Casual InfoVis

CS 7450 - Information Visualization

October 17, 2012

John Stasko

Guest Speaker: Zach Pousman

Casual InfoVis

- Let's start off with ideas and concepts from the paper…

Casual Information Visualization:
Depictions of Data in Everyday Life

Zachary Pousman, John T. Stasko, *Member, IEEE*, and Michael Mateas

Abstract—Information visualization has often focused on providing deep insight for expert user populations and on techniques for amplifying cognition through complicated interactive visual models. This paper proposes a new subdomain for infovis research that complements the focus on analytic tasks and expert use. Instead of work-related and analytically driven infovis, we propose Casual Information Visualization (or Casual Infovis) as a complement to more traditional infovis domains. Traditional infovis systems, techniques, and methods do not easily lend themselves to the broad range of user populations, from expert to novices, or from work tasks to more everyday situations. We propose definitions, perspectives, and research directions for further investigations of this emerging subfield. These perspectives build from ambient information visualization [32], social visualization, and also from artistic work that visualizes information [41]. We seek to provide a perspective on infovis that integrates these research agendas under a coherent vocabulary and framework for design. We enumerate the following contributions. First, we demonstrate how blurry the boundary of infovis is by examining systems that exhibit many of the putative properties of infovis systems, but perhaps would not be considered so. Second, we explore the notion of insight and how, instead of a monolithic definition of insight, there may be multiple types, each with particular characteristics. Third, we discuss design challenges for systems intended for casual audiences. Finally we conclude with challenges for system evaluation in this emerging subfield.

Index Terms—Casual information visualization, ambient infovis, social infovis, editorial, design, evaluation.

1 Introduction

Much of the work in information visualization assumes a population of expert users who have knowledge and experience in analyzing problems in specific domains. Workers in widely varying domains from fi-

Are these types of tools really infovis systems? The question arises, where are the limits of infovis with respect to the everyday uses of computational artifacts.

Card, Mackinlay, and Shneiderman define information visualiza-

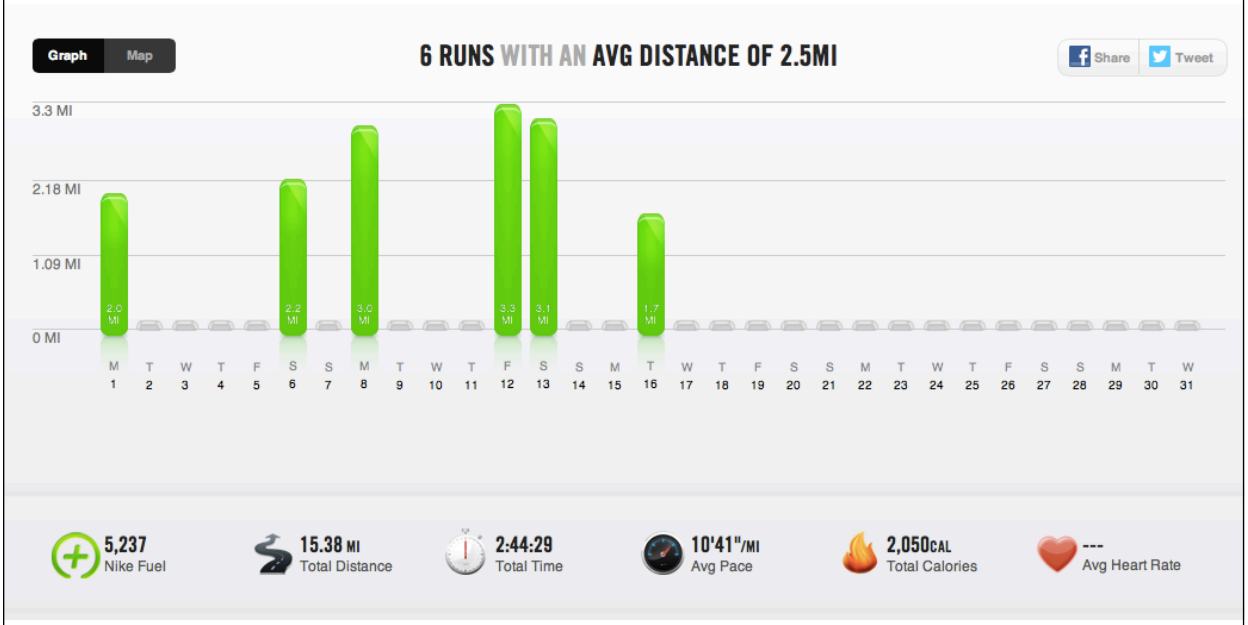
Casual InfoVis

- Let's start off with ideas and concepts from the paper…
- A complement to the majority of 'central' infovis; which is a focus on analytic tasks and analysts as the idealized user.
- Infovis for the everyday person
- Spend some time looking at the 'edges' of the infovis domain

Definition of casual infovis

- Casual Infovis is the use of computer mediated tools to depict personally meaningful information in visual ways that support everyday users in both everyday work and non-work situations.

A good example



Changes to traditional notions

- The user population
  - Expand to include many more kinds of people and many more situations and scenarios.
  - People who are not explicit or implicit analysts
  - Non-professionals in general
  - Low(er) motivation

Changes to traditional notions

- Usage pattern
  - New patterns of use that depart from the more traditional deep-dive explorations and sensemaking
  - In a word, more casual
  - Fleeting awareness and monitoring tasks
  - Could also include more substantial reflections
  - Mobile and ubiquitous, not just desktop

Changes to traditional notions

- Data types also change
  - Often personally relevant (about 'me')
  - Tight coupling between user and the data
  - Tight coupling gets at what is meaningful about the data stream… not always what is important. Sometimes the most minute and boring detail is still very meaningful.

Changes to traditional notions

- Insight
  - Gets a one of the fundamental questions of infovis. We all agree that the purpose of infovis is insight… Do you agree?
  - But the examples on the edges show different kinds of insights.
  - Maybe insights are not perfectly quantifiable in a way that's rigorous

    (for an attempt see Saraiuya and North 2005)

Areas to explore for today

- Artistic InfoVis
- Ambient InfoVis
- Social InfoVis (an appetizer)

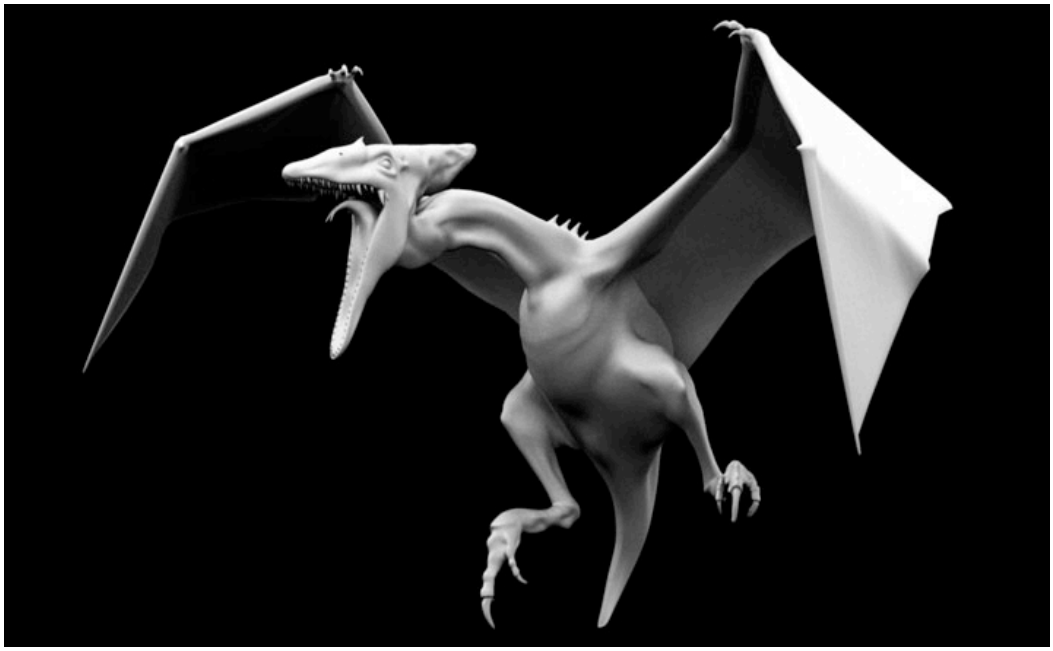
A quick word…

A quick word… on birds

A quick word… on birds

A quick word… on birds

A quick word… on birds



Areas to explore for today

- Artistic InfoVis
- Ambient InfoVis
- Social InfoVis

Artistic InfoVis

Artistic InfoVis

- Artistic expression using visualizations of data
- They are not just generative art – they still read data, represent it, and some are interactive
- Systems often depart from the central notion of infovis that first and foremost, a visualization should be easy to read.
- Also can 'problemitize' the data…

