

Multi-User VR Environments on the Internet

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Information Design

인터넷 상에서의 멀티 유저 가상현실 환경

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<개요>

본 논문은 인터넷을 통한 공유 가상 환경(Shared Virtual Environment)의 총체적인 경험에 대해 논하고 있다. 3차원 가상환경에서 다른 사람과 만나고 상호작용하는 공간의 사용 그리고 환경에 대한 지각은 현실(Reality)에 대한 '공간적 메타포'라 할 수 있다. 따라서 본 논문에서는 멀티유저 가상현실 환경에 대해 논함에 있어서 주요 개념들의 출현 과정을 개괄한 후, 그러한 개념들의 적용을 사례를 통해 제시하고 특히, 멀티유저 가상 현실 환경(Multi-User VR Environment)에서 사용자를 대체하는 '아바타(Avatar)'라는 개념을 중심으로 현실에 점점 다가가고 있는 3차원 가상환경에서의 발전된 상호작용의 의미와 앞으로의 발전방향에 대해 고찰하고자 하였다.

Why would we leave home to go somewhere else to meet friends, to go shopping, to the library or the theater, if Virtual Reality can provide us with all the sensory stimulation we feel in the real environments? How about virtual environment? Why don't we work and enjoy our life there together?

Mark Pesce, co-founder of VRML



Fig.1) Multi-User Internet VR Gallery in Active World
So-Yeon Yoon's Digital Art Exhibition

Introduction

The term 'Multimedia' has been one of the most pervasively used terms for the recent years. Dyrli and Kinnaman (1995) defined multimedia as "the seamless digital integration of text, graphics, animation, audio, still image, and motion video in a way that provides individual users with high levels of control and interaction". Multimedia, computer-generated media as what *digital* implies, provide us with realistic sensory effects in an interactive way.

Multimedia became a crucial ground for the emergence of the concept of Virtual Reality in the 1980's. Virtual Reality, or computer generated environments with and within which people can interact, were initially induced through science fiction, NASA and military researchers.

Virtual Reality environment is becoming a remarkable representation tool for decision-making of architects, a solution for learning process from a distance, a setting for shopping and so forth. In addition, more advanced interface supports even social activities. This kind of interactive environment is commonly called Cyberspace. One of the most outstanding features of Cyberspace from other media is that its participants respond to the environment simultaneously.

The whole experience will be described in this paper as the "Shared Virtual Environment". The sense of space and the use of the space for meeting and interacting with others in a 3D environment is known as the spatial metaphor¹. This paper attempts to review the development of important concepts in discussing multi-user virtual reality environments. It also puts forward to demonstrate

¹ Benford, S., & Fahlen, L. (1993) A spatial model in large virtual environments. Paper at ESCW '93, Milan Sept, 1993

advances in the application of such conceptualization, followed by a particular example of such applied concept focusing on a case of *Avatar*. Finally, it presents some points for further consideration in the future of virtual environments.

Cyberspace and VR

Cyberspace and Virtual Reality, two concepts which came out about same time and have been so closely connected that many people seem to suppose they mean same. Marcos Novak (1991) describes the difference is that virtual reality is the enabling technology and Cyberspace is the 'content'. Especially the term Cyberspace was coined by William Gibson in his SF novel *Neuromancer* (1984) during the literary Cyberpunk movement, as Lester W. Smith (1989) defines that is 'the realm of cyberpunk: to explore what it means to be human, or inhuman, in the world of the future'.

Accordingly, Cyberspace seems to be accessed only through virtual reality interface, so that virtual reality can serve as a path way to access Cyberspace. William Gibson's characterization of Cyberspace has at least three dimensions, where the virtual environment exists only as a "consensual hallucination" on the part of the hosts and users who participate in it. This new concept has been realized through the new technology called "Virtual Reality" for some, and "Cyberspace" or "Virtual Environment" for others.

Cyberspace is a globally connected network that is computer-sustained, computer-accessed, and computer-generated, multidimensional, artificial, or "virtual" reality. In this reality, to which every computer is a winder, seen or heard objects that are neither physical nor necessarily representations of physical objects but rather characters and actions, made up of data, of pure information (Benedikt, 1991, p. 21)

As Novak (1991) points out, the transition from real space to Cyberspace like other sorts of conversion – for example, from prose to poetry, from fact to fiction, from static to dynamic, from passive to active, from the fixed in all forms to the fluid in ever-changing countenance –, is best understood by examining the human effort that combines science and art, the worldly and the spiritual, the contingent and the permanent: architecture.

