Chapter V
Interacting with Interaction Histories in a History-Enriched Environment

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ABSTRACT

A ubiquitous computing environment would capture a large amount of interaction histories of objects in the environment over a long period of time. Such interaction histories serve as valuable sources of information for people to solve problems and make decisions in the present time. Our approach is to enrich the space by providing interaction history information through noticeable wear expressed within a physical environment. A history-enriched environment (HEE) allows people to use interaction histories of people, things, and places on demand, and to obtain relevant information by tracing links among objects. We argue that taking into account two aspects of people's cognitive activities—situated encountering and information-triggered information needs—is key to building an HEE. This chapter describes how to design an HEE through the Optical Stain environment, which we designed as an HEE.

INTRODUCTION

Omnipresent sensors and cameras placed in a real world make it possible to keep track of objects, such as people, things, and places, in a large space over a long period of time. We envision that a ubiquitous computing environment would be one that is *enriched* with such information, where the descriptor *ubiquitou*s refers not only to the spatial aspect but also to the temporal aspect. Just like footprints left on a mountainside help trekkers decide which path to take, and signs of wear on a university telephone directory help to locate pages listing faculty members, the ubiquitous computing environment would help us find ways to solve problems, to make decisions, or, to put it simply, to relax, feel better, and enjoy life.

People do not always engage in consciously purposeful activities. They become interested in what they encounter in certain situations (Suchman, 1987). For example, when a person walks by a restaurant that smells good, that person may become interested in knowing more about the restaurant. This does not preclude a purposeful activity such as looking for an appropriate restaurant for a birthday party. However, people often experience situations such as these in their everyday lives; for example, just by walking by a place, a person may become interested in knowing more about it.

A person's information needs do not always arise from well-planned problem-solving steps. Often, a person does not become aware of information needs until the person becomes aware of the existence of relevant information (Fischer & Nakakoji, 1991; Nakakoji & Fischer, 1995). New information often triggers a person to become aware of more information needs, and such information needs cannot be predicted a priori because they are situated, depending on an unspecifiable context (Winograd & Flores, 1986). For instance, if a person becomes aware of a restaurant that he/she is passing by, that person may examine a menu placed in front of the entrance. If the menu looks appealing, that person may then look inside the restaurant through a window to see whether it is crowded. In everyday life, finding information should not be regarded as a one-time affair. Presenting information in response to an initial information request should be treated as a trigger to subsequent information exploration steps.

A ubiquitous computing environment would capture a large amount of data from a physical environment over a long period of time. Such data would serve as a valuable source of information for people to solve problems and make decisions. We argue that taking into account the above two aspects of people's cognitive activities, *situated encountering* and *information-triggered information needs*, is key to building an information-enriched ubiquitous computing environment.

THE TEMPORAL ASPECT OF UBIQUITY

Time, History, and Social Settings

Capturing a large amount of data from a physical environment over a long period of time necessarily deals with three factors: time, history, and social settings.

Time, or, more precisely, the timestamp of information, has been regarded as an important element to locate, understand, and coordinate the information. A prototypical example is Time-Machine Computing by Rekimoto (1999), which describes the time-centric approach for organizing electronic information stored on a personal computer. Rekimoto's (1999) TimeScape uses several visualization techniques to explore the timestamped information space, and his Time-Casting links heterogeneous objects by using the temporal information. Time is also used to coordinate people's activities. Timewarp (Edwards & Mynatt, 1997), for instance, uses explicit and editable timelines to coordinate collaboration among team members. These approaches primar-