Haptic Illusion as Intangible Add-on

Andrea Brogni
Alma Artis Academy, Pisa, Italy

Keywords

Augmented Heritage, Creative Media, Software Culture

Abstract

To create a Virtual Reality system in which the user reacts as if he/she were in the real world is the dream for the researchers in the field. To design a graphical interface simple, effective and able to naturally provide to the user emotions and stimuli is the objective for many developers. Many aspects have been studied and implemented, such as 3D vision and audio, and many are under continuous improvement, including haptic feedback to provide a physical aspect to the virtual environment experience.

Physical interaction with virtual objects or with the environment itself is a very important requirement. Users typically report this lack of interaction but instinctively they report perceptions, such as temperature, or just the presence of surfaces, even though the information is only visual. This is a process made by the brain, that tries to make the information it is receiving coherent with normal life expectations.

Taking realistic reactions of the user as the main value in the assessment of the effectiveness of the systems, we can assume that haptic illusions can be used to provide a better perception of the environment itself.

1 Let me introduce you to the Haptic Illusion

The evolution of Immersive Virtual Environment (IVE) systems has been incredibly fast in the last decade. Visual feedback has been the modality that has produced nearly realistic sensory data streams, creating an illusion of "real" 3D objects to the users. In the last few years, many researchers have been working on increasing information channels in simulated environments, including audio and touch. The difficulty of designing and implementing a believable virtual environment is still a major issue for researchers. Traditionally it has been assumed that the more believable virtual experiences are constructed by making the environment as visually realistic as possible [Hendrix and Barfield, 1996].

Today's virtual environment (VE) systems cannot produce sensory output that has fidelity close to physical reality, or at least not for all the human sensory channels. Despite the relatively poor quality of the stimuli being created, evidence suggests that people do tend to exhibit behaviour and responses as if the situation depicted in the virtual environment were real; it is as if there are basic minimal cues operational providing sensory data that is sufficient for the human perceptual system to respond to as if they were real [Sanchez-Vives and Slater, 2005]. Simulations with a lower degree of realism can still contain the most important information necessary to give believable experiences such as those perceived in flight simulators or in stressful scenarios. We can extend all these considerations to the creative and

graphical world, where applications for cultural heritage or social activities are designed with continuous improvements in functionalities and graphical effects, with touchable interfaces and visual/audio/haptic feedbacks.

In everyday life, we continuously interact with objects and people. We tend to communicate using interactive devices and systems, like smartphones, computers and network, manipulating information in virtual worlds, dealing with real devices. There is a strong relationship between the visual input and the sensation of touch, that may also occur when the environment is virtual. Considering a virtual environment with only visual feedback, like a smartphone screen, we may be interested in evaluating the possibility of the user getting perceptions related to physical aspects of the virtual objects, like weight, inertia and perceptions related to the sense of touch.

In 1966, Gibson [Gibson, 1966] defined the haptic system as "The sensibility of the individual to the world adjacent to his body by use of his body". The haptic perceptual system is closely linked to the movement of the body so can have a direct effect on the world being perceived. Among all senses, the human haptic system provides unique and bidirectional communication between humans and interactive systems, and for this reason it has a very important role during the interaction with virtual objects. Studying haptics means designing systems that use the sense of touch to interact with the VE, and the haptic field clearly becomes connected to the human sensations and therefore to the illusions (of touching and exploring).

Many researchers already have shown the existence of haptic illusions, re-creating equivalent of visual illusions in the haptic context. In 2006, Pasquinelli proposed a neutral characterization of the notion of illusory phenomena, based on the idea that illusions present features that are not common in other perceptual phenomena [Pasquinelli, 2006]. The first characteristic was that "an illusory experience can always be recognized as being non-veridical by the subject", the second was the robustness of the illusion and the third one was "the reaction of surprise which is provoked by the discovery that an error has been committed". Those, of course, were valid for all the types of illusions. She also suggested that implicit expectations based on motor skills and previous knowledge might play an important role in the occurrence of some illusions.

This aspect is very interesting, if we consider that we may use this consideration for designing interfaces and virtual worlds.

2 Realistic Reactions in Virtual Worlds

One of the main motivations for developing applications that use IVEs is that participants may respond realistically to virtual situations and events. In the virtual environment and creative/graphics fields most development has focused on visual realism, but an important research question relates to the extent to which the brain automatically fills in missing sensory information and automatically provides the haptics, and the related perceptions, given that the only input is visual. Our brain can store information and use previous experiences for elaborating new situations, helping us to interact with the surrounding world. Some researchers report comments from the volunteers, where they claim light physical interactions and feelings during the experience, even if the system was without force feedback devices. They imagine having had a warm feeling on approaching a red object, or a cold one on trying to get a virtual glass of beer. What is this? Is it only imagination of some volunteers or is something more related to the processes of the brain in fact happening? Understanding the mental process that guides human perception during virtual experiences is fundamental for the design process. A IVE system or a graphical interface are designed for a purpose and they

have to be effective, so the different features have to be defined according to the specification of the task. The idea of having the perfect environment with all the feedback and all the possible interactions is a dream that cannot be achieved at the moment and maybe it is not even necessary for every situation. The key to an effective design without a complete system lies in the ability of our brain to modify and adapt our perception to the situation.

Can we exploit these possibilities in the field of developing applications, using network and design creative and compelling environments for the users? Can we consider illusory reactions as an augmented reality immaterial tool?

3 Conclusions

Our perceptual system makes inferences about the world based on relatively small samples of the surrounding environment, and uses top down prior expectations to automatically fill in missing information. How the user perceives the virtual/graphical environment is an indicator of the involvement and the level of presence, and combining perception and interaction is an important feature for virtual reality applications.

The idea is to explore haptic illusions and to understand whether or not we could use these for specific design, increasing the perception of the users. Designing environments and graphical interfaces, considering that an illusion may increase the perceptions of the user and save the complexity of the system could be options, especially when the data go on the network, not to mention the cost in terms of money and development time.

Possible applications are environments that do not require strong haptic interaction, but that will drastically increase in performance and sense of presence if a sort of haptic perception is provided. Here are some examples of application fields:

- Showrooms - Having the feeling of touch can give a better impression to the customer.

- Virtual prototyping - Changing the internal walls of a fridge to light blue could provide a cold sensation that helps the tester to ergonomically evaluate the appliances.

- 3D data representation – Increasing the emotion of the exploration.

- Virtual museums - Changing the perception of the tridimensional environment.

Illusory strategies may be used as tools to augment the actual capability of a system to induce emotions, to open to new possibilities in all the creative tasks designed for us as users: Immaterial add-ons for material experiences.

References

[Gibson, 1966] Gibson, J. (1966). The Senses Considered as Perceptual Systems. Greenwood Pub Group.

[Hendrix and Barfield, 1996] Hendrix, C. and Barfield, W. (1996). Presence within virtual environments as a function of visual display parameters. Presence-Teleoperators and Virtual Environments, 5(3):274-289.

[Pasquinelli, 2006] Pasquinelli, E. (2006). An analysis of the notion of illusion and illusory phenomena. PhD thesis, Institut Jean Nicod - E.H.E.S.S Paris and Dipartimento di Filosofia, Università di Pisa.

[Sanchez-Vives and Slater, 2005] Sanchez-Vives, M. V. and Slater, M. (2005). From presence to consciousness through virtual reality. Nature Neuroscience, 6(4):8-16.