Many examples

Jason Salavon

Jason Salavon

Homes for Sale

109 Homes for Sale,
Seattle/Tacoma

117 Homes for Sale,
Chicagoland

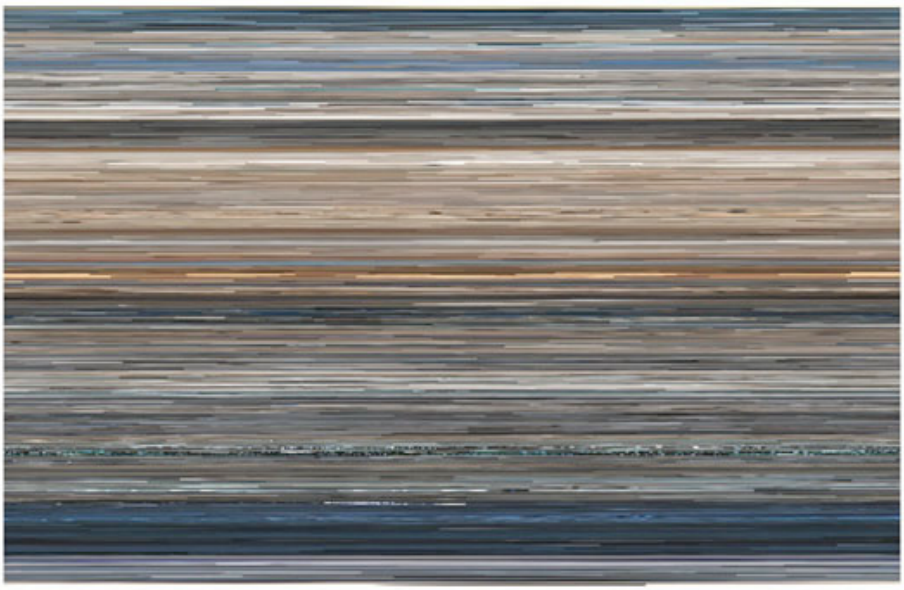
124 Homes for Sale,
The 5 Boroughs

121 Homes for Sale,
LA/Orange County

114 Homes for Sale,
Dallas/Ft. Worth Metroplex

112 Homes for Sale,
Miami-Dade County

Jason Salavon

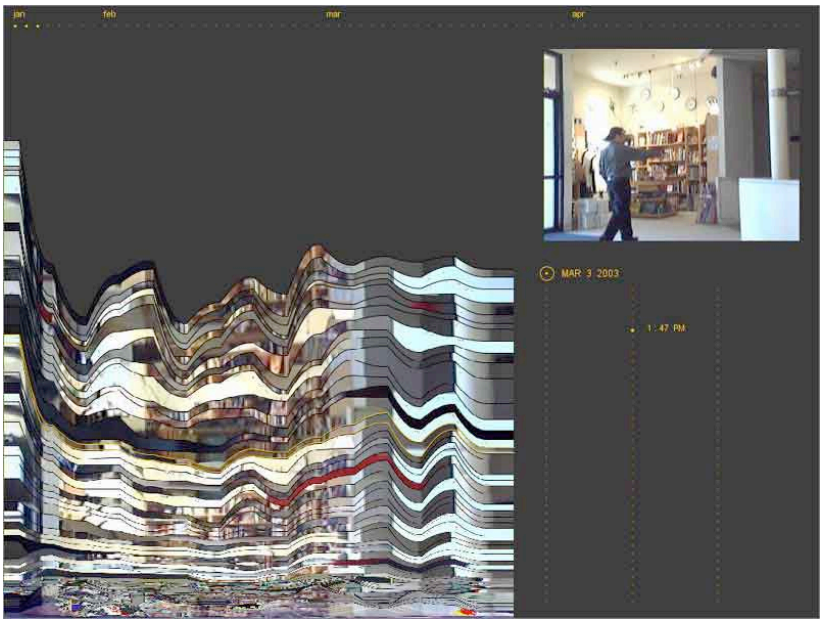


The Top Grossing Film of All Time, 1 x 1 2000

Wignell

Sorting (real time)

Viegas, et al.



Artifacts of the Presence Era

Romero, Pousman, Mateas

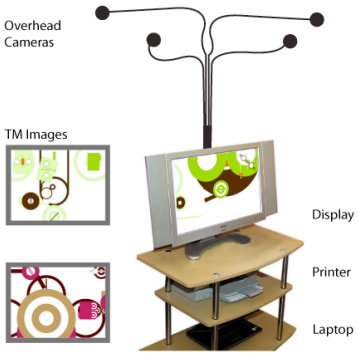
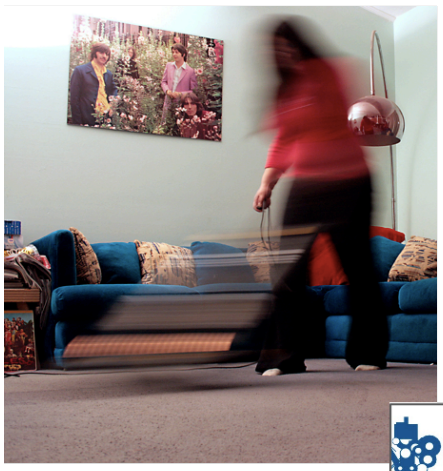
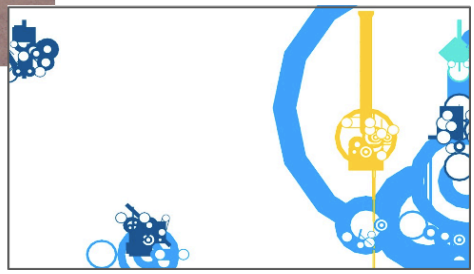


Tableau Machine

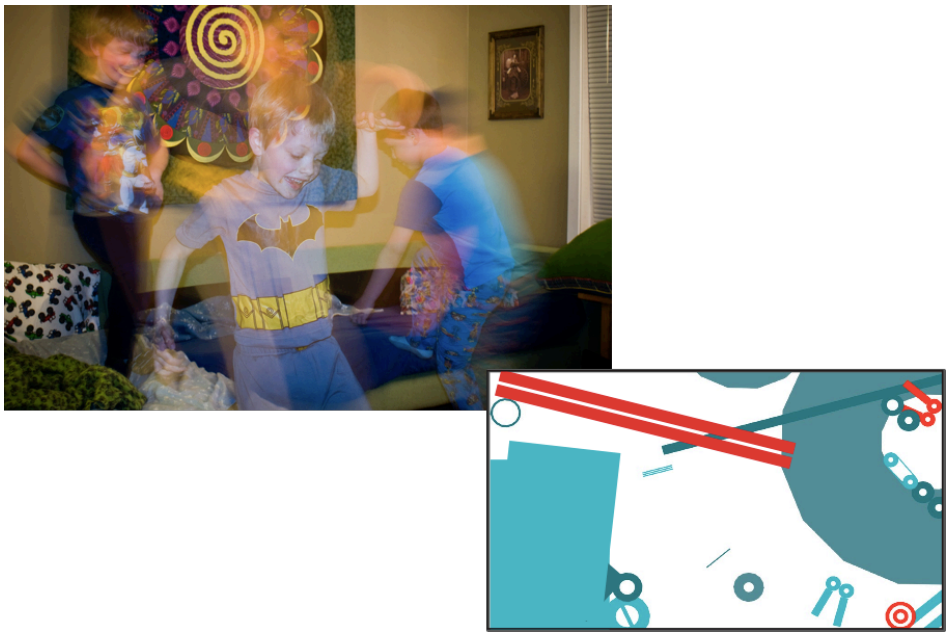
Romero, Pousman, Mateas





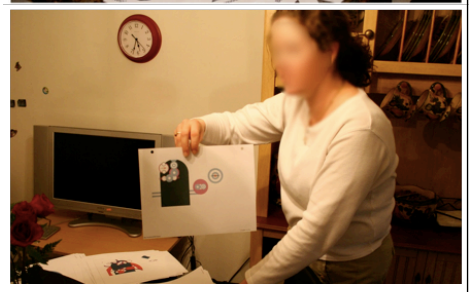
Romero, Pousman, Mateas

Romero, Pousman, Mateas

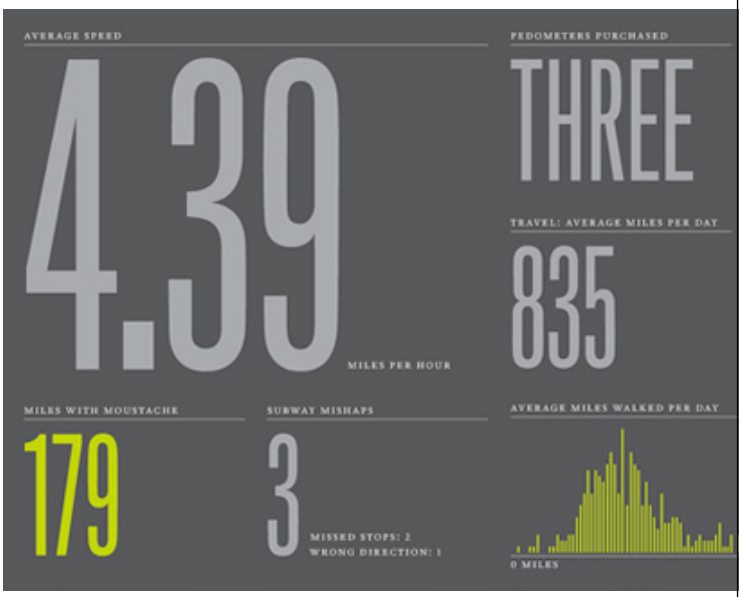


TM Evaluation (it's hard)

- 6-8 week deployments
- 3 houses
- Very different uses
- Games
- Printouts
- Generated discussion
- Generated reflection?



Feltron



Annual Report (2008)

