

A decorative graphic consisting of several circles and lines. On the left, a large orange circle is partially cut off by the edge, with a smaller white circle connected to it by a thin white line. Below the orange circle is a green circle. On the right, a green circle is at the top, and a larger blue circle is at the bottom, both connected to the central white area by thin white lines. The background is a solid blue color.

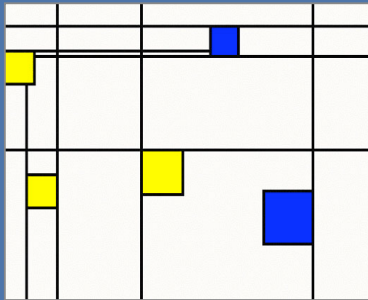
A Taxonomy of Ambient Information Systems: Four Patterns of Design

Zach Pousman, John Stasko
Information Interfaces Laboratory
Georgia Institute of Technology





What is an Ambient Information System?

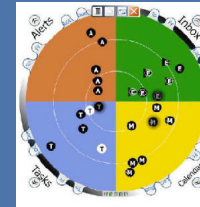


Informative Art

Pinwheels



Scope



InfoCanvas

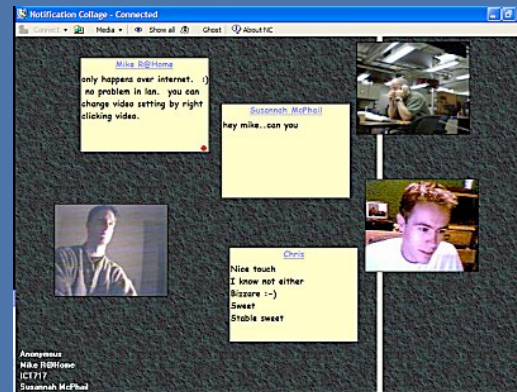
What is an Ambient Information System?

Sideshow

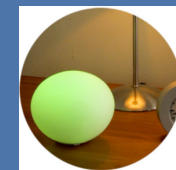


Digital Family Portrait

LiveWire

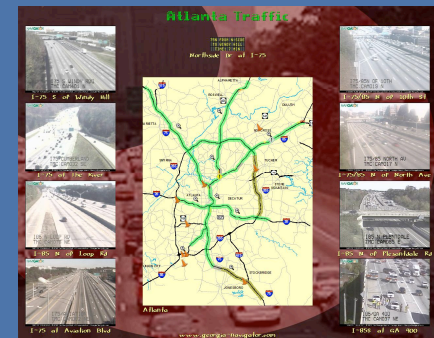


Notification Collage



Ambient Orb

The Buzz



Information Perculator



Purpose



- Settle on definitions of this class of UbiComp systems
- Provide a set of design dimensions and design patterns that developers have used
- Identify open areas in the design space
- Identify “growth areas” in this design space





