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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Spring Semester 2006

February 13, 2006

Overview

- Feedback from Students

- 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
Feedback from Students

- **Nathan:** This research could be extended by looking at software that is vastly available and used that contains critiquing (such as Word, Eclipse, Visual Studio) and studying the effects of these critics on their users. Do they help or hurt the user, does the user learn or does he/she ignore them, etc.

- **Min-Chieh:** Maybe this can be applied to the programming development software like “eclipse”, “visual studio”. It seems this software can help the customer to become designer.

- **John/Gary:** One way this could be extended is seeing an easy to use user interface that allows the designer to add new rules to the system instead of just relying on the pre-defined ones.

- **Kirill:** I would like to learn more about the mechanism for creating/maintaining rules and constraints that HYDRA and other similar systems use. Creating such rules (and making sure they’re consistent, complete, etc) seems a difficult issue, especially for non-programmers.
Feedback from Students — Continued

- **Keisuke:** The actual usefulness of the concept is not assessed in the article. Perhaps we should evaluate the effectiveness of the system in terms of the completeness of designed artifacts and the designer's preference compared with other design environments.

- **Lisa:** The HYDRA-KITCHEN makes designing a kitchen seem almost trivial so that average homeowners could customize and design their own kitchens. This is bit of an oversimplification since there are still many things to take into account when designing a kitchen, but it doesn’t seem like a giant leap to suggest that anyone could use the software to do what kitchen designers do for a career.

- **Cortney:** a critiquing system that avoids unnecessary interruptions
Laoleng: What about independent design? It is obvious that a designer doesn’t have to follow the suggestions and critiques of the system, but what if a designer does so blindly. Would this critique system allow for human creativity?

Mark:
(a) Simply being critiqued with being guided to requisite pertinent knowledge that address a criticism is of limited value.
(b) An important addition might be to focus on HOW to critique since critiquing carries with it a negative connotation that something was not done right

Malte: another example for critiquing: Turbo Tax →
(a) what can we learn from Turbo Tax;
(b) what can Turbo Tax learn from us?
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-Construction

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

Catalog
- L-Shaped-Kitchen

Work Area
- DW

Clear Work Area
- Load Catalog
- Save In Catalog
- Edit Global Descriptions
- Select Context

Messages
- The length of the work triangle (Double-Bowl-Sink-1, Four-Element-Stove-1, Single-Door-Refrigerator-1) is greater than 26 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 workflow 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)
VDDE: Voice Dialog Design Environment
Domain-Oriented Design Environments (DODEs)

**specification**
Is the cook right- or left-handed?

**perspectives**
resale  personal
electrical  plumbing
American  Japanese

**design rationale**
issue:
  answer:
    argument:
    argument:
  answer:
    argument

**construction**

**critics**
Reflection-in-Action as a Problem Solving Theory

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

reflection on knowledge

DESIGN

situated action
(construction specification perspective)

breakdown (critics)

catalog
design rationale interpretation
Computational Critics (= “Virtual Human Critics”)

- **spelling correctors** — example of a “simple” critiquing system
  - simple: a “correct” answer exists
  - passive $\leftrightarrow$ active
  - suggestions for corrections $\leftrightarrow$ “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.
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.”


  “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

- 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"
- **construction**
  - "this design"
  - graphical construction
- **specification**
  - "left-handed kitchen"
  - partial specification
- **perspective**
  - "the resale perspective"
  - redefined knowledge

**generic critics**
**specific critics**
**interpretive critics**

catalog of past designs
**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

<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?
- \textit{left-handed}
  (left-handedness)

**Design Rationale**

\textit{issue:}
Where should the dishwasher be placed?

\textit{answer:}
Right side of sink.
(right-of dishwasher sink)

\textit{argument (pro):}
If the cook is left-handed then the dishwasher should be right of the sink.

**Construction**

\textit{Specific Critic}
(left-handedness)
(right-of dishwasher sink)

\textit{Critic Message}
"Move the dishwasher to the right of the sink."
Interpretive critics in perspective

Define a new perspective

Name: **Smith's Kitchen**

- Resale
- Ranch House
- Residential

Add Perspective  Save  Cancel

Smith's Kitchen

DW left of sink
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