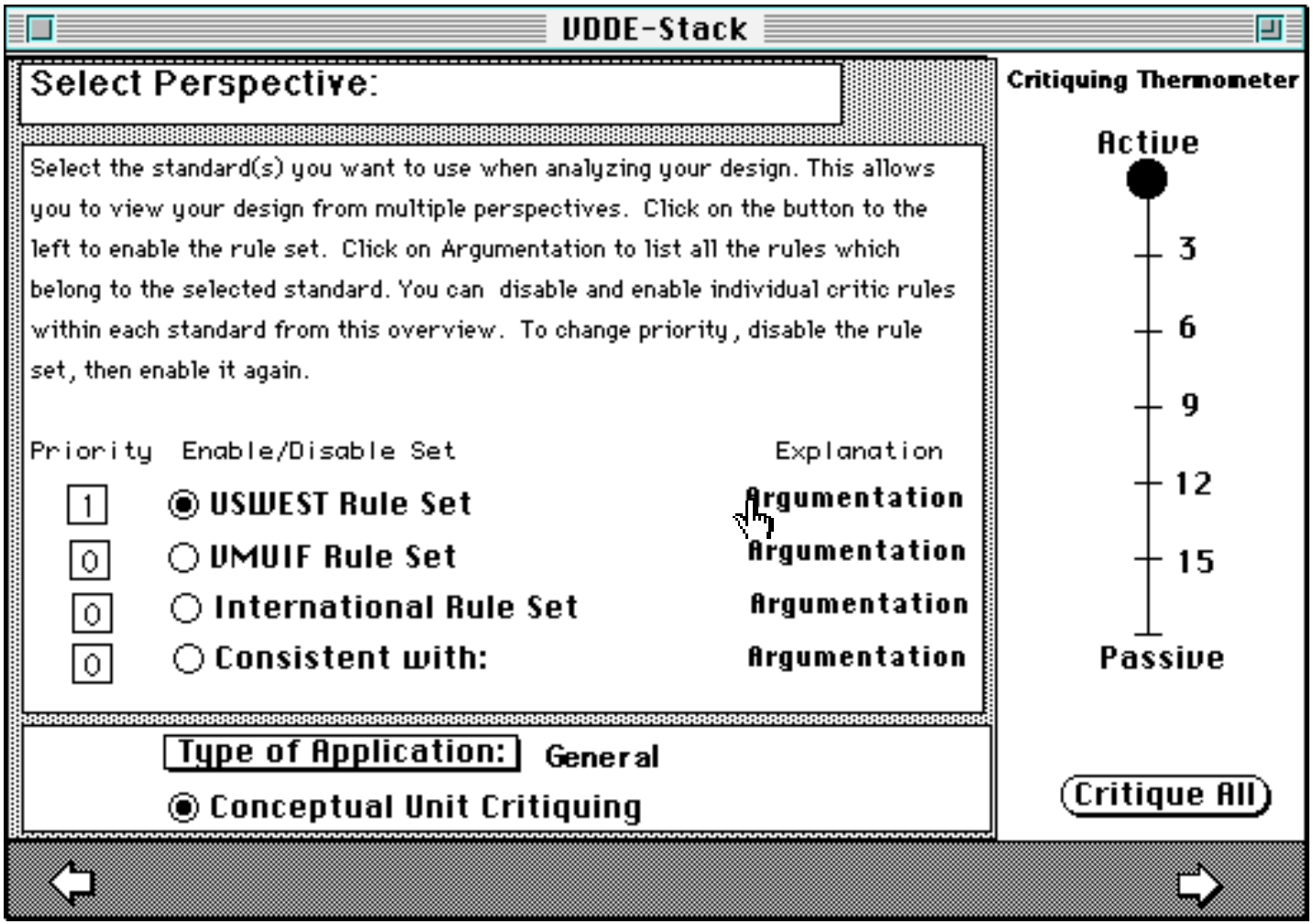


Computer-Based Critiquing: Examples and Mechanisms

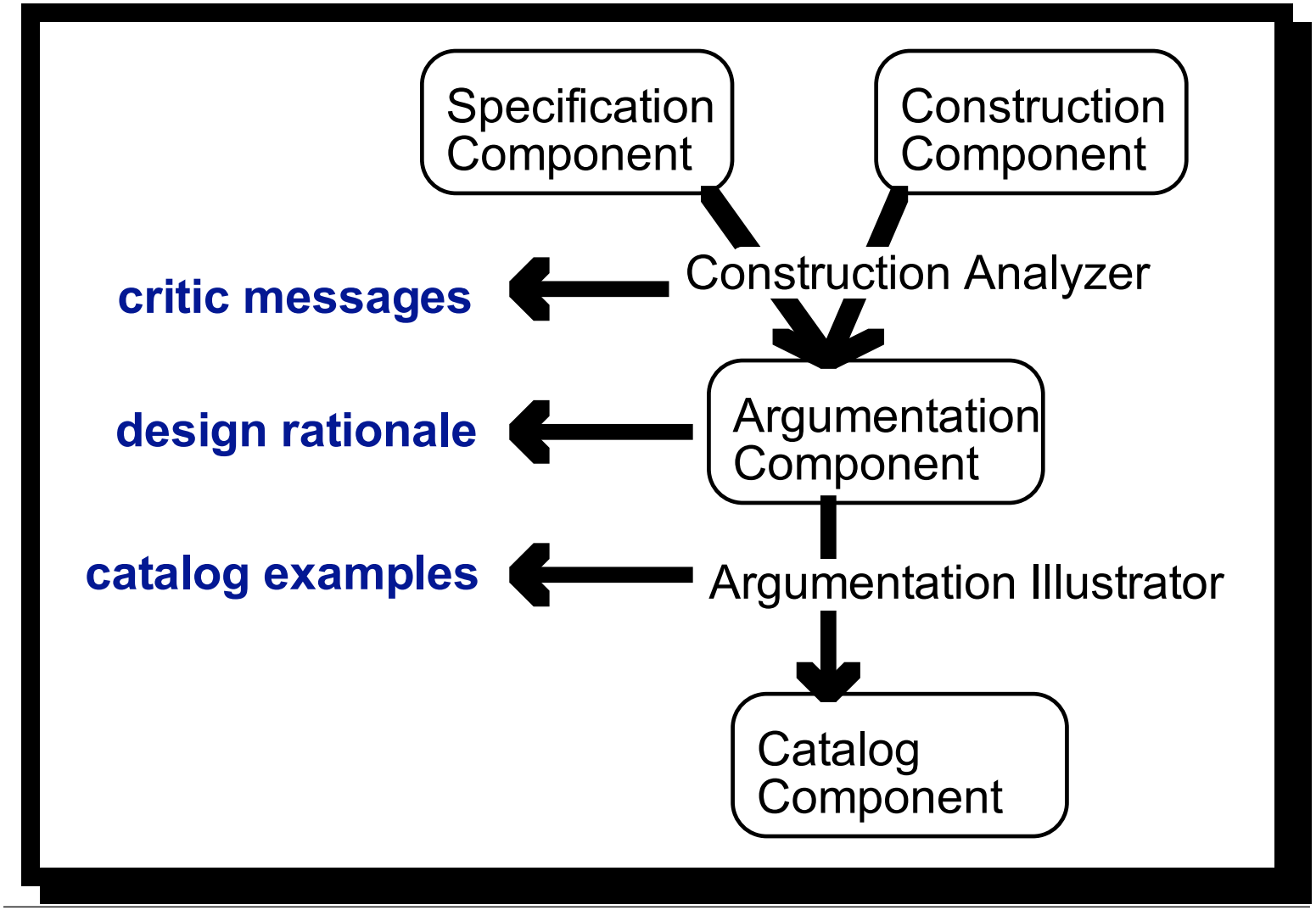
- **examples:**
  - the length of the work triangle is more than 23 feet
  - a critiquing rule in the EDC: “the maximum distance between two bus stops is 1mile”

- **mechanism:**
  - enable relevant critics
  - analyze construction and specification (e.g., the specification states that this is a part of town where many old people live)
  - signal breakdowns
  - deliver relevant knowledge

