Making Interfaces Re-appearing in Ubiquitous Environments

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Context

We are at the dawn of the next computing paradigm where everything will be able to sense human input and augment its appearance with digital information without using screens, smartphones, or special glasses; making user interfaces simply disappear [3,5]. This introduces many problems for users including the discoverability of commands [4] and use of diverse interaction techniques, the acquisition of expertise [2] and the balancing of trade-offs between inferential (AI) and explicit (user driven) interactions in aware environments. We argue that interfaces must reappear in an appropriate way to make ubiquitous environments useful and usable. This Ph.D. tackles these problems, addressing the study of human factors related to ubiquitous and augmented reality environments and the development of new interaction techniques helping to make interfaces reappear; the improvement of transition between novice and expert use and optimization of skill transfer, and, last, the question of delegation in smart interfaces and how to adapt the trade-off between implicit and explicit interaction.

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Objectives

The goal is to make interfaces re-appearing in ubiquitous environments, by following the directions detailed hereafter.

State-of-the-art of disappearing interfaces

One premise of ubiquitous computing is that the interface should disappear [5]. In practice, what this means is that, while the user can still interact and control the environment, the environment itself is instrumented in ways that allow it to track and monitor the user, to capture user action, and to infer intended command-invocation targets. A first goal is to establish a state-of-the-art of what has been proposed in the scientific literature and commercial products to support disappearing interfaces. When available the associated design rationales will have to be clarified and it will be necessary to analyze the benefits and drawbacks these design choices introduce.

Designing mechanisms and interaction for novices, experts, and the novice to expert transition

Ubiquitous environments are made of various technologies that can be used to dynamically augment user interactions. The goal is to study how these technologies can be used to increase the system's communicability to assist novice users both for discovering the features available in the system, as well as assisting the user in improving her skill executing tasks with the system. Most notably, augmented reality technology makes it possible to overlay information in context, providing a unique opportunity to make the interface reappear in a way that will depend on interaction context. More precisely, the goal is to study how augmented reality, combined with audio and haptic guidance [1], can be used to help a novice user to discover the features supported by the system, as well as provide contextual feed-forward to assist her while carrying out her task.

Transparency in input and output

One known challenge with intelligent systems is that users need to understand how systems behave, why they make errors, and how to avoid errors. Understanding errors can become particularly challenging when systems are designed to infer actions and behaviors. Ideally, richly interactive environments would be "calm technologies", and interfaces would "vanish from perception" but this goal exist in tension with a need for a user to be able to perceive allowable actions and system state and to formulate plans to act. Specifically, one common model of interaction with interactive systems is Norman's Model of Interaction. In this model, Norman examines interaction from the perspective of a human user, separating interaction into two phases: execution and evaluation. From the perspective of execution, the user has tasks he or she would like to perform. These tasks require an intentional manipulation of the state of the system,

formulated as a series of actions on the system. Once performed, the user moves to the evaluation phase: the computer provides feedback to the user which is perceived, interpreted, and then evaluated with respect to the ultimate goal of the user.

Candidate

The candidate has to hold a Master degree in Computer Science, with a background in Human-Computer Interaction.

References

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