A definition

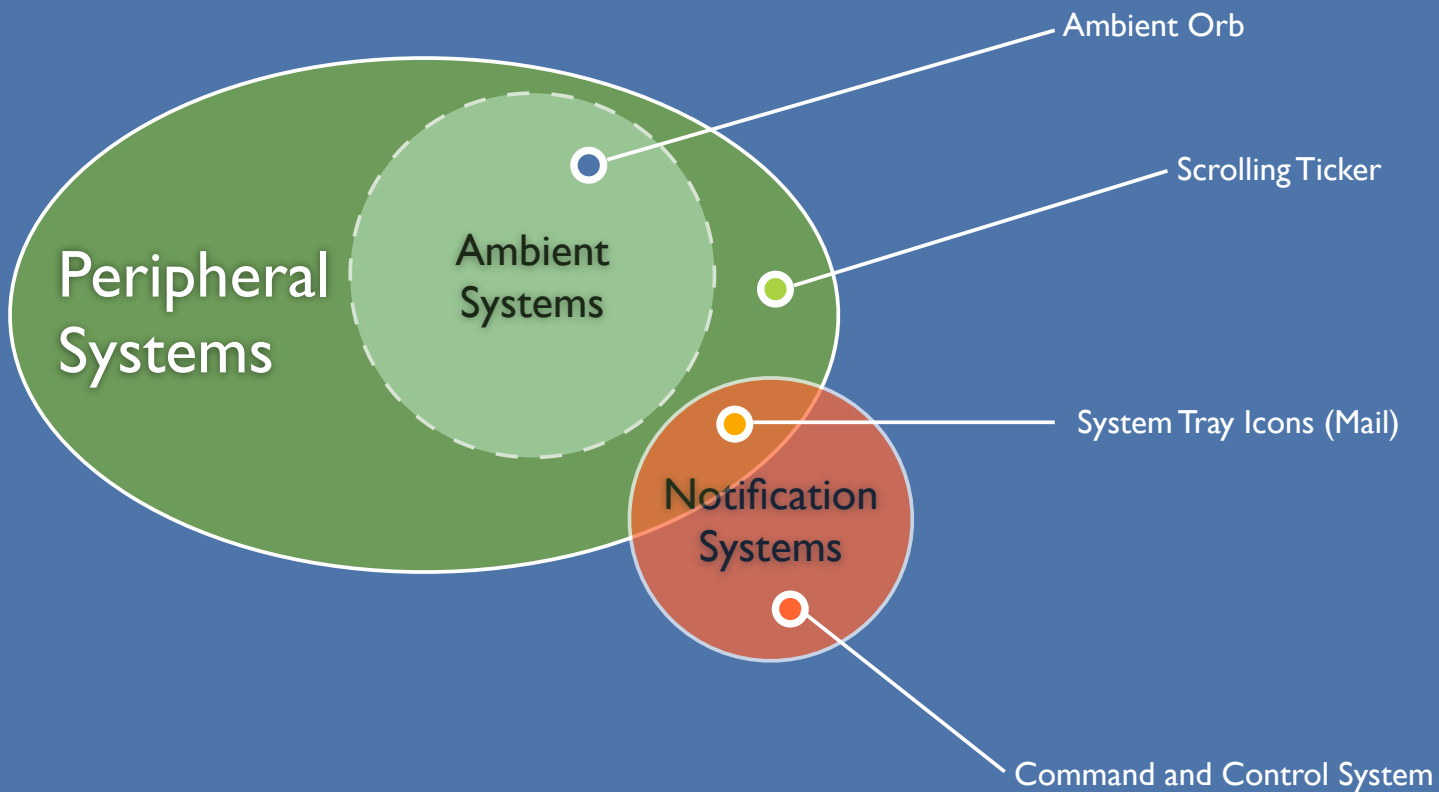


○ Ambient Information Systems

- Representations **in the environment** (peripheral in space), Focus on the **tangible**
- Can **move from the periphery to the focus of attention** and back again
- **Are aesthetically pleasing** and environmentally appropriate
- Display information that is **important** but not critical



A definition





Previous Taxonomies

McCrickard *et al*
ToCHI '02



● Design space split along 3 axes

● interruption:

“we define interruption as **an event prompting transition** and reallocation of **attention focus** from a task to the notification.”

● reaction:

“The second critical parameter we propose is the **rapid and accurate response** to the stimuli provided by notification systems, an effect which we refer to as reaction.”
(user responds to the stimulus)

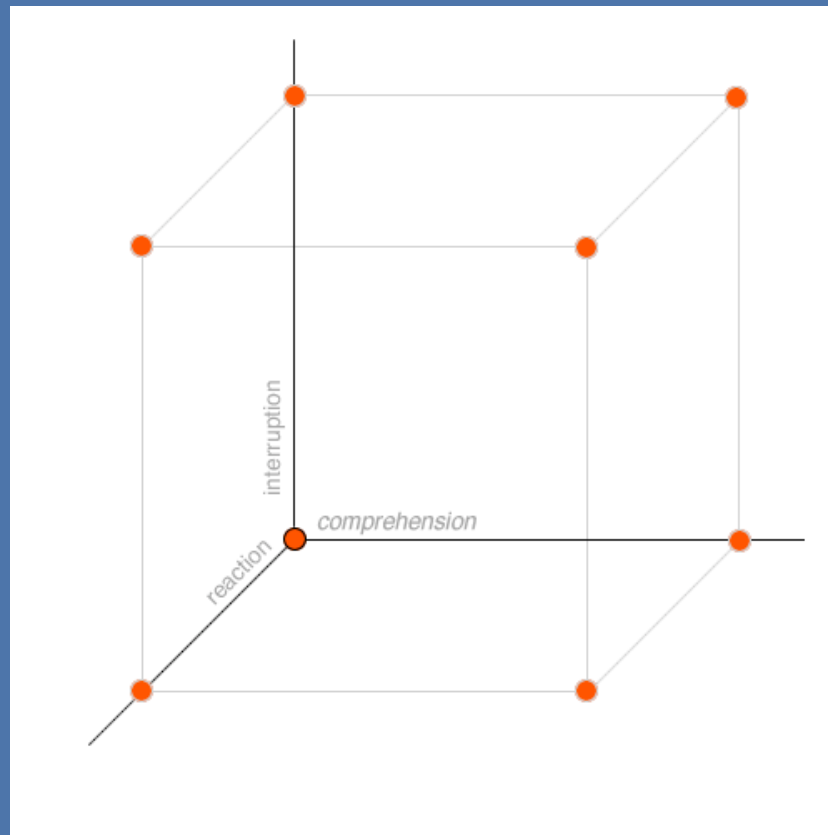
● comprehension:

“...often it is also ... vital to use notification systems with the goal of **remembering and making sense** of the information they convey at a later time.”
(sense-making of data with or without behavioral ‘reaction’)



