



Center for
**LifeLong
Learning
& Design**

University of Colorado at Boulder

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

Embedding Critics into Design Environments



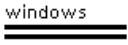

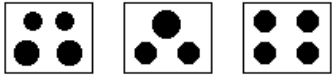
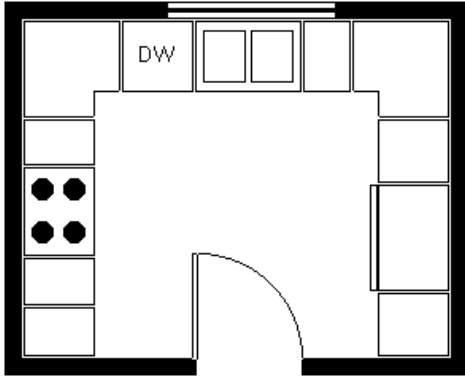
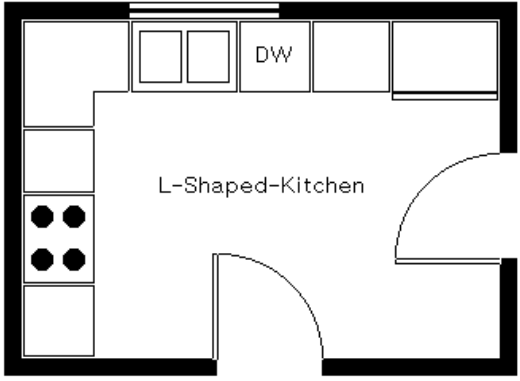
Gerhard Fischer, Hal Eden, Hiroaki Ogata, and Eric Scharff
DLC Course, Spring Semester 2002
February 13, 2002

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.

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

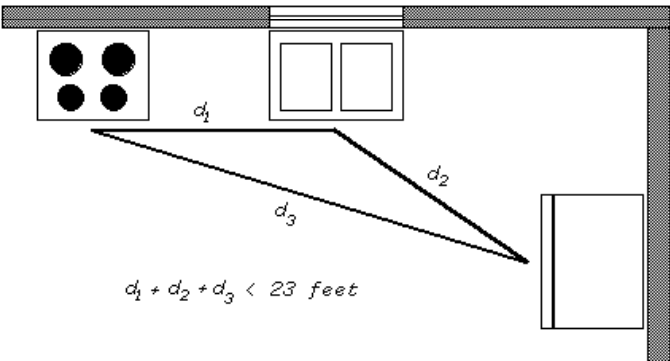
Domain-Oriented Design Environments (Janus-Construction)

<i>Janus-Construction</i>		Clear Work Area Load Catalog	Critique All Save In Catalog	Edit Global Descriptions Select Context
<p>Appliance Palette</p> <p>walls</p>  <p>doors</p>  <p>windows</p>  <p>sinks</p>  <p>stoves</p> 		<p>Work Area</p> 		
<p>Catalog</p> 		<p>Messages</p> <ul style="list-style-type: none"> • The length of the work triangle (Double-Bowl-Sink-1, Four-Element-Stove-1, Single-Door-Refrigerator-1) is greater than 23 feet. • Single-Door-Refrigerator-1 is not near Four-Element-Stove-1. 		
		<p>Commands</p> <ul style="list-style-type: none"> ▶ Critique All ▶ ■ 		

Janus-Argumentation

Janus-Argumentation

Answer (Refrigerator, Sink, Stove)
 The distance between sink, stove and refrigerator, the *work triangle*, should be less than 23 feet.



$d_1 + d_2 + d_3 < 23 \text{ feet}$

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!

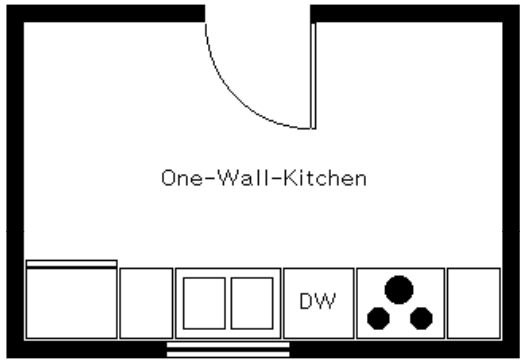
Argument (Small Room)
 In small kitchens where the work triangle is less than 16 feet,

Viewer: Default Viewer

Commands

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

Catalog Example



One-Wall-Kitchen

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

Visited Nodes

- ⇒ Answer (Refrigerator, Sink, Stove) Section

Show Outline

Search For Topics

Show Argumentation

Show Context

Resume Construction

Show Construction

Show Example

Show Counter Example

VDDE: Voice Dialog Design Environment

VDDE-Stack

Voice Mail Personal Options Menu

VMUIF Guidelines:

The Menu options are shown below. Whether the functions are mandatory (M) and/or Reserved (R) is shown in parentheses. If M or R is not displayed, then the function is Optional and/or Not-Reserved.