Flags as infographics

Foote, Cone & Belding

Flags as infographics

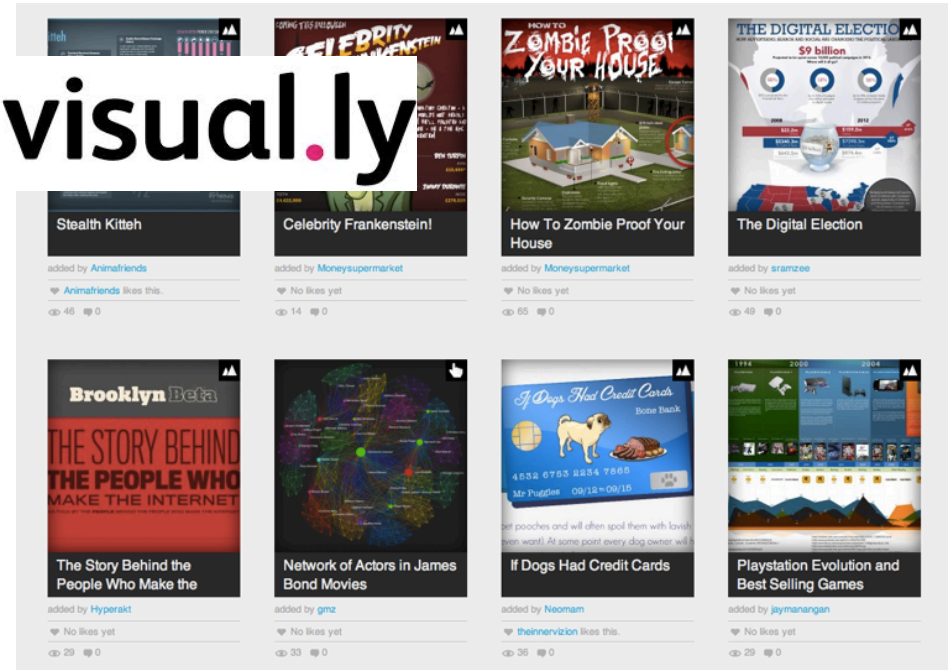
Foote, Cone & Belding

Flags as infographics

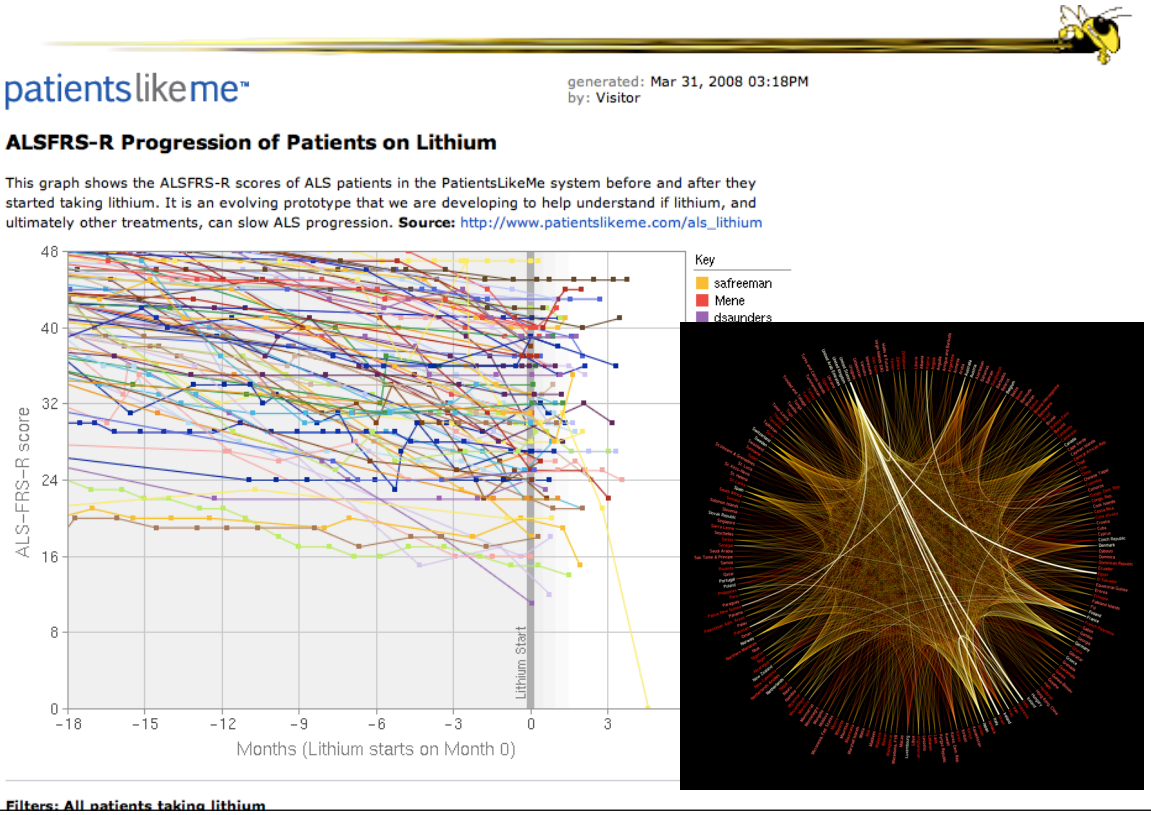
Foote, Cone & Belding

New communities

visual.ly



New communities



Ambient InfoVis

Objectives

- Systems so far
  - What is their purpose or objective?
    - High-level purpose or task
  - Analysis, Exploration, Learning
- Are there other high-level tasks that infovis can assist with?
  - Awareness, monitoring

Central idea

- People interpret images well
- As they say, a picture's worth thousand words … so use visualization for information awareness

Calm Technology

- Mark Weiser
  - "A calm technology will move easily from the periphery of our attention, to the center, and back."

Ambient Displays

- Conveys low- to medium-priority information to people, while residing in the periphery of their attention
- Other terms sometimes used
  - Peripheral display, notification system

Ambient Displays

- Purpose:
  - Information awareness, perhaps monitoring
- Focus:
  - Aesthetics

    Visually pleasing enhancement to surroundings

Other dimensions in the space

Information capacity

How much info can they transmit?

Notification level

Are they subtle or more attention-grabbing?

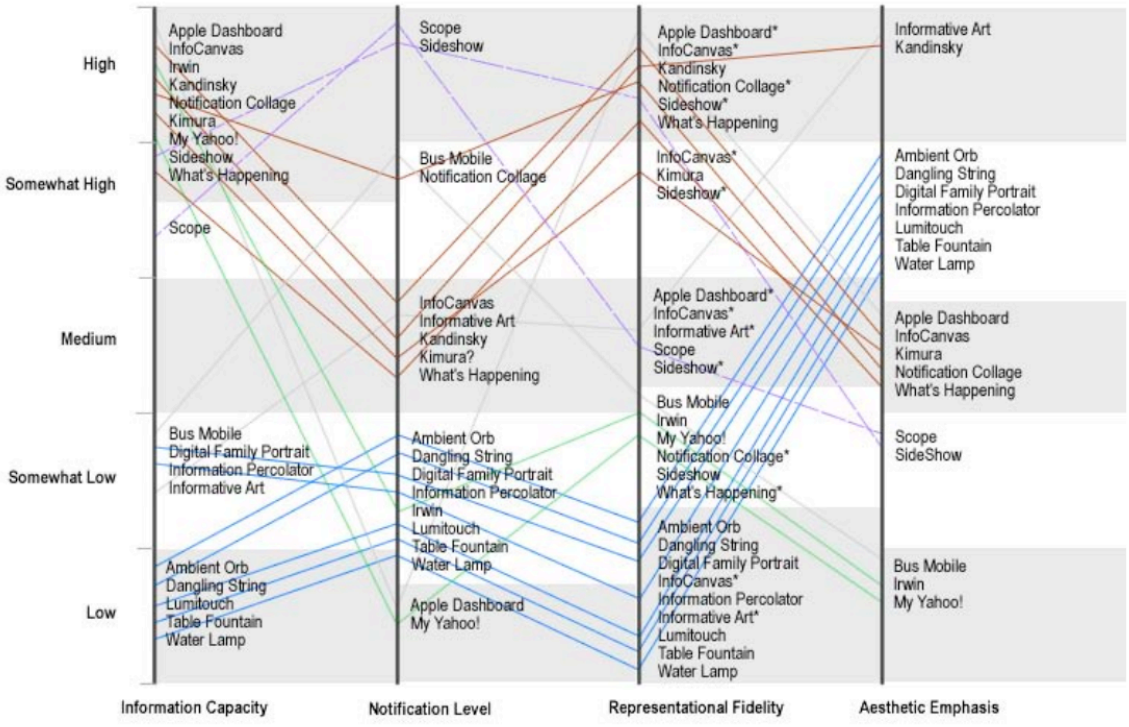
Representational Fidelity

Flexibility with regard to data mappings

Aesthetics

Visually pleasing enhancement to surroundings

Other dimensions in the space



Ambient InfoVis

- InfoVis off the desktop
- Still visually encoding information, but not for analytic purposes
  - Presenting the information in places where you're not doing "desktop computing"

Examples

- Let's look at some examples of ambient displays or ambient information visualizations

Dangling String

- Plastic spaghetti wire hanging from ceiling
- Hangs from motor in ceiling
- Electrically connected to ethernet cable so bits going by cause it to jiggle
- Created by artist Natalie Jeremijenko

Ambient Room

- Use variety of physical objects in office to communicate the state of relevant information
- Hiroshi Ishii's group at MIT

Wisneski et al
CoBuild '98

Karlsruhe Projects

Web awareness

Gellersen & Schmidt
Personal Technologies '99

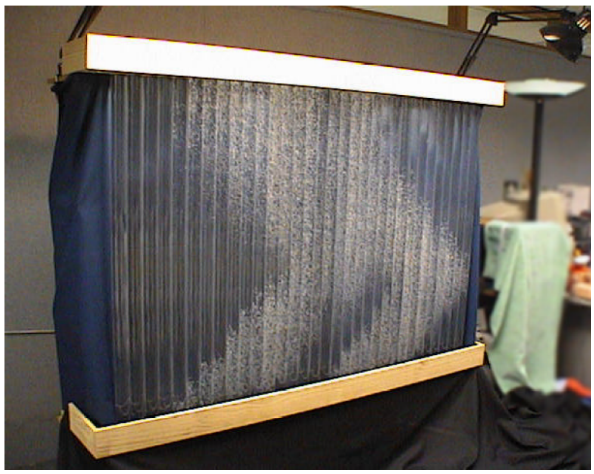
Lumitouch

- Touch one picture frame, the other lights up

Chang et al
CHI '01 Extended Abstracts

Information Percolator

- Fish tank with bubble controller
- Various messages can be sent in bubbles



Heiner et al
UIST '99

Busmobile, Weathermobile

Mankoff et al
CHI '03

Ambient Orb

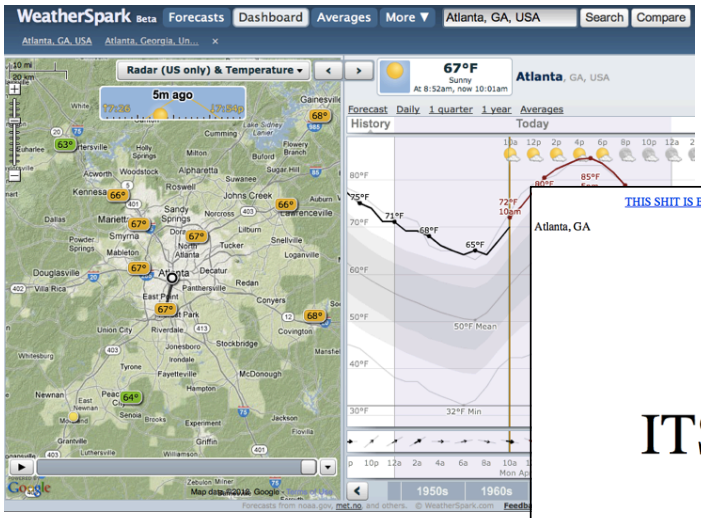
Monitor stock market data, weather, etc.

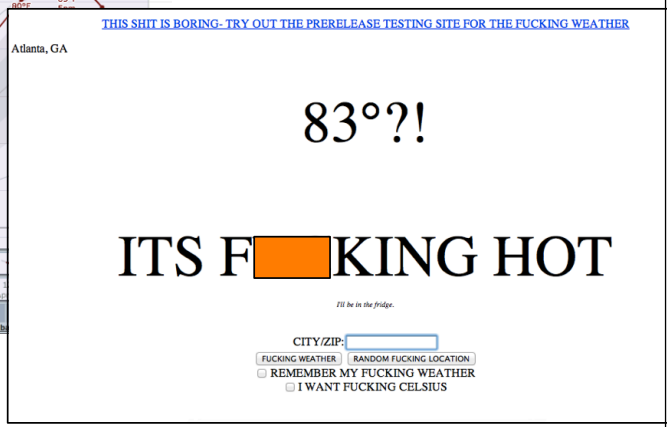
www.ambientdevices.com

Information

- Well, they are visually presenting information
- But perhaps not an emphasis on the information
  - More about peripherality, calmness, aesthetics

weatherspark vs the f**ing weather



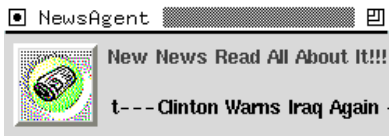


Other Styles

- Another set of techniques/systems focus less on aesthetics and more on the quality of information conveyance

Ticker Displays

- Animated text strings (ticker, fade, roll, blast) typically in periphery of person's monitor