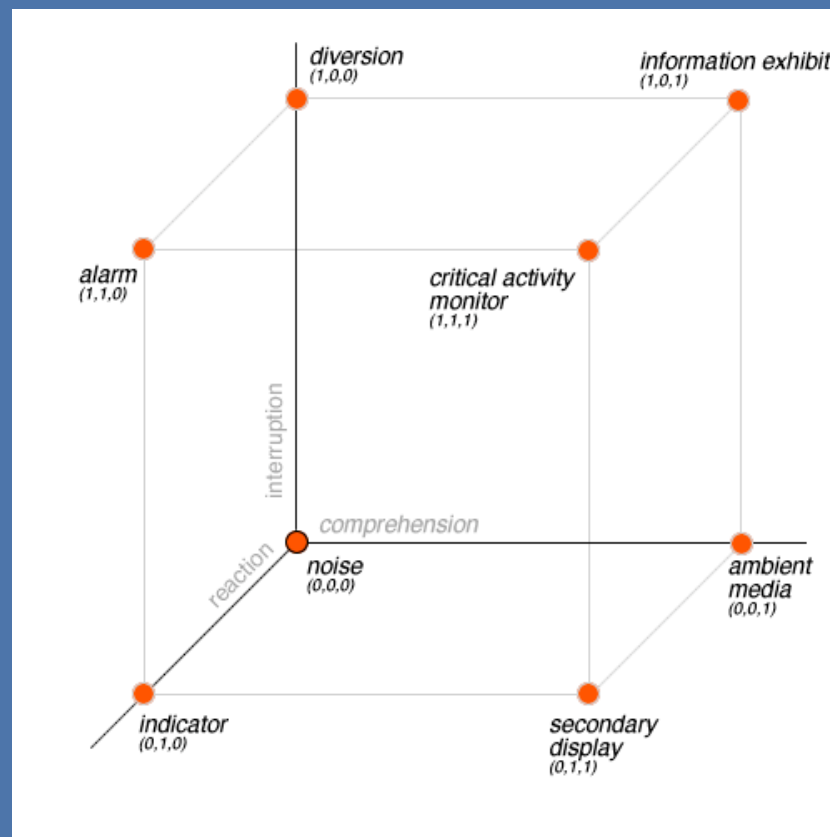
Previous Taxonomies

McCrickard *et al*
ToCHI '02



Previous Taxonomies

McCrickard *et al*
ToCHI '02





Previous Taxonomies

Matthews *et al*
Berkeley TR '02



● Design space has 3 main categories, each subdivided:

● **Notification:**

A relative metric assigned to the stream of information - its "importance"

Ignore
Change Blind
Make Aware
Interrupt
Demand Attention

● **Transition:**

Explicitly supported switches between new and old data (animations, fading, scrolling, etc)

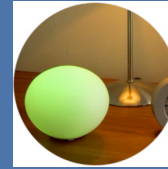
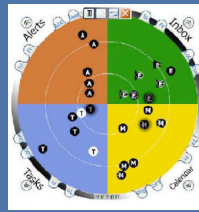
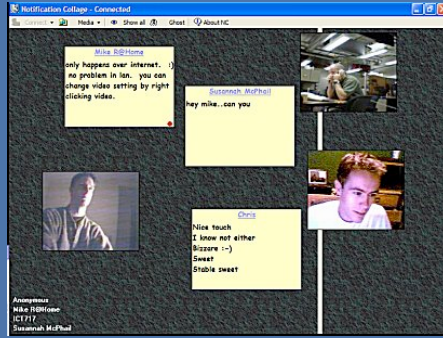
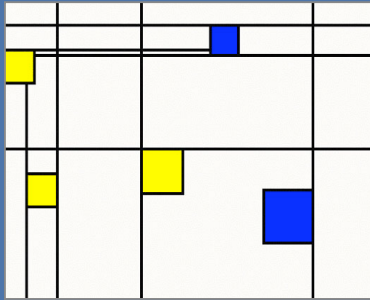
Change Blind
Make Aware
Interrupt
Demand Attention

● **Abstraction:**

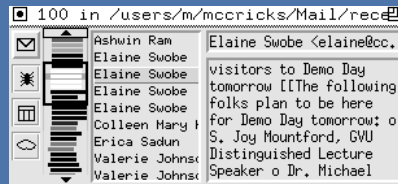
Mapping between information and display

Degradation
Feature Abstraction





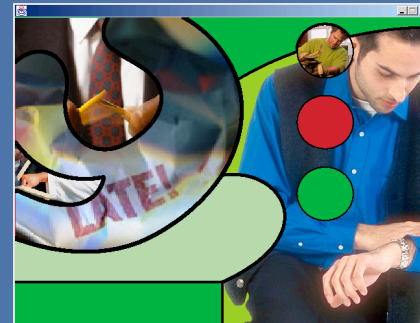
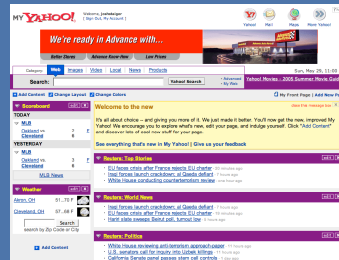
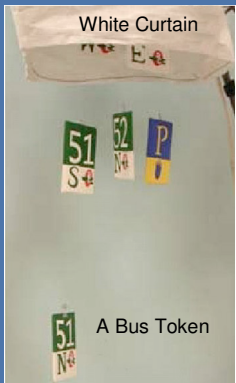
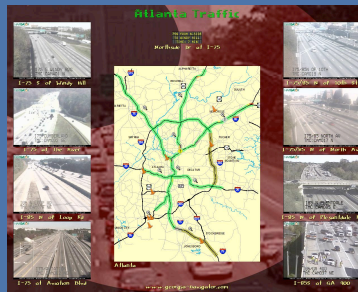
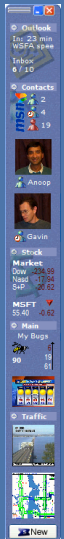
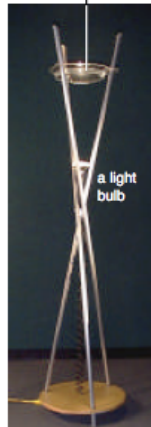
Design Space



reflectio n of water ripple on a ceiling



water pan with 3 computer-controlled solenoids





Our Taxonomy



- Information Capacity
- Notification Level
- Representational Fidelity
- Aesthetic Emphasis





Information Capacity



- How much info the system can display
- Quanta of information - “nuggets”
 - Tradeoff: Time vs. Space



Information Capacity

Low

Medium

High





Notification Level



How interrupting is the system?