1	2	3
4	5	6
7	8	9
-	0	8

Global Arguments:

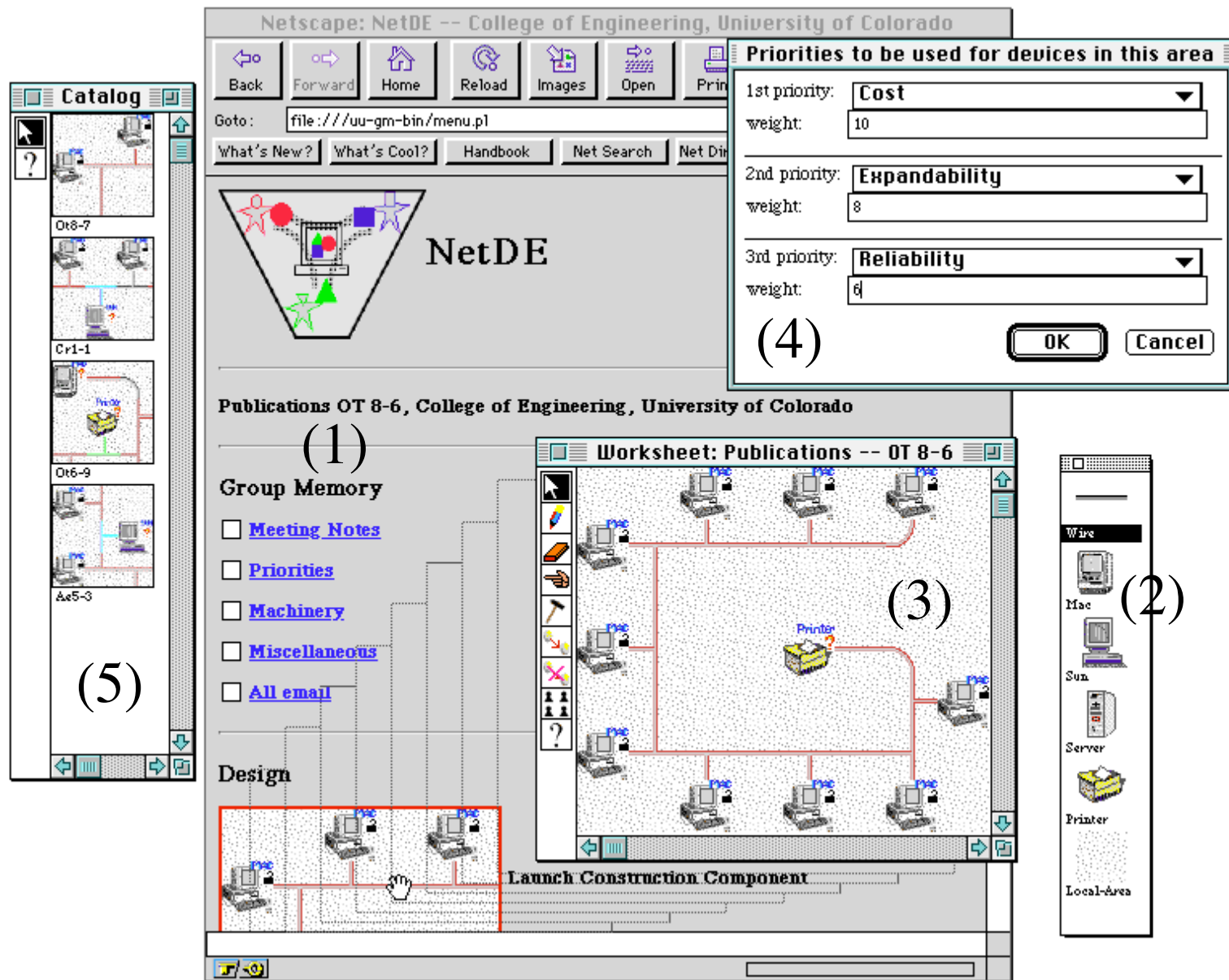
Specific Arguments:

111595: All Rejected because consistency with related design "VoiceMail Business" is more important for usability than compliance with the VMUIF guidelines. (This comment regards the VoiceMail Residential application).

