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3D VIRTUAL WORLDS AND LEARNING: AN ANALYSIS OF THE IMPACT OF DESIGN AFFORDANCES AND LIMITATIONS IN ACTIVE WORLDS, BLAXXUN INTERACTIVE, AND ONLIVE! TRAVELER; AND A STUDY OF THE IMPLEMENTATION OF ACTIVE WORLDS FOR FORMAL AND INFORMAL EDUCATION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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The Ohio State University
1999

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Abstract

Within this decade there has been a proliferation of computer technologies that allow users to communicate and collaborate over time and space. These emerging technologies have had a great and resounding impact on the field of education by not only influencing practices within the classroom, but by expanding and challenging our notions of how we learn. During the past few years, educators have begun to experiment with the use of text-based virtual worlds to both supplement and expand classroom practices. While text-based virtual worlds offer many unique opportunities for collaborative and cooperative learning, they lack the visual opportunities afforded by such technologies as virtual reality. 3D virtual worlds represent an emerging technology that offers the communicative opportunities of text-based virtual worlds, but with a 3D environment that provides a visual representation of space and place for users to interact within. This thesis is a two-part study into the design and implementation of 3D virtual worlds for educational purposes. Part one of this study provides an analysis of the impact of design affordances and limitations of three popular 3D virtual worlds (Active Worlds, blaxxun interactive, and OnLive! Traveler) by addressing the way the user is constructed. This study relied on the use grounded theory methodology to analyze the various design features that serve to construct presence, representation, and
embodiment of users. The findings indicated that although all three 3D virtual worlds had roughly comparable design affordances and limitations, each functions in different ways. In turn, it was revealed that these three worlds provide interesting and different potential as learning environments. Part two of this study is an investigation of how Active Worlds is currently being used for both informal and formal education. The two case studies provided in this investigation are an AW object modeling class offered by Active World University (informal) and an undergraduate business-computing course offered by the University of Colorado—Boulder College of Business (formal). Findings revealed that in both case studies the use of a 3D virtual world provided unique learning opportunities that would be difficult to replicate in a physical classroom. Implications of this study can be applied to the design, practice, and future research of the educational use of 3D virtual worlds.
Dedicated to my parents in appreciation of all of their support.
ACKNOWLEDGEMENTS

I am deeply indebted to my advisor, John Belland, for his patience, wisdom, and mentoring throughout my doctoral studies. His generosity is the hallmark of a great teacher.

I was also very fortunate to be able to work with the other members of my committee, Wayne Carlson, Midori Kitagawa, and Keith Hall. I would like to express my appreciation to both Wayne Carlson for serving as my co-advisor and Keith Hall for providing me with so many opportunities. I would especially like to thank Midori Kitagawa for providing such an excellent foundation in the study of 3D modeling and animation.

In addition to my committee, I would like to express my gratitude to my family for all of their support.

Interacting in a 3D virtual world is an experience in community and collaboration on all levels. Conducting research into these environments is not a solitary endeavor. It would be impossible for me to list all the individuals who enabled my research, however, I would like to try.

I am indebted to Magine who shared her time, talent, and reflections about teaching in a virtual world. Lucretia Borgia (Mandee Tatum) of Active Worlds University not only provided a history of AWU, but also continues to promote education within AW. I would also like to express my gratitude to Dr. David Monarchi, Michael P. Miller, and the other members of the BCOR design team at the University of Colorado–Boulder for providing access, assistance, and materials for the amazing virtual BCOR 1000 site. Through their innovative design they have managed to put space, place, and community into distance and distributed learning.
Bruce Damer helped me in ways too numerous to mention by sharing stories, histories, explanations, sources, names, and an occasional telephone number. I would like to express my gratitude and appreciation to Bruce who is an infinite source of wisdom for all things related to 3D virtual worlds.

Finally I would like to thank all of the citizens I encountered in Active Worlds, Colony City, and the various Traveler worlds that willingly shared their stories, opinions, experiences with me.
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Studies in: Instructional Design and Evaluation

       Computer Generated, Three-Dimensional Graphics and Animation Production
       (Advanced Computing Center for the Arts and Design)

       Multimedia Design and Production
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CHAPTER 1
INTRODUCTION

The Internet and the World Wide Web (WWW) have had a great and resounding impact on the field of education and the design of instructional materials. Unlike any predecessor technology, the computer and subsequently computer mediated communication is not only influencing and changing our practices within the classroom, but is also expanding and challenging our beliefs and definition of what constitutes a classroom or learning environment.

While the Internet has certainly impacted education, it the WWW which has in many ways made computers, networks and servers everyday terms. The WWW marked a great departure in not only the ways in which information is presented and accessed, but it also shifted our relationship to information and called into question the notion of how learners acquire knowledge. With the widespread use of this hypertext or hypermedia system, information no longer had to be presented in primarily linear forms afforded by books and films, instead information could be organized and presented in a relational fashion. The WWW has added much fuel to constructivist theories that learners construct knowledge through relationships rather than acquire knowledge through transmission.
be presented and accessed has added much fuel to constructivist theories that learners construct knowledge through relationships rather than acquire knowledge through transmission.

The influence of the WWW is only beginning to be realized. In addition to impacting education and theories of knowledge construction, the WWW has also caused educators to look into the role of collaboration both within the classroom and as an extension of the learning environment.

As the WWW has evolved, new technologies have emerged that will continue to impact the field of education. Recent developments in programming systems such as Virtual Reality Modeling Language (VRML), Java, and chat applications have allowed for the emergence of desktop Web based 3D multi-user worlds (virtual worlds). Roughly, these 3D virtual worlds can be described as a combination of the 3D settings of desktop virtual reality (VR) and VRML, interactive multimedia, and a chat application. Although relatively little research has been done about 3D virtual worlds, they may offer a great many opportunities and prospects for distributed and distance learning.

One area worth further investigation is the educational use of these 3D virtual worlds. Three-dimensional virtual worlds offer the availability of learning experiences that are not always possible to replicate in a physical classroom. Like educational VR applications, 3D virtual worlds present many possibilities and implications for education by offering alternative means of accessing information through experiential learning. With limitations, these worlds offer the multi-sensory channels and interactivity of multi-media, but with the added elements of self-
representation and the interconnectivity of chat applications. Like VR, they "provide a different way to see and experience information, one that is dynamic and immediate" (McLellan, 1996). Unlike more traditional VR, 3D virtual worlds allow for collaboration both over time and space.

Research Questions

Three-dimensional virtual worlds may offer great potential for education, however, there is need for much research into the dynamics of these worlds in order to aid developers, designers, and educators in creating effective learning environments. This investigation focused on a three-part study to identify and explicate various elements of design of several of the more popular 3D virtual worlds as well as investigate current educational uses. The purpose of this study is to examine both the design and educational practice by addressing the following questions.

1. How is the user constructed by the design?
2. What unique learning opportunities are available through the use of 3D virtual worlds?