Fitzpatrick et al
CHI '99 Extended Abstracts

McCrickard et al
IJHCS '03

What's Happening/The Buzz

Screen-saver or projected display using collages of images

Zhao & Stasko
AVI '02

Eagan & Stasko
CHI '08

Sideshow

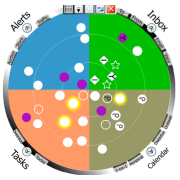
- Sidebar on edge of monitor
- Provides info on weather, traffic, presence, project status, etc.
- Can author new items
- From Microsoft

Cadiz et al
CSCW '02

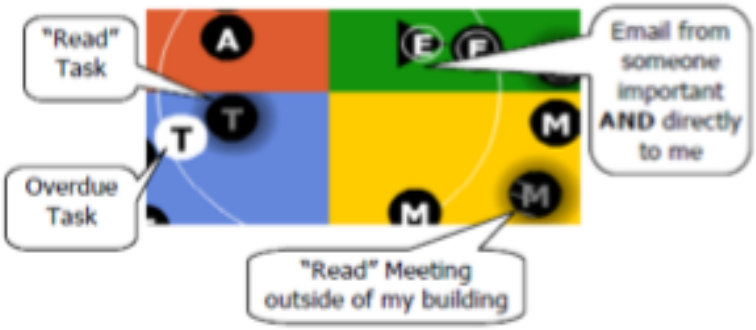
Scope

- Corner of the screen awareness widget to help with tasks, appts, etc.
- Glanceable awareness, more details on demand

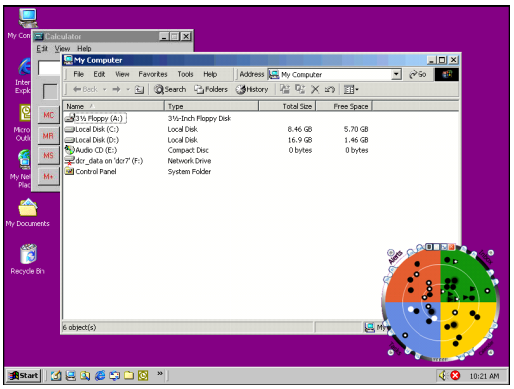
van Dantzich et al
AVI '02



Encoding

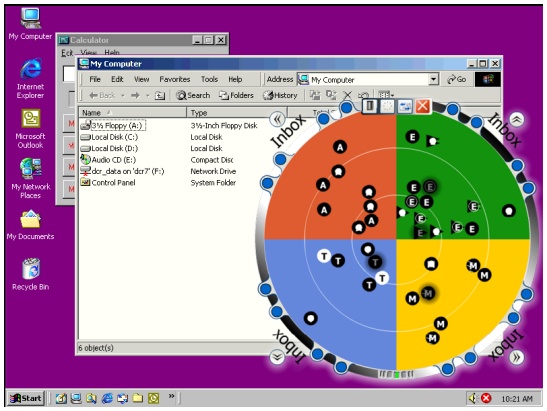


Ambience

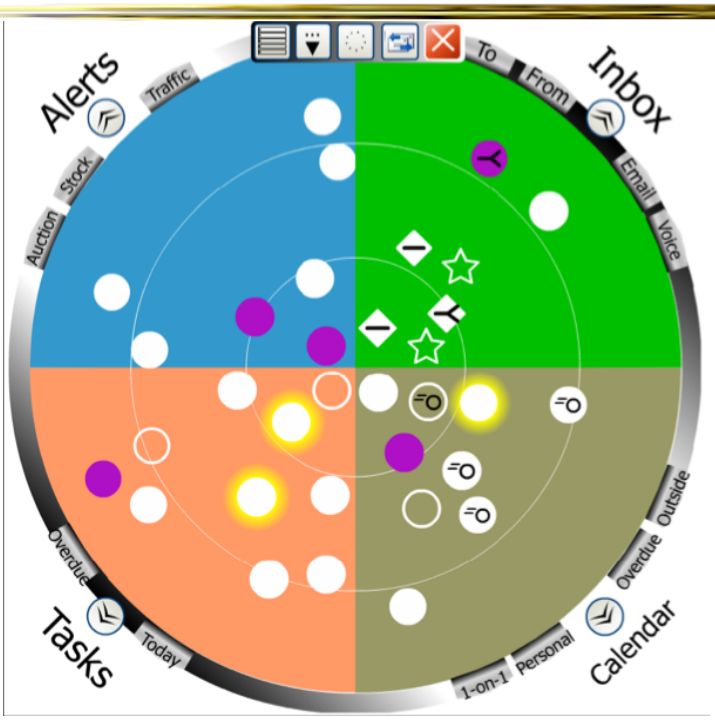


Low Level-of-Detail

High Level-of-Detail

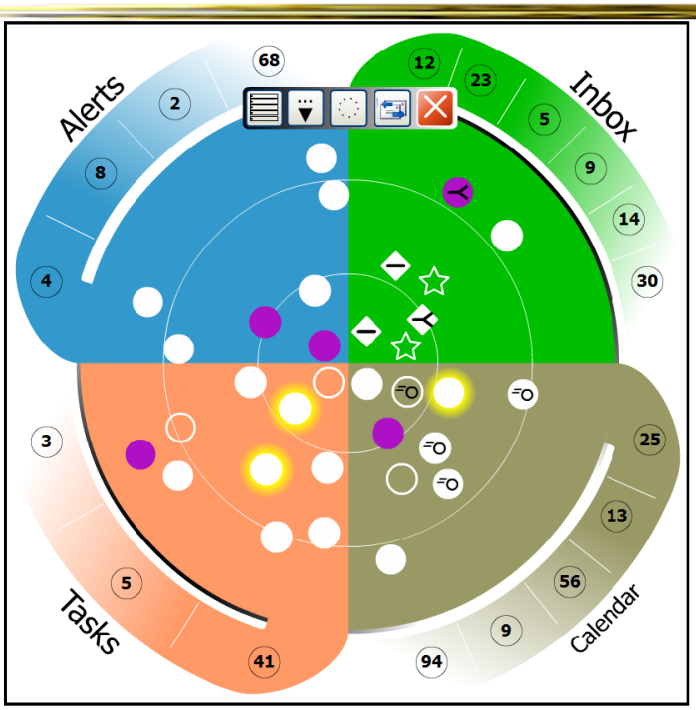


Redesign



Encoding

Round 3



Trade-off

Aesthetics — Utility

Kandinsky

- Generates aesthetic information collages
- Information Collage:
  Ambient information display of an object
- Aesthetic Template:
  Express Aesthetic concepts in visual form

Fogarty, Forlizzi & Hudson
UIST '02

System Architecture

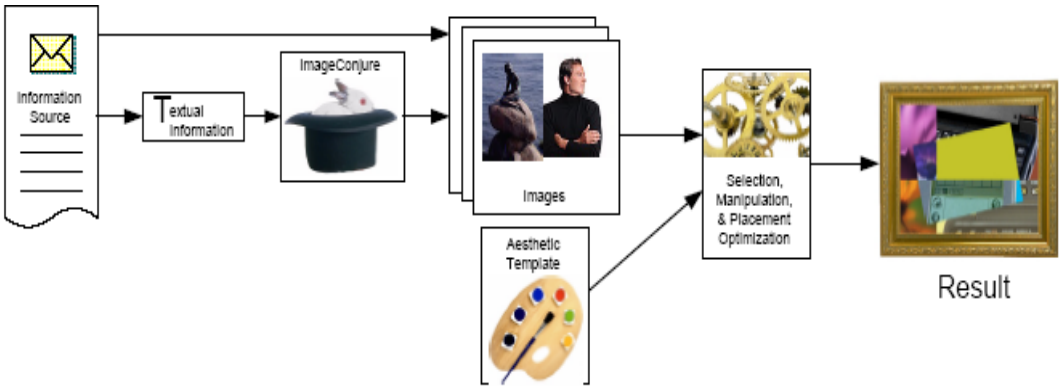
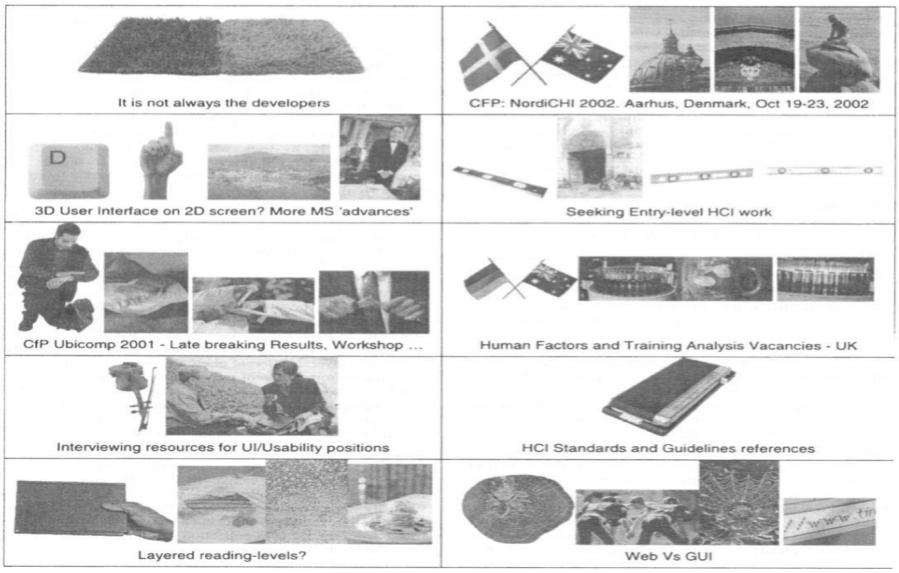


Figure 2. Architecture of the Kandinsky System

Representative Images

- ImageConjure subsystem
  - Converts text into representative images
  - Selects from large photo/clip art collections
  - Uses a textual summary; prepared by a person
  - Scores the images; returns the best matches

ImageConjure Results



From: PhotoDisc Inc. (24,000 images) and Hemera Inc. (50,000 images)

Optimization Process

- Configuration of components (selection of information images, placement within collage)
- Uses aesthetic templates and "temperature" parameter
- 4-Layered Regions
  - Fixed visual elements
  - Initial image selection and placement strategy
  - Evaluation criteria
  - Post-processing