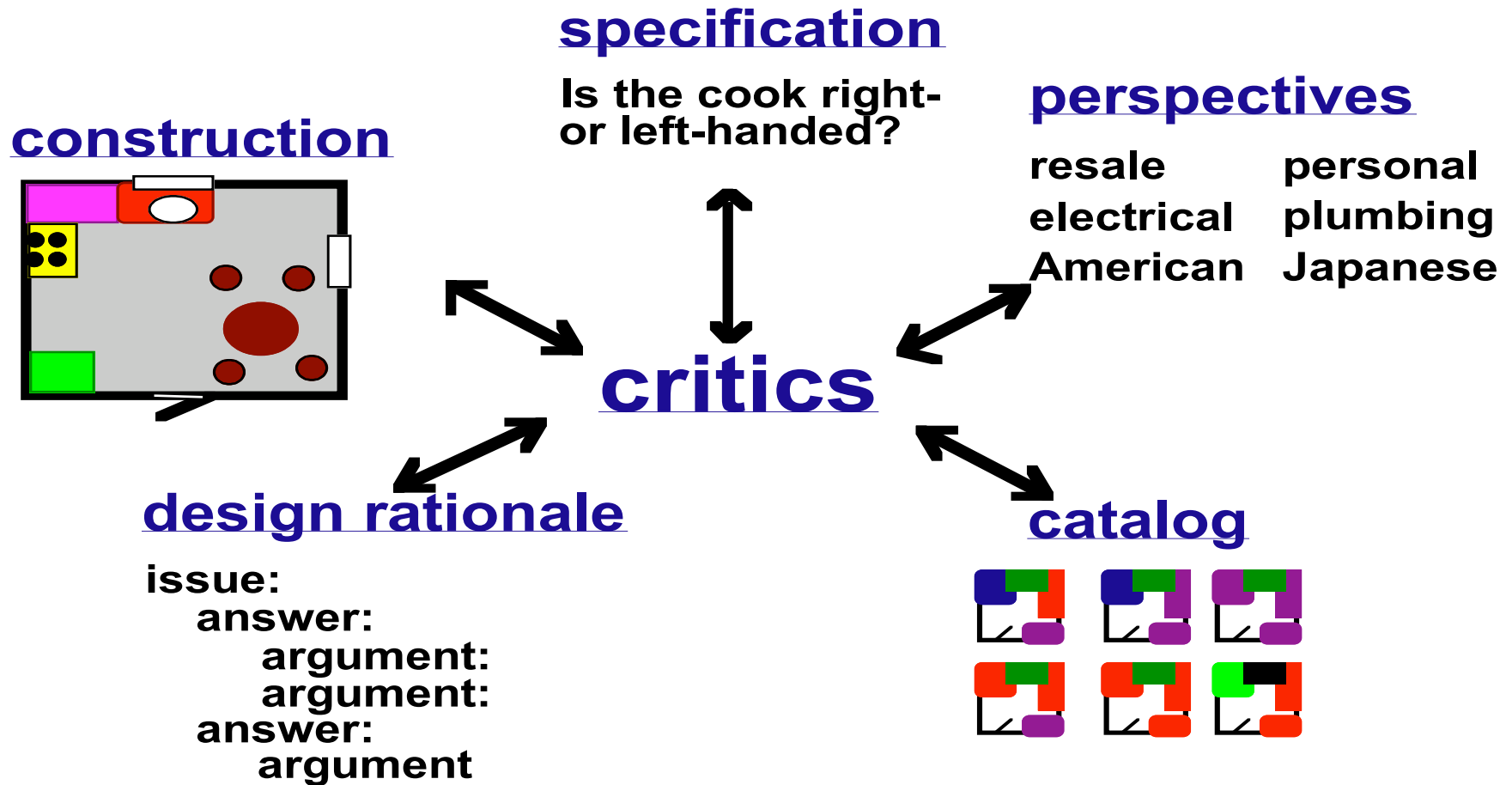
Critique Message Pane

Consistency: Function 'Personal Options' in Main Menu is assigned key 5 in the related design 'voice mail business'
 Consistency: Key 2 in Main Menu is associated with function 'send' in the related design 'voice mail business'
 Consistency: Key 1 in Personal Options Menu is associated with function 'greeting' in the related design 'voice mail business'
 Consistency: 'Listen Menu' is missing. It only exists in the related design 'voice mail business'
 Generic: The keys in Personal Options Menu should have no gaps
 SIBEST: Function 'greeting' is mandatory in Personal Options Menu