A number of traits regarding Cyberspace seems to indicate that it would be the most proper tool for simulation of real spaces in respect that virtual environments require users to imagine "being there". Users can interact with their virtual environments almost as naturally as they do in actual environments.

Cyberspace makes it easier to communicate and access information. Under environments in Cyberspace, there are no distance, gravity, and geographical background within architecture in Cyberspace. As a good example of conceptualization of this illusive notion, Michael Benedikt (1991) embodied the necessity of Cyberspace with his point of view. In his proposition, the creation of Cyberspace is not only a good but necessary, and even inevitable step (1) toward providing the maximum number of individuals with the means of creativity, productivity, and control over the shapes of their lives within the new information and media environment, and (2) toward isolating and clarifying by sheer contrast, the value of unmediated realities—such as the natural and built environment, and such as the human body—as the source of order truth, silence of a sort, and perhaps sanity.

Through the inevitability of Cyberspace, when virtual environments replace physical environments, namely, buildings such as school, library, and shopping malls may be all replaced from physical buildings into virtual ones.

3-D Virtual Environment

Today's worlds are connected by invisible networks in which information, images and money flow from place to place. As social philosopher Paul Virilio (1994) wrote,

“the representation of the contemporary city is no longer determined by a ceremonial opening of gates, by a ritual procession of parades nor by a succession of streets and avenues. From now on architecture must deal with the advent of a ‘technological space-time’. Since the computer-generated network system deeply pervades our society, many sociologists and architectural theorists have defined our future in Cyberspace.

The impact of new electronic technologies on our cities gave birth to the Virtual Environment concept from Cyberspace. Narrowed down to an architectural point of view, Virtual Reality is the basic procedure to complete Cyberspace. From the architect, Peter Eisenman's perspective, architecture has left the “mechanical paradigm” of physical structure for the “electronic paradigm” of the information superhighway reality headset. “Virtual Reality is the new possibility for reality”, he says. “Actual places will be supplanted by a “place of communication” (Slatin, 1994). In an apt reading of architectural history, Bernard Tshumi (1993) describes “continuing transformation of buildingsfrom material to immaterial...from the heavy stones of the Egyptians to Roman vaults, then gothic arches, then iron construction, the curtain wall, structural glass, immaterial light screens, Albert Speer's Cathedral of Light, Holograms, and Virtual Reality”. Once a Virtual Environment level is developed by digital technology it can convert into Cyberspace.

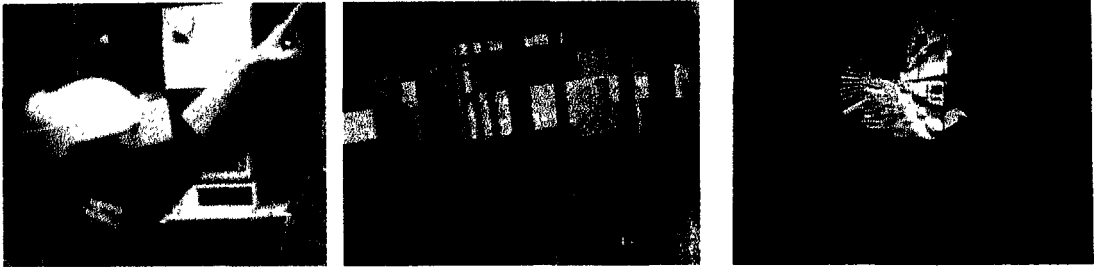


Fig.2) Virtual Environment types

The applications for virtual environments are many and varied, from database exploration, virtual teleconferencing and simulation to games. Throughout the growth of virtual world, there have been various genres of virtual environments fashioned after the emphasis on interaction to the world. In *Game worlds*, performance is everything; as if how well and fast you shoot determine your success in Doom. In the genre that can be called *Learning worlds*, advancement is dependent upon performance, but usually in a less aggressive environment, for example, as in Lifespan's Mathworld. *Shopping worlds* can be a social or non-social experience, although studies indicate shopping is for many a very social experience and worlds. In *Social worlds*, social interaction, the use of facial expressions and avatar creation are integral for many parts of the experience. Habitat is an example of this kind of virtual world.

