

# Aladdin's lamp: understanding new from old

## Poster Preview

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The ubiquitous vision paints a world where the day-to-day activities of our lives are suffused with computation. Each item from briefcase to breakfast cereal packet becomes a locus for interaction. Some of this is incidental to the activities we are doing [Dix, 2003]: the briefcase keeps track of its contents and talks to the wall calendar so that it can warn if an important document for today's meeting is missing. But other actions require more intentional although still implicit interactions [Schmidt, 2000]: tipping the placement from side to side to turn the pages of the morning paper displayed on it. Others are more explicit still, the magic wand that acts as universal control [Fails et al., 2003].

We will focus here on the latter two categories the intentional but implicit and the more explicit interactions. Both involve physical objects or controls. However, as the world fills with physical objects that have meaning in the electronic world, then how do we understand those meanings? How do we turn the device that is a wonderful demonstration when you know how it works to an object that is "pick up and use"? And even when you know how it works, what are the affordances of the object and the properties of the physical-logical relationship that allows the use to become natural?

In the current world our lives are suffused with computation. Many items from Walkman to washing machine are a locus for interaction. Some of this is incidental to the activities we are doing: the set-top box that monitors your watching habits and consults the electronic TV guide so that it can pre-record the programmes you may want to see later. But other actions require more intentional although still implicit interactions: the volume control on the phone that naturally sits under your thumb. Others are more explicit still: the dial and switches on the washing machine control panel.

Focusing on the latter two categories, designers of day-to-day products are constantly faced with the issue of how to make these devices comprehensible to ordinary people. A mini-disk controller that makes a wonderful demo to a group of fellow designers ... or even computer scientists ... could win you a design award, but will be a market flop if people cannot pick it up and use it. A 27 page manual is not acceptable whilst jogging.

We are studying the real physical controls on really-used artefacts in order to understand the features of physical interaction and of the physical-logical mapping that make them comprehensible and natural. This naturalness of interaction is called fluidity in [Dix, 2003] and is related both to both Gibson's notion of natural affordance as well as the more culturally informed aspects of affordance brought into HCI by Gaver and Norman [McGrenere et al., 2000].

In this poster (initial sketch attached) we will present some of our initial work in this area. The poster shows a small selection of day-to-day devices and consumer appliances including a speaker control and washing machine. These are chosen to represent some of the rich physical interactions available on these mundane appliances.

In most of these, the explicit design of the physical object enables the user to understand how to manipulate the device, that is they exhibit strong affordances. However, there are additional aspects of these devices that exploit the physical

form of the device to inform the users' interaction with the logical function they control:

#### exposed state

Some controls, such as simple on-off switches, expose by their physical state the underlying logical state of the system. The interaction potential and feedback for the user is thus immediate as there is a direct mapping between the physical appearance and logical state. Thus the user can immediately apprehend how to control the device. The washing machine dial is a more complex example showing the state of the wash cycle as well as allowing the user to set it.

#### hidden state

In contrast, the twist control of the speaker has no intrinsic on/off position given by its physical shape. Instead this has to be indicated by painted dots. In addition the physical control has a palpable bump so that you can feel it go past the on/off position. This latter effect has been emulated in the iDrive haptic controller for the BMW series 7 [Immersion, 2003].

#### inverse actions

As with any dial, turning the rotary knob clockwise increase volume, turning it anti-clockwise decreases volume. In many of these controls, these inverse effects, like the dial, exploit natural physical inverse actions. This is especially important if the user does not have a perfect knowledge of the physical-logical mapping.

#### compliant interaction

The rotary knob on the washing machine is not just a good example of exposed state, but also exhibits a symmetry of machine-system interaction. The user sets the program by turning the dial, but the system also turns the dial itself as the program advances. Expert users can thus easily learn how to fine tune the device, skipping parts of the program, starting in unconventional places etc.

Our study and incipient set of physical-logical design principles compliment other work in tangible interfaces and augmented reality. For example, Ullmer and Ishii's MCRpd interaction model exposes various aspects of the physical-digital mapping [Ullmer et al., 2000] and Koleva et al. discuss a variety of attributes of tangible interfaces that contribute to a sense of 'coherence' between the physical and digital representations [Koleva et al., 2003]. The sensible/sensible/desirable framework focuses more on the affordances of a ubiquitous device and how this can suggest opportunities for manipulation and extending the physical-digital mapping [Benford et al., 2003].

Looking at the conventional interface literature, it is interesting to look at Shneiderman's direct manipulation principles of continuous representation, physical actions instead of syntax and rapid incremental and reversible operations [Shneiderman, 1998]. These are effectively about trying to harness the naturalness of physical interactions in the digital domain.

In the real world we have physical devices with an immediate physical effect (the thing itself!), in direct manipulation we have logical devices and logical effects, and in our studies, tangible and some ubiquitous computing we have physical devices with logical effects. All exploit our innate abilities to live and act in the physical world.

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**Initial sketch:**