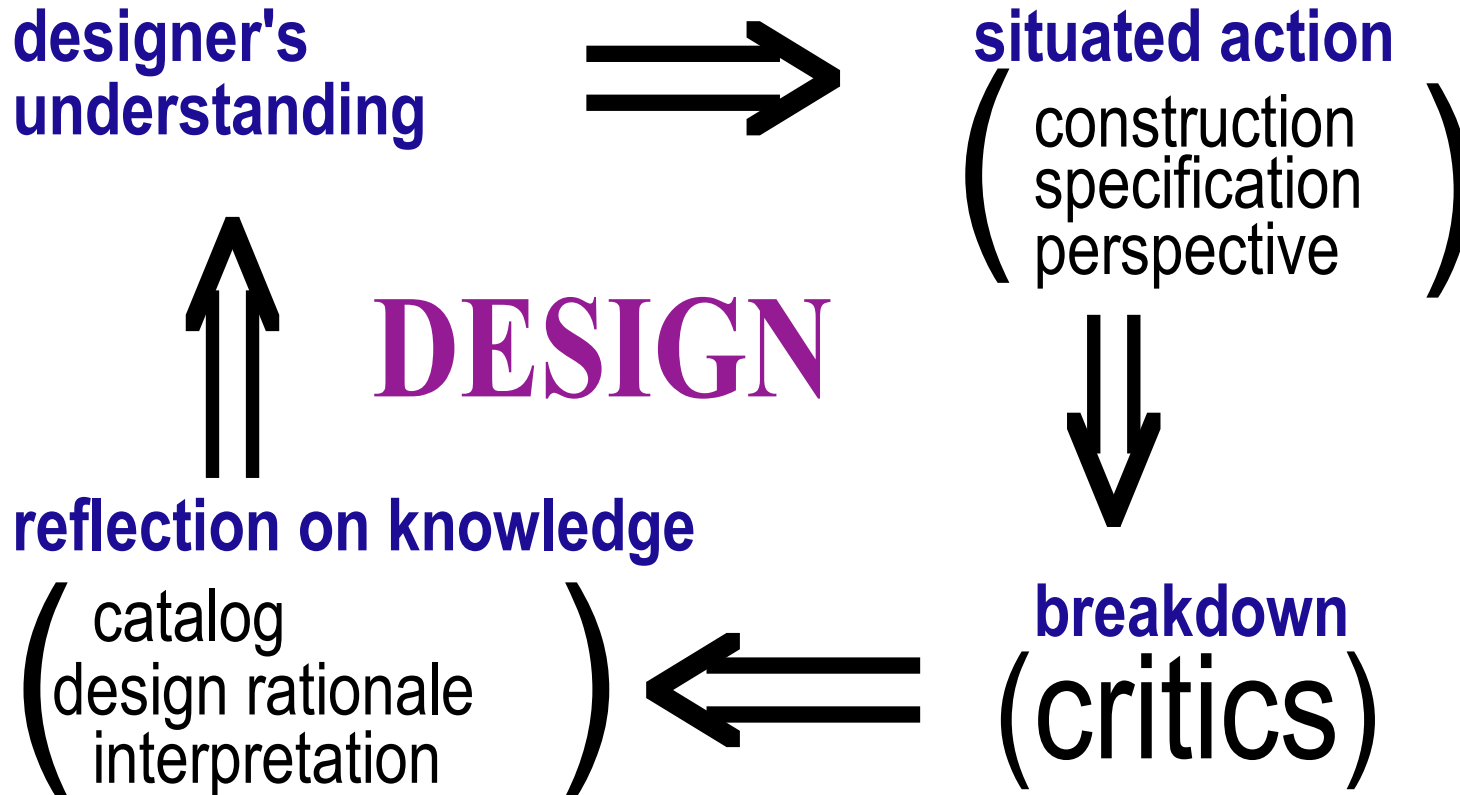
Buttons: Explain Rule, Disable Rule, Critique All, Clear Msg, Clear All, Close Pane



Domain-Oriented Design Environments (DODEs)



Reflection-in-Action as a Problem Solving Theory



Computational Critics (= “Virtual Human Critics”)

- spelling correctors
- grammar checkers
- color critics
- graphs critics
- **webpage critics** — <http://websitegarage.netscape.com/>
 - **Web Site Garage** → provides services for maintaining and improving your Web site. Automate site maintenance checks, optimize your graphics and analyze your traffic.
 - **“tune up”** → performance is critical for a Web site's success. Tune Up delivers comprehensive, automated diagnostics on your Web page. Run anytime to find hidden problems on your site.
 - **“gif lube”** → are you losing visitors because your Web page takes too long to load? GIF Lube will decrease your load time quickly and easily by optimizing your graphics.

