Towards Using the Full Human Potential in Games and Virtual Environments

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Abstract: Humans have complex sensory and control capabilities. Only a few are used in standard games and virtual environments. Examples of games using interfaces beyond mouse, keyboard and screen show the effectiveness of these interfaces in their context. To enhance the experience in games, to generate more immersive VEs, to facilitate new interaction paradigms, and, ultimately, to increase the fun factor, it is worth expanding the current view on interaction techniques and devices and considering the full human potential for display and control options.

1 The Human Perspective

Current games and virtual environments commonly only use the visual, and sometimes also the audio and the haptic channel, to display information and thus provide us with sensory experiences. Control is achieved with hands and arms – as used in the handling of mouse and keyboard – and sometimes by voice. VEs additionally allow to move physically and to use interaction techniques based on head-tracking, hand-tracking and device tracking to control the viewpoint, system parameters, or to manipulate the world. Beyond this, the human capabilities are only used in specialized applications and settings, often not available for sale, let alone available to the mass market.

Nevertheless, the human sensory and control systems potentially allow much more. Sensory capabilities include the perception of visual, auditory, olfactory, gustatory, somatic stimuli, kinesthetic and vestibular cues. Control capabilities include the mouth, face, eyes, foot, full body, breath, and biological reactions of the body such as heart rate, skin resistancy, muscle, and neural activity.

2 Examples

There are already examples, some commonly available, some still in research, which demonstrate the effective use of additional sensory channels or new kinds of control.

The PainStation extends the classic Pong game with punishing elements [MR01]. A bad score in the game results in pain induced by a sledge and a heating element under the palm of the hand. Users seem not to object to the pain but state that the pain immerses into the game and makes it more realistic. Research institutes like ATR develop mouth interfaces or experiment with olfactory cannons [HW,Ya04]. Theme park rides, like at the Bremen Space Center, combine rollercoaster generated vestibular cues with virtual environment rides. The MIT Media Lab Gait Shoe allows creating and influencing music while the dancer, who wears the shoe, dances to the music [MP02]. Japanese arcades commonly feature games like DanceDanceRevolution (DDR), a sensitive floor device involving dancing to score in the game. Also, they include props like taiko drums, electric guitars, or fire fighter equipment in their games [Co03]. The Sony EyeToy™, a camera-based interaction device for the PlayStation 2, shows an image of the user overlaid with the game environment. It successfully introduced a new full body interaction game paradigm into the game world [Et04]. The Wild Divine game measures skin resistancy and heart rate [Wd04]. Users control the game by controlling their mind. EEG controlled Biofeedback games are used to treat hyperactivity or other disorders in children and adults [Ee04]. EEG is also used to control the Brain-Pacman game [Kr03].

3 Conclusion

The success and effectiveness of these examples in their application area make it worth to further explore the full potential of the user and apply this, for example, in arcade game scenarios, games and VEs. Here, we can learn from the Japanese or the Media Lab's vision and joy in experimenting with other senses and other possibilities to control an application. The playful games community can act as a testbed and eventually as a driving force for the availability of technology in the same way it already did for the development of graphics cards. Once new interaction paradigms are established by the games community, the according interfaces will become available to the mass market and then find their way into everyday applications. Eventually, reality may come closer to Morton Heilig's vision of a full sensory experience and computer interfaces may acknowledge the full potential of the humans who have to work with them.

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