- User Request
- Change Blind**
- Make Aware**
- Interrupt**
- Demand Attention**

 *Italicized categories are from Matthews et al (2002)

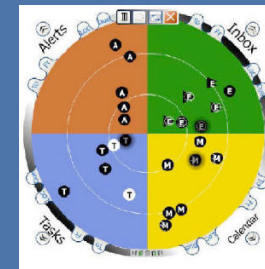
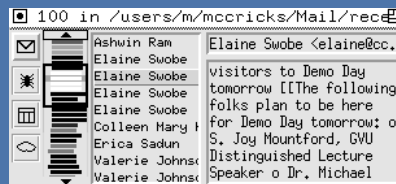


Notification Level

User Request

Make Aware

Interrupt



Representational Fidelity

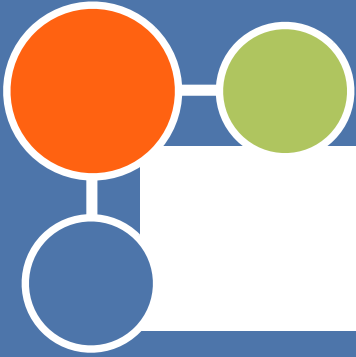
- Is the mapping from information to visual abstract or literal
- What is “abstract”? - Language of Semiotics
 - Indexical (maps, etc.)
 - Iconic (doodles, caricatures)
 - Iconic (metaphors)
 - Symbolic (language symbols)
 - Symbolic (abstract symbols)



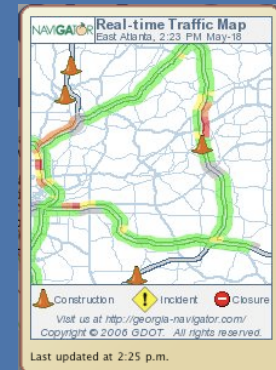
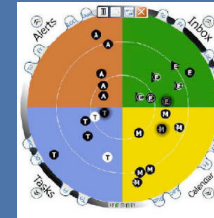
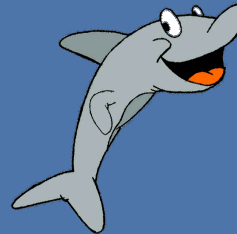
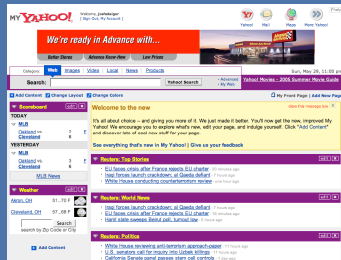
Representational Fidelity

- Is the mapping from information to visual abstract or literal
- What is “abstract”? - Language of Semiotics
 - Indexical (maps, instruments, etc.)
 - Iconic (doodles, caricatures)
 - Iconic (metaphors)
 - Symbolic (language symbols)
 - Symbolic (abstract symbols)





Symbolic (abstract) Symbolic (language) Metaphorical Iconic Indexical





Aesthetic Emphasis



- Look at the designer's intent, not results.
 - (Common) Tradeoff between Information Capacity and Aesthetics

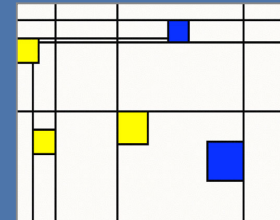
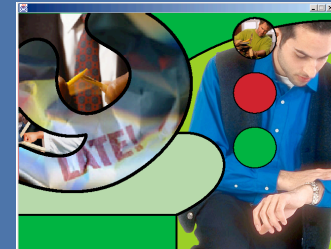
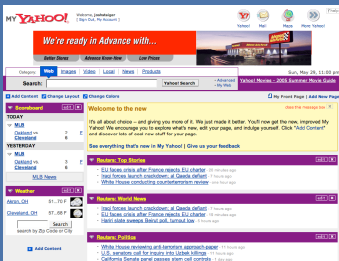