The Rationale / Need for Critiquing

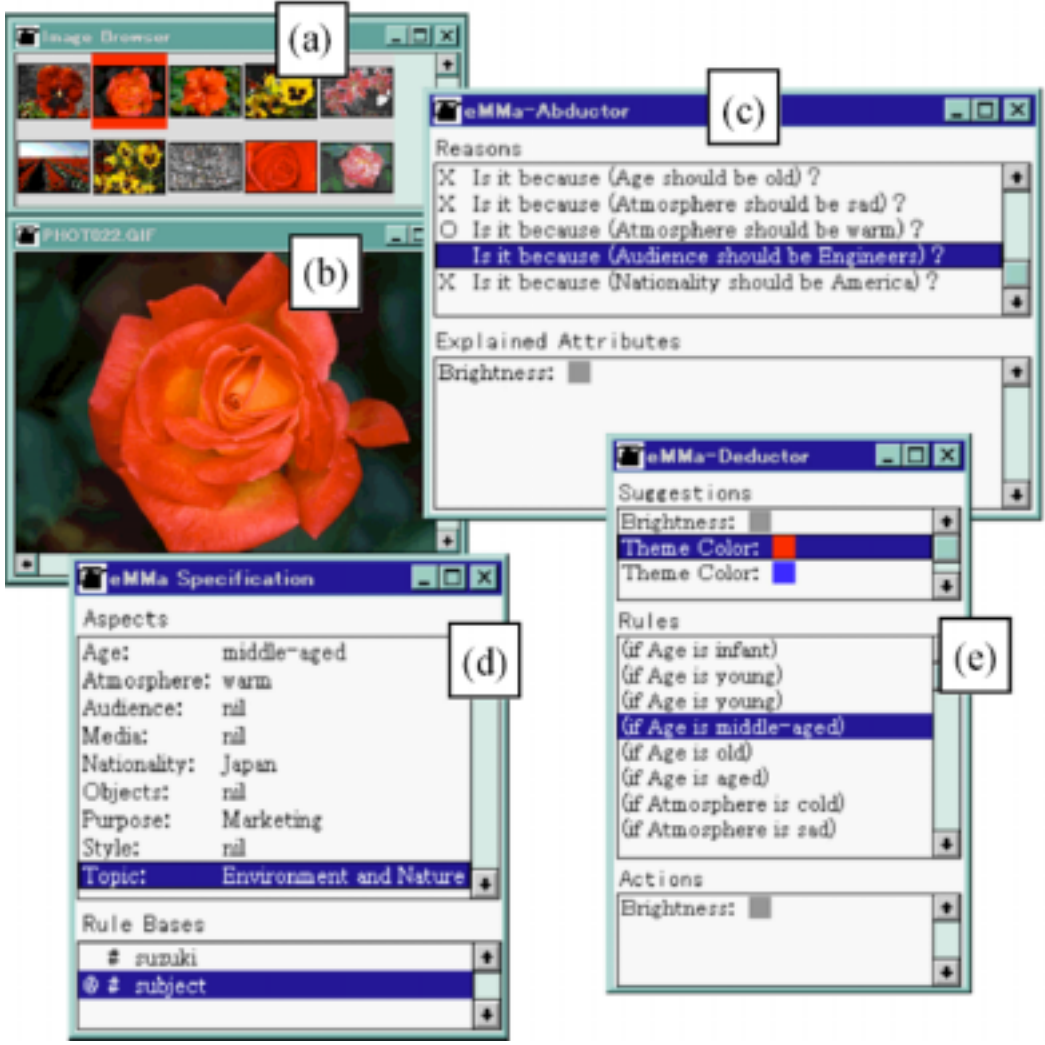
- **color** → Travis, D. (1991) *Effective Color Displays—Theory and Practice*, Academic Press, London:

