UbiComp: Becoming Superhuman

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Abstract. UbiComp aims to offer superhuman capabilites to users. By referring to fictional superhuman skills, we can provide users with interaction paradigms that are easy to understand, and which work across many UbiComp applications.

1 Introduction

> Any sufficiently advanced technology is indistinguishable from magic.
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> *— Arthur C. Clarke, "Profiles of The Future", 1961*

Much of recent technology strives to overcome the limits imposed on humans by physics. We can now communicate across continents nearly instantaneously, using a medium which we cannot directly sense ourselves. We can perform limited actuation at a distance, e.g. with TV remote controls. We can travel at speeds way beyond our own capabilities. Such technologies are indistinguishable from magic.

Ubiquitous Computing (UbiComp) can enable other forms of magic. By embedding computing, sensing and actuation into everyday objects and environments, it becomes feasible to provide new abilities for users, allowing them to exert levels of control and sensing in the physical world that were not previously possible. However, one continuing problem in UbiComp has been in finding compelling user interfaces in the 3D world. One way of expressing this is to ask "what are the physics of UbiComp" — since we want real-world actions to cause real-world effects. The advantage of using a physics metaphor is that humans intrinsically understand the afforances and constraints of physics, and this understanding can potentially be used to make UbiComp systems more accessible to untrained end users.

Real-world physics alone, however, is not enough. We are interested in creating magic, i.e. allowing people to do what they would not have thought possible — but somehow making this intuitively easy to use nonetheless. One answer to this lies in the widespread knowledge of superhuman abilities due to stories (in novels, comics, movies or other media) which appeal to our overactive imaginations. For example, superman has X-ray vision; we have augmented reality.

This paper presents the notion that superhuman skills can be used as metaphors in Ubiquitous Computing. It is intended as a thought-provoking exploration of this idea, without claiming to be complete or fully refined.

2 Becoming Superhuman

We now discuss some superhuman powers and their relation to UbiComp.

Telekinesis Telekinesis is action-at-a-distance. While we may be some way from enabling telekinesis with (non-motorised) real-world objects, we are certainly able to perform telekinesis on virtual objects. One application of this is in the movement of data, e.g. transferring pictures between a digital camera and a web server, or transferring streaming video from one screen to another in a separate room. Another application is in the actuation of "virtual controls" of objects, i.e. remote control. There are many examples of devices that we would like to ubiquitously control, e.g. turning on the coffee machine from the warmth of the bed, or remotely instructing a home TV recorder to record a show that a colleague recommends.

Teleathesia Teleathesia is sensing at a distance, and is an obvious complement to telekinesis. We wish to allow users to remotely sense events that are important to them, such as when your spouse is leaving work, or if there is an intruder in your home.

Telepresence Telepresence involves teleathesia, but also implies interaction between local and remote users. Many applications involve remote collaboration, e.g. in meeting room scenarios, remote training, etc. UbiComp technologies can make this more realistic - instead of a voice on a phone or an image on a screen, we hope to enable seamless interaction experiences, involving physical avatars, exchange of (virtual) objects, and realistic soundscapes.

Precognition/Postcognition Many UbiComp applications deal with navigating time, i.e. answering the question "what happened a week ago" (postcognition) or "what will happen in future" (precognition). Navigation of time is relevant for particular objects ("has this used car been damaged in the past?"), places ("what will happen in this meeting room tomorrow?"), or people ("who did I meet at that party on Thursday?").

3 Enabling technologies

We now look at enabling technologies for the superhuman abilities above.

Surrogate objects Surrogate objects refers to the use of real-world objects to represent other (less easily manipulated) real or virtual objects, and hence enabling telekinesis. Ishii and Ullmer proposed "tangible bits" [1], where physical icons ("phicons") are used to represent other (virtual or real) objects, and manipulating the phicons caused actions to occur to whatever they represented. CMU's Claytronics project (`http://www-2.cs.cmu.edu/~claytronics/`) is creating electronic "clay" which can form itself into 3D objects, which may eventually facilitate realistic telepresence.

Magic gestures/words Many fictional characters have made use of magic words or gestures in order to activate their superhuman abilities. A number of UbiComp projects have looked into enabling this in real life. Audio Location [4] detects a 3D position for human sounds such as finger clicking, and thus allows users to define special regions

of space which, when "clicked", initiate programmed actions. Gesture recognition has been proposed using cameras [6] and accelerometers [7]. Both of these can provide control interfaces for particular superpowers which may operate across many applications.

Ubiquitous output Output devices such as ubiquitous displays (using steerable [3] or fixed [2] projectors, or screens) and speaker arrays allow whole rooms to be used as interaction environments. For example, an LCD screen normally used as a photo display might display the identity of a phone caller, allowing the user to perform teleathesia. Objects on displays can also be easily moved around, enabling telekinesis. These output mechanisms can also allow users to experience an environment as it was or will be, thus facilitating precognition and postcognition.

Synaesthesia Synaesthesia refers the mixing of the senses, e.g. hearing pictures, tasting sounds, etc. With teleathesia, we wish to provide users with sixth or seventh senses, sadly we are restricted to reusing the ones they already have. However, in order to avoid flooding users with data, we need to provide unintrusive cues to users, e.g. transforming virtual events into ambient environmental changes [5] that the user can sense.

4 Conclusions

Ubiquitous Computing involves the implementation of indistinguishable-from-magic, superhuman capabilities. One way to allow users to quickly learn, understand, and enjoy using the capabilities that UbiComp systems provide is to present them as superhuman powers such as telekinesis, teleathesia, telepresence, and pre/postcognition. By abstracting out these aspects of UbiComp applications and providing consistent ways of activating them, we can give users both intuitive understanding of systems, and knowledge that they can easily transfer from one system to another.

References

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