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

Embedding Critics into Domain-Oriented Design Environments

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Overview

- Domain-Oriented Design Environments (DODEs)

- Examples
  - video-tape of Janus: a DODE for kitchen design

- Critiquing in Domain-Oriented Design
  - reflection-in-action
  - intrusiveness
  - generic, specific, interpretive critics
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)

## Appliance Palette
- walls
- doors
- windows
- sinks
- stoves

## Work Area
- **Messages**
  - 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.

- **Commands**
  - Critique All
**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.
VDDE: Voice Dialog Design Environment
Domain-Oriented Design Environments (DODEs)

specification
Is the cook right- or left-handed?

critics

design rationale
issue:
answer:
argument:

perspectives
resale personal
electrical plumbing
American Japanese

catalog

construction

issue:
answer:
argument:

argument

argument

argument
Reflection-in-Action as a Problem Solving Theory

designer's understanding  \[\Rightarrow\]  situated action

reflection on knowledge

DESIGN

breakdown

situated action
(construction specification perspective)

D\textsc{E}SIGN (catalog design rationale interpretation)
Critiquing Process in a DODE

**Designers**
- creates/ modifies design
- analyzes design
- experiences breakdown and reflects on critique
- may request for related information
- reflects on the delivered information
- may modify argumentation

**DODE**
- Construction
- Specification
- Critiquing window
- Argumentation
- Catalog

**Critiquing Mechanism**
- monitors design
- analyzes design
- signals potential problems as critiques
- delivers information relevant to the critiques
- reflects the changes made by the designer in its knowledge-bases
Computational Critics (= “Virtual Human Critics”,)

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

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

- **webpage critics and universal access**

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](http://www.watchfire.com).
The Rationale / Need for Critiquing

  - “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.”
  - question: what are the benefits of “critiquing systems” compared to “guidelines”

  - “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”
  - question: can a critiquing system be developed for “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 Envisionment and Discovery Collaboratory: “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
  - identify the right level of intrusiveness:
    - on demand ↔ critical points (“windows in Janus”) ↔ all the time (MS Word)
Giving Domain Designers Control about the Intrusiveness of Critics
An Implementation of Critics

- Specification Component
- Construction Component

- Construction Analyzer
  - Argumentation Component
  - Argumentation Illustrator
  - Catalog Component

- critic messages
- design rationale
- catalog examples
Embedding Critics in the Contexts of Design

generic domain knowledge
"kitchen design"
design rationale
catalog of past designs

construction
"this design"
graphical construction
generic critics

specification
"left-handed kitchen"
partial specification

perspective
"the resale perspective"
redefined knowledge

interpretive critics

design knowledge
"kitchen design"
"this design"
**Generic Critics in Construction**

**Construction**

**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.

**Generic Critic**

If the dishwasher is right of sink, then "move dishwasher left of sink"
A Partial Specification of a Specific Client

<table>
<thead>
<tr>
<th>questions in specification component</th>
<th>answers by client:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- name:</td>
<td>Smith’s kitchen</td>
</tr>
<tr>
<td>- size of family:</td>
<td>four to six</td>
</tr>
<tr>
<td>- primary cook:</td>
<td>left-handed</td>
</tr>
<tr>
<td>- size of meals:</td>
<td>huge (big eaters)</td>
</tr>
<tr>
<td>- entertainment:</td>
<td>often</td>
</tr>
<tr>
<td>- cooking frequency:</td>
<td>often</td>
</tr>
<tr>
<td>- type of sink:</td>
<td>double bowl sink</td>
</tr>
</tbody>
</table>

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

American  Plumbing  Electrical

Resale near Ranch House Residential

Smith's Kitchen

 DW left of sink

Define a new perspective

Name: Smith's Kitchen

Resale Ranch House Residential

Add Perspective  Save  Cancel
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