HyperReality

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INTRODUCTION

On the Internet, a cyberspace is created where people communicate together, usually by using textual messages. Therefore, they cannot see each other in cyberspace. Whenever they communicate, it is desirable for them to see each other as if they were gathered at the same place. To achieve this, various kinds of concepts have been proposed, such as a collaborative environment, Tele-Immersion, and tele-presence (Sherman & Craig, 2003).

In this article, HyperReality (HR) is introduced. HR is a communication paradigm between the *real* and the *virtual* (Terashima, 1995, 2002; Terashima & Tiffin, 2002; Terashima, Tiffin, & Ashworth, in press). The *real* means a real inhabitant, such as a real human or a real animal. The *virtual* means a virtual inhabitant, a virtual human, or a virtual animal.

HR provides a communication environment where inhabitants, real or virtual, that are at different locations, meet and do cooperative work together as if they were gathered at the same place. HR can be developed based on virtual reality (VR) and telecommunications technologies.

BACKGROUND

VR is a medium composed of in teractive computer simulations that sense the viewer's position and actions, and replace or augment the feedback to one or more senses such as seeing, hearing, and/or touch, giving the feeling of being mentally-immersed or present in the virtual space (Sherman & Craig, 2003). They can have a stereoscopic view of the object and its front view or side view, according to their perspectives. They can touch and/or handle the virtual object by hand gesture (Burdea, 2003; Kelso, Lance, Steven, & Kriz, 2002; Stuart, 2001).

Initially, computer-generated virtual realities were experienced by individuals at single sites. Then sites were linked together so that several people could interact in the same virtual reality. The development of the Internet and broadband communications now allows people in different locations to come together in a computer-generated virtual space and to interact to carry out cooperative work. This is the collaborative virtual environment. As one of these collaborative environments, the NICE project has been proposed and developed. In this system, children use avatars to collaborate in the NICE VR application, despite the fact that they are geographically at different locations and using different styles of VR systems (Johnson, Roussos, Leigh, Vasilakis, Marnes, & Moher, 1998). A combat simulation and VR game are applications of the collaborative environment.

Tele-Immersion (National Tele-Immersion Initiative-NTII) will enable users at geographically-distributed locations to collaborate in real-time in a shared, simulated environment as if they were in the same physical room (Lanier, 1998).

HR provides a communication means between real inhabitants and virtual inhabitants, and between human intelligence and artificial intelligence. In HR, a communication paradigm for the real and the virtual is defined clearly. Namely, in HR, a HyperWorld (HW) and coaction fields (CFs) are introduced.

Augmented reality (AR) is fundamentally about augmenting human perception by making it possible to sense information not normally detected by the human sensory system (Barfield & Caudell, 2001). A 3D virtual reality derived from cameras reading infrared or ultrasound images would be AR. A 3D image of a real person based on conventional camera imaging that also shows images of their liver or kidneys derived from an ultrasound scan is also a form of AR. HR can be seen as including AR in the sense that it can show the real world in ways that humans do not normally see it. In addition to this, HR provides a communication environment between the real and the virtual.

HR CONCEPT

The concept of HR, like the concepts of nanotechnology, cloning, and artificial intelligence, is in principle very simple. It is nothing more than the technological capability to intermix VR with physical reality (PR) in a way that appears seamless and allows interaction. HR incorporates collaborative environment (Sherman & Craig, 2003), but it also links the collaborative environment with the real world in a way that seeks to be as seamless as possible. In HR, it is the real and virtual elements which interact and, in doing so, they change their position relative to each other. Moreover, the interaction of the real and virtual elements can involve intelligent behavior between the two, and this can include the interaction of human and artificial intelligence. However, HR can be seen as including AR in the sense that it can show the real world in ways that humans do not normally see it.

HR is made possible by the fact that, using computers and telecommunications, 2D images from one place can be reproduced in 3D virtual reality at another place. The 3D images can then be part of a physically-real setting in such a way that physically-real things can interact synchronously with virtually-real things. It allows people not present at an actual activity to observe and engage in the activity as though they were actually present. The technology will offer the experience of being in a place without having to physically go there. Real and virtual objects will be placed in the same space to create an environment called a HW. Here, virtual, real, and artificial inhabitants and virtual, real, and artificial objects and settings can come together from different locations via communication networks, in a common place of activity called a CF (coaction field), where real and virtual inhabitants can work and interact together.

Communication in a CF will be by words and gestures and, sometimes, by touch and body actions. What holds a CF together is the domain knowledge which is available to participants to carry out a common task in the field. The construction of infrastructure systems based on this new concept means that people will find themselves living in a new kind of environment and experiencing the world in a new way.

HR is still hypothetical. Its existence in the full sense of the term is in the future. Today, parts of it have a half-life in laboratories around the world. Experiments which demonstrate its technical feasibility depend upon high-end work stations and assume broadband telecommunications. These are not yet everyday technologies. HR is based on the assumption that Moore's law will continue to operate, that computers will get faster and more powerful, and that communication networks will provide mega bandwidth.

The project that led to the concept of HR began with the idea of the virtual space teleconferencing system. It was one of the themes of ATR (Advanced Telecommunications Research) in Kansai Science City. Likened to the Media Lab at MIT or the Santa Fe Institute, ATR has acquired international recognition as Japan's premier research center concerned with the telecommunication and computer underpinnings of an information society. The research lasted from 1986 to 1996, and successfully demonstrated that it was possible to sit down at a table and engage interactively with the tele-presences of people who were not physically present. Their avatars looked like tailors' dummies and moved jerkily. However, it was possible to recognize who they were and what they were doing, and it was possible for real and virtual people to work together on tasks constructing a virtual Japanese portable shrine by manipulating its components (Terashima, 1994).

The technology that was involved comprised two large screens, two cameras, data gloves, and glasses. Virtual versions were made of the people, objects, and settings that were involved, and these were downloaded to computers at different sites before experiments started. Then it was only necessary to transmit movement information of the positions and shapes of objects in addition to sound. As long as one was orientated toward the screen and close enough not to be aware of its edges, interrelating with the avatars appeared seamless. Wearing a data glove, a viewer can handle a virtual object by hand gesture. Wearing special glasses, he/she can have a stereoscopic view of the object. A snapshot of the virtual space teleconference system is shown in Figure 2.

Most humans understand their surroundings primarily through their senses of sight, sound, and touch. Smell and even taste are sometimes critical too. As well as the visual components of physical and virtual reality, HR needs to include associated sound, touch, smell, and taste. The technical challenge of HR is to make physical and virtual reality appear to the full human sensory apparatus to intermix seamlessly. It is not dissimilar to, or disassociated from, the challenges that face nanotechnology at the molecular level, cloning at