Initially these questions may seem unrelated, however, both address different, but closely related aspects of the study of 3D virtual worlds for educational purposes. The first question addresses issues of design, while the second focuses on practice.
Design of the Study

The methodological framework for this qualitative investigation will employ Grounded Theory Methodology (Strauss and Corbin, 1994). Grounded theory is an approach to research in which theory is generated during an iterative process of data collection and analysis. Unlike the positivist tradition of deductive top-down hypothesis testing, grounded theory does not rely on a priori theory, but rather theory evolves out of a "continuous interplay between analysis and data collection" (Strauss and Corbin, 1994). Methods of data collection, similar to most other methodologies that fall into the qualitative research continuum, include observations, formal and informal interviews, and documents (Strauss and Corbin, 1994). The choice to employ grounded theory for this investigation is due primarily to the fact that 3D virtual worlds are emerging technologies. Little research has been conducted about them; subsequently there are few theories about the use of them for specific purposes such as education.

Throughout this investigation, no a priori theory is offered, but rather theory is been generated from the iterative process of data collection and analysis. It is acknowledged that by employing grounded theory, subjectivity is part of the process.

This research will take the form of a two-part study. Part one is an investigation into how three, 3D virtual worlds construct the user. The three applications discussed are Circle of Fire’s Active Worlds; blaxxun interactive’s Contact 4.0 within the context of Colony City; and OnLive! Traveler. Various aspects of the design discussed are based on the following categories: presence, representation, and embodiment. Part two of this study consists of two case studies
investigating the use of Active Worlds (AW) for both informal and formal education. The first case study focuses on a class offered through the Active Worlds University for users wishing to learn to create AW objects. The second case study investigates an undergraduate business-computing course offered by the University of Colorado–Boulder, College of Business. The primary tools used for data collection include ongoing participatory observations, formal and informal interviews, documents, and the applications.

**Significance of the Study**

It is hoped by conducting this qualitative investigation into the use of virtual worlds as learning environments I can add to the limited body of research about these environments by characterizing and comparing elements of design and how design operates in constructing users. In addition, it is hoped that my research will yield significant information into unique learning opportunities 3D virtual worlds might offer for both formal and informal learning environments. That in turn will aid both 3D world developers as well as educators interested in using these environments for distributed and distance education.

**Assumptions**

1. It is assumed that collaboration and communication are important components for learning. This assumption is based on work in social constructivism (Vygotsky, 1978). Additionally, it is assumed that active learning is important in the learning process. This assumption is based on
the foundation of a constructivist approach to learning (Duffy and Cunningham, 1996) and further re-enforced by such learning theories as situated learning (Lave and Wenger, 1991; Brown, Collins, and Duguid, 1996), and engagement theory (Kearsley and Shneiderman 1998). It is also assumed that both the behaviorist and social-cognitivist approach to instructional design hold value in the learning environment, although the constructivist approach is stressed because of the relevance of it in 3D virtual worlds. This assumption is based on previous work conducted in text-based virtual worlds (Bruckman, 1997). However, it should be noted that while a constructivist approach may be most suitable to these environments, by no means is it the purpose of this study to imply that a constructivist approach is the only instructional approach with merit.

2. It is assumed that Grounded Theory methodology is an appropriate approach for investigating 3D virtual worlds. The triangulation of methods such as prolonged engagement in the field, participatory observations, and formal and informal interviews will serve to provide validity and reliability in this investigation.

Limitations

This study consists of a two-part investigation preceded by a short history and background information (Chapters Two and Three). Chapters Four, Five, Six, Seven, and Eight, focus on how the user is constructed within three, 3D virtual worlds. It
should be noted that the proceeding investigation is by no means comprehensive, but rather meant to serve as a representative sample. The final section of this study (Chapter Nine) consists of an investigation into how one particular 3D virtual world (Active Worlds) is currently being used for education. Two case studies of the use of Active Worlds for informal and formal education are presented.

The overall focus of this study is on the construction of users with regards to the educational implications of using these 3D virtual worlds as learning environments as well as to present two cases in which one 3D virtual world (Active Worlds) is being used. However, it should be noted that this study does not attempt to delve deeply into the construction of societies, communities, the psyche, or address social/psychological construction of "self." This research is limited to the realms of instructional design and 3D virtual world technology.

In addition to limitations of the scale of this investigation, it is also acknowledged that this research is historical in nature. 3D virtual worlds are emerging technologies and as such are subject to continual revision. As new features are added the dynamics of these environments alter.
Definition of Terms and Acronyms

**Avatar**: An avatar is the visual representation of a user in a multi-user environment.

**CMC**: Computer-Mediated Communication

**GZ**: Ground Zero. Within the Active Worlds universe, GZ is the 0 north, south, east, and west coordinates for a world. Typically when users arrive in a world, they land at GZ.

**In-World**: The term "in-world" is most often used with Active Worlds (AW) to refer to a user as being present somewhere within the AW universe.

**IRC**: Internet Relay Chat

**Lol**: Laugh out loud.

**Lurk**: To lurk in a world means that a user is not actively participating, or making his/her presence known to others.

**MOO**: MUD Object Oriented is a text-based social chat application. See Chapter Two for a more in-depth description.
**MUD**: Multi-User Dungeons or Domain is a text-based role-playing environment (RPG).

**PW**: Primary World. This term and definition is coined by Michael Heim in his book, *Virtual Realism*. According to Heim, the PW, refers to "the world (the context of human involvement) outside the computer generated world...and has distinguishing properties such as natality or mortality, fragility or vulnerability to pain and injury, and personal care."

**Teleport**: A teleport is a transport device usually found in various worlds within the Active Worlds Universe that transports users from one site or world to another. While any object may serve as a teleporter, typically teleporters resemble and allude to various transport mechanisms of science fiction films and books.

**Virtual Worlds**: Virtual Worlds is a somewhat generic term used to describe multi-user environments such as text-based chats, IRCs, MUDS, MOOs, as well as 3D simulated environments. The term is sometimes used to refer to VRML sites as well.

**VR**: Virtual Reality

**VRML**: Virtual Reality Modeling Language

**WWW**: World Wide Web
Summary

Though the WWW is relatively new, it has impacted the field of education. Within a few short years the WWW has evolved into not only a tool for information dissemination, but is now a medium for distributed and distance education. In order for the field of education to remain current and perhaps even play a role in shaping technology it is important to investigate what emerging technologies may offer. 3D virtual worlds have much potential for distance and distributed education because they provide synchronous communication with a simulated 3D environment in which users (learners) can meet and collaborate from spatially distance locales. In addition to distance education, they also provide many unique learning opportunities. However, it is important that we understand both the characteristics and contributions of the applications in order to access their potential as learning environments.