“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

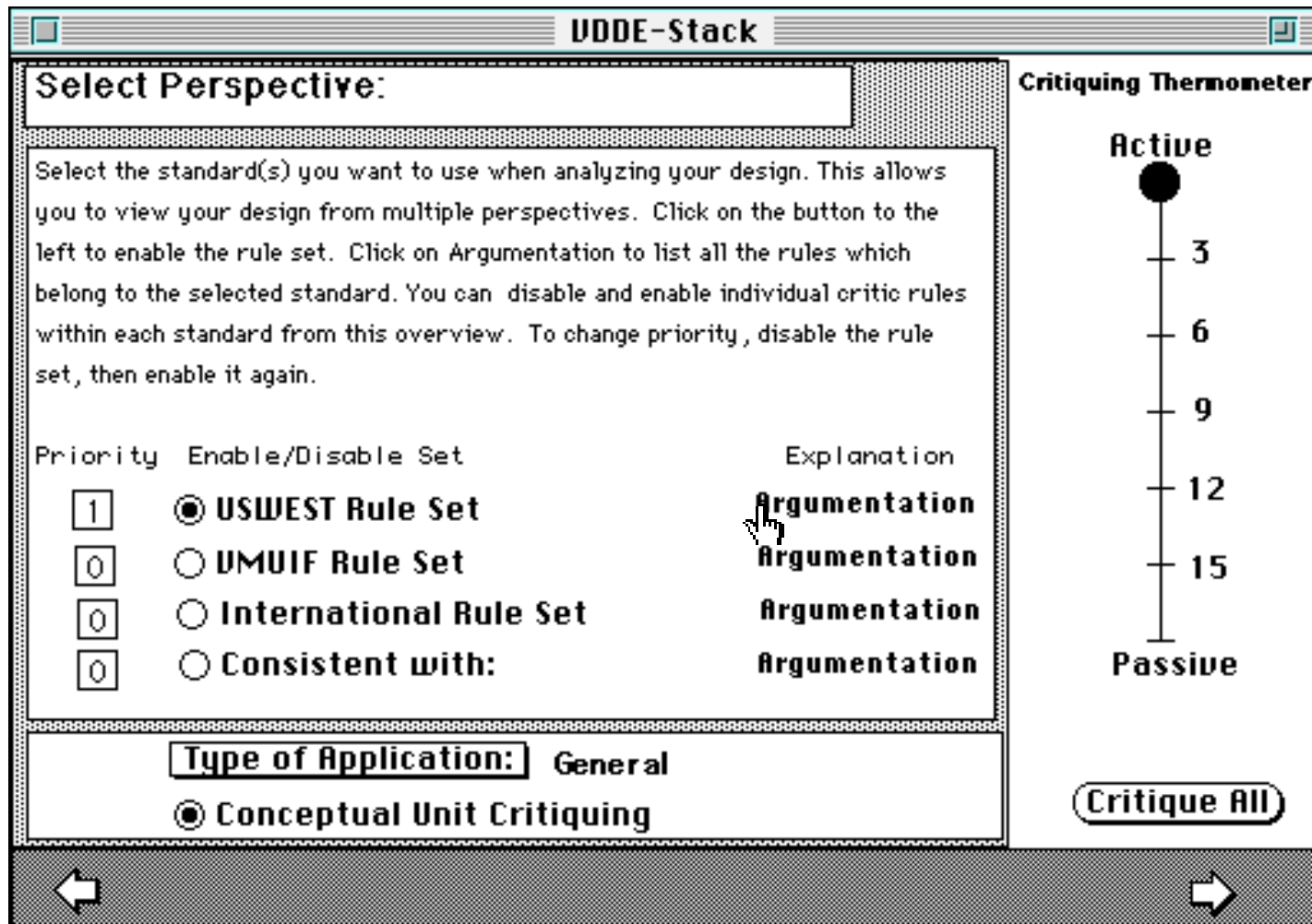
- **examples:**

- 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 1 mile”

