Ambient and Artistic Visualization of Residential Resource Use
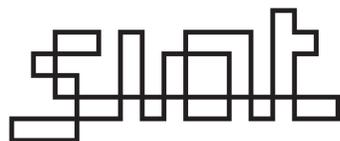
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AN ALTERNATIVE APPROACH TO FEEDBACK

Supporting sustainable resource use in the home requires a range of feedback techniques to enable informed decision-making. These techniques can include traditional screen-based interfaces, but these tools often require too much effort and attention from already-busy residents. An alternative approach is the provision of ambient and artistic visualizations integrated into the domestic environment. This method reduces the attention required of residents, increases aesthetic interest and coherence with the home, and enables situated and timely feedback on resource use.

AMBIENT AND ARTISTIC?

Many interrelated definitions exist to describe ambient and artistic approaches to information visualization. We base our inquiry on the following:

AMBIENT INFORMATION SYSTEMS [3]
• Display information that is important but not critical
• Can move from the periphery to the focus of attention and back again
• Focus on the tangible; representations in the environment
• Provide subtle changes to reflect updates in information (should not be distracting)
• Are aesthetically pleasing and environmentally appropriate

PERIPHERAL DISPLAYS [2]
• Allow a person to be aware of information without being overburdened by it
• Require minimal attention and cognitive effort
• Are not part of a user's primary activity

ARTISTIC VISUALIZATION [1]
• Goal is to communicate a concern, rather than to show data
• Transforms data into something visible and interesting
• May not be immediately recognizable or readable as information visualization
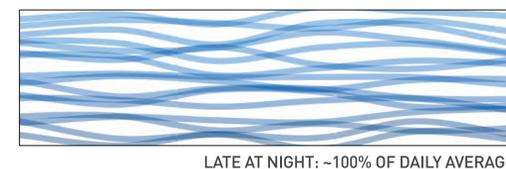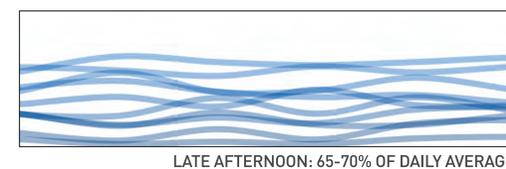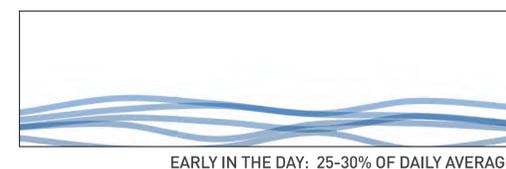
INFORMATIVE ART [4]
• Resides in the environment, rather than on a screen
• Must balance aesthetic appeal and usefulness
• Will be "lived with rather than used"

THE AMBIENT CANVAS

Ambient Canvas Prototypes [clockwise from left]: Version 2 in West House, Version 1 in North House, and a 3D rendering of the version 1 concept. Each prototype utilizes LED strings mounted behind a transmission medium (glass, acrylic, or Corian®) embedded in the kitchen backsplash.

• informative art to provide feedback on residential resource use
• provides feedback through the display of light
• subtle feedback does not require active attention
• integrates into the home cohesively and beautifully
• promotes awareness to enable sustainable decision-making

EARLY IN THE DAY: 25-30% OF DAILY AVERAGE

LATE AFTERNOON: 65-70% OF DAILY AVERAGE

LATE AT NIGHT: ~100% OF DAILY AVERAGE

The Ambient Canvas can be configured to provide feedback on energy use. First, a baseline of typical use is established using collected sensor data. Then, as residents go about their daily activities, the LED strings light up and fill the Canvas to indicate cumulative use against the baseline, as shown in the figures at left. The intent is to enable residents to gain awareness of their energy use and adjust their activities over time, continually 'competing' against their own self-adjusting baseline of use.

INFORMATIVE ART APPROACHES

A pilot study was run to assess different representations of water use conveyed through informative art. Different designs were deployed in digital photo frames and studied in the homes of five participants ranging in age from 41 to 90.


Informative Art for Household Water Use: The melting glacier design is oriented from low water use at left to high water use at right.

The study aimed to evaluate a variety of visualization designs in terms of their environmental appropriateness, and to determine effective information mapping.

PRELIMINARY FINDINGS

• All participants associated the largest amount of water visualized with high consumption, as opposed to water availability. In the case of the lake landscape (right), this was opposite to the intended mapping.
• Participants demonstrated a preference for placement of the photo frames in a central location in the home, such as the kitchen.
• Participants preferred artistic representations to bar and line graphs showing the same data.
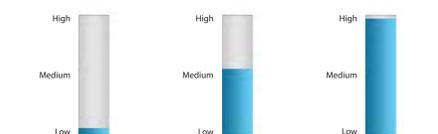
A variety of designs were tested, including bar charts, waterfall photographs, and a lake landscape. Each was oriented from low to high water use from left to right. However, interpretations of each design varied considerably between participants, indicating that these mappings are ambiguous.

REFERENCES

[1] R. Kosara, "Visualization Criticism—The Missing Link Between Information Visualization and Art," Proc. InfoVis, pp. 631–636, 2007.
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[3] Z. Pousman and J. Stasko, "A Taxonomy of Ambient Information Systems: Four Patterns of Design," Proc. AVI, pp. 67-74, 2006.
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ACKNOWLEDGEMENTS