Programming Reality within the Reality-Based Interaction Framework

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Abstract

In this position paper, we propose the *Reality-Based Interaction* (RBI) framework as a basis for analyzing, designing, and understanding organic user interfaces and transitive materials. This framework also allows us to relate these research paths to the broader domain of emerging post-WIMP interaction techniques. We believe that viewing interaction through the lens of Reality-Based Interaction (RBI) might provide insights for design and uncover gaps or opportunities for future research.

Keywords

Reality-based interaction, organic user interfaces, transitive materials

ACM Classification Keywords

H5.2. [Information interfaces and presentation]: User Interfaces

Introduction

Transitive materials, organic user interfaces, and other emerging human-computer interaction techniques are redefining our understanding of both computers and interaction. These emerging interaction styles are moving into the real world in ways that would have been impossible for the generation of graphical user

interfaces. With ubiquitous, mobile interfaces, computation has moved out of the lab or office and into the greater world.   While portability is a major part of this shift, both the integration of devices within the physical environment as well as the acquisition of input from the environment, serve as factors contributing to it. As Rekimoto notes, "the interaction concept is thus no longer limited to interaction between humans and computers but can be expanded to cover interaction between the physical world and computers" [3]. In addition, emerging technologies such as flexible displays and e-textiles, enable the integration of computers into the real, non-digital world in ways that were not previously possible. As technology moves into the real world, we observe interactions that are closer to actions and skills we use every day in the real world. These new technologies and interaction techniques blur the line between the real, non-digital world and computers, allowing us to "program reality."

As discussed in more detail in [2], we believe that all of these new interaction styles draw strength by building on users' pre-existing knowledge of the everyday, non-digital world to a much greater extent than before. They employ themes of reality such as users' understanding of naïve physics, their own bodies, the surrounding environment, and other people. They thereby attempt to make computer interaction more like interacting with the real, non-digital world. We believe that viewing interaction through the lens of Reality-Based Interaction (RBI) might provide insights for design and uncover gaps or opportunities for future research.

Reality-Based Interaction

We use the term "real world" to refer to aspects of the physical, non-digital world. However, the terms real world and reality are problematic and can have many additional, interpretations. Thus, to clarify, our framework [2] focuses specifically on the following four themes from the real world:

Naïve Physics

People have common sense knowledge about the physical world. This includes concepts like gravity, friction, velocity, the persistence of objects, and relative scale. In the context of organic interfaces and transitive materials, user interfaces increasingly simulate or directly use properties of the physical world.

Body Awareness & Skills

People have an awareness of their own physical bodies and possess skills for controlling and coordinating their bodies. This refers to the familiarity and understanding that people have of their own bodies, independent of the environment. For example, a person is aware of the relative position of his or her limbs (proprioception), his or her range of motion, and the senses involved in perceiving certain phenomena. Emerging interfaces support an increasingly rich set of input techniques based on these skills, included two-handed interaction and whole-body interaction. Materials such as e-textiles will allow the creation of user interfaces that rely on body awareness and skills even further, blurring the boundaries between the interface and users' bodies.
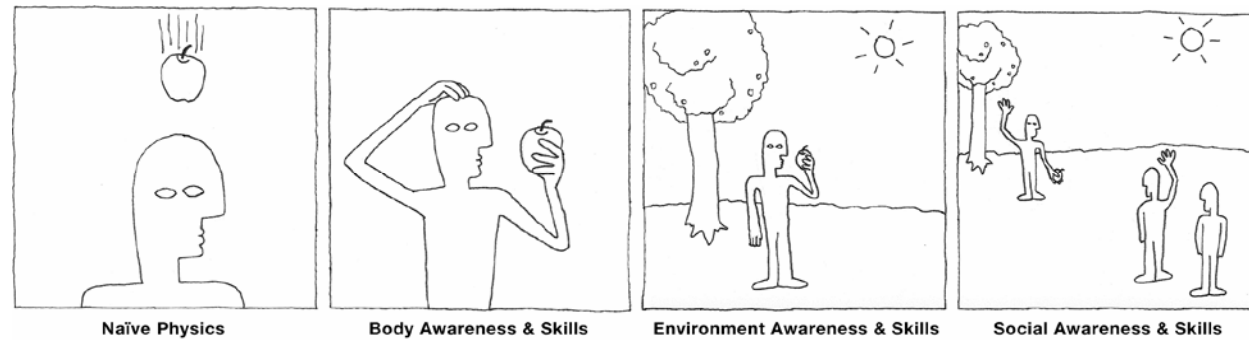
Figure 1. The four RBI themes introduced in [2].

Environment Awareness & Skills

People have a sense of their surroundings and possess skills for negotiating, manipulating, and navigating within their environment. In the real world, people have a physical presence in their spatial environment, surrounded by objects and landscape. Clues that are embedded in the natural and built environment facilitate our sense of orientation and spatial understanding. Organic user interfaces allow users to modify and manipulate their environment to a greater extent than before, enabling users to change not only the topology of objects in their environment but also their shape and basic physical properties.

Social Awareness & Skills

People are generally aware of others in their environment and have skills for interacting with them. These include verbal and non-verbal communication, the ability to exchange physical objects and the ability to work with others to collaborate on a task.

RBI in Current Research

With the view of RBI as a unifying thread for organic user interfaces and transitive materials, one can go back through the literature and identify many examples of designers following RBI principles. For example, Rekimoto explains that organic interfaces "more closely resemble natural human-physical and human-human interaction (such as shaking hands and gesturing)" [3]. Other researchers use RBI principles by making design choices based on the intuitive, familiar, or realistic qualities brought to the interface by that design choice. For example, Holman and Vertegaal suggest that deformability in user interfaces "eases many real-world tasks, like storing things, or reading this magazine article, for example. The page flip is, in fact, a wonderfully effective way of navigating documents. Its affordance and ability to open a document at a random location is not easily mirrored by a mouse click" [1]. Schwesig notes that the characteristics of organic interfaces "inspires a suspension of disbelief: intangible information feels as though it is part of our tangible physical environment" [4]. Viewed from this perspective, we can find many such uses of RBI

principles throughout current research on organic interfaces, transitive materials and other emerging human-computer interaction techniques.

Implications for Design

A useful interface will rarely entirely mimic the real world, but will necessarily include some unrealistic or artificial features and commands [2]. In fact, much of the power of using computers comes from this multiplier effect—the ability to go beyond a precise imitation of the real world. Designers must strike a balance between the power of their interface and its level of reality. The RBI framework [2] makes these design tradeoffs explicit and provides explanatory power for understanding the costs and benefits of such decisions.

In [2], we propose that the goal is to give up reality only explicitly and only in return for other desired qualities, such as expressive power or efficiency. Thus, one could identify some fraction of a user interface as based on the RBI themes plus some other fraction that provides computer-only functionality that is not realistic. As a design approach or metric, the goal would be to make the first category as large as possible and use the second only as necessary, highlighting the tradeoff explicitly [5]. In the design of a reality-based interface we can go a step further and ask that these non real world commands be analogous to some realistic counterpart. The designer's goal when developing organic user interfaces and transitive materials should be to allow the user to perform realistic tasks realistically, to provide additional non real-world functionality, and to use analogies for these commands whenever possible.

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