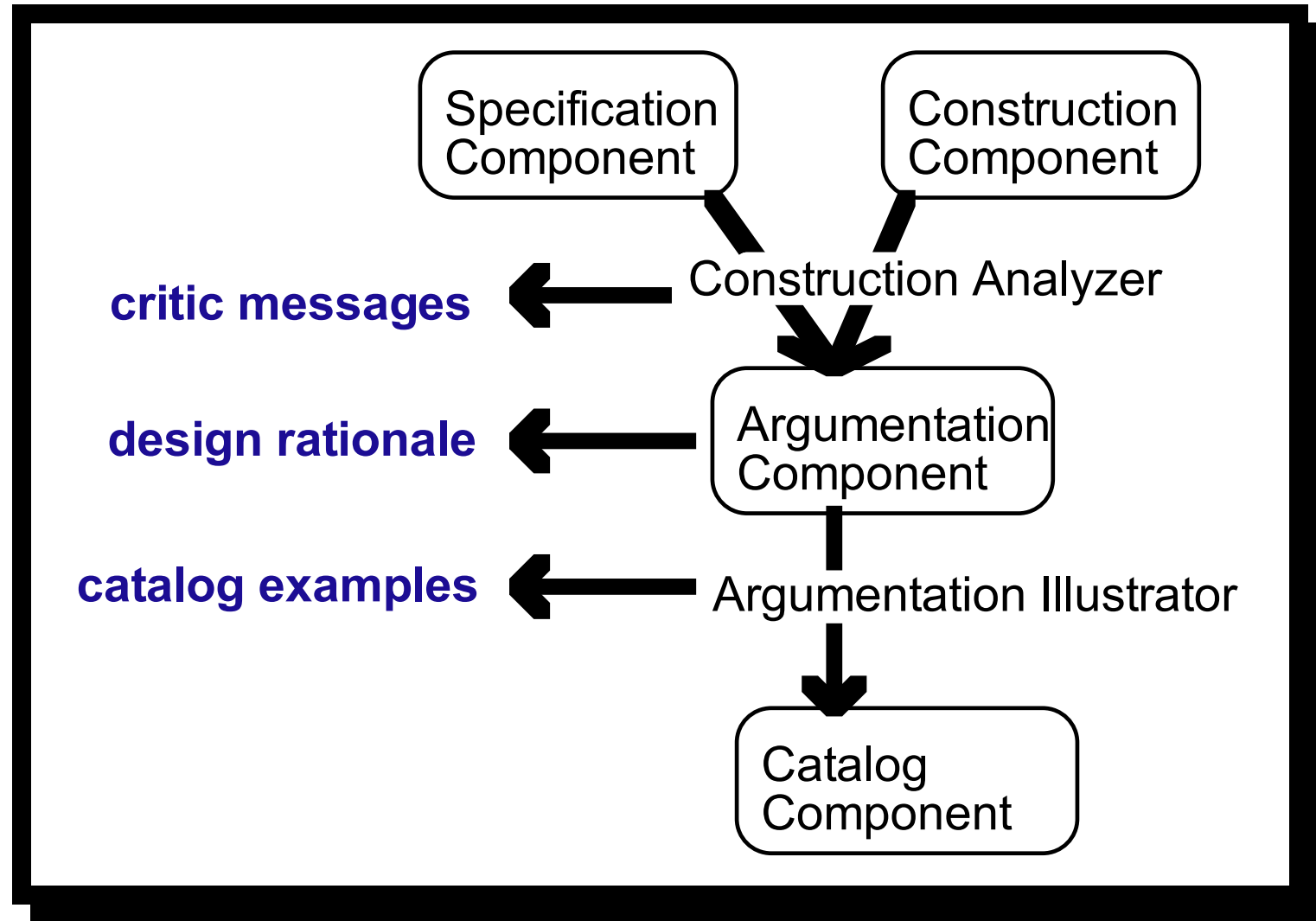
- **mechanism:**

- 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

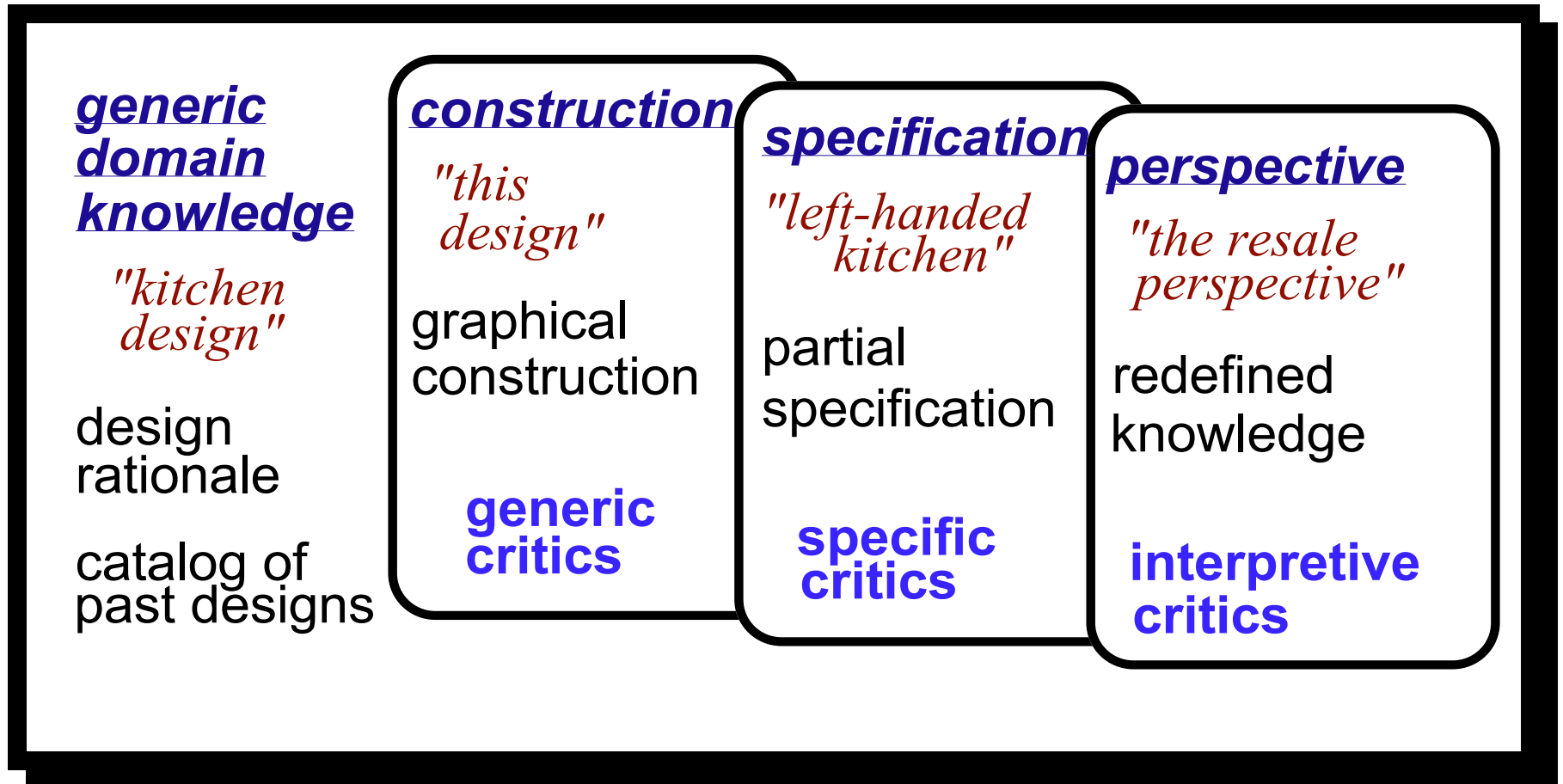
Giving Domain Designers Control about the Intrusiveness of Critics



An Implementation of Critics

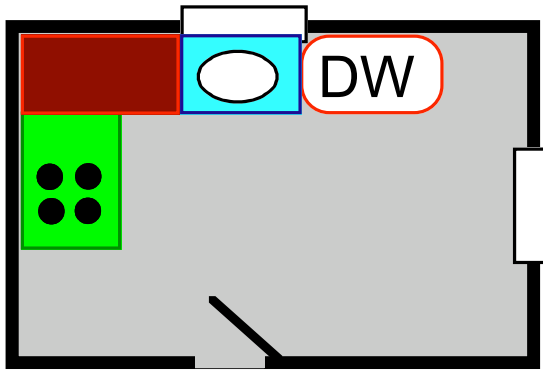


Embedding Critics in the Contexts of Design



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)

Design Rationale

issue:

Where should the dishwasher be placed?