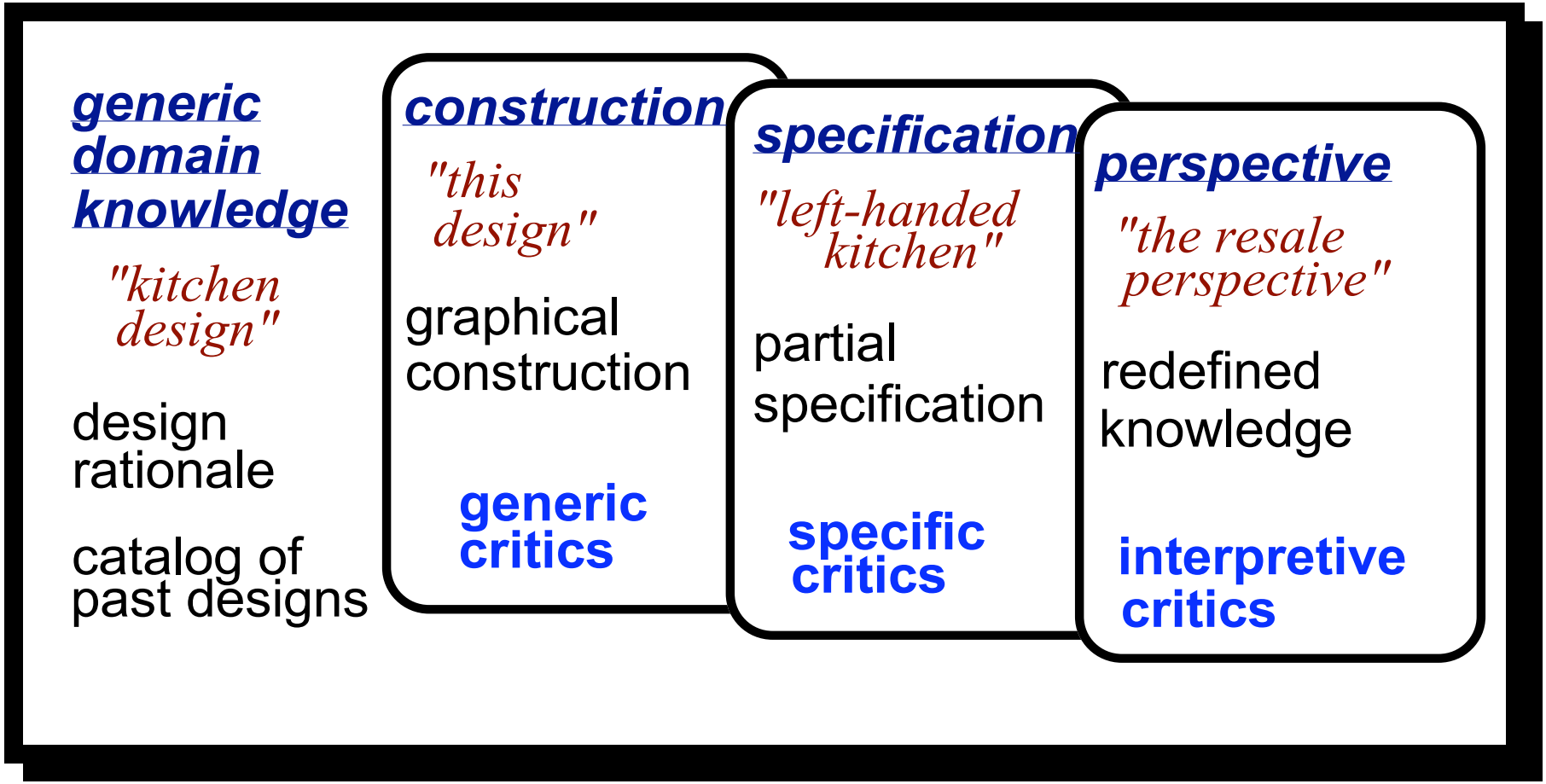
Giving Domain Designers Control about the Intrusiveness of Critics



An Implementation of Critics

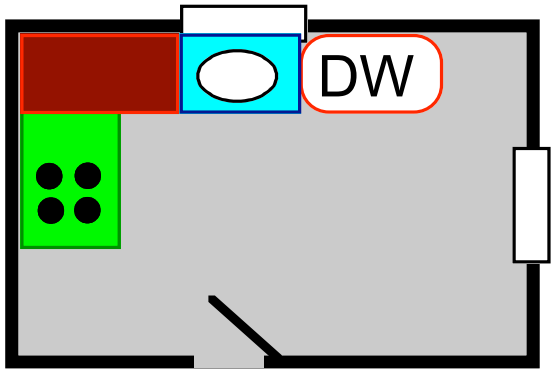


Embedding Critics in the Contexts of Design



Generic Critics in Construction

Construction



Generic Critic

IF the dishwasher is right of sink, THEN "move dishwasher left of sink"

Design Rationale

issue:

Where should the dishwasher be placed?

answer:

Left side of sink.

argument:

Dishwasher on left provides efficient work flow for right-handed people.

A Partial Specification of a Specific Client

questions in specification component	**answers by client:**
- name:	Smith's kitchen
- size of family:	four to six
- primary cook:	left-handed
- size of meals:	huge (big eaters)
- entertainment:	often
- cooking frequency:	often
- type of sink:	double bowl sink

specification component in EDC: questionnaire for citizens how long they would wait for the bus

Specific critics in specification

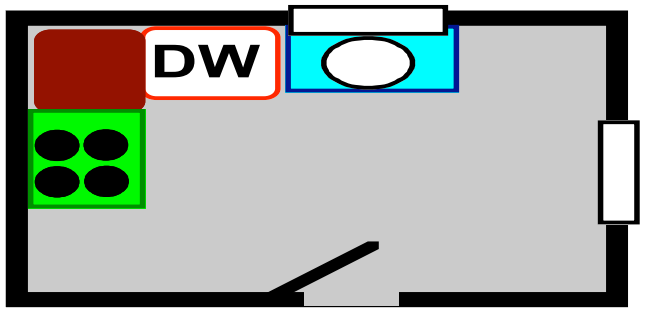
Specification

Is the primary cook right or left-handed?

left-handed

(left-handedness)

Construction



Design Rationale

issue:

Where should the dishwasher be placed?

answer:

Right side of sink.