In a world of ubiquitous computation and telecommunication, electronically augmented bodies, and the infobahn, the notion of the city is challenged and must eventually be reconceived.

The computer network has become as fundamental to urban life as the street system (Mitchell, 1995).

The Virtual World is constructed by 'bits' of digital data just as the physical 'urbs' are composed of blocks of stone. Electronic 'malls' and 'shops' are placed on computer networks (both Internet and the commercial dial-up service).

Virtual Reality in Cyberspace was originated from spatial metaphor of reality.

The concept of representing reality has been on the Internet as superficial expression and symbolism for long time (Fig.3).

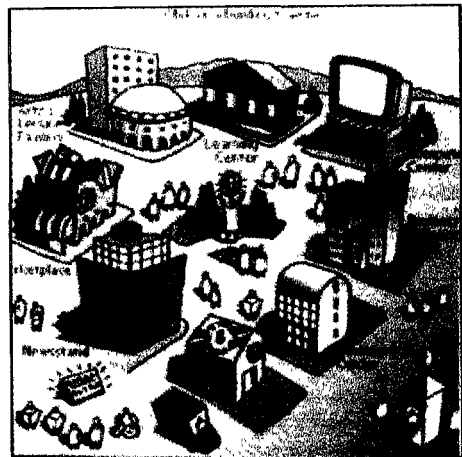


Fig.3) 2D spatial metaphor on the Internet

However, three-dimensional virtual environment has been developed in a different approach to provide users for the full sensory perception of Cyberspace with real-time rendering (Fig.4).

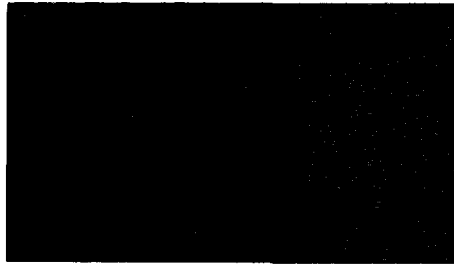


Fig.4) 3D Virtual Environment in VRML1.0

In this reality, to which every computer is a window, seen or heard objects are neither physical nor, necessarily, representation of physical objects but are, rather, in form, character and action, made up of data, of pure information.”

Venturi and Post-Modern architects derived architecture of surface symbolism and ornament as mixed media. Virtual Architecture in Cyberspace exists without physical space and geography.

There is only surface symbolism with a full range of messages and information



```
Separator {
  DirectionalLight {
    direction 0 0 -1 # Light shining from viewer into
world
  }
  PerspectiveCamera {
    position -8.6 2.1 5.6
    orientation -0.1352 -0.9831 -0.1233 1.1417
    focalDistance 10.84
  }
  Separator { # The red sphere
    Material {
      diffuseColor 1 0 0 # Red
    }
    Translation { translation 3 0 1 }
    Sphere { radius 2.3 }
  }
}
```

```

Separator { # The blue cube
  Material {
    diffuseColor 0 0 1 # Blue
  }
  Transform {
    translation -2.4 .2 1
    rotation 0 1 1 .9
  }
  Cube {}
}
}

```

VRML code for a simple world defining
a view of a red cone and a blue sphere, lit by a directional light

Multimedia communication in the distance world of the Cyberspace, digital world, is being developed toward its ultimate goal through WWW Internet. Recently there has been research in developing Virtual Reality, which hopes to bring a three-dimensional (3D) in the World Wide Web. VRML (Virtual Reality Modeling Language) programming enables us to build 3D worlds. And it hopes to bring a three-dimensional view to the normal HTML, the core page description in the World Wide Web. VRML was first introduced in 1995. VRML editors, such as SGI Cosmo Worlds and Kinetix 3D studio Max, are much like HTML editors in that they convert pages.

