

The RayMatic: A Thermostat with a Human Face

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ABSTRACT

This paper presents the concept and the design of an ambient display with an anthropomorphic interface to communicate environmental data. Numeric display and control, as in a thermostat, is replaced by a digital interactive portrait with the aim of making interaction engaging and undemanding.

Author Keywords

Tangible interface, facial expression, gesture, ambient display, user interface, ubiquitous computing, awareness

ACM Classification Keywords

H5.m. Information interfaces & presentation (e.g., HCI): Miscellaneous

General Terms

Design

AMBIENT DISPLAYS & ANTHROPOMORPHIC INTERACTION

The RayMatic, a thermostat with a human face, illustrates a class of anthropomorphic machines that use facial expressions to indicate the machine's internal state. We attempted to make a thermostat control more interesting, fun, and friendly than the typical numeric display.

Many meters such as thermometers, barometers, and air pollution meters display values as numbers, which users must read and interpret. When precise information is needed then numeric displays are important. However sometimes only approximate information is desired; then a numeric display needlessly demands attention.

Early human-computer communication employed command-based interfaces [1] but today human-to-human communication modalities are becoming increasingly common. Anthropomorphizing the interface adds human characteristics such as appearance, voice, gesture, affect, and so on. The human face is among the most compelling

components and has played an important role in computer interfaces since the early days of HCI. Our RayMatic interface to a simple household appliance, the home heating/cooling system, demonstrates how such an interface can be engaging, amusing, and playful.

RayMatic has two principal characteristics: it is anthropomorphic and it is an ambient display. An anthropomorphic interface such as an interface agent, guide, or wizard interacts using voice, gesture and facial expression. Employing a face to represent an agent has been shown to increase engagement and motivation and makes a user pay more attention [2].

Ambient displays inform people without demanding attention. For example, the well-known Ambient Orb™ device (<http://www.ambientdevices.com/cat/orb>) is a frosted glass sphere containing a bicolor LED. Its hue depends on changes with information that the Orb receives, such as weather conditions or stock market performance. A user can track real time information merely by glancing at the color of the Orb.

THE RAYMATIC

The RayMatic is a thermostat in the form of an interactive wall-mounted photograph: It appears to be an ordinary picture frame on the wall (Figure 1a). It's mildly amusing—when you tap Ray in the face, his head pushes back and he turns away as though responding to your tapping. More seriously though, the RayMatic is actually part of the home heating and cooling (HVAC) system. If the room is too hot or too cold the image of Ray in the frame fans himself or shivers (Figure 2).



Figure 1. a) RayMatic is a playful interface to a home heating system. b) Adjusting the set-point on the RayMatic.

When the user taps Ray's shoulder area (Figure 1a), the device enters setting mode and allows the user to see numeric values and adjust their preferred range (Figure 1b). Figure 2 shows all states of the RayMatic.

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The RayMatic prototype is implemented using Flash with Actionscript 3.0. I took videos of myself: smiling (good state), shivering and wearing a scarf (cold state), fanning myself (hot state), being pushed (touch state), and doing nothing (neutral state). When the system detects a change in temperature through a temperature sensor (LM35DZ) connected to an Arduino microcontroller board, it signals Flash via a socket (TinkerProxy). The Flash program uses this value as an input and plays a corresponding movie clip in the RayMatic frame. 3M™ MicroTouch™ M1700SS Display allows users to interact with the agent in the picture frame by touching.



Figure 2: RayMatic conveys messages through facial expression, corresponding to ambient conditions:
(Clockwise) Doing nothing (default state), smiling (good state), being pushed (touch state), fanning himself (hot state), shivering and wearing a scarf (cold state), and setting mode.

DISCUSSION

Walker, Sproull, and Subramani [1] argue that people spend more time and respond better to face-based than text-based interfaces because psychologically, the presence of another person increases arousal and motivation. Nourbakhsh et al. [5] observe that it is increasingly common to use expressive faces for mobile robots to engage users and argue that this makes them more willing to interact with a robot. Our device takes advantage of facial expression and gesture but using them alone to represent a complex message has a limit. If we added voice to the RayMatic, it would have been straightforward to convey its message, but this would also make RayMatic more demanding. Instead, we wanted a quiet and subtle home agent in an ordinary picture frame.

To avoid confusion it is good that the facial expressions and gestures in the frame are expressive, realistic, and universal to avoid confusion. However, RayMatic can also be customized. Users make videos of their own gestures and with facial expressions, then, at the setting mode they assign each video clip to the appropriate state. Although we represent each state with movie clips, we could have used static images.

CONCLUSION AND FUTURE WORK

RayMatic is a touch-based interactive display that represents ambient information using human facial expressions and gestures. Designed for monitoring home energy usage and controlling home HVAC systems, RayMatic could serve other purposes, for example an air pollution monitor (Ray coughs or has trouble breathing), a noise meter (Ray covers his ears and frowns). Like the Ambient Orb, RayMatic can display other information such as weather, traffic [6], daylight [6], elders' health [3,4], or someone's emotional state as indicated in Facebook. In addition to this flexibility of input signals, RayMatic can be customized to indicate conditions with a wide variety of facial expression and gestures.



Figure 3: RayMatic could be added to personal objects such as a keychain, or a wallet to monitor important signs.

RayMatic is also not limited to the picture frame. Using a wireless protocol, RayMatic can be applied to personal objects such as a keychain, a necklace or a wallet (Figure 3) so that a user can monitor electricity usage, or a friend's emotional state with the object. The RayMatic points to a style of interaction with household appliances and devices that is simple, fun, and friendly.

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