Properties of Interest

Low-Level

- Color
- Texture
- Edges and Lines
- Direction
- Shape

High-Level

- Relative Contrast
- Dimensionality
- Balance
- Motion
- Stress

Example Generation

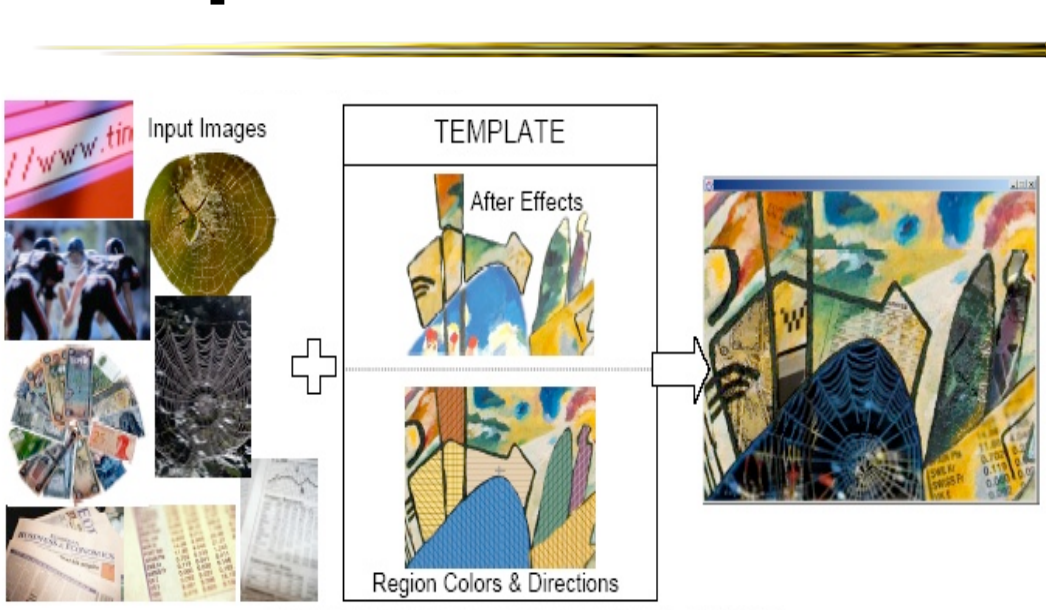


Figure 6. Example Images, Aesthetic Template, and Result

Summary

- Less information conveying, more aesthetic appeal

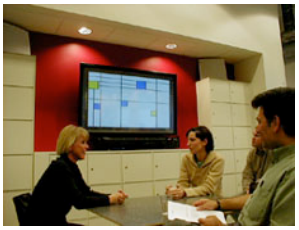
Figure 7. Example Results

Informative Art

- Electronic paintings–Flat panel LCDs hung on the wall
- Abstract art in which aspects of the picture change to signify underlying data values
- From Future Applications Lab, Viktoria Institute, Sweden

Redstrom et al
DARE '00

Skog et al
InfoVis '03

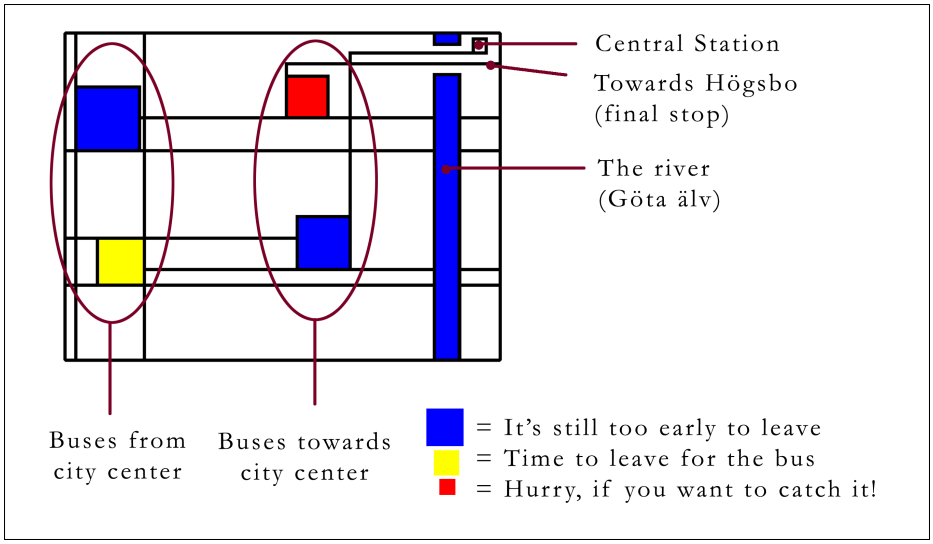


Design Criteria

- Communicate useful information
- Blend in with surroundings and be appealing to look at
- Minimize animation – Don't want to draw the eye too much

Example

Mondrian



Example

Andy Warhol

Cans gradually change from asparagus soup to tomato soup to signify upcoming event

Lessons Learned

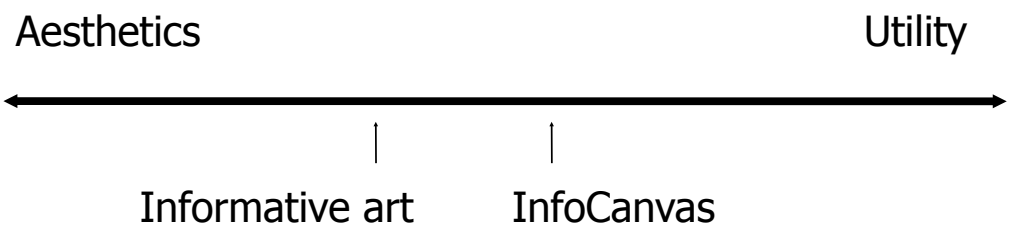
- Find info relevant to place where display is located
- Rate of change of info should be enough to promote relevance and draw interest
- Base visualization on artistic display, may support readability and promote comprehension
- Let features of info source affect visual encoding to improve memory of mapping

InfoCanvas

- Information Art–Similar approach as in Viktoria project
- Electronic painting deployed on LCDs in the environment
- Focus: User-driven views
- II group at Georgia Tech