A number of companies already have products on the market that can turn an Internet screen into a 3-D experience. They are doing it with a new authoring language- the computer language that creates the documents such as VRML or Renderware etc. Now a widely accepted standard, VRML is key to the use of virtual reality in business. VRML was first developed in mid-1990's to let users run Virtual Reality over the Internet. Recently, Netscape and Microsoft pledged to include VRML-compliant software in their Web browsers. In order to view 3D worlds we need to have plug-ins for commonly used browsers or stand-alone players

Virtual Environments for multiple users

With the advent of VRML, we have been able to visualize information in three dimensions on the Internet, much in the way we do perceptually in the physical world. The worlds are represented as collections of visual objects, with properties giving them color, shape, texture, behaviors or other attributes.

One of the most promising future directions for the Internet is the possibility of supporting virtual environments for multiple users in remote locations². This could allow users to experience and manipulate models of remote objects in three dimensions. For example browsers could 'walk-through' a representation of building on a different continent, or co-workers could manipulate a three-dimensional model of a product even though they may be at different company sites.

There are examples of interactive shared environments, that are multi-user virtual environments, but they are in traditional physical based engineering, design or scientific domains. There are a number of graphical modeling languages for 3D environments but the most promising, although not yet developed for interaction, is VRML³. One of the ideas of VRML is to allow multiple participation inside a virtual world to create a VRMUD (Virtual Reality Multi User Dimension). This raises synchronization problem, since each user essentially downloads a copy of the environments then when one user manipulates part of the scene this need to be transmitted to all other participants. There fore Virtual environments made by VRML have features just as a tool to review engineering and scientific models from providing meeting space as socialware.

Virtual environments can function not only as setting for individual action, but also as meeting venues. And this creates a demand of some form of electronically mediated self-representation. In responds, software designers have presented such spaces as scrolling text in which users are minimally designated by their "handles," as two-dimensional pixel-puppets standing for users, and most elaborately, as three-dimensional walkthrough environments which are depicted in perspective and inhabited by three-dimensional characters known as avatars⁴.

The followings are currently available Multi-user VR Environments on the Internet. Each one has unique browsing interface and different types of avatars. Especially we will focus on Active Worlds, which is the one that information design of the university of Ulsan has been involved in building worlds such as virtual shopping malls and cyber gallery.

OZ Virtual

OZ Virtual is a crafted VRML world brought by OZ Inc. The browser interface is quite difficult to understand and use while it looks cool. Another issue is that the ground zero entry plaza is so dark as to make it hard to see the features there. A serious problem with OZ Virtual is navigation.

² Rae Earnshaw, John Vince, (1997) Visualization and virtual reality on the Internet, The Internet in 3D. Academic Press, 1997

³ Yokote, Y., The Apertos reflective operating system; the concept and its implementation. ACM OOPSLA '92, SONY report SCSL-TR-92-104, 1992

⁴ Peter Anders, Envisioning Cyberspace, McGraw-Hill. 1999

It is very hard to figure out how to operate in this world. However lighting is very advanced in OZ world. It is rare to meet anyone in OZ Virtual. It seems that it does not attract much of a user base yet.



Fig.5) OZ Virtual browser interface and Avatars

CyberHub

CyberHub by Black Sun Interactive is the result of long work on a powerful multi-user VRML server and a previous browser called CyberGate. CyberHub runs within Netscape as a series of plug-ins and uses Java for its interface, which means it can run on any platform supporting Java and the plug-ins such as Live3D or Cosmo Player. Thus Cyberhub can be very slow related to network latency and large VRML worlds.

We can message users, open private chat, or even start Cooltalk or Microsoft Netmeeting for voice conversations. However, avatars in this world have no name badges or other identifying marks so it very difficult to associate the chat with the avatars in the scene. The avatars are very geometric. Also most avatars have no arms, so no hand waving gesticulations.

