
Bodily Interaction, Human Computing, and User Profiling

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Abstract

In future Ambient Intelligence environments we assume intelligence embedded in the environment and its virtual, sometimes visualized agents (virtual humans). These environments support the human inhabitants or visitors in their activities and interactions by perceiving them through their sensors. In our research we look at bodily and gestural interaction with environments equipped with simple sensors, application-dependent intelligence, and an embodied virtual agent employed in the display of reactive and pro-active support. The virtual humans with whom we have bodily interaction play roles such as dance partner, conductor or trainer. All of them require the perception and the generation of bodily activity and other display of nonverbal communication. It is argued that smooth and natural interaction with a virtual human in the exertion interface also requires that the interface and environment 'knows' about the user.

Keywords

Bodily interaction, multimodal interaction, affective computing, entertainment computing, user profiling.

ACM Classification Keywords

H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces (D.2.2, H.1.2, I.3.6).



Figure 1: Virtual dancer, virtual conductor, and virtual trainer.

Introduction

In future Ambient Intelligence (AmI) environments we assume intelligence embedded in the environment, its objects (furniture, mobile robots) and its virtual, sometimes visualized agents (virtual humans). These environments support the human inhabitants or visitors of these environments in their activities and interactions by perceiving them through their sensors (proximity sensors, cameras, microphones, etc.). Support can be reactive, but also and more importantly, pro-active and unobtrusive, anticipating the needs of the inhabitants and visitors by sensing their behavioral signals and being aware of the context in which they act [6].

Health, recreation, sports and playing games are among the needs inhabitants and visitors of smart environments will have. Sensors in these environments can detect and interpret bodily activity and can give multimedia feedback to invite, stimulate, guide and advise on bodily activity. Exertion interfaces are among the interfaces we consider in our research. Presently, in our applications we look in particular at interfaces where we interact with virtual humans, rather than with remote human partners [5]. Some applications have been built or are under development (see the next section). Currently we look at ways to use information about personality, mood or physical condition of the user in order to adapt the interface and the interaction modalities and to coach the user in his or her performance.

Applications Requiring Bodily Interaction

In our own HMI Lab we have designed three applications in which our ideas about nonverbal and bodily interaction have been implemented. The

applications are illustrated in Figure 1. The implementations are available, but they are certainly not final. We looked at the design, implementation and evaluation of a virtual dancer that invites a visitor to her environment to dance with her [7], a conductor that guides musicians in its environment to play according the score designed by a composer [4], and a virtual trainer (e.g. in the role of fitness trainer or physiotherapist) that knows about exercises that need to be performed by a user or patient [8]. Obviously, although our virtual conductor can demand quite some effort from the musicians, the virtual dancer and the virtual trainer application require severe physical effort from the user. In all these applications there is a continuous interaction between embodied agent and its human partner. Moreover, rather than have the more traditional verbal interaction supported by nonverbal communication, here the main interaction that takes place is nonverbal, and speech and language, when present at all, take the supporting role. External signals like music being played can also have a role in addition to the multimodal communication. Music determines the rhythm to which interactions have to be tuned.

Learning from Bodily Interaction

In ambient intelligence environments we have the technology to capture human behavior in everyday life. Our ambient entertainment environments make use of the same technology. Apart from user profiles that have been obtained using questionnaires and gathering demographic information, we can now look at additions to an existing user profile that can be obtained during (possibly playful) bodily interactions with the environment. Such information can be used by the environment to adapt to the user's characteristics (for

example, personality, preferences, mood and capabilities).

In [1] results are reported from short observations of expressive behavior. Personality judgments from 'thin slices of behavior' and their accuracy are also discussed in [3]. An example where real-time behavioral analysis is done by a computer can be found in [2]. In their approach a participant is invited in front of a video camera for about 30 seconds. At the end of this period a personality profile for the well-known Big Five personality traits is generated. In our research on bodily interaction we look at possibilities to adapt the interaction and the interface to the characteristics of the user, where these characteristics preferably are obtained in real-time during natural interaction with the (exertion) interface, rather than through questionnaires.

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