Stasko et al
Ubicomp '04

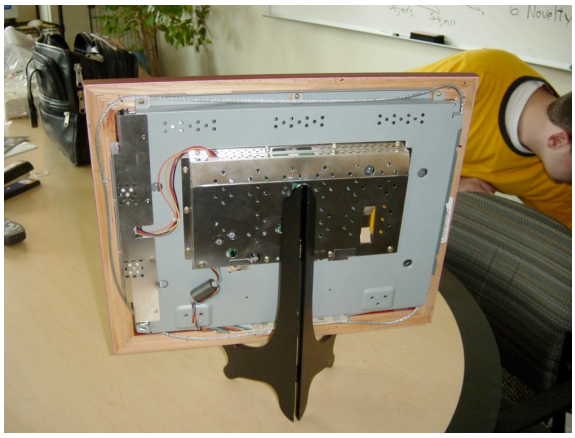
Revisit Trade-off



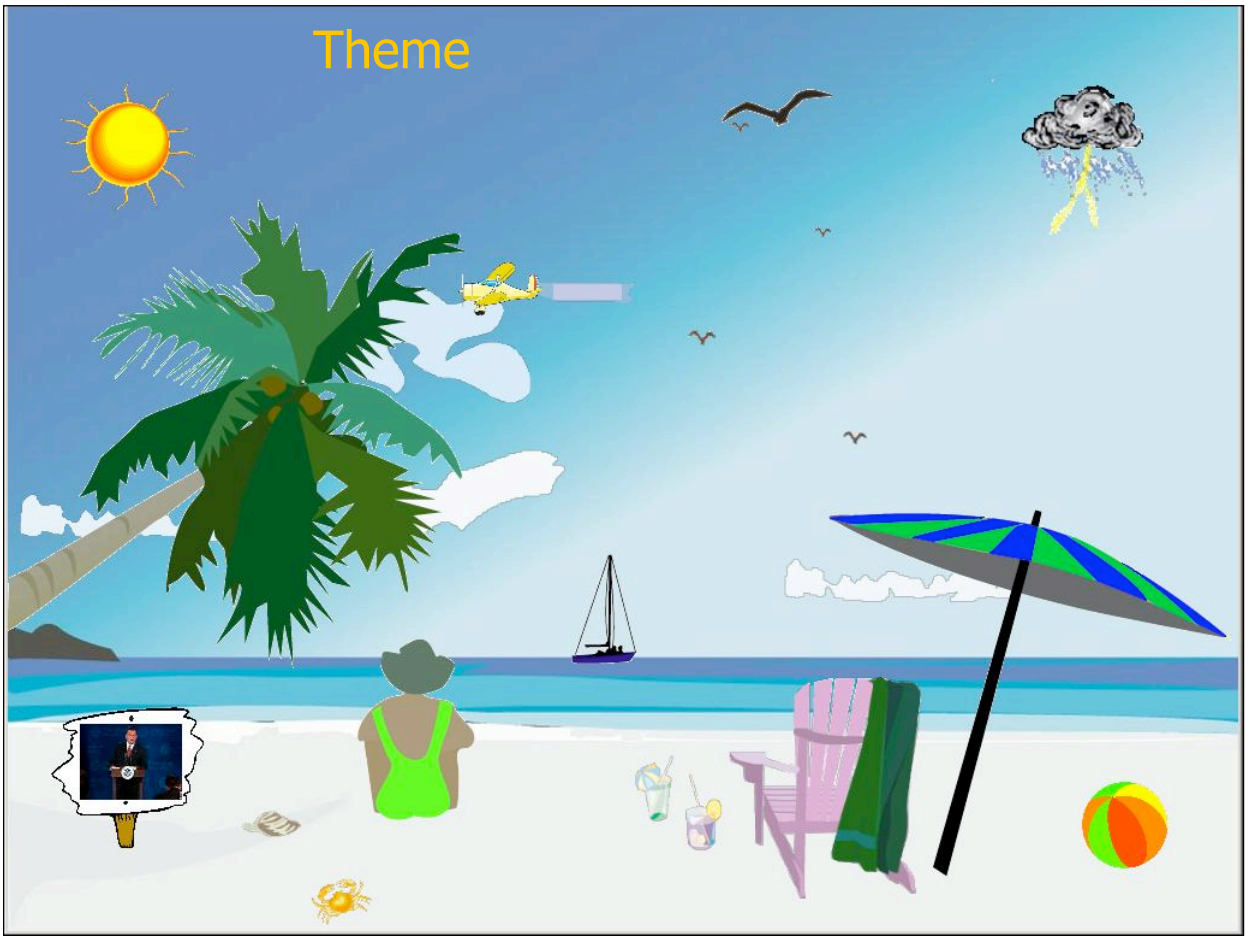
Objectives

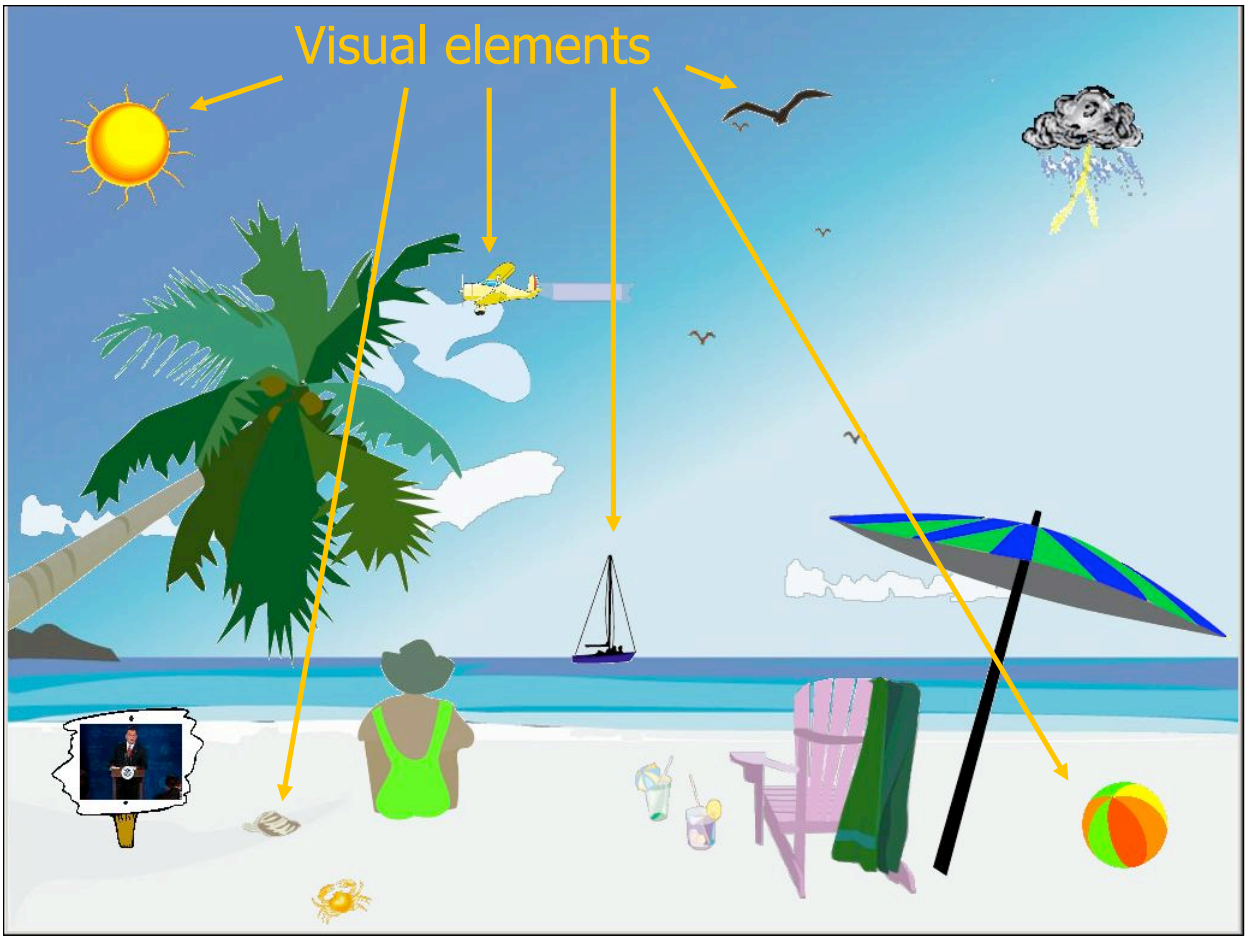
- Personalized
  - Display individual's personal information
- Flexible
  - Variety of info sources and representations
- Consolidated
  - Present multiple data items on one display
- Accurate
  - Be clear, and highlight uncertainty
- Appealing
  - Fun to use, aesthetically pleasing