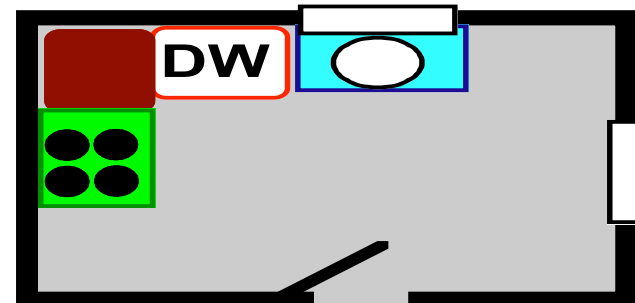
answer:

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

Construction



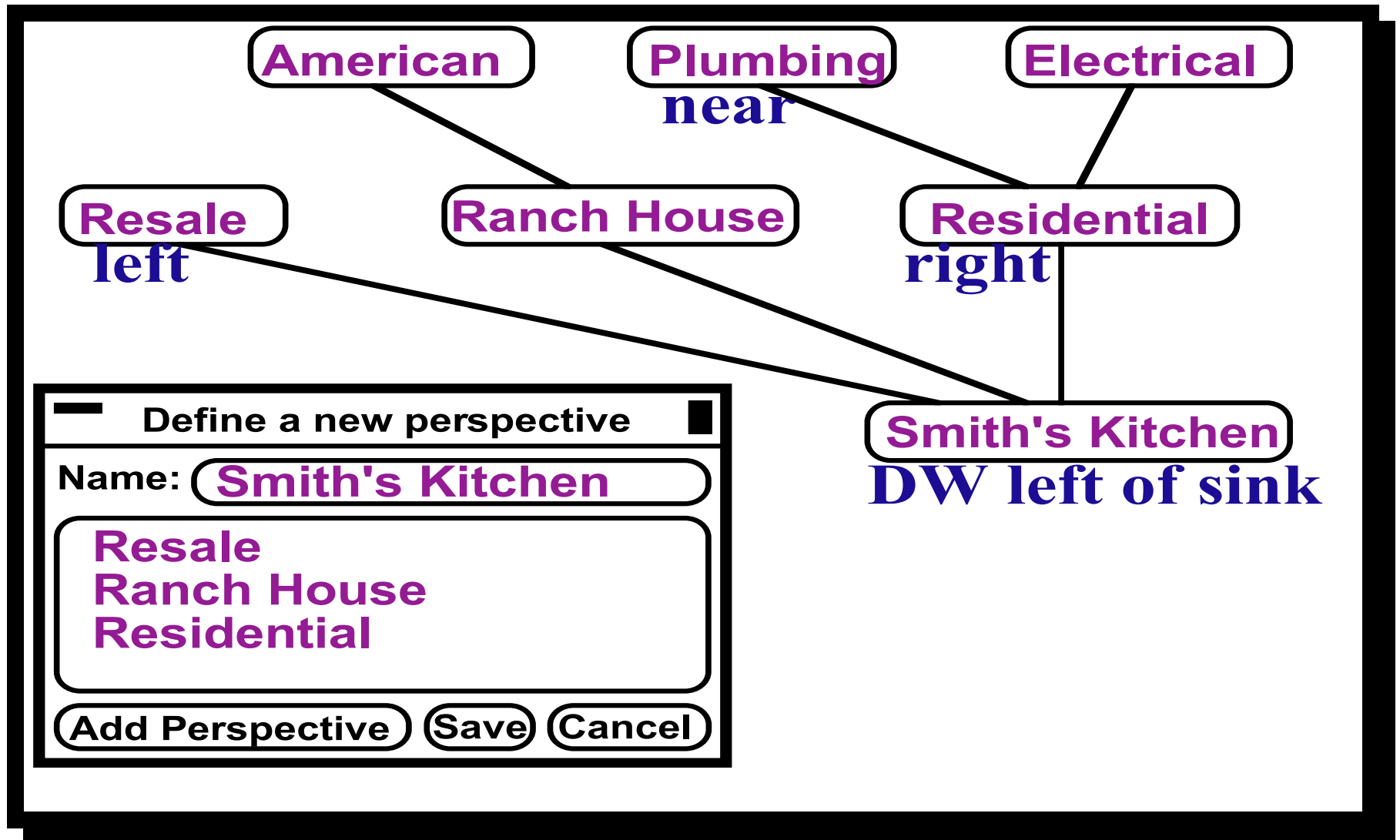
Specific Critic

(left-handedness)
(right-of dishwasher sink)

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

saying the **'right' thing**
at the **'right' time**
in the **'right' way**