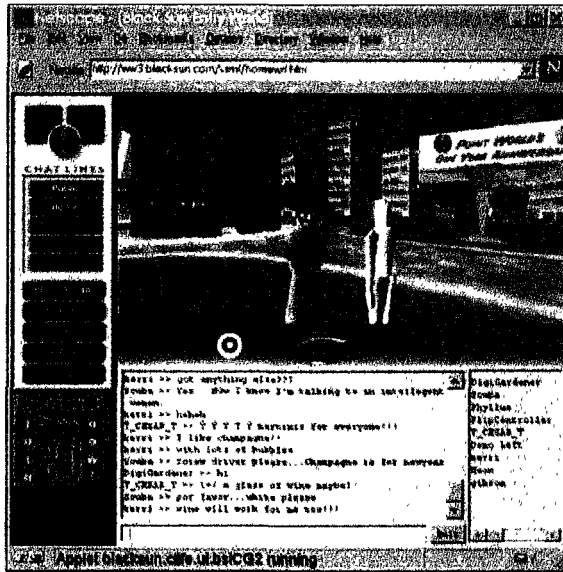


Fig.6) CyberHub Browser Interface and Avatars

Pueblo

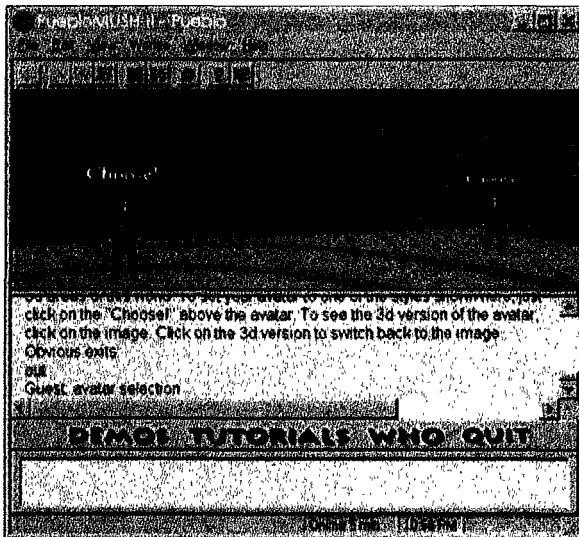


Fig.7) PuebloMUSH avatar selection gallery

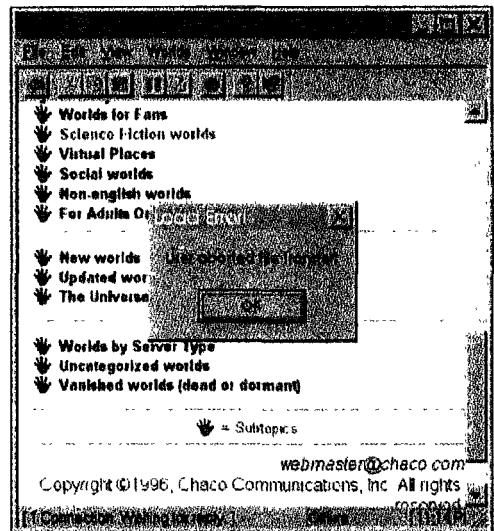


Fig.8) Pueblo browser

Pueblo from Chaco Communications is an interesting hybrid of a 3D world and a MUSH/MOO/MUD⁵ Telnet client. Pueblo leverages the existing community of text based virtual worlds, giving them HTML and VRML graphics.

The problem with Pueblo world is that it takes too long to travel and too few pages available in the Web to consider it a multi-user VRML environment. Users are seldom found in Pueblo VRML space. MUDs have incredibly rich communities, if Pueblo certainly is not going to convince them that a VRML graphical interface is more than just window dressing on what they already have. A Pueblo on its own cannot compete with other fully designed multi-user VRML spaces.

IDMOO

IDMOO is a text and voice chat supported VRML avatar world. IDMOO includes the basic technologies and tricks such as personally created VRML avatars and rooms, queued audio and text chat, multiple views of the virtual environment, URL-based browsing of Intel Distributed MOO servers world wide. IDMOO is very much an experimental test bed.

