Preface: Facial and Bodily Expressions for Control and Adaptation of Games

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1. Ambient Intelligence Environments

In future Ambient Intelligence (AmI) environments, we assume intelligence embedded in the environment, in its devices (furniture, mobile robots) and in its virtual human-like interaction possibilities. These environments support the human inhabitants and visitors of these environments in their activities and interactions by perceiving them through their sensors (e.g. cameras, microphones). 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. 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 nonverbal activity and can give multimedia feedback to invite, stimulate, advise and engage. Activity can aim at improving physical and mental health, but also at improving capabilities related to a profession (e.g. ballet), recreation (e.g. juggling), or sports (e.g. fencing). Plain fun, to be achieved from interaction, can be another aim of such environments.

Such AmI environments know about the user. Maybe, rather than talk about a user, we should talk about an inhabitant, a gamer, a partner or an opponent. Humans will partner with such environments and their devices, including virtual and physical human-like devices (physical robots and virtual humans). Sensors and display technologies allow us to design environments and devices that offer implicit, explicit and human-like interaction possibilities. In particular, these environments allow multimodal interaction with mixed and augmented virtual reality environments, where these environments know about human interaction modalities and also know about how humans communicate with each other in face-to-face, multi-party, or human-computer interaction. Knowing about the ‘user’ means also that the environment knows about the particular ‘user’. Indeed, smart environments identify users, know about their context and know about their preferences. Dealing with preferences and anticipating user behavior requires collecting and understanding patterns of user behavior.

Sensors embedded in current and future AmI environments allow reactive and pro-active communication with inhabitants of these environments. The environment, its devices and its sensors can track users, can recognize and anticipate the actions of the user and can, at least that is our assumption, interpret facial expressions, head movements, body postures and gestures that accompany turn-taking and other multi-party interaction behavior. There is still a long way to go from nowadays computing experiences to future visions where we can experience interactions in mixed reality and virtual worlds, integrated in smart sensor-equipped physical environments, and allowing seamless perceptual coherence when we have our body and our interactions mediated between the real and the virtual worlds and vice versa. Nevertheless, there are already applications where we have interactive systems observing the body movements and facial expressions of a human inhabitant or user of a particular environment and use information obtained from such observations to guide and interpret a user’s activities and his interactions with the environment [1–4].

2. Ambient Entertainment Environments

The video game market is still growing. But there is also the success of the dance pads of Dance Dance Revolutions, Nintendo’s Wii and its applications for games, sports and exercises, and Sony’s EyeToy. Rather than using keyboard, mouse or joystick, there are sensors that make a game or sports application aware of a gamer’s activities. The application can be designed in such a way that the gamer consciously controls the game by his activities (e.g., using gestures or body movements to navigate his avatar in a 3D game environment or to have a sword fight with an enemy avatar). The application can also use the information that is obtained from its sensors to adapt the environment to the user (e.g., noticing that the gamer needs more challenges).

We mentioned 3D environments and avatars. There are many applications (sports, games, leisure, and social communication) where we want to see ourselves acting and performing in virtual worlds and where we want to have others seeing us acting and performing in these virtual worlds.

We may want our nonverbal expressions displayed on our avatar in social communication. We may want our moods and emotions expressed by our avatar in a game or in a Second Life-like environment. This allows us to increase our presence in these environments and it allows others present and represented in these environments to communicate with us in natural, human-like, ways. It requires the sensors to mediate our, often unconsciously displayed, non-verbal social cues in the interaction with virtual game environments. It also requires sensors to mediate our consciously produced gestures, facial expressions, body postures, and body movements that are meant to have effect on the environment or on its synthesized virtual inhabitants.

3. Control and Adaptation of Games: The Workshop

In this workshop of the 8th IEEE International Conference on Automatic Face and Gesture Recognition (FG 2008), the emphasis is on research on facial and bodily expressions for the control and adaptation of games. We distinguish between two forms of expressions, depending on whether the user has the initiative and consciously uses his or her movements and expressions to control the interface, or whether the application takes the initiative to adapt itself to the affective state of the user as it can be interpreted from the user's expressive behavior. Hence, we look at:

- Voluntary control: The user consciously produces facial expressions, head movements or body gestures to control a game. This includes commands that allow navigation in the game environment or that allow movements of avatars or changes in their appearances (e.g. showing similar facial expressions on the avatar's face, transforming body gestures to emotion-related or to emotion-guided activities). Since the expressions and movements are made consciously, they do not necessarily reflect the (affective) state of the gamer.

- Involuntary control: The game environment detects, and gives an interpretation to the gamer's spontaneous facial expression and body pose and uses it to adapt the game to the supposed affective state of the gamer. This adaptation can affect the appearance of the game environment, the interaction modalities, the experience and engagement, the narrative and the strategy that is followed by the game or the game actors.

The workshop shows the broad range of applications that address the topic. For example, Cockburn *et al*. present a game where obstacles can be avoided by performing facial expressions. The game is used to help children with Autism Spectrum Disorder to improve their facial expression production skills. Bodily control is used to play a quiz in libraries, presented by Speelman and Kröse. Children can answer questions by pointing at answers, and dragging choices around. The experience of the game was compared to mouse control. A further investigation of the type of body movements that users make when playing Wii games is done by Pasch *et al*. They analyze motion capture data and user observations to identify different playing styles.

Van den Hoogen *et al*. present a study into the involuntary behavior of users that play video games. They measure mouse pressure and body posture shifts, which they correlate to the user's arousal level. Wang and Marsella present a game that invokes emotion in the user, and investigate the variety of observed facial expressions. Work by Wiratanaya and Lyons regards both voluntary and involuntary control. By reacting on a user's involuntary behavior, the user is encouraged to engage in a conscious interaction with a virtual character. They intend to use their work to entertain and engage dementia sufferers. Wang *et al*. present a system that reproduces observed facial expressions in an efficient manner, to be used in online applications. This type of work can be used in combination with automatic facial animation systems such as presented by Orvalho.

At ECAG, invited talks were given by Louis-Philippe Morency on "Understanding Nonverbal Behaviors: The Role of Context in Recognition", and by Nadia Bianchi-Berthouze on the experience of interacting with physically challenging games. We are grateful to the program committee, the FG 2008 organization and all others that helped in organizing this workshop.

References

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