The following chapters are roughly divided into three sections. The first section, Chapters Two and Three contain a short history of virtual worlds (Chapter Two), and the literature review (Chapter Three). The second section (Chapters Four, Five, Six, Seven, and Eight) focuses on how the user is constructed by three, 3D virtual worlds. Chapter Four provides an overview of the methodology and organizational structure for the three chapters to follow. Chapter Five focuses on Active Worlds. Chapter Six focuses on blaxxun interactive's Contact 4.0 within the context of Colony City, while Chapter Seven focuses on OnLive! Traveler. Chapter Eight provides a discussion of all three 3D virtual worlds as well as a discussion of
the educational implications. The third section, Chapter Nine, presents two case studies of how Active Worlds is currently being used for both informal and formal education. Finally Chapter Ten provides a summary of the study and discusses conclusions that may be drawn from the investigation. In addition, recommendations for design, practice, and future research are presented.
CHAPTER 2
A HISTORY OF VIRTUAL WORLDS

From the inception of computer networks and computer mediated communication (CMC) individuals have been striving to reach and represent themselves over time, space, and distance through the computer first by text and 2D Web environments, and more recently by way of 3D environments. 3D virtual worlds are the culmination of a variety of predecessor technologies. If one were to completely trace the history of CMC, it would be necessary to go back to the very inception of the networks. This review, however, will focus on the more recent technologies that have had a more immediate influence on the conception of 3D virtual worlds.

MUDs, MOOs, and IRC

MUDs

MUD is an acronym for Multi-User Dungeons, or as they are often referred to "Multi-User Domains" or "Dimensions." A MUD is a program for synchronous, networked, communication that accesses a shared database. This database consists of
text descriptions of "rooms," "exits," and "objects" which users access and interact by way of a textual interface. Most MUDs are also user-extensible systems that allow users to add to the database by creating "objects" and "rooms" for other users to interact with and in. MUDs grant users access to a textually descriptive, shared virtual environment in which the user is able to manipulate the database from "inside" the environment. Typically that environment is described as a "room" or some other representation of a PW environment. Users are given text descriptions and through the use of commands, are able to interactively move and often manipulate objects within the room. In addition, users are also able to "speak" to one another and describe actions by way of text.

The origins of MUDs are derived from the text based "Dungeon and Dragons" fantasy games. MUDs can be traced back as early as the late sixties (Bruckman, 1997) with a game written by Will Crowther and Donald Woods. Woods and Crowther created a "Tolkienesque" fantasy game called ADVENT (later to be referred to as "Adventure"). In this game, users assumed identities, fought enemies, and overcame obstacles to discover a treasure (Reid, 1994). However, Adventure was a game for single players. Subsequent games such as Jim Guyton's Mazewar, WIZARD, and *E*M*P*I*R*E* created by Alan Klietz were designed as multi-user, networked games (Reid, 1994; Bruckman, 1997). Around the same time, Roy Trubshaw, a student at the University of Essex, England teamed up with Richard Bartle and created a multi-user text-based game and named it "MUD" for "multi-user
dungeon." This first MUD (now referred to as MUD1) was a fantasy-based game, which allowed users to communicate, collaborate, and fight one another as they attempted to win treasures. On attaining enough treasures, users were granted privileges. One of the earlier versions of the game included the extensibility so prevalent in MUDs today. However, this option was subsequently removed for a variety of reasons (Reid, 1994).

In 1989, Jim Apnes, a graduate student at Carnegie Mellon University created "TinyMUD." Unlike the predecessor gaming MUDs, TinyMUD was the first "social" MUD. Apnes had removed the combative oriented commands and thereby created an environment that focused on social interactions (Bruckman, 1997).

**MOOs**

MOO is an acronym for Multi-user Object-Oriented environment. In Multi-Object-Oriented programming, users are able to create objects and to program actions performed by these objects by way of inheritance.

One of the most infamous of all MOOs, LambdaMOO, is also one of the oldest. LambdaMOO continues to be one of the most popular MOOs running today. In 1990, Pavel Curtis, a researcher at Xerox Palo Alto Research Center (PARC) began investigating MUDs as a model for language programming design.

Discouraged by many of the limitations he encountered in existing MUDs, Curtis

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1 Of the many accounts I have read, most to some degree conflict. For the purposes of this review, however, these conflicts are of no great significance. This review is intended to give some historical perspective and basic information of the technology.
came across the work of Stephan White, a student from Waterloo, who had written what he called a "MOO." Unlike most of the MUDs running at the time, White’s MOO was based on "a simple but powerful object-oriented programming model" (Curtis, 1995). With the help of a few other experienced "mudders," Curtis launched LambdaMOO. Much of the controversies and problems encountered with LambdaMOO have impacted the design of not only subsequent MOOs, but have also impacted the design of 3D multi-user environments as well.

Although MOOs have been around for a while, it’s only more recently that they have been used and studied for educational purposes. One of the first forays into this area was then MIT graduate student, Amy Bruckman’s, work with MediaMOO. MediaMOO, which became publicly accessible in early 1993, was designed as a tool for "enhancing professional community among media researchers" (Bruckman and Resnick, 1995). Bruckman who has written extensively on the subject of MOOs and education, later went on to develop MOOSE Crossing; a text-based virtual environment designed specifically for children eight to thirteen to promote " a meaningful context for learning reading, writing, and computer programming" (Bruckman, 1997).

IRC

Around the same time MUDs developed into social mediums, Jarkko Oikarinen of the University of Oulu, Finland created the original Internet Relay Chat

There are several versions of the full name for MOO including Multi-User Object-Oriented and Multi-User Object Oriented Simulation, and MUD Object Oriented. The definition I choose was an amalgamation of several.
(IRC) program, a technology that allows for text-based synchronous communication for spatially distant users. Unlike MUDs, IRC accommodates and encourages a more social and recreational form of communication accomplished by way of IRC "channels." The channels are usually loosely based on designated topics and a user telnets into a particular channel to talk to other users about that topic (Reid, 1991; Rheingold, 1993). Oikarinen launched his IRC program in 1988 and by the early 1990’s there were thousands of users worldwide with hundreds of channels to choose from (Rheingold, 1993). Significant about the history of IRC to the development of 3D virtual worlds is the idea of "social" or recreational chat. IRCs allowed groups of spatially distant users the opportunity to converse in a synchronous environment. The point of IRC was to chat, not to role-play, not to create an environment, but to communicate with people of common interest.

Graphical Chat Worlds

Habitat

In 1985, Lucasfilm launched the first networked multi-user virtual world, Habitat. Habitat was an experiment in virtual or computer mediated communities that ran for six years in the US and Japan. It was also one of the first graphical multi-user environments. Whereas MUDs, MOOs, and IRCs were text-based environments, Habitat was a 2D world in which visuals were used to construct both the environment and the objects within it (Farmer and Morningstar, 1994). It was also the first to use avatars as a visual representation of users (Damer, 1998a). The 2D scenes that composed the setting of Habitat consisted of real-time animated scenes of the world.
Users were represented by animated avatars and communicated with each other via a text window. The text would then appear in balloons over their avatar’s head within the scene. Lessons learned from Habitat would serve as a guide for subsequent 3D virtual worlds as well as serving as inspiration for a variety of 2D worlds.

**The Palace**

One of the most popular of the graphic chat worlds is The Palace. The Palace is a 2D virtual world in which users are represented by a 2D graphical avatar. Typically, the Palace interface is comprised of a background image with small individual avatars pasted across the front. Users communicate by way of a text box located at the bottom of the screen. That text is then transferred to a balloon above the user’s avatar. Users are able to select from an existing library of avatars, or create their own representation.

