

Living Interfaces: The Thrifty Faucet

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ABSTRACT

In this paper, we present a novel type of persuasive home appliance: A thrifty water faucet. Through a servo motor construction, it is enabled to move and behave in life-like manners and to step into dialogue with the user. For example about water consumption or hygiene. We sought to research the reactions of users to such an appliance, alongside possible implications for the design of future human-machine interfaces.

This project is part of a larger series of experiments in the *Living Interfaces* project, exploring ways in which reduced and abstract life-like movements can be beneficial for Human-Machine Interaction.

KEYWORDS

Gesture, posture, ambient interface, behavior, kinetic interaction, sustainability, HRI

INTRODUCTION

Sustainability is currently of wide research interest. Especially the consumption of water is often not reflected and therefore a field of high potential for the creation of awareness. Strikingly, life-like kinetic interfaces have, even though they are of highly affective nature, not been in the focus of these investigations to date. We therefore propose the Thrifty Faucet.

In this project, it was of our interest if a water dispenser of life-like appearance would be an applicable means of helping the user to reflect better about his daily water consumption. Dealing with life-like interfaces, a major issue e.g. of zoomorphic and anthropomorphic systems is the 'Uncanny Valley' effect [12]. It is also of our interest whether this effect could possibly be avoided by reducing the system to an abstract appearance, but equipped with life-like behavior. Focussing on concise bodily behaviour in the field of posture and gesture, meaningful and vital

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Figure 1. Prototype, tube bent by steel wires

expressions could be created. These are now the basis for a kinetic alphabet that enables the faucet to step into active communication with the users.

BACKGROUND

The field of kinetic interaction and research on tangible communication [8] is an emerging one. A term for these topics, the notion of *Organic User Interfaces* was recently introduced [1]. Furthermore, implicit communication [10], and especially facial expressions have been in the focus of novel man-machine interfaces [11], and a recent study indicated that users 'frequently mirror the posture of a socially expressive robot when engaged to a social interaction' [2]. Further research focused on graphical representation of body language [3] and machine learning of such by employing actors and analysing their movements [4]. Looking at contemporary projects, we can increasingly see solutions that focus on physical interfaces and interaction to achieve a maximum impact [13 - 16].

PROTOTYPE

The Thrifty Faucet is constructed around a stiff yet bendable plastic tube. Seven plastic rings mounted to its outside are used to guide three pairs of steel wires that, when exerted a force on, bend the tube (Fig. 1). The very characteristic, organic movement is here achieved by allocating the force on many hinges, so that normally the whole body is affected, also by a single movement. The control wires are driven by three separate servo motors,



Figure 2a-c: The Thrifty Faucet in different postures: Seeking, curious, and rejecting.

controlled by a nearby Arduino microcontroller board. Two servos affect the movement of the tubes body, the third controls the head movement.

EVALUATION

The Thrifty Faucet was tested in an actual bathroom, as for the applicability of its body language. The tests with 9 subjects between 20 and 40 years (5 female, 4 male) were based on demonstrations of 15 live motion patterns that were to be interpreted by the testers. The motion patterns were extracted from the envisioned interaction with the water-tap covering expressions for reward and positive feedback up to denial. After that, a questionnaire was handed to the users, asking them about their attitude towards kinetic interfaces like the presented one. A short interview was conducted about the experiences during the test.

RESULTS

Generally, movement patterns including a moving of the 'head' part tended to acquire more attention than those who didn't. High attention can especially be achieved by simulating the faucet to 'look' at its user, or simply heavy wagging (which was bound to be ambiguous, though).

Although some testers were at first somehow irritated by the unfamiliar robotic device, the overall feedback was positive and conducted by curiosity. The emotions reported ranged from fright to amusement. Astonishingly many people envisioned in the beginning, that the tap would splash them with water and therefore acted carefully in face-to-face situations with the tap. Permanent subtle movements, which have been described as Perlin Noise [7] before, enriched the impression of a living object.

CONCLUSION

This pilot study revealed a considerable potential for affective interaction with household appliances. Users were often curious to interact with the faucet, and showed emotional reactions to its behavior – this indicates that it might be an eligible means to create awareness, e.g. for water consumption, through organic body postures (Fig. 2).

OUTLOOK

This initial prototype is not able to spray water – a feature that will be included in the next version regarding also possibilities of additional, abstract, verbal expression. We have been testing so far only a limited number of posture and gestures. Further experiments will have to follow to understand the value of kinetic organic user interfaces.

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