Hardware



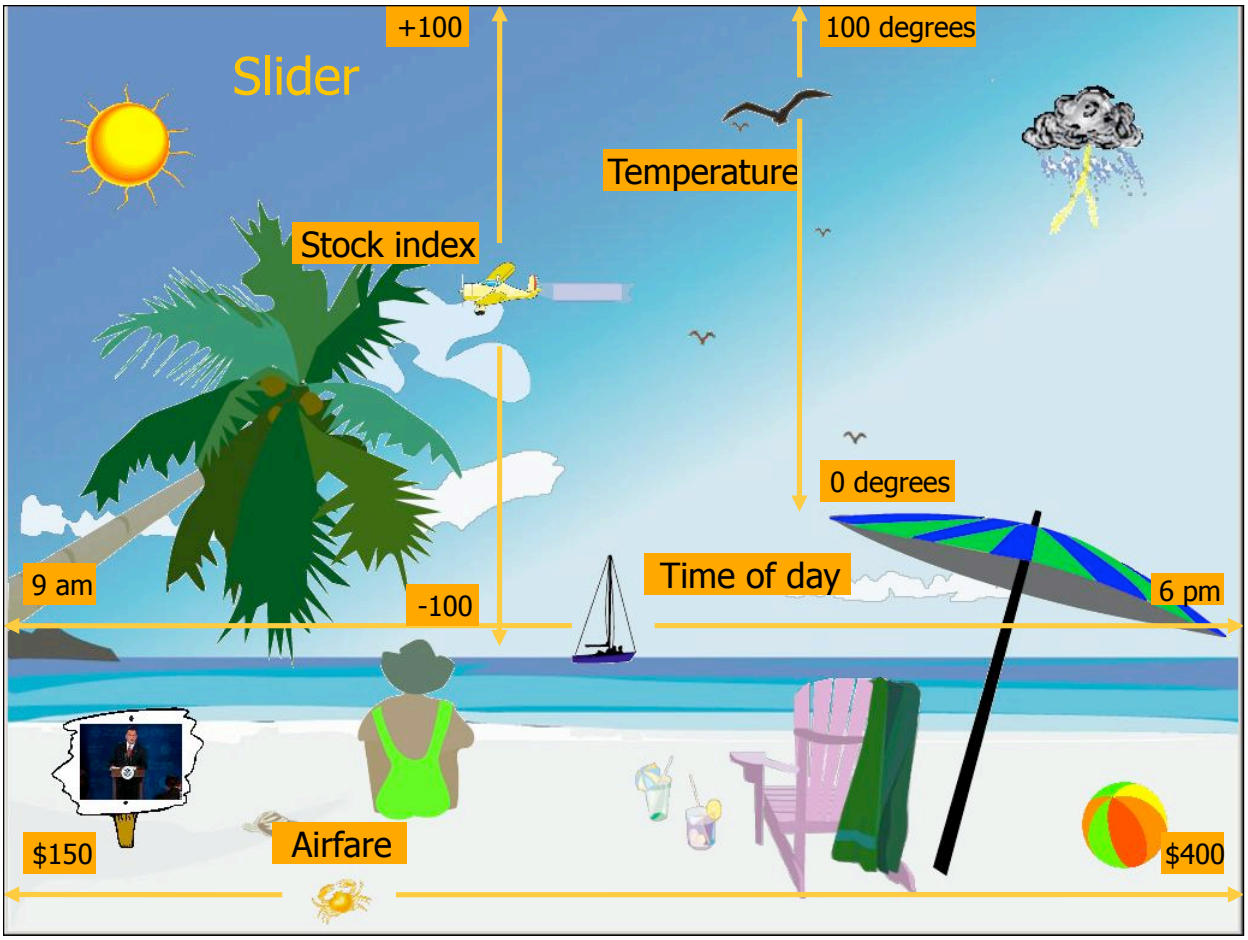
LCD – bezel + picture frame

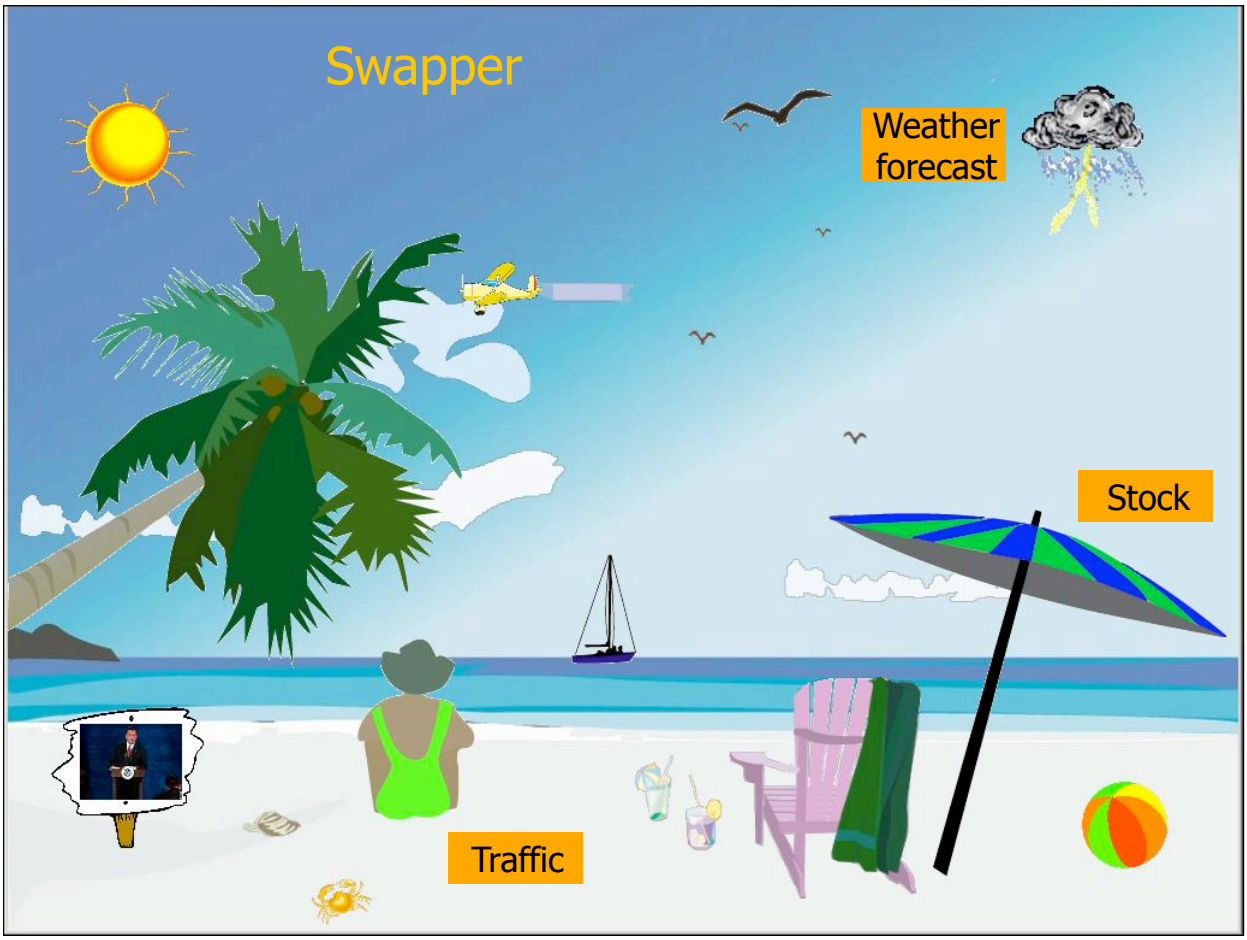


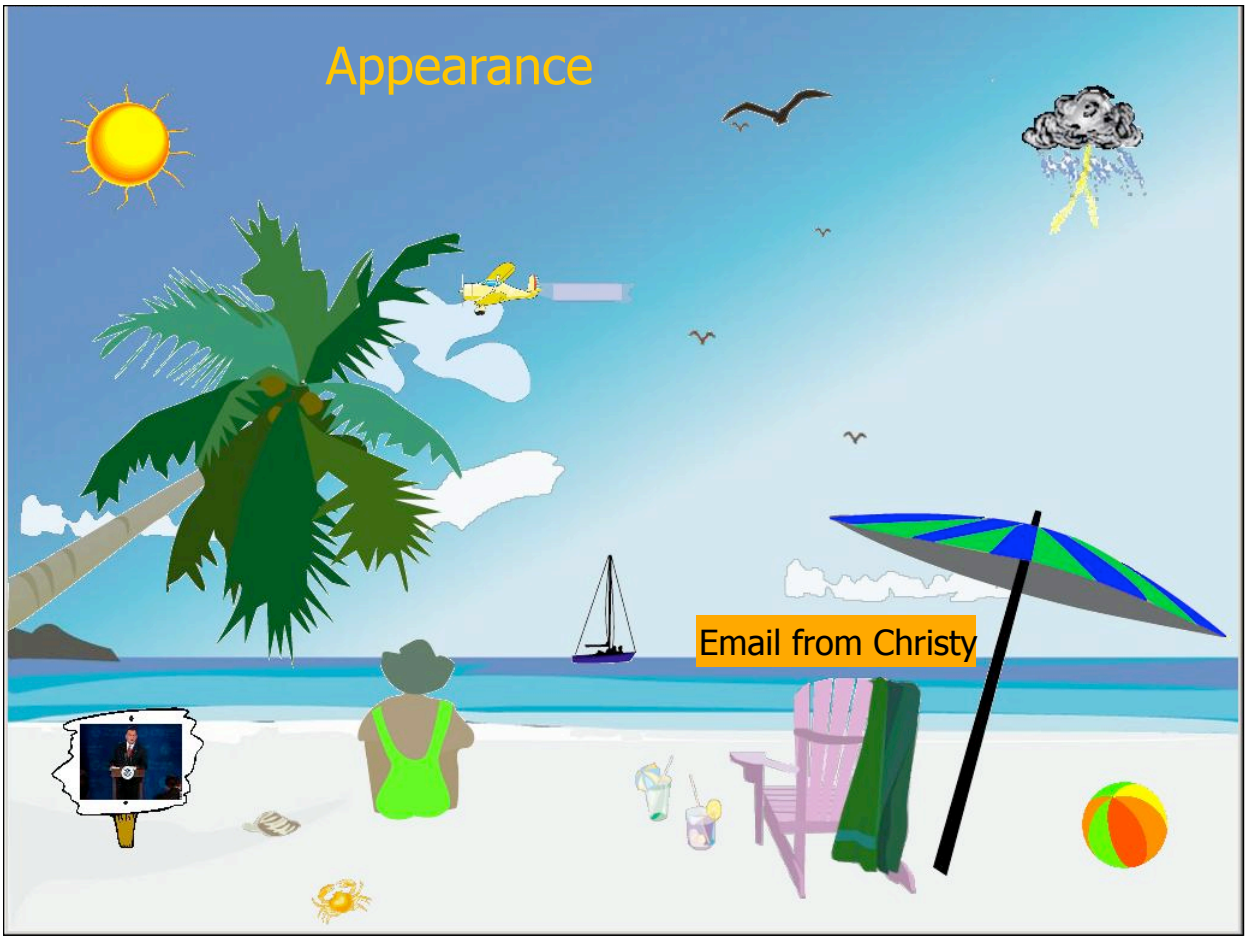


Transformations

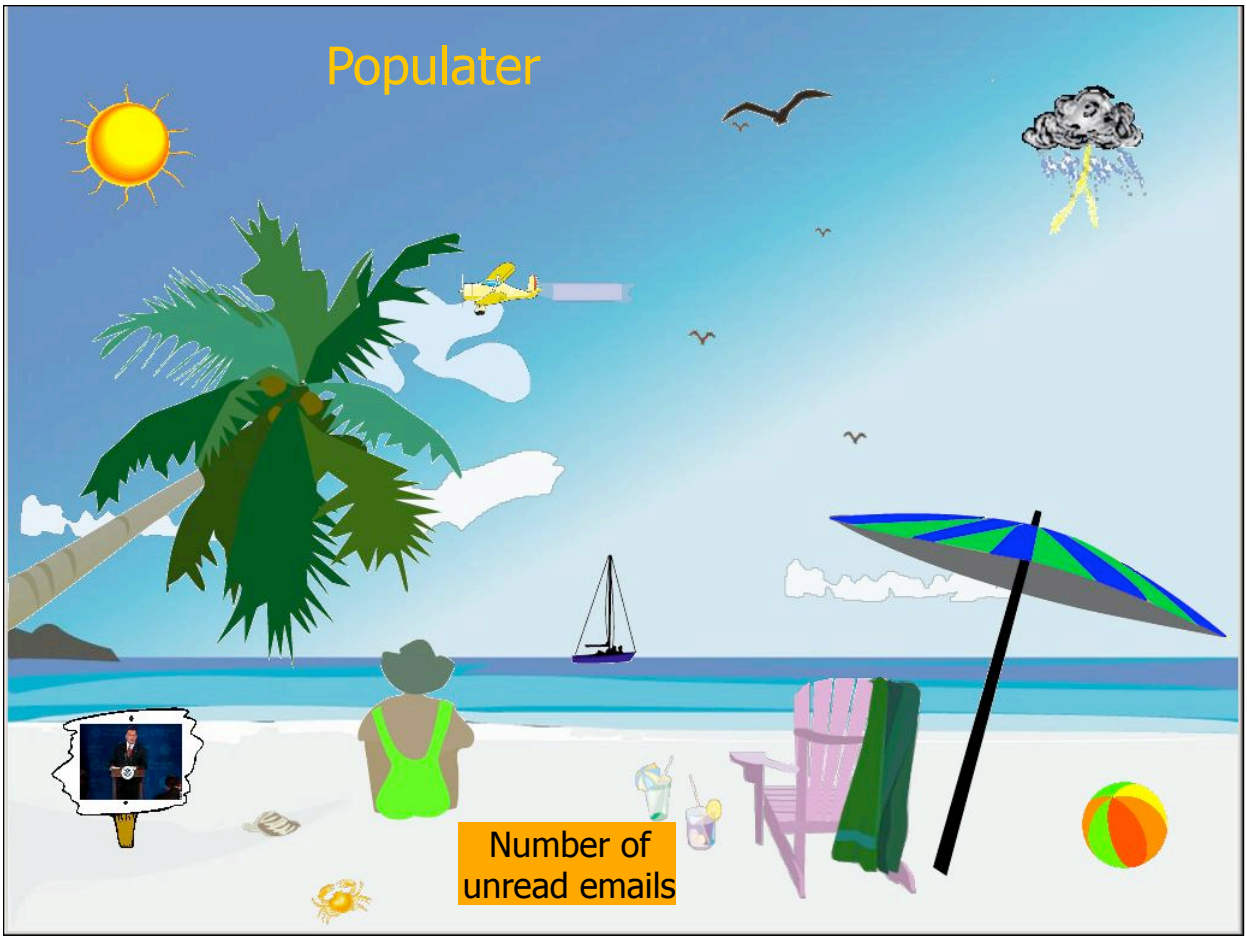
- Slider
- Image swapper
- Appearance
- Scaler
- Populater
- Projector


Slider
+100
100 degrees
Temperature
Stock index
0 degrees
9 am
-100
Time of day
6 pm
$150
Airfare
$400


Swapper
Weather forecast
Stock
Traffic


Appearance
Email from Christy


Scaler
Account balance


Populater
Number of unread emails


Projector
www.cnn.com

Other Example Themes

Fall 2012

Implementation

- Java application
- Data harvester classes
- Painting specified through XML file
- System establishes data->visual mapping and polls data sources to maintain current representation

canvas - Notepad

File Edit Format View Help

```
                <dimension><width>113</width><height>150</height></dimen
            </swap>
            <swap>
               <key>sleet</key><image>snowcloud.gif</image>
               <coordinate type="origin"><x>885</x><y>135</y></coordina
               <dimension><width>113</width><height>150</height></dimen
            </swap>
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               <key>snow</key><image>snowcloud.gif</image>
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               <dimension><width>113</width><height>150</height></dimen
            </swap>
         </swaptable>
      </representation>
   </object>



   <!-- CURRENT TEMPERATURE -->
   <!-- BIRD'S HEIGHT IN SKY -->
   <object type="active">
      <data get="Weather" with="curtemp">
           <harvesterdata>zip:30332</harvesterdata>
      </data>
      <representation type="slider">
         <image>gull_medium.gif</image>
         <coordinate type="start"><x>640</x><y>353</y></coordinate>
         <coordinate type="end"><x>640</x><y>5</y></coordinate>
         <dimension><width>92</width><height>31</height></dimension>
         <minval>20</minval>
         <maxval>100</maxval>
      </representation>
   </object>
```
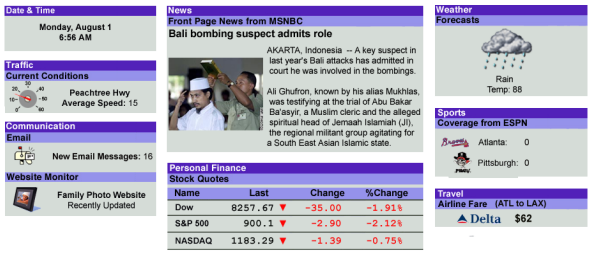

Evaluation: Laboratory

- Information Conveyance
  - Compare InfoCanvas to web portal to text display for acquisition and memory of different information sources
  - Evaluate viewing "at a glance"
  - Empirical study with 49 participants

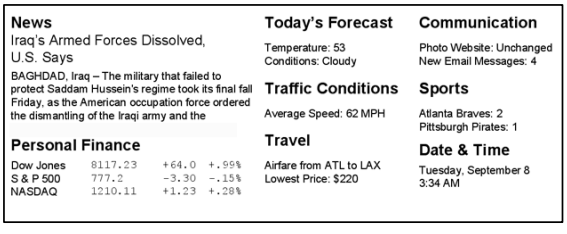
Plaue, Miller & Stasko
GI '04

Displays



Web portal

InfoCanvas



Text

Information Nuggets

time of day	weather forecast
temperature forecast	traffic conditions
stock update	airfare prices
website updates	new emails
baseball score update	news headline

Methodology

- Within subjects
- Participants view display for 8 seconds then receive questionnaire about state of 10 items
  - Vary order of topics on questionnaires
- Three trials with each display type

