12. Ambient Information Visualization
Peripheral display of information

Vorlesung „Informationsvisualisierung”
Prof. Dr. Andreas Butz, WS 2011/12
Konzept und Basis für Folien: Thorsten Büring
Outline

• Ambient Information Visualization
• Show cases
• Taxonomy

• Organizational stuff
InfoVis vs Ambient InfoVis

• Traditional Information Visualization
  – „The use of computer-supported, interactive visual representations of abstract data to amplify cognition“ (Card et al. 1998)
  – Compress complex high-dimensional data while preserving a maximum of information
  – Scale to large amounts of data
  – Targeting work places of expert users (e.g. business analyst, chemists, ...)
  – Systems require to be in the focus of attention
  – Used for longer time periods
InfoVis vs Ambient InfoVis

• Ambient Information Visualization
  – Usually low level of interaction (if any)
  – Abstract summary of (often real-time) non-critical information bits (e.g., current stock price, weather forecast)
  – Embedded into the (physical or virtual) environment
  – Based on peripheral awareness - users can and should focus on their primary tasks
  – Usually non-distracting update of the visualization
  – Pre-attentive processing - users gather the information provided at a glance
  – Often artistic and aesthetic objectives

• Often used as synonyms: calm computing, ambient displays, peripheral displays, notification systems

• Works range from non-interactive physical informative art to interactive screen-based peripheral display of notification data
Informative Art

• Dangling string by artist Natalie Jeremijenko
  – 2.5m long plastic string hanging from the ceiling and providing information about network traffic
  – String is attached to a small electric motor connected to a nearby Ethernet cable
  – A busy network causes a madly whirling string with a characteristic noise
  – A quiet network causes the string to only twitch occasionally
  – [Link](http://sandbox.xerox.com/hypertext/weiser/calmtech/calmtech.htm)

• Smoker’s lamp by Galerie Quang
  – Smoke sensors
  – Light turns red by the exhalations of the cigarette smokers nearby
Ambient Orb + Umbrella

- Glass lamp showing stock market trends, weather forecast, local traffic via color encoding
- Umbrella handle showing weather forecast
- http://www.ambientdevices.com
More ambient concepts

- Conceptual ambient displays presented by David Rose in his keynote talk at the Ambient Information Systems Workshop (Pervasive 2007)
  

- Google clock
  - Integrates with Google calendar
  - Shows appointments of the day
  - Background-color changes from blue over yellow to orange to alert people to the beginning & end of events.

- Wallet
  - Notifications of special offers
  - State of your credit card accounts (?)
  - Not sure I want that information...
Ambient Room

- Ishii et al. 1998
- Physical architectural space to serve as an interface between humans and digital informations
- Display multiple sources of information in the background of awareness
- Humans can monitor these sources concurrently
- Example mappings
  - Activity level of distant person / animal shown as water ripples projected to the ceiling (water lamp)
  - Network traffic represented by different levels of vehicle noise - played on demand by uncorking a bottle
Bus Mobile

- Mankoff 2003
- Provides information about bus lines approaching a bus stop
- Busses are represented by paper tokens labelled with bus numbers
- Tokens hang from a „white screen“ - a bag
- A bus remains out of sight under the white screen until it is less than 25 minutes away from the bus stop
- Then it moves down to the lowest possible depth in order to start its “approach“
Informative Art

- Holmquist & Skog 2003
- Borrows the styles of modern artists to encode information
- Example 1: weather display inspired by Piet Mondriaan
  - Each colored square represents a city
    - Top row, from left to right: Los Angeles, Göteborg, Tokyo
    - Bottom row: Rio de Janeiro, Cape Town, Sydney
- Size of the square: temperature (the bigger the hotter)
- Color of the square: current weather condition, yellow: sunny, red: cloudy, blue: rain
Informative Art

- Example 2: soup clock / egg-timer inspired by Andy Warhol
- Two flavors of Campbell soup can: asparagus soup (yellow) and tomato soup (red)
- When starting the clock, all cans are yellow
- While time passes by the asparagus cans are more and more replaced by red tomato soup cans
Digital Family Portrait

- Mynatt et al. 2001
- Provides qualitative visualizations of a family member’s daily life
- Attempts to capture the observations that would naturally occur to someone living next door or in the same home
- Four sides of the frame map to four variables
  - Events, e.g. planned and unplanned events, special occasions
  - Relationships, e.g. phone calls, letters written etc.
  - Activities: physical movement
  - Health: eat healthy, get exercise etc.
Digital Family Portrait

- Each side has 3 layers of time represented by 3 bands
  - Inner band: the current day
  - Middle band: average of previous three days (before today)
  - Outermost band: average of previous seven days
- Redundant time encodings: size of icons, color shading
- Each variable has 10 levels of measurement
- Represented by density of icons
- Different icon styles matching people’s gender and age
- Field trial with web-based portrait and manual measuring
- Result: too complex design, misinterpretation of encoded information, but: users reacted very positive to the idea of a dynamic picture frame
- Redesign reducing the information load
The Whereabouts Clock