Technically the Palace is a client/server system that runs on a large network of individual computers. It supports multiple platforms and requires only a computer, an Internet connection, and a 14.4 modem. It may also be used on a LAN. Its extreme flexibility and interconnectivity makes it one of the most popular chat programs today (Damer, 1998a).

**VRML**

In January of 1994, Mark Pesce and Tony Parisi teamed up in an attempt to create a "virtual reality interface to the Internet" (Pesce, 1998). At the time the 2D web browser, Mosaic, was gaining in popularity and forever altered the face of the
Internet. With the advent of Mosaic, Pesce began to envision a more "sensual interface to the Web" that would permit users to explore in three dimensions (Pesce, 1998). In May of 1994 at the First International Conference on the World Wide Web (WWW), Pesce presented his and Parisi’s work on a prototype for a 3D interface to the Web (Pesce, 1998) to a "Birds-of-a-Feather" (BOF) session on 3D interfaces. Due to the response from this session, a mailing list was established with hundreds of participants within the first week. It was also during this session that the name "VRML" was established.

VRML serves as the basis for the 3D environment of several 3D virtual worlds such as OnLive! Traveler, blaxxun interactive, and Sony's Community Player. Despite the initial flurry of VRML, there is still much debate and skepticism as to its future (Damer, 1998b). VRML offers some advantages, but even greater disadvantages for 3D virtual worlds. The lack of streaming files is often sited as one of its major flaws (Damer, 1998b).

3D Virtual Worlds

In the spring of 1995, Worlds Inc. launched one of the first 3D virtual worlds on the Internet. Unlike previous world or environments created with VRML, Worlds Chat users could select and move avatars and talk to one another in a simulated 3D setting (Damer, 1998a). Since that time, there has been a proliferation of 3D virtual worlds.

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3 The acronym originally stood for Virtual Reality Mark-Up Language analogous to HTML, however, was subsequently changed to Virtual Reality Modeling Language to be more reflective of its purpose.
4 Damer (1998a) claims that Worlds Chat was the first 3D virtual world, however similar claims have been made about DIVE (Distributed Interactive Virtual Environment).
worlds on the net. The standard, styles, and means vary from application to application, however, there does not seem to be an end to the interest as more and more worlds are created each year. ActiveWorlds, Worlds Chat, OnLive! Traveler, blaxxun interactive, Interspace VR, Talkworld, Virtual Oz, and, Sony Community Place are among the most popular.

Though 3D virtual worlds are still relatively new, as more 3D virtual worlds enter the public arena, the number of users continues to grow. Many worlds have been created for commercial and entertainment purposes. Some 3D virtual worlds have developed a large enough user base to now charge users, while others are free or are still in the beta-testing phase of development. Chapter 4 will provide an in-depth analysis of three of the more popular 3D virtual worlds.

**Summary**

Although 3D virtual worlds represent emerging technologies, the notion of virtual worlds has been a part of CMC for well over a decade. By looking into such predecessor technologies as MUDs, MOO, Chats, and VRML it is clear that virtual worlds to varying degrees and in many ways have played in role in the gradual development of 3D virtual worlds.
CHAPTER 3
REVIEW OF RELATED LITERATURE

Because 3D virtual worlds are relatively new, there has been little research about their educational use. Most research to date has tended to focus on the technical aspects of design. For this reason, it is necessary to review studies in areas closely related. These areas include: 1.) educational value, and social and personal aspects of MUDs, MOOs, and IRCs 2.) 2D graphical chat worlds; 3.) educational uses of virtual reality applications; 4.) games and simulations; and 5.) design of virtual worlds and related areas. This review is by no means comprehensive, but instead focuses on relevant studies (either by explicit statements or by implicit content) that have direct relevance to the design of 3D virtual worlds. Though most of these studies employ the use of qualitative methodologies, it is important to note that I did not purposely exclude quantitative studies, but merely did not find many relevant to my research questions.
MUD, MOO, and IRC

Educational Value

With the evolution of web-based learning environments, there has been a growing interest in the use of MUDs, MOOs, and IRCs to aid in the establishment of community among virtual classmates (Bruckman, 1994; Bruckman and Resnick, 1995; Bruckman 1997; 1998). Recent forays in the educational use of popular online chat applications owe their success to such predecessor applications as MUDs, MOOs, and IRC. Research into these types of chat applications is of great relevance to the study of 3D virtual worlds (Bruckman and Resnick, 1994; Bruckman 1997; 1998; Curtis, 1993; Dibell, 1994; Reid 1991; 1994; Stone, 1995; Turkle 1995). In particular, MIT educated Amy Bruckman has conducted long-term studies in the use of MOOs as both a resource tool for educators and as an educational environment for learning. Her studies in many aspects are relevant to the study of 3D virtual worlds inasmuch as she focuses on the role of student as creator in constructivist environments. Much of Bruckman's work is influenced by LOGO creator, Seymour Papert's, theory of "constructionism" which "argues that learning by working on personally meaningful projects is better than learning by being told." (Papert, 1991, as reported by Bruckman, 1998).

As a Ph.D. student at MIT, Bruckman along with several others created a MOO called MOOSE Crossing. According to Bruckman, MOOSE Crossing is a text-based virtual reality designed for children eight to thirteen as a constructionist environment for reading, writing, and computer programming (Bruckman, 1997). Through her investigations of MOOSE, Bruckman found that her MOO presented an
environment that supported constructionist learning by providing avenues for community support and the development of social relationships unique to virtual environments. Community support was facilitated by way of the natural emergence of peer role models, open classrooms and role reversal, emotional and technical support, and the presence of an appreciative audience. According to Bruckman, in essence, MOOSE Crossing accomplished what constructionist rhetoric has failed to do— it allows "student directed learning" by providing an environment that supports the constructionist philosophy of learning.

In her 1997 dissertation entitled, "MOOSE Crossing: Construction, Community, and Learning in a Networked Virtual World for Kids", Bruckman documents her experiences creating a MOO for educational purposes. Although she is quick to dismiss the use of 3D virtual worlds for education, her chapter dealing with the design of MOOSE Crossing offers insights for perspective designers of 3D worlds as learning environments. Not only is her writing accessible for non-programmers, she presents interesting insight into accessibility and flexibility in the design of a virtual environment that may be often overlooked with a visual interface.

Bruckman's work is important because she is one of the first designers develop a "virtual reality" specifically for educational purposes. She had both the ability and support to develop an environment that was not only specifically geared for education, but also one in which her philosophy of learning could be supported. This is an option not available to many instructional designers, teachers, or educators. The theoretical foundation that underlies her design is in many ways applicable to the design of 3D virtual worlds for education. Bruckman (1998) as well as others
(Fanderclai, 1995) warn against is the use of MUD/MOOS to re-create a traditional classroom with all it's barriers and levels of hierarchy. Using a virtual environment to replicate a traditional styled classroom not only fails to exploit the unique opportunities of that environment, but also perpetuates a system of education that is at times antithetical to the collaborative, cooperative purposes for which MOOs were designed.