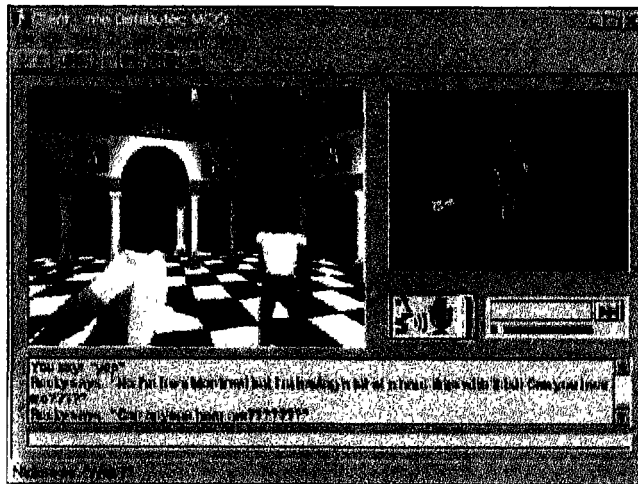


Fig.9) IDMOO browser interface and avatars

⁵ There are a number of computer systems on the Web to sign onto the system and interact inside a "virtual" world. Depending on how the virtual world is set up, you can move around from place to place, create or move objects, and interact with other users. These virtual worlds are called MUD (Multi-User Dimension), MOO (Multi-user Object Oriented), MUSH (Multi-User Shared Hallucination), and so forth.

V-Realm Multi-User Browser

Integrated Data Systems of Savannah, Georgia has a powerful set of VRML 2.0 authoring and server tools that includes integrated voice streaming.

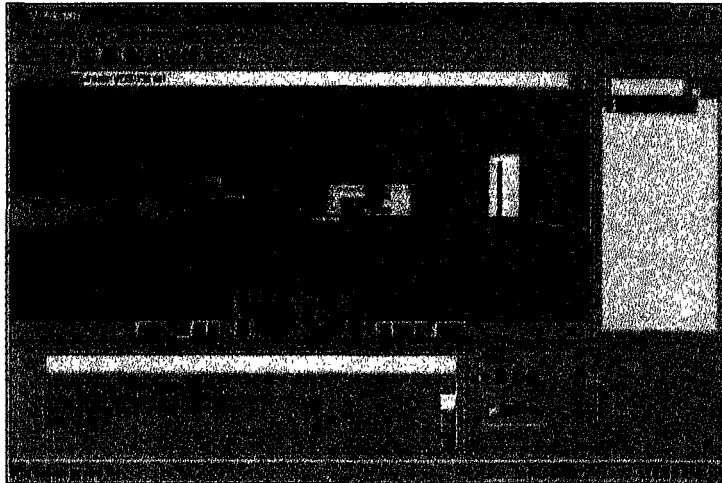


Fig.10) V-Realm Browser

Navigation controls seem effective but movement is not smooth or intuitive. The sad fact is that V-Realm never stayed running long enough to do any serious exploring and it takes too much memory to browse. Users hardly meet others in V-Realm.

Community Place Browser

Sony's Community Pleace Browser is a small and simple application. Despite its name, Community Place Browser does not have much of a developed community yet. The look of the initial Sony world is either too dark to be inviting or too bright to seem natural. Text chat is shown right avatar heads in a translucent bar, a nice touch allowing you to look through someone else's chat to read another conversation. read another conversation. It provides a separate chat window.

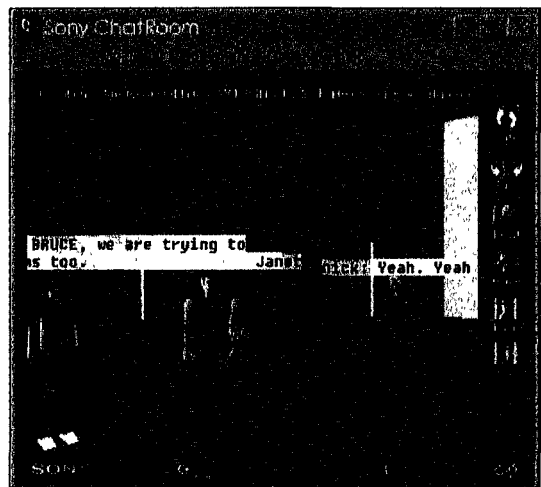


Fig.11) MultiUser Window and Avatars in the Sony ChatRoom

Active Worlds

The Active Worlds produced by Circle of Fire Studios are some of the most advanced virtual worlds in Cyberspace. Users of avatar worlds are called citizen: A sign that they should be respected as members of a community.