- [Sellen et al. CHI 2006], prototype!
- Displays where all family members currently are
- Clock metaphor:
  - positioned in a useful, visible place
  - broadcasts info to everybody
  - only visible in the home
  - coarse grained info at a glance
    - a person is either home, at school/work, or „out“ without further details
- Technical basis: cell phone data
  - sends SMS when entering/leaving a zone
  - user can add text if needed
InfoCanvas

- Miller & Stasko 2003
- Abstract pictorial representation of awareness information
- Presented as a painting hung on a wall or a picture frame set on a desk
- Highly customizable display: the user maps each element of a scene to an information source
- Individual mappings also allow for privacy
Scope

- Dantzich et al. 2002, MS Research
- Glanceable notification summarizer
- Shows notifications from e-mail, task manager, information alerts, and appointments
- Circular radar-like screen divided into sectors that group different kinds of notifications
- The more urgent a notification is, the more it moves to the center
- Additional visual attributes of icons are used to encode further notification properties
- Users can magnify areas and drill down on items
Sideshow

- Cadiz et al. 2002, MS Research
- Sidebar on the screen
- Shows weather, traffic, stock market, presence, project status, etc.
- Provides additional alert windows
- Allows for information drill-down

Figure 3: Two types of alert windows provided by Sideshow. When new mail arrives or when a bug of interest changes, a window fades in with a summary of the information. Users can click on the alert window to get more information.
Widget and Feed Collections

- Provides awareness of information
- Is this still ambient information visualization?
Taxonomy of Ambient InfoVis

• Pousman & Stasko 2006
• Based on 19 systems
• Design Dimensions
  – Information capacity
  – Notification level
  – Representational fidelity
  – Aesthetic emphasis
• Design Patterns
  – Symbolic sculptural displays
  – Multiple information consolidator archetype
  – Information monitor display archetype
  – High-throughput textual display archetype
Information Capacity

• Number of information elements that are displayed

• Information capacity can be increased by devoting more space for visualizing information and/or by transitioning through a set of views over time (e.g. automatic slide show, scrolling)

• Problem: too many information sources decrease the „view at a glance“ objective

• Observation
  – Systems with low information capacity are typically physical displays
  – Systems with high information capacity are typically screen-based
Notification Level

• Degree to which system alerts are meant to interrupt a user
  – Demand attention (e.g. system dialog window)
  – Interrupt (e.g. alarm)
  – Make aware (e.g. flashing)
  – Change blind (see lecture on perception)
  – User poll (user receives information on-demand, e.g. Apple Dashboard, My Yahoo)

• In adherence to the objective of peripheral awareness most systems fall into the „Change blind“ and „Make aware categories“
Representational Fidelity

• Degree of concreteness / abstractness of information display
  – Indexical (concrete): photographs, measuring instruments, maps, descriptive text segments
  – Iconic: drawings, doodles, caricatures
  – Iconic: metaphors
  – Symbolic: language symbols (letters and numbers)
  – Symbolic: abstract symbols

• Systems marked with an * are present in more than one category

• Systems featuring physical displays usually focus on abstract symbols
Aesthetic Emphasis

• Degree to which the system designers focussed on aesthetic considerations (very subjective)
• Does not / cannot measure how successful the designers were at doing so
• Most systems have medium to high degrees of aesthetic emphasis
Design Patterns

- Clustering in PCP (emphasized by color) remain four main archetypes of ambient InfoVis systems.
Design Patterns

• Symbolic sculptural displays
  – Display few information elements - often a single element
  – Abstract information representation, often sculptural
  – Intended to be decorative objects - highly aesthetic
  – Examples: Family Portrait, ambient orb, dangling string

• Multiple information consolidator archetype
  – Display many individual information elements in a consolidated manner
  – Typically screen-based
  – Make users aware of changes, often through blinking of elements
  – Reasonably decorative for the benefit of customization and information capacity
  – Examples: InfoCanvas
Design Patterns

• Information monitor display archetype
  – Peripheral part of a user’s computer desktop
  – Visualize multiple sources of information, often via visual metaphors
  – Offer multiple notification mechanisms of different strengths
  – Achieve aesthetics but it is not their main focus
  – Example: Sideshow

• High-throughput textual display archetype
  – Represent voluminous information by using text and icons
  – No interruption-level notification
  – Focus on information conveyance
  – Example: My Yahoo!
The End
Final exam

• 7.2. (in a week), 10:00-12:00
• registration until 3.2.
• Hörsaal B 138 in Theresienstr. 39

• open book
  – can use the script (slide printouts and own notes)
  – can use a (printed) dictionary if needed
  – must not use anything with internet access or which computes
    • except a pocket calculator!
  – bring ID and student ID