Although much of Bruckman's work has direct significance to the design of educational 3D virtual worlds for both educational theory as well as design, MOOSE Crossing is a text-based environment. For insights into the role of visuals and 3D represented environments, it is necessary to look to literature of other related areas.

Another MOO and subsequent documentation is that of Northern Arizona University anthropology professor, Reed Riner's work with SolSys. SolSys is the nickname for the *Northern Arizona University Solar System Simulation*. SolSys is an "educational role-playing 'virtual' laboratory in which students collaborate in building working models of communities for a future Solar System" (Riner, 1996). This futuristic based MOO was created with the purpose of uniting students across universities in developing communities of the future. It has turned out to be a study in communication and anthropology, as well as providing much fodder about educational practices in and out of the classroom.

Several works by Riner and others (Riner and Clodius, 1995; Riner, 1996) have reported some interesting outcomes of using SolSys with undergraduate students. In "Virtual Ethics- Virtual Reality" (1996), Riner reveals the pedagogical ethics that arise from using a MOO for educational purposes. Though most of his
findings are similar to others who have investigated educational MOOs (Bruckman, 1997, 1998; Fanderlai, 1995), he does note that the type of interaction promoted by virtual environments—"acephalous, consensual, reciprocal" may disadvantage students who's interpersonal and organizational styles are not suited to these environments.

**Summary**

Research into the educational use of MUDs and MOOs indicate they do provide some unique learning experiences when used within a constructivist framework. Bruckman (1994; 1997; 1998) argues that MOOs can provide for collaborative, interactive, student-centered learning. She further claims that there is a natural emergence of such features as peer role models and role reversal when MOOs are used to their advantage. Both Bruckman (1998) and Fanderlai (1995) warn against the use of MOOs when used to replicate traditional classrooms. By their nature, these environments promote a collaborative environment that facilitates a more interactive style of learning. Riner's (1996) research, like Bruckman's asserts that MOOs allow for greater collaboration among students both within and across classrooms. Riner also indicates that MOOs provide many unique opportunities for meaningful engagement across time and space.

Although much of Bruckman (1994; 1997; 1998) and Riner's (1996) respective works have direct significance to the design of educational 3D virtual
worlds for both educational theory as well as design, MOOs are text-based environments. For insights into the role of visuals and 3D represented environments, it is necessary to look to literature of other related areas.

**Social and Personal Aspects**

Articles by Reid (1991; 1994), Stone (1995), Turkle (1995), Curtis (1993) and Dibbell (1994) all focused on social and personal aspects of text-based chat applications. While Turkle tended to focus on the social psychological aspects of role playing, Stone delved into the more personal aspects of how these environments enabled users to reinvent or express multiple selves. Both researchers have looked at various aspects of how virtual environments impact the socially constructed self. Curtis' (1993) and Reid’s (1994) respective research, though somewhat related to that of Stone’s, focused more on the social construction of societies that arise within these environments. Like Stone and Turkle’s work, Curtis (1993) and Reid’s (1994) separate research has illuminated the unique opportunities these environments offer for personal and social reflexivity. Dibbell’s (1994) descriptive research illuminated the often-overlooked dark side of socially constructed environments by addressing issues of deviance and control. Although these studies are relevant to the study of 3D virtual worlds, they are limited inasmuch as they refer to text based chat applications and lack the necessary and complex investigation into the dynamics of multi-user environments.
Race

Though much has been written about issues of access, the works of such artists and researchers as Cameron Bailey (1996) and Loretta Todd (1996) offer revealing insights into issues concerning race and ethnicity. According to both authors, race and ethnicity to a large degree determine who is present in an environment. Issues of access and equity that naturally arise from addressing race and ethnicity are important considerations when investigating both the paradigms articulated by a design and the construction of user and the community.

Gender

There are many researchers dealing with the construction of gender in virtual communities (Pryor and Scott, 1993; Stone, 1994, 1995; Turkle, 1995; Balsamo, 1994; Branwyn, 1994; Dibbell, 1994; Morningstar and Farmer, 1994; Cherny, 1995), however, much of this research deals with issues concerning the representation of female gender from a feminist perspective. Turkle (1995), Stone (1995), and Morningstar and Farmer (1994) have individually addressed gender swapping in chat environments. All three have noted cases of individuals (often male, in the cases of these articles) representing themselves as a different gender. This might be attributed to a larger ratio of male to female participants. In some cases females initially get more attention and assistance in an environment (Morningstar and Farmer, 1994). Both Stone and Turkle have investigated how computer mediated environments allow
for experimentation and self construction that is not predicated on the physical body and both have elicited provocative thought about how gender is constructed in the PW as well as in a disembodied environment.

One article of particular interest with regards to gender is Rob Milthorpe’s "Fascination, Masculinity, and Cyberspace" (1996) in which he claims that the very design of cyberspace is one in which traditional male values and priorities are privileged and perpetuated. Unlike many feminist theorist, Milthorpe maintains that cyberspace is not a disembodied environment because "The body sits at the keyboard, wears the visor, develops the software..." and for the most part those bodies have been white males. Those bodies in turn perpetuate their values, interests, and priorities through the design of both hardware and software. Milthorpe argues that cyberspace is not the disembodied environment as is often alleged because of the "bodies" who have created much of it.

Summary

Research concerning the more personal and social aspects of MUDs, MOOs, and IRCs speculates that the user is uniquely "constructed" both in terms of the design of the environment as well as by interactions with other users. Stone (1994, 1996), Turkle (1996), Curtis (1992), Reid (1991; 1994), and Dibbell's (1994) respective research indicates that the design of the environment impacts the role of the user and the overall community. Research into gender, ethnicity, and race further alleges that the presence of a user is in many ways reflective of that users gender and culture (Bailey, 1996; Todd, 1996; Pryor and Scott, 1993; Stone, 1994, 1995; Turkle,
1995; Balsamo, 1994; Branwyn, 1994; Dibbell, 1994; Milthorpe, 1994; Morningstar and Farmer, 1994; Cherney, 1995). However, like the studies dealing with the educational use of MOOs, this information however insightful is still based on the use of text-based environments. Though in many ways these bodies of research are relevant to design of 3D virtual worlds, they do not address all of the dynamics involved in a graphical multi-user environment.

**Graphical Chats**

**Habitat**

One of the first graphical multi-user worlds was Lucasfilm's Habitat. In "The Lessons of Lucasfilm's Habitat," Chip Morningstar and F. Randall Farmer (1994) reveal the lessons they learned and offer advice for designers of interactive environments based on their experiences. Although much of the information addresses technical advice and concerns, they do offer advice issues central to the design of interactive environments. Key elements include providing a setting that facilitates interactions between users. Morningstar and Farmer argue that the most important aspects of virtual environments are the communications, interactions and relationships between users, not between and among users and the computer. They state,

...cyberspace is defined more by the interactions among the actors within it than by the technology with which it is implemented...things that are important to the inhabitants of such an environment are the capabilities available to them, and the ways various participants can affect one another. Beyond a foundational set of communications
capabilities, the details of the technology used to present this environment to its participants, while sexy and interesting are of relatively peripheral concern (1994).