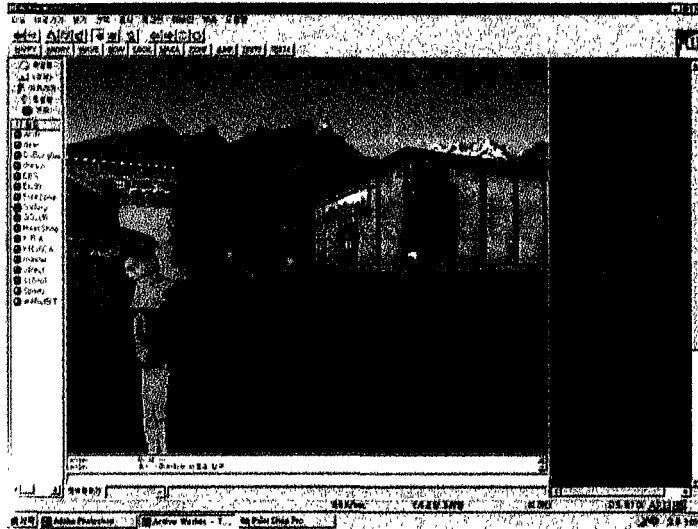


Fig.12) Active Worlds browser interface and avatars
Front yard of Gallery world for So-Yeon Yoon’s Digital Art Exhibition

While many other virtual environments are built in VRML, Active Worlds are generated by Renderware, in other worlds RWX⁶ code, for real-time rendering.

Active Worlds browser is constantly evolving. You could meet over thousand people in Active Worlds in around 600 different worlds for American domain, 44 for Korean domain.

Since July 1999, department of information design, university of Ulsan has been working on building a modern shopping plaza for a pleasant and enjoyable shopping experience beyond a mere purchasing behavior(Fig.13).

⁶ Renderware scripting file format is the 3D format used by ActiveWorlds, OuterWorlds, and City4ALL universes

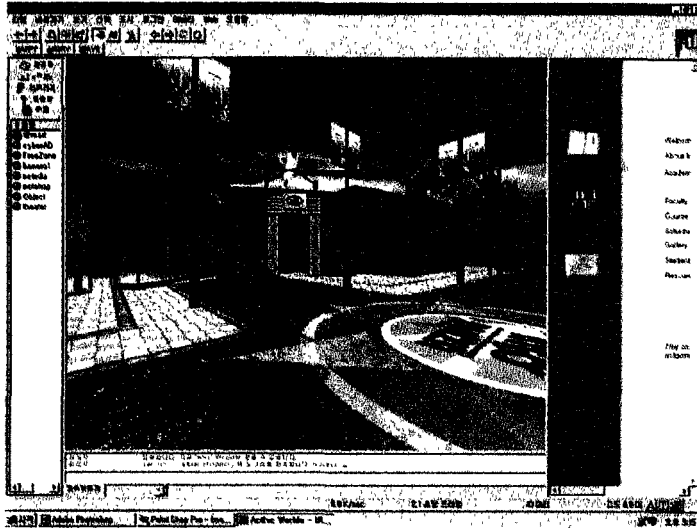


Fig.13) Info Plaza, a virtual shopping mall

Avatar: body extensions in Cyberspace

Avatar is the name we use for people in multi-user virtual worlds. The representation of people in shard space is usually through simple “avatars” or body icons, showing the location of a users view point and gaze direction in virtual world More realistic forms are being developed which have full body kinematics.

The viewpoint technique most commonly used in a virtual world is the first-person view, as would be seen through the users eyes. However, ‘out-of-body’ views, when users can see their own representation or avatar in the virtual world can sometimes convey greater meaning. In social worlds, social interaction, the use of facial expressions and avatar creation are integral for many parts of the experience. Habitat is an example of this kind of virtual world.

Any social event can take place in those worlds, such as wedding ceremonies or birthday parties. The visitors can get together and join the events or even help it by creating objects like 3D birthday cake in the Cyberspace. Ultimately, Cyberspace is social space as long as there are multiple avatars are present at the same time(Fig.14).

Davis, head of the Computer Institute, a San Francisco group seeking support to build a computer museum in the city, disputes the term virtual reality.

"It's reality," he said. "We seem to have come into a place in society where we have a duality between ourselves and technology. Technology is a biological byproduct of the human race."

