# The Next Generation of Computer Supported Interaction and Communication

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## Extended Abstract

A human being's daily activities – professional or private – are based on a broad range of interactions with numerous external objects: discussing project plans with colleagues, setting up a multimedia presentation in the conference room, editing documents, delegating travel planning to a secretary, driving a car, buying a ticket from a vending machine, visiting an exhibition, controlling the TV at home, etc.

As computers are becoming more and more ubiquitous, moving from the desktop into the infrastructure of our everyday life, they begin to influence the way we interact with this environment – the (physical) entities that we operate upon in order to achieve our daily goals. The most important aspect of future human-computer interaction therefore is the way, computers support us in efficiently managing our personal environment. This might be called the ecological level of user-interface design.
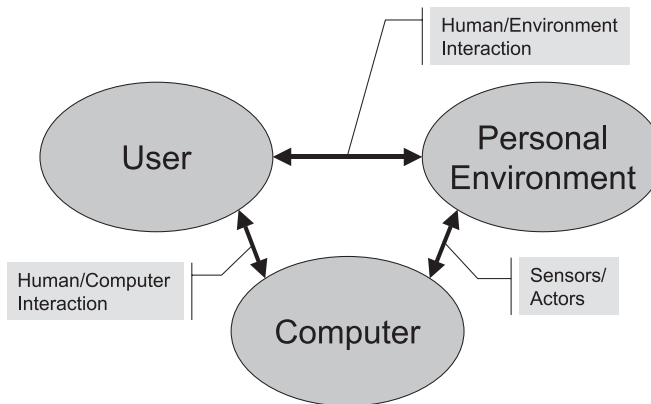


At the ecological level, we look at future developments from the perspective of helping a user in achieving his individual goals and purposes by providing computer-based assistance for interacting with his personal environment.

The goal is to have the computer acting as a mediator between the user and the environment – e.g., giving the user hints for operating an obstinate ticket vending machine, reminding him of things he wanted to tell a colleague just approaching across the corridor, etc. Because the machine has no direct access to the human/environment interaction, it needs to achieve the desired effects indirectly through the other interfaces: i.e., by sensing the environment, by cleverly guessing the user's goals and future interactions with the environment, and by proactively providing the user with information needed for those activities (or by actively controlling the environment itself).

Central challenges for providing such personal ubiquitous assistance are:

- Understanding the user's goals and the specific strategies employed by the user for achieving these goals.
- Sensing and understanding the user's personal environment and the ways the current environment influences his activities and strategies.

In addition, in order to minimize the cognitive (and sensomotorical) gap between human/computer interaction on the one side and human/environment interaction on the other side, natural (anthropomorphic) interaction should be supported: Multimodal interfaces lead the way with features such as:

- speech input (command phrases as well as natural dialog) and output,
- video based interaction (e.g., gesture and position recognition),
- avatars as graphical output metaphors,
- haptic feedback for buttons and knobs (e.g., in a car environment).

These technologies are implemented as a modular system from which different user interfaces depending on the requirements of certain appliances can be build.

Two major application areas currently investigate the use of natural interaction and personal ubiquitous assistance for creating ecological interfaces:

- On the professional side, the office environment will be reorganized by means of agent-based assistant systems in order to reduce time consuming routine tasks and unnecessary interrupts. Progress in the fields of delegation-based interfaces, intelligent assistant systems, man-machine-communication, mobility, and security will lead to new multimedia workspaces.
- On the other hand, interactive appliances will allow a unified and simplified access to the gadgetry of modern life. Having a single, personal control with a customized user interface for interacting with appliances at home (e.g. audio/video-appliances, washing machine), in the streets (e.g. ticket-vending machine), on the road (e.g., car stereo and air conditioning), on-site or remote, will make us feel at home everywhere.

As outlined above, the ecological level is concerned with exploiting new ways for helping a user in interacting with the various objects in his personal environment in order to achieve his individual goals and purposes effectively and successfully. Common to both application areas outlined above is the proactive and environment-sensitive nature of the underlying solution concepts. The systems need to use knowledge on the user's individual goals, her strategies for achieving them, and the dependencies of those strategies on the user's current personal environment for anticipating the next steps of the user. In doing this, those systems effectively become intimate personal assistants to the user – up to the degree that they might be regarded as a kind of mental prosthesis: (simplified) projections of the user's mind and his specific cognitive structures onto a different (electronic) substrate.

In the presentation, we will discuss current major research activities focusing on the area of Natural Interfaces and Personal Ubiquitous Assistance.

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