Recall Questions

What is the current time of day?
4:32 AM
7:40 AM
3:20 PM
7:55 PM

What is the current news headline?
Pair pleads not guilty to embezzlement
Pair pleads guilty to obstruction charges
Jury hung on money launderer
Couple found not guilty on conspiracy charge

What is the lowest airfare price from Atlanta to Los Angeles?
$330
$292
$160
$99

How many new emails were present?
22
16
1
0

Results

	1st Trial	2nd Trial	3rd Trial
	5.14 (1.59)	5.12 (1.33)	5.02 (1.57)
	5.67 (1.61)	5.65 (1.54)	5.29 (1.89)
	6.27 (1.80)	6.22 (1.79)	6.31 (1.76)

Statistical Significance for:
InfoCanvas over Web Portal
Web Portal over Text-Based
InfoCanvas over Text-Based

Results

- Statistically significantly more information recalled with InfoCanvas than portal and more with portal than text
- Pictures helped
  - Participants were able to rapidly learn mappings
  - Strange mappings didn't hurt

Evaluation

- Usage Study
  - Eight trial users ran system for a month
  - Selected own information to monitor and designed own scene from an existing theme
  - We implemented the view
  - Picture frame monitor deployed in office

Stasko et al
GVU TR

Evaluation Dimensions

- Usefulness
- Personalization and flexibility
- Aesthetics
- Distraction
- Novelty and fun
- Summary impressions

Results - General

- 6 themes chosen
- 6 – 17 visual elements
- Participants easily remembered mappings
- Swapper, slider, and image display were primary transformations
- More direct than abstract mappings, but significant amount of each
- Felt it was fun and useful

Usefulness

P1: "***I could just glance over*** and check out something without searching for it like going to Yahoo weather. It saved me time. It was quick. It was easy to learn for me, what things meant, kind of quick."

P6: "I like the fact that I can look at it in ***one quick glance*** and get it OK, then return to what I'm doing. With a website, I can take a half hour there."

P4: "It's ***useful without being irritating***…this doesn't feel heavy. Now of course one of the reasons it doesn't feel heavy is because it's sort of out of my normal line of sight. It's in a sort of natural place where when I lean back and I'm staring off so I can kind of get it. So my eyes kind of drift there through the natural course of things when I'm not particularly concentrating on something else. So it's been positive—it's been useful without being terribly distracting. It hasn't been distracting at all. It's there when I need it, but doesn't require me clicking and mousing."

Lessons Learned

- Ubiquitous computing technologies can operate effectively in the field
- Consolidating information is valuable
- Abstractness/symbolism can be beneficial
- "Push" technology merits reconsideration
- Personalization is important
- Better customization tools are needed

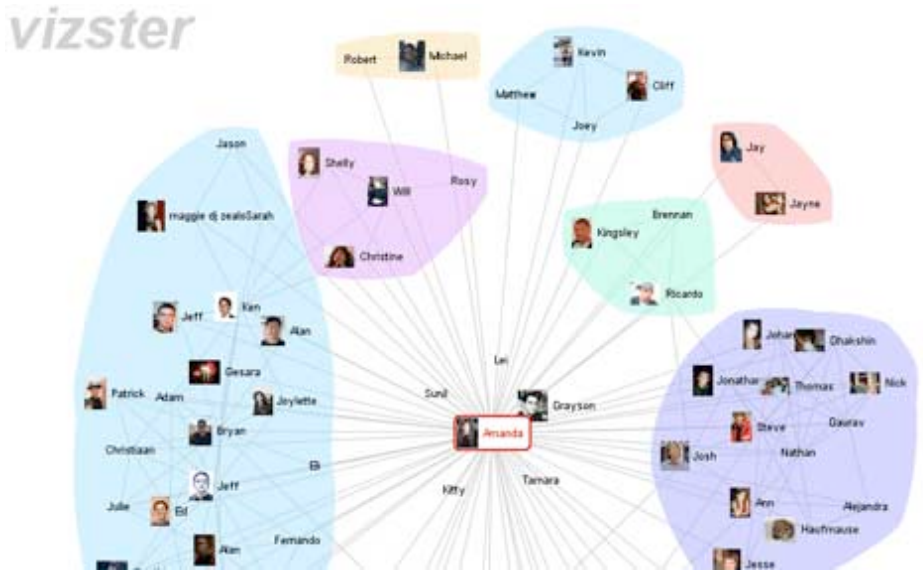
Social InfoVis

- Another big (and growing) area… let's just scratch the surface today. Next week, we'll devote an entire class to social infovis.

Xiong & Donath

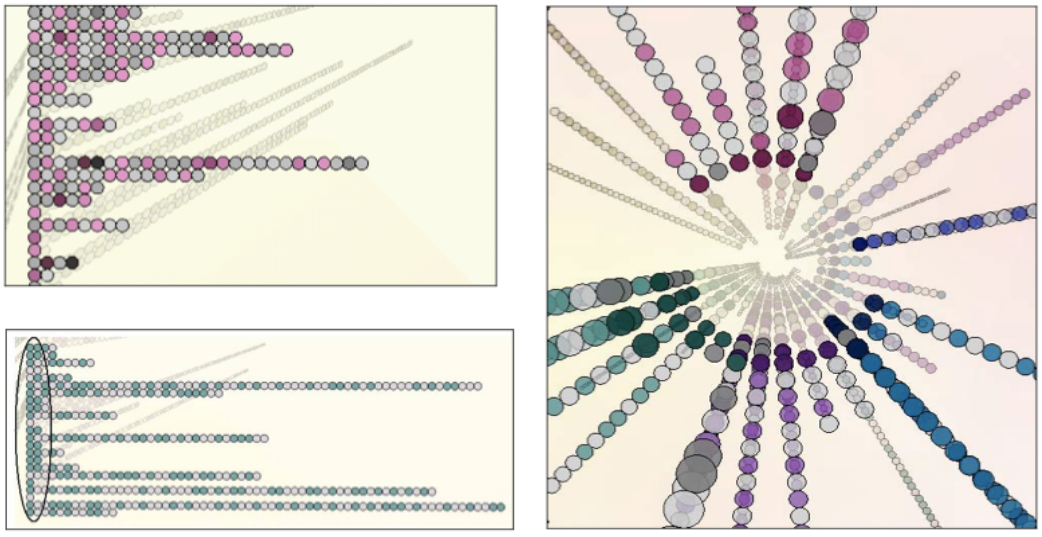
People Garden (1999)

Heer & Boyd



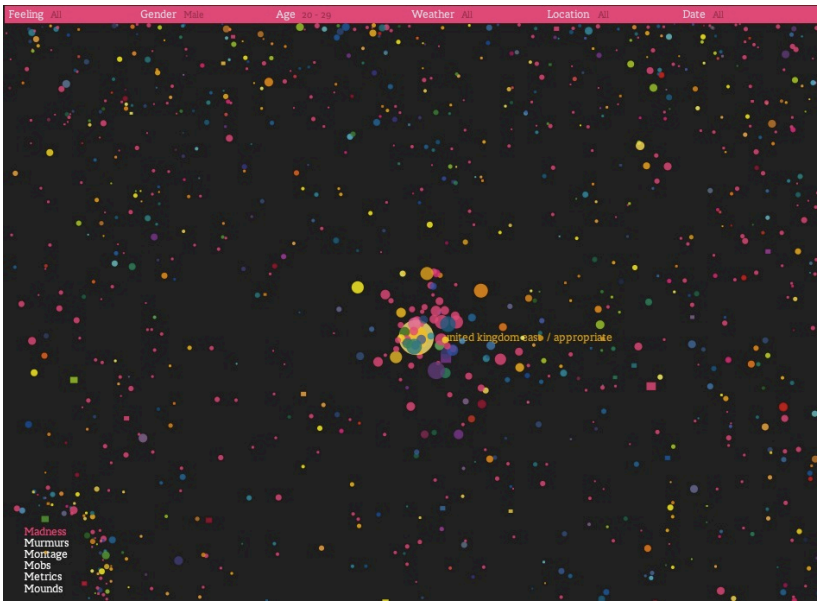
Vizster (2005)

Tat & Carpendale

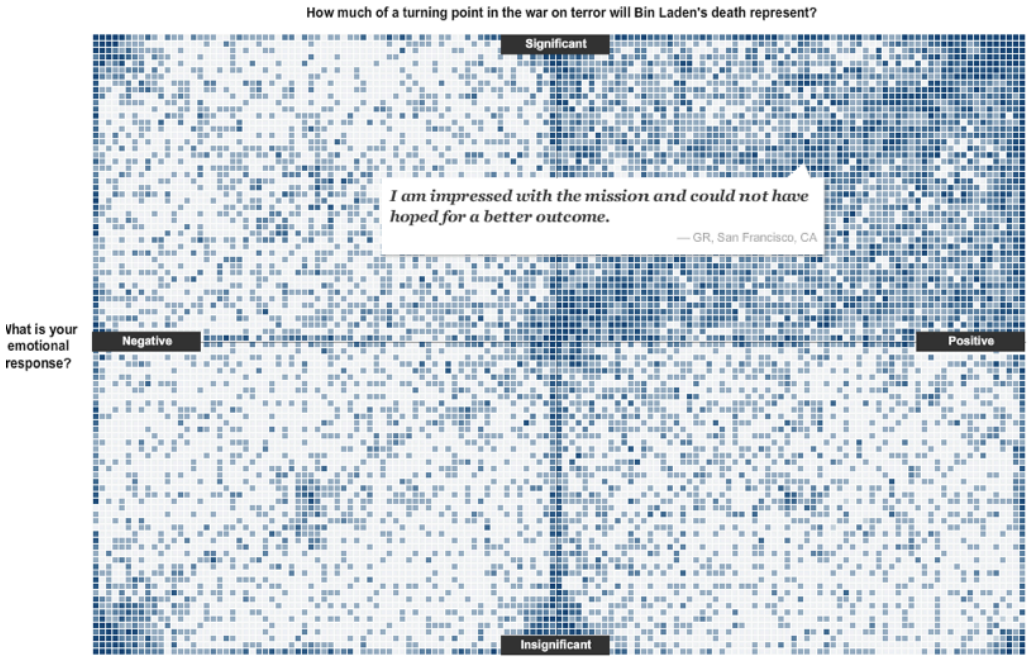


Crystal Chat system

Harris & Kemavar



'We Feel Fine' (2007)



In sum…

- Different kinds of 'insight'
  - Analytical insights (more traditional concept)
  - Reflective insights
  - Awareness insights
  - Social insight

In sum…

- Info Vis is moving into lots of life, not just desk work and data analysis by experts
  - News, commerce, story-telling, sociality
  - Self-reflection
  - One way to help manage information overload
- Requires a change to evaluation techniques (what matters is changing)
- Opens new design spaces

Thanks!