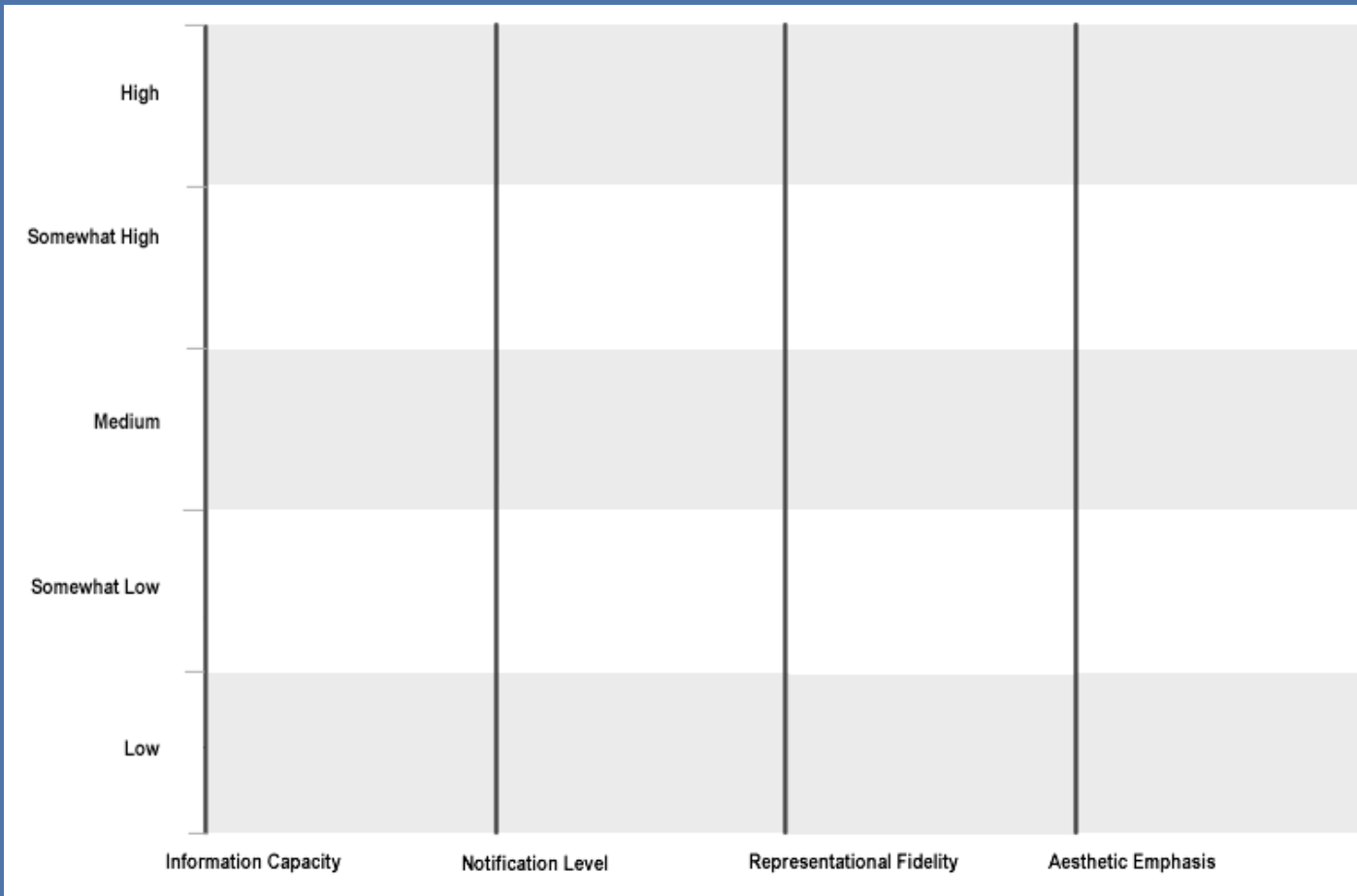
Aesthetic Emphasis

Low

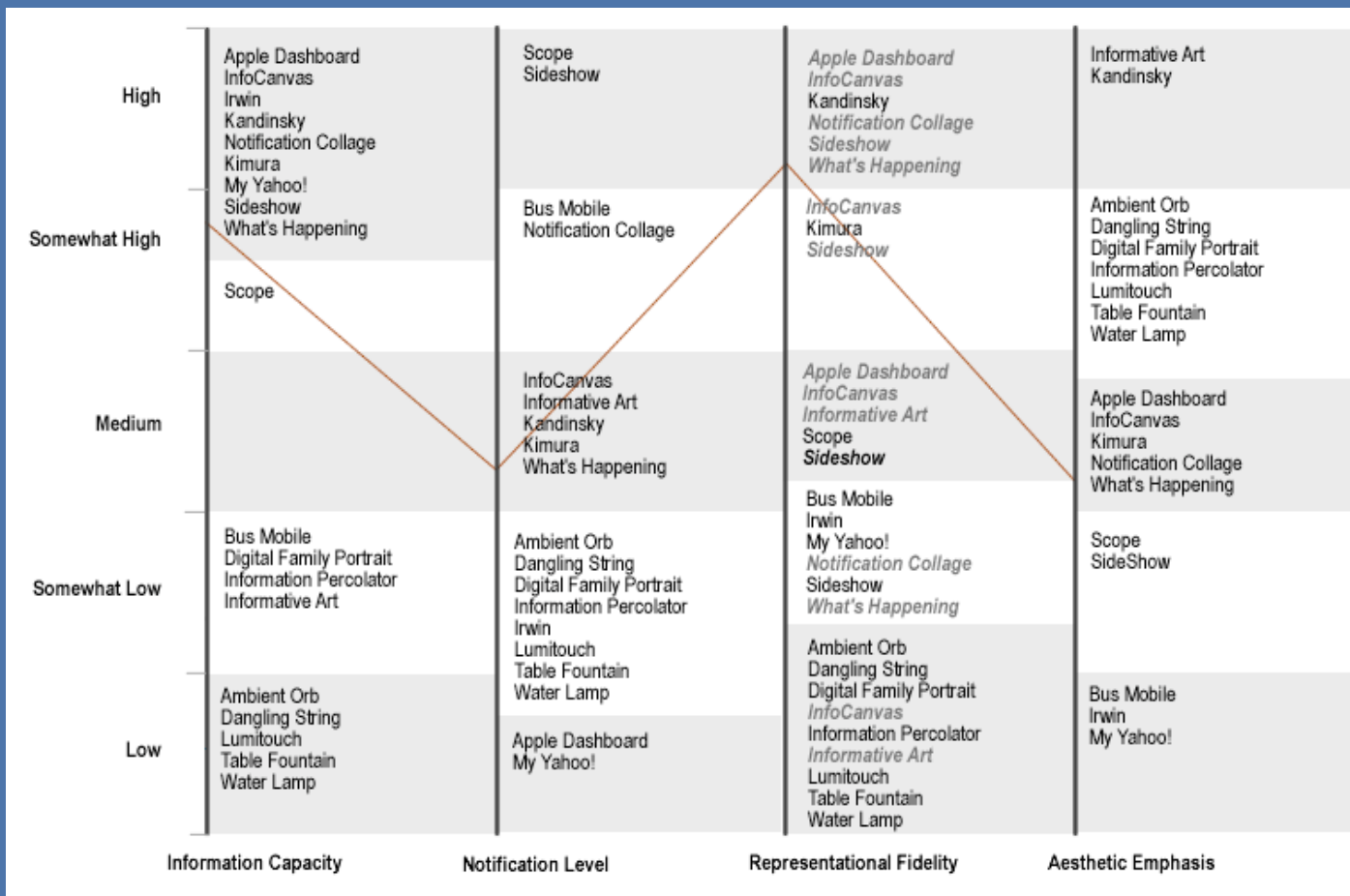
Medium

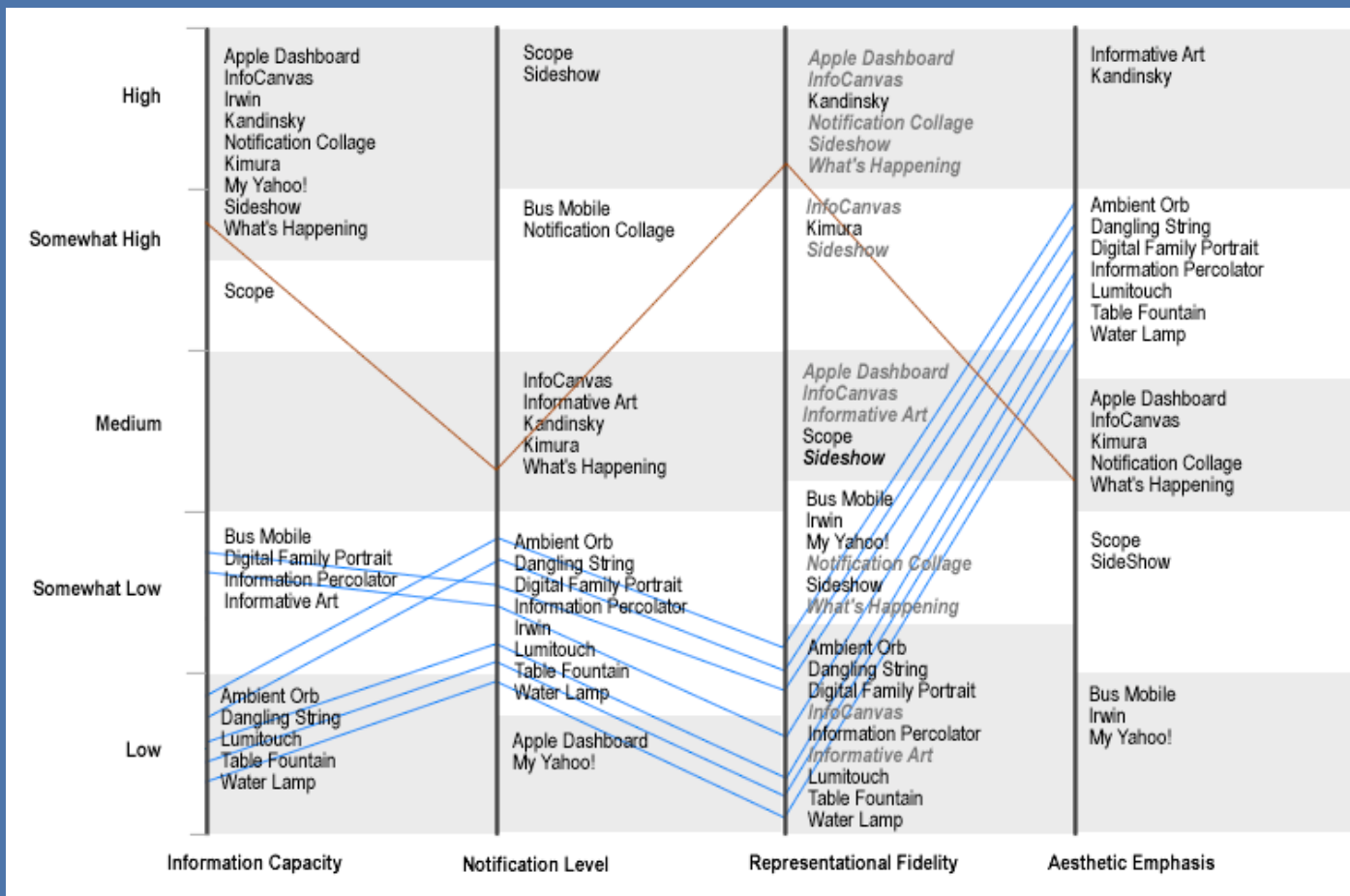
High



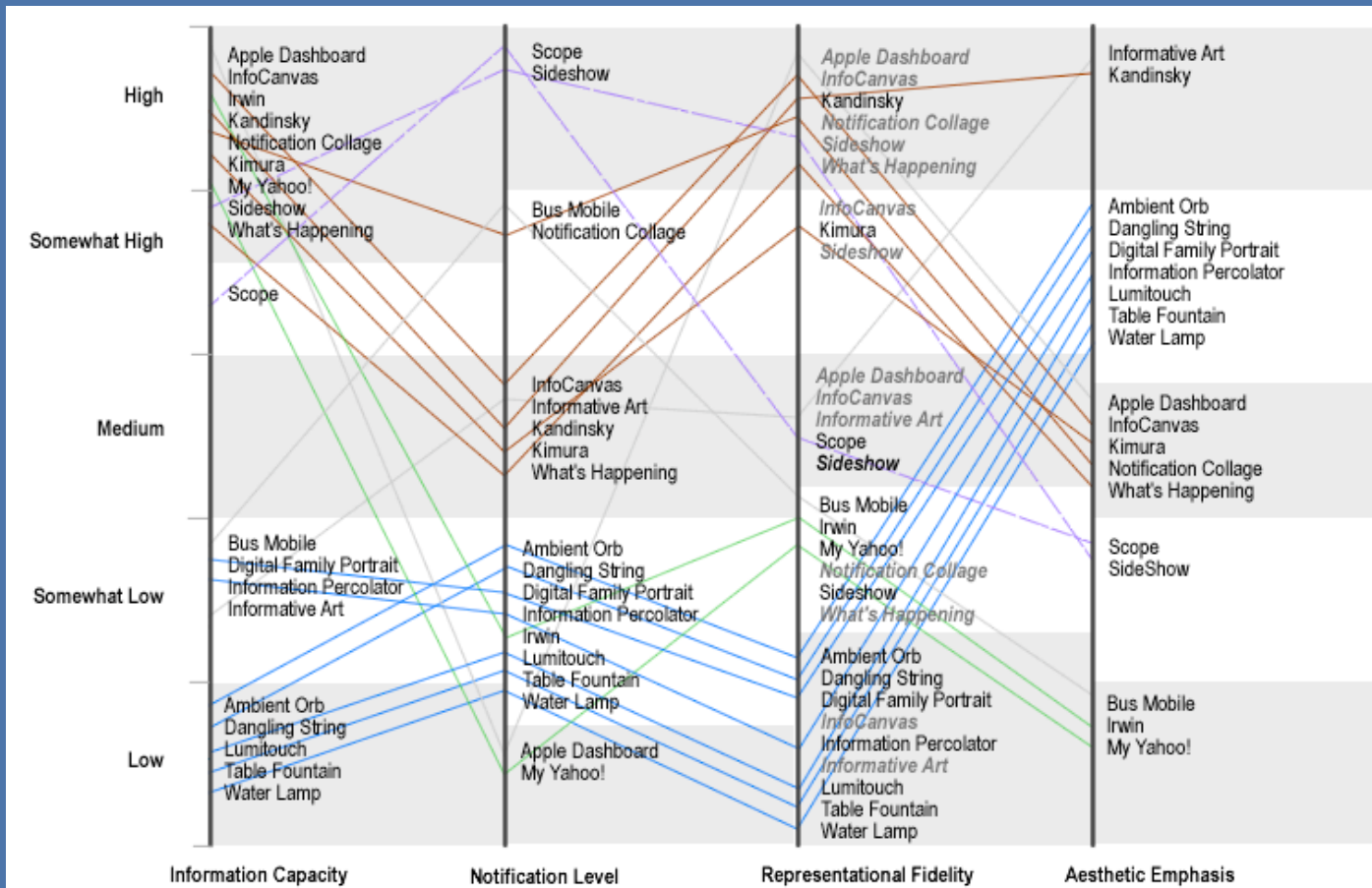


High	Apple Dashboard InfoCanvas Irwin Kandinsky Notification Collage Kimura My Yahoo! Sideshow What's Happening	Scope Sideshow	<i>Apple Dashboard</i> <i>InfoCanvas</i> Kandinsky <i>Notification Collage</i> <i>Sideshow</i> <i>What's Happening</i>	Informative Art Kandinsky
	Somewhat High	Bus Mobile Notification Collage	<i>InfoCanvas</i> Kimura <i>Sideshow</i>	Ambient Orb Dangling String Digital Family Portrait Information Percolator Lumitouch Table Fountain Water Lamp