(right-of dishwasher sink)

argument (pro):

If the cook is left-handed then the dishwasher should be right of the sink.

Specific Critic

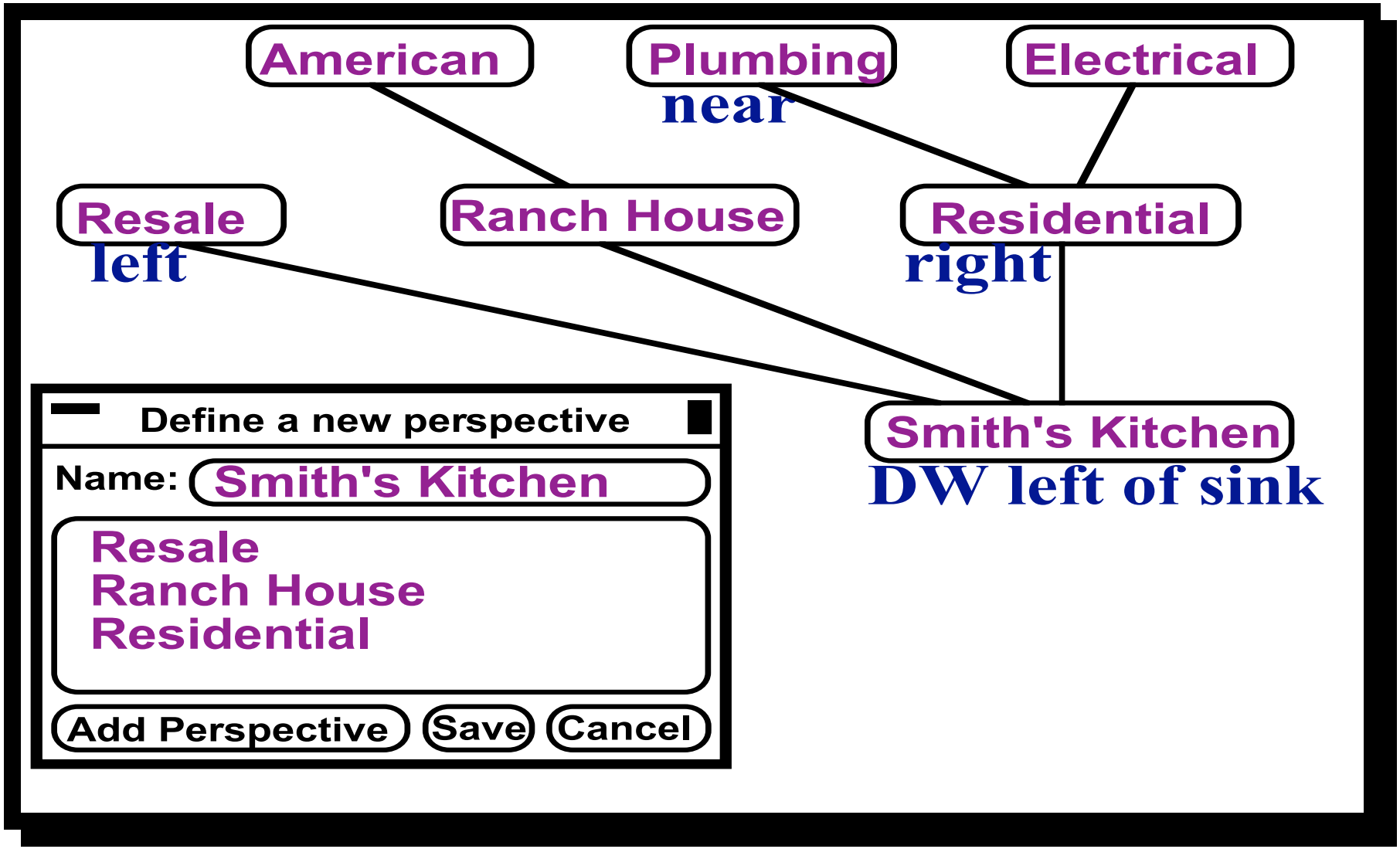
(left-handedness)

(right-of dishwasher sir

Critic Message

"Move the dishwasher to the right of the sink."

Interpretive critics in perspective



Benefits of Embedding Critics

- increase integration of design environment components
- allow system to infer “task at hand”
- enabling only relevant critic rules
- deliver richer, more relevant information

Global Objective of Embedding Critics

- increasing the **"back-talk" of the situation**
- supporting **reflection-in-action**
- supporting **learning on demand**
- reducing information overload: saying the 'right' thing **at the 'right' time in the 'right' way to the 'right' person**
- making information relevant to the **task at hand**