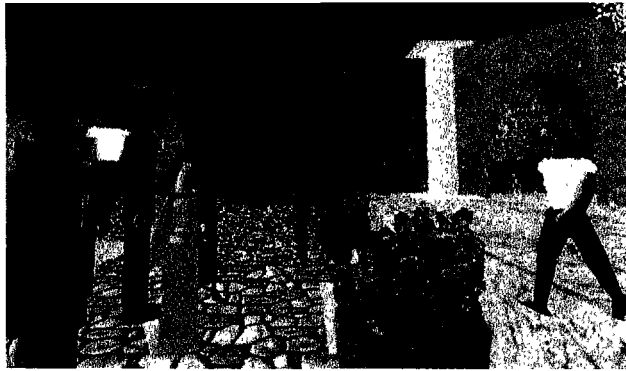


Fig.14) Avatars' virtual wedding

Outlook: The future of virtual environments

Currently 3D VR on the web is still in its evolutionary stage and yet has limitations due to dial-up and slow links on the Internet. One of the best uses for this technology is on corporate Intranets. Even over a T1 line, it takes fairly long to bring up and maneuver around. It also causes that on-line 3D VR can only deliver humble quality in color, texture and lighting. However, as the technology develops so fast, it would not take long until we experience powerful 3D environments. ISDN has a strong role to play, with its conventional dial-up, but fully digital access, it will be very effective in the first use of network supported shared environments.

3D VR worlds are now in the unique position of being commercially available (Bricken,1992) before being academically understood due to its powerful interactive feature between user-environment and among users.

As to the future urbanism, Novak described (1996), there is no question that urbanism, our cities will become our interface to the new.....a new, nonlocal urbanism is in the making. City planning becomes data structure design, construction costs become computational costs, accessibility becomes transmissibility, proximity is measured in numbers of required links and available bandwidth.

We seem to enter the electronic era living at the intersection points of physical and virtual world. 3D VR worlds on the web will make fewer cases to go out. As people spend more and more time in virtual world, different patterns will occur in real world. There will be another culture in Cyberspace whether something identical with reality or something else. It is a kind of anthropology for another culture in information era we are living. Therefore future study will be focusing on distinguished

behavior patterns in virtual environment from reality and design criteria to develop the setting, both will be based on qualitative study interviewing visitors as well as observing them.

Currently, the whole conception of on-line virtual reality is underdeveloped. But in the future, humans will be place with network address in Cyberspace as well as street addresses. And as network and information appliances deliver expanding ranges of services (Michell, 1995).

We face a conceptual restructuring that includes understanding of environment from the vision of basically immaterial qualities promoted by electronic, digital technologies. We stand at the threshold of the intersection of the physical and virtual worlds. The rise of the city is integrally linked to advances in communication technology.

In Cyberspace there is no need for foundation, enclosure or shelter. But there will be an abundance of sign and information. Neither space nor time is important in such a 'place'. Communication across space becomes superior. It will require a vocabulary of symbol that replaces the physical form of our environment.

It may be too early to gauge the impact of the interactive multi-user VRML, but to date, it has attracted critical mass of people on the superior virtual environments. As we have better understanding of how virtual reality modeling power handles three-dimensional graphics, especially interactive 3-D presentations, the future of our daily interaction's mode and scope should be much closer to reality. Furthermore, the meaning of our interaction should expand its compass beyond the current human-environment interaction, not to mention far beyond the limits of the communicative barriers of the use of interactive technology. While we are still talking about a home page in the Internet, if you want to be cutting edge, now you can have your own home space, your own world, more "real" and less "virtual" in terms of interactive range of communication between you and your environments. The full power of the spatial metaphor and multi-party interaction will not become apparent, until the more abstract data applications in knowledge engineering are evaluated. However, the day will not be far away when web surfers, by plugging their own "avatars" into VRML universes and interact with other users in real-time, explore the landscape of multi-user virtual classrooms, galleries, and shops.

Now Virtual Reality, widely recognized as a Reality technology, even though it is still mentioned that VR technology is in the infancy (Campbell, 1995) or lingering on the threshold (Chaplin, 1995), is well on its way carrying out the idea of fuller, freer, and far closer to real human life experience. As the technology continues the development, one thing that can be inferred from the process of its evolution is the general direction that the interface will evolve and become less clumsy, and then it will reach its goal of "reality" someday in the near future.

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