Medium	Scope	InfoCanvas Informative Art Kandinsky Kimura What's Happening	<i>Apple Dashboard</i> <i>InfoCanvas</i> <i>Informative Art</i> Scope Sideshow	Apple Dashboard InfoCanvas Kimura Notification Collage What's Happening
	Somewhat Low	Bus Mobile Digital Family Portrait Information Percolator Informative Art	Ambient Orb Dangling String Digital Family Portrait Information Percolator Irwin Lumitouch Table Fountain Water Lamp	Bus Mobile Irwin My Yahoo! <i>Notification Collage</i> <i>Sideshow</i> <i>What's Happening</i>
Low		Ambient Orb Dangling String Lumitouch Table Fountain Water Lamp	Apple Dashboard My Yahoo!	Ambient Orb Dangling String Digital Family Portrait <i>InfoCanvas</i> Information Percolator <i>Informative Art</i> Lumitouch Table Fountain Water Lamp
	Information Capacity	Notification Level	Representational Fidelity	Aesthetic Emphasis





Parallel Coords Plot





Four Design Patterns



- Analysis of trends in the data
- Look at each group, find the coherent wholes - these are design patterns
- Using the patterns



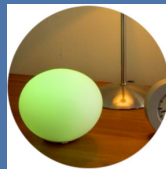
Symbolic Sculptural Display

Design Pattern Members

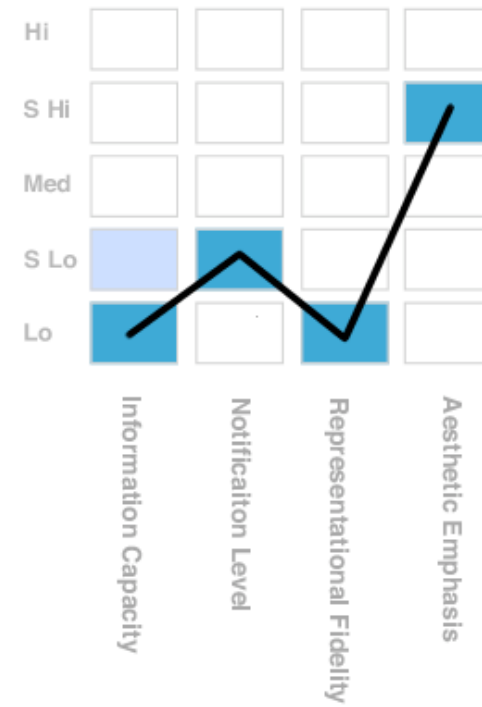
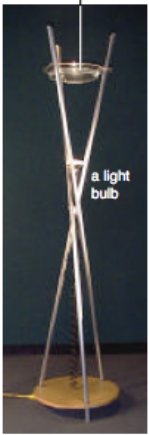
reflectio n of water ripple on a ceiling



water pan with 3 computer-controlled solenoids

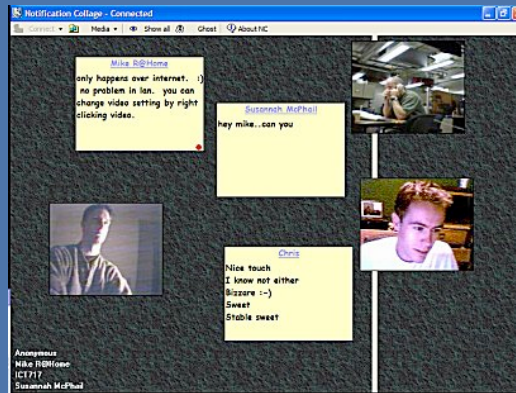
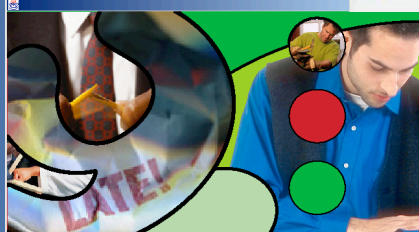


a light bulb



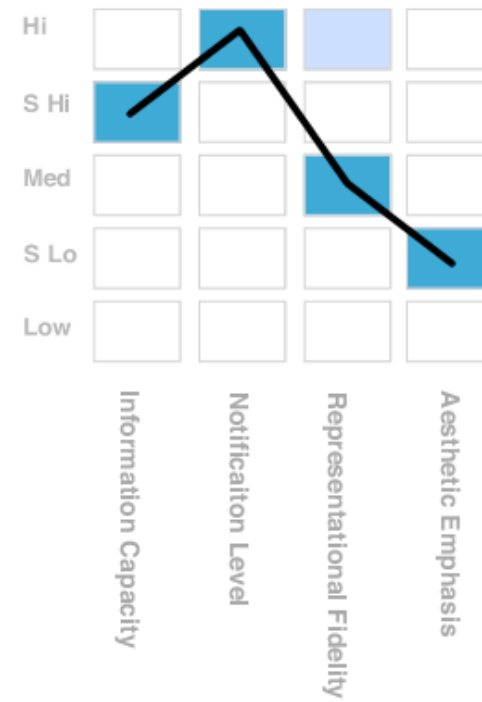
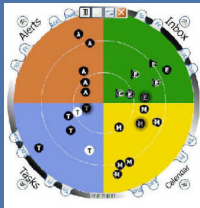
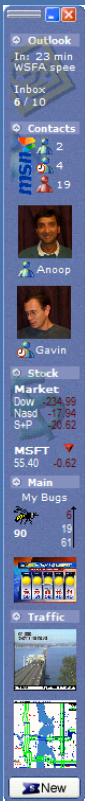
Multiple Information Consolidator

Design Pattern Members



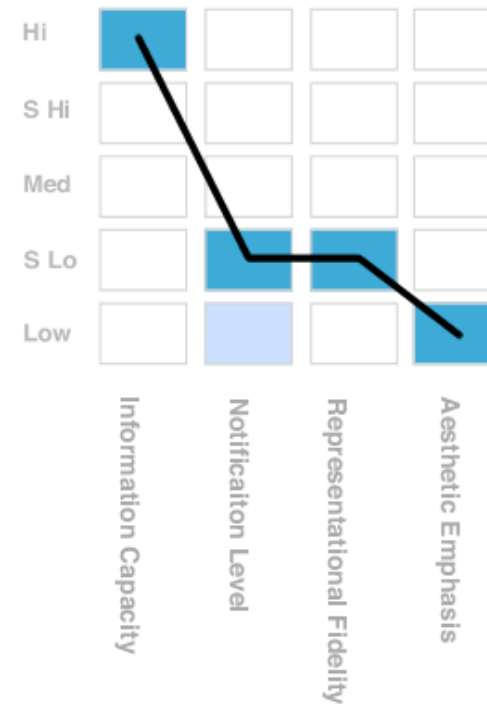
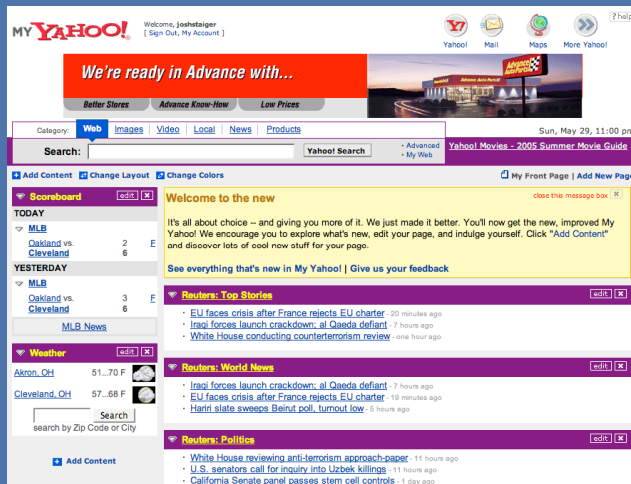
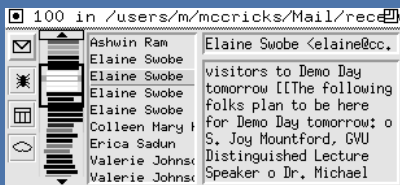
Information Monitor Display

Design Pattern Members



High Throughput Textual Display

Design Pattern Members





Further Discussion



- Using the patterns
- Growth areas in Ambient Information Systems
 - Information Capacity - getting away from nuggets toward convolution?
 - Notification Level - Ambient Intelligence agenda
 - Aesthetic Emphasis - True “ambient art” systems





Future Work



- Building/analyzing more systems
- Extending the taxonomy dimensions
 - Social versus personal
 - User-configurability
 - How does the experience change habits?





Thanks! Questions?



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