According to Morningstar and Farmer, designers of these interactive environments should not try to control the environment. Instead they should serve as facilitators responding to the needs of the users as a guide for design. To do this, designers should use as their basic building blocks the types of objects that "correspond more or less to the objects in the user’s conceptual model of the virtual world, that is, people, places, and artifacts." Morningstar and Farmer argue that the focus for designers should not be on creating rich and complex settings, but instead to focus on designing environments that provide for rich and complex interaction.

It is interesting to note some similarities in the recollections of Morningstar and Farmer and LambdaMOO creator Curtis Pavel. They both note the dominant role that societal interactions play in shaping the design of a virtual community.

**ExploreNet**

Inspired by Habitat, in 1995, Computer Science professors from the University of Central Florida, Charles Hughes and J. Michael Moshell premiered their educational 2D graphical multi-user world, ExploreNet. The original version ran on 486 PCs and allowed only two users at a time. (Hughes and Moshell, 1995). Subsequent releases now accommodate multiple users. According to Hughes and Moshell, ExploreNet is "a general-purpose object oriented, distributed two dimensional graphic-based environment with features to support role-playing games
for educational purposes, and cooperative learning of many kinds." Hughes and Moshell argue that although constructivist methods are thought to provide learners with better learning skills by being actively engaged by constructing their own understanding, too often teachers are not trained in constructive methods of teaching. ExploreNet was created in response to their perceived need to provide constructive environments for learning (Hughes and Moshell, 1997).

Hughes and Moshell promote the constructivist aspect of their design, in a 1995 article entitled, "The Virtual Communities Experiments at Hungerford Elementary School." This article documents their attempt to conduct qualitative research on the use of ExploreNet with third, forth, and fifth graders. The dependent variables that they intended to measure were "vocabulary acquisition and the complexity and richness of stories after the experience" (Moshell and Hughes, 1995). The independent variables included: the use of the computer versus traditional methods, age and corresponding roles played by participants, and shared vs. single user per screen. This research is difficult to interpret not only because it was unsuccessfully conducted because of technical difficulties, but also the methods of inquiry did not seem to directly match what was intended to be measured.

The study illustrates the importance of selecting the appropriate methodology for formative and summative evaluations, as well as the study of virtual environments in general. Constructivist environments are messy. Learning environments that promote communication and collaboration may seem chaotic to the outside observer. Students getting up and moving around, looking at each other's screens, and sharing observations and findings may be an intrinsic part of the learning experience. To
fully exploit and use virtual environments for constructivist learning may mean releasing our notions of how learners should behave and what constitutes appropriate behavior in the learning environment. For purposes of evaluation, methods should be appropriately matched to reflect the epistemology of the learning environment. One need only read the thick descriptions offered by Bruckman (1998) to get a sense of how qualitative methodologies may offer more information for shaping the design of a virtual environment for educational purposes.

Summary

Research into the use of graphical chat environments for social use reveals that one of the primary goals of the design should be to provide an environment for meaningful interaction among users. Morningstar and Farmer (1994) argue that this is achieved by providing an environment and tools that users can relate to such as "people, places, and artifacts". Studies into the use of graphic chat worlds for education "(Moshell and Hughes, 1995) support both Bruckman (1997; 1998) and Riner's (1996) claims that chat environments do provide for constructivist context for learning.

Both the respective works by Morningstar and Farmer (1994); and Moshell and Hughes (1995) address particular aspects of using graphical chat environments for social and educational purposes. While Morningstar and Farmer look at the overall community, they do not deal specifically with how the user is constructed by the design. Additionally, although graphical chat worlds are in many ways very
similar to 3D virtual worlds, they lack the complexity of simulated motion through 3D space. For these reasons, it is important to look to further related areas of research.

Educational Uses of Virtual Reality

Relatively little has been written about the use of Virtual Reality (VR) technology for educational purposes (McLellan, 1996). However, within the limited body, there is some pertinent research of VR applications for educational use that is relevant to the study of 3D virtual worlds (Auld and Pantelidis, 1994; Bricken, 1990; 1991; Bricken and Byrnes, 1993; Dede, Loftin, and Saltzman, 1992; Kelly, 1993; Winn 1993; 1997).

Researchers Meredith Bricken and Chris Byrne (1993) studied the benefits of using VR from a constructivist perspective which may offer insight into how 3D virtual worlds can be used as learning environments. In their findings, they claim that VR provides for experiential learning and social learning within a constructivist framework by "providing more direct and intuitive interaction with information." Along similar lines, David Traub (1991) explored the promotion of experiential learning that results from using VR simulations for educational purposes. Traub's research is relevant to the study of 3D virtual worlds inasmuch as Traub addresses the often-overlooked issue of the underlying epistemology of the design of instructional applications. Traub also argues that VR reduces "the distance between the user and the interactive content." Richard Kelly (1993) also examined the advantages that VR offers in promoting the experiential nature in learning. However, his research like
that of Bricken and Byrnes', and Traub's focused on a contained VR environment which involves less dynamic variables than that of a 3D virtual world.

In an article entitled, "A Conceptual Basis for Educational Applications of Virtual Reality," William Winn (1993) argues that VR provides for learning experiences not available to students in a traditional classroom setting. He claims that much of what we learn is based on "first-person non-symbolic" experiences we have with the world. In contrast, schools lean towards "third-person symbolic experiences" as the primary means of education. According to Winn, this divergence can be bridged through the use of VR supported by constructivist theories of learning.

Winn's work is important to the study of 3D virtual worlds he addresses the issue of the context in which learning takes place. He distinguishes between first-person primary experiences (the experiential) versus a third-person account of an event or phenomena. According to Winn, third-person accounts are usually presented in symbolic forms. This may not be congruent with how students learn naturally. VR provides a new set of tools for students to gain entrée into knowledge that may have previously only been available through third-person symbolic accounts. Winn (1993) provides a solid understanding as well as arguments about how VR offers new tools for more and fuller access to knowledge construction.

**Summary**

Research into VR in education provides greater insight into how the complex dynamics of a 3D simulated environment afford learners many unique opportunities and tools for learning. The respective work of Bricken and Byrne (1993), Traub
(1991), Kelly (1993), and Winn (1993) all stress the importance of using VR within a constructivist framework. Traub, Kelly and Winn further provide greater insight into the relatively unexplored area of "experiential learning".

Despite the limited, though rich research arising from the educational use of VR, the applicability of this research to the study of 3D virtual worlds is still somewhat limited. For the most part, VR technology is a closed system that does not allow for user collaboration within the environment. 3D virtual worlds are interactive communities. It is necessary; therefore, to couple this body of research with research into collaborative environments such as MOOs and graphical chats. What is particularly interesting to note is how in many regards, Bruckman (1997; 1998) and Riner's (1996) respective findings correspond with the findings of Bricken and Byrne (1993), Traub (1991), Kelly (1993), and Winn (1993). This most likely is because all these researchers are working within a constructivist paradigm. Nevertheless, the combined findings of all these researchers indicate that emerging technologies may provide for richer environments that allow for the natural development of a constructivist framework for learning.

**Games and Simulations**

Much has been written about the use of computer games and simulations in the field of education technology. Of the research there are several studies that offer information relevant to the use of 3D virtual worlds for educational purposes. Many of the more popular games such as Oregon Trail, Yukon Trail, and Where in the World is Carmen Sandiego have been used as supplemental resources for social
studies units. Simulations such as SimCity, Colonization, and Civilization are reported to have shown positive outcomes when used as the primary medium for social studies and history units. Research into games and simulations claim that they offer many advantages over more traditional methods of education by helping students gain a better understanding of different places and times (Miller-Lachmann et al, 1995). In addition, they promote cooperative learning, aid in developing problem-solving and critical thinking skills, and they often stimulate and motivate students by providing "authentic learning experiences" (Frye and Frager, 1996; Pahl, 1991; Teague and Teague, 1995). Simulations such as SimCity and Civilization also offer the benefit of being open ended without any "one right" way or answer.

Students are faced with choices on how to manage resources and deal with problems. Many of these issues are currently being explored in text-based virtual worlds such as SolSys and MOOSE Crossing. However, text-based virtual worlds lack some of the multimedia elements (visuals and sound) that are available through many games and simulations.

Despite the educational advantages claimed by proponents of these games and simulations, it is in the critique of them that may be most relevant for the design and implementation of educational 3D virtual worlds.

In her article, "Reading Educational Computer Programs", Ann DeVaney (1993) offers a rhetorical analysis of the computer game, Where in the World is Carmen Sandiego. She applies "reader theory" to uncover values promoted by this game. By deconstructing the game against the claims made by the game's producers, DeVaney reveals the cultural stereotypes and conceptual flaws between what the
game purports to provide and what it delivers as an educational tool. Her study is particularly relevant to the analysis of 3D virtual worlds in terms of how an application may work to "construct" the user.

Along similar lines, in an article entitled, "A Critical Analysis of the Use of Computers in Education" (1986), Michael Streibel deconstructs three types of computer software: drill and practice, tutorial, and simulation. It is his investigation of the simulation, Oregon Trail that is of most relevance to this review. According to Streibel, the popular and purported educational simulation, Oregon Trail, is not a simulation to learn about history. Because of the underlying design, the game actually "a well-disguised numbers game." The game, which simulates the trials and tribulations of users as they simulate crossing the country to Oregon, allows users to stock up on supplies prior to and during the trip. Streibel alleges that the game has little to do with experiential knowledge, but instead is based on "algorithmic logic" of "looking for patterns among the numbers". This in turn "limits" the learner's knowledge not only of the historical event of the Oregon crossing, but also with "an under-developed intellectual agency within the qualitative, dialectical, and experiential domains of natural and social events". While that is quite a burden for one simple game to shoulder, Streibel does make an interesting point by looking into the underlying assumptions, values, and biases to assess the types of knowledge is elicited, and the types of knowledge are prevented. Streibel's work holds much relevance for the investigation of 3D virtual worlds for educational purposes. It is important to investigate and be aware of the types of learning experiences or knowledge that can be constructed by learners in a computer mediated environment.
Another interesting article, "Exploring America in Computer Simulation Games" by Miller-Lachmann, et al. (1995), compares the cultural representation presented/perpetuated in several educational games and simulations. This research is important to the study of 3D virtual worlds because it explores such questions as whose story is being told; who is represented; and how are they represented?

Summary

Initially games and simulations may not seem to hold much relevance to the design of 3D virtual worlds for education. In computer games, characters, cultures, roles, and scenarios are often predefined or the user is given a limited selection. In most 3D virtual worlds, users are not participating in a structured event and they have the ability within varying degrees to represent themselves, however, it is these "varying degrees" that require more scrutiny. The availability to custom create an avatar is not always possible. Many applications rely on a preset library of avatars for users. It is important to look at who (or what) is represented, how they are represented, and who (or what) is not present in the environment. Research by DeVaney (1993) and Miller-Lachmann (1995) illuminates the importance of looking at how the use is constructed by the design of a simulation.

In addition to design issues, research into games and simulations offer insight into how 3D virtual worlds may be used for educational purposes. Comparing what is afforded in the design of these two types of technologies may yield greater insight into what unique learning opportunities may be available for learners. With several games and simulations, users make choices and collaborate on (purportedly) authentic
tasks. In comparison, 3D virtual worlds also offer possibilities for collaboration both within the classroom (lab) and with a larger community of learners. Additionally 3D virtual worlds offer collaboration over time and space, but also with authentic voices. This option is not always available with many games and simulation. Virtual worlds offer the possibility for multiple perspectives and cultures to collaborate on a problem, task, or scenario.

Design of Virtual Worlds

"Virtual Worlds" is an often-bandied term that seems to have as many definitions as researchers and designers writing about them. To some "virtual worlds" encompass such broad categories of computer mediated communication technologies as email, newsgroups, and electronic mailing lists, whereas others more narrowly define "virtual worlds" as such technologies as VRML and VR. Despite the lack of congruity in definitions, there is much relevant information to be gleaned from the study of "virtual worlds design" (Laurel, 1993; Naimark, 1990; Gigliotti, 1993; 1995; Damer, 1998; Stone, 1997; Rockwell, 1995; DeVaney, 1993; and Morningstar and Farmer, 1994).

Although Naimark, Laurel, and Gigliotti investigations mainly precede the advent of 3D virtual worlds, their respective work offers understanding into how the affordances and limitations in the design of a virtual world may work to perpetuate various worldviews. Naimark, Laurel, and Gigliotti's respective research is important to the design of 3D virtual worlds because they identify and discuss various design elements such as realness/thereness/presence (Naimark, 1990), transparency (Laurel
1991), and plasticity (Gigliotti, 1995). Virtual world designers Bruce Damer (1998), Linda Stone (1995), and Robert Rockwell (1995) are among the very few that deal directly with design issues of 3D virtual worlds. Much of Damer's work has focused on the more technical side of designing 3D multi-user environments, although he is informally acknowledged as one of the leading authorities on the role, use, and design of avatars. Stone, a designer for Microsoft's V-Chat, along with Rockwell, a researcher for blaxxun, offer insightful information into various design issues of their respective applications. Similarly, Morningstar and Farmer's revealing look into the dynamics of Lucasfilm's 2D world; Habitat (a forerunner of Fujitsu's "Worlds Away") offers many insights into how design helps to construct "community".

One of the most significant books addressing the design of virtual worlds is noted virtual reality philosopher, Michael Heim's Virtual Realism (1998). Virtual Realism is a critical yet pragmatic exploration of the present state and future evolution of VR. Heim's discussions of virtual world design are grounded in the pragmatics of how and why these worlds can and should (and by the same token cannot and should not) be used. Unlike much of the predominate rhetoric surrounding VR, Heim's does not situate himself as either a VR idealist or alarmist, but instead offers an strategy for reconciling these polar positions by way of technalysis or Virtual Realism.

In Virtual Realism Heims's offers an eclectic range of sources to support and illustrate his strategies for critical analysis of VR technology (technalysis). By drawing on examples ranging from fine art exhibits, the music of Glenn Gould and Jim Morrison, and extending to UFOs and Tai Chi, he envisions not only ways to
live with technology, but ways to make technology more humane. Of particular relevance to the design of virtual worlds is a chapter entitled "Interactive Design: Tunnel or Spiral". Heim's addresses design issues of virtual world building and how they can perpetuate particular worldviews. His application of a pragmatic view of technology and of virtual worlds in particular is important for assessing both the benefits and limitations these applications offer.

**Snow Crash**

Initially, a science fiction novel may seem to be out of place in a section of a literature review addressing the design of virtual worlds, however, science fiction has played a large role in defining, promoting, and advancing virtual communities. William Gibson's book *Necromancer* is often cited as the work that defined and in some respects guided the phenomenon of "cyberculture." For 3D virtual worlds, Neal Stephenson's *Metaverse* in his 1992 novel *Snow Crash* has in many regards served as the inspiration and aspiration for many 3D virtual worlds. In a future without bandwidth limitations, *Metaverse* is the ultimate 3D interactive world in which users (by way of realistic looking avatars) interact in a fully immersive virtual world.

*Metaverse* has in some regards become the "ideal" model for 3D interactive environments. In *Metaverse* users interact via avatars which have all of the behaviors and attributes of humans as well as some added super-human features. In *Metaverse*, users can build homes, drive cars and ride buses, go to bars, walk, talk, fight, and die. For 3D virtual worlds, *Metaverse* may represent the "ideal" for design in regards to
avatar control, communication, interaction, representation; and in terms of envisioning virtual space. For the design of 3D interactive environments it is important to look at how the future is being envisioned. Futuristic novels may provide us with fodder for analyzing and critiquing not only current designs, but also a means of addressing how embedded values guide the design process.

**Summary**

Although the respective works of Gigliotti (1995), Naimark (1990), and Laurel (1990) do not deal explicitly with 3D virtual worlds, they deal with ideas that are applicable for investigating and analyzing the design of them. What is most relevant about the works of these three researchers is they provide a basic vocabulary for various features and elements that serve to construct users in terms of embodiment and representation as well as a means of gaining entrée into how communities are constructed by the design.

There is relatively little research that is explicitly about 3D virtual worlds, however, of that limited body, Damer (1998), Stone (1995) and Rockwell (1995) provide insight into design issues specifically related to individual features of several 3D virtual worlds. Of the few researchers dealing with 3D virtual worlds, Heim's (1998) work is most unique inasmuch as he delves into the use of 3D virtual worlds for a variety of purposes. Although his work is not limited to these multi-user environments, he does offer many ideas for how they can and should be by way of *technalysis*. According to Heim, *technalysis* is "the analysis of technologies...from a critical but practical standpoint. To support his argument, Heim offers ten steps or
"signposts" for both demystifying VR technology and for a critical, yet pragmatic understanding of how VR technology might be used. His pragmatic approach to virtual worlds also provides much insight into how the design functions.

Though Stephenson's (1992) novel is not a traditional work of research it does provide some history into various features and elements of 3D virtual worlds. Indeed, scattered throughout such 3D virtual world applications as ActiveWorld and blaxxun are references to *Snow Crash*, both in terms of names of characters and locations. The impact of how Stephenson envisioned his 3D virtual world, *Metaverse*, will most likely be a continual source of inspiration for designers.

Most of the studies in this literature review are not based on 3D virtual worlds, but are based predecessor technologies. In order to understand the complex dynamics of combining 3D visual representation, interactivity and interconnectivity, there needs to be studies into the design and application of 3D virtual worlds. This is particularly important for their use as both formal and informal learning environments. Because 3D virtual worlds may offer many of the same unique learning opportunities as MUDs, MOOs and VR it is also important to investigate them in terms of how the user is constructed through the design as well a exam how these applications are currently being used for educational purposes.
CHAPTER 4

CONSTRUCTING THE USER

As technology becomes more and more prevalent in our lives, it is important that we also become critical consumers of it. This is particularly important for the educational use of technology. To insure that the interests of learners are protected teachers, administrators, and instructional designers need to be the vanguard when it comes to issues of ethics and equality within the learning environment. It is by developing questions and criteria that are critical of a particular technology that we can insure the interests of our students are not only being protected, but promoted by the educational use of technology. Several researchers have delved beneath the surface of various educational games, programs, and computer simulations to examine and at times challenge the hidden assumptions, values, and agenda embedded within the technology (Streibel, 1986; DeVaney, 1993; Miller, Chaika, and Groppe, 1996; Pomper, 1990; Miller-Lachmann, Jones, Stone-Farina, DeLoach, and Kloten, 1995; Teague and Teague, 1995; Frye and Frager, 1996; Turkle, 1997).
Research Question

In an article entitled "Reading Educational Computer Programs," Ann DeVaney (1993) poses the argument that educational computer programs construct their users as subjects by way of the visual and verbal codification and discourses presented through the program. She convincingly supports her case by deconstructing the popular educational computer game, Where in the World is Carmen Sandiego. In her investigation, she applies the use of Readers Theory to examine how the user comes to be constructed by values perpetuated through the design of the game. She examines such features as ethnicity and how various groups are represented; gender; politics; and gaming features such as user help and resources. She also looks at the chasm between what a game purports to provide and what it actually does provide. Her investigation proves to be most illuminating. Though her work relies on the use of Reader Theory and is based on one computer game, it holds much relevance in terms of providing a critical starting point and a rough outline applicable to the examination of how the user is constructed in a 3D environment.

Three-dimensional virtual worlds hold some similarities with computer games inasmuch as there are values embedded in the way people, objects, and environments are represented. However, they are also very different. 3D virtual worlds are often the composite of many developers as well as user input. They are not closed systems like games, but are dynamic environments. Much of the way the user is constructed depends upon what the design affords by way of design features and how these various features function within the design. Users are not only constructed as a subject per se, but they also in turn become the object.
DeVaney's question, "how do computer programs construct their subjects" offers a good point of departure for investigating, and deconstructing 3D virtual worlds. While I found her question to be most intriguing, I was reluctant to approach the investigation of these environments with a priori theory or view them through any particular paradigm. Many 3D virtual worlds are a composite of various influences, including the designers and programmers, owners, and also the input and impact of the users. Therefore, in an attempt to investigate these environments, I have liberally "borrowed" from DeVaney by posing the question, "how is the user constructed by the design of a 3D virtual world." However, unlike DeVaney, my investigation will not rely on a priori theory, but rather will rely on the lack of theory afforded by Grounded Theory methodology (GT).

Relevance of Inquiry

Three-dimensional virtual worlds are for the most part pre-constructed environments. Parameters for both personal and social construction are to some degree predetermined by the values and assumptions embedded in the design. Although it might be argued that parameters for both personal and social construction are to a large degree predetermined in the PW, 3D virtual worlds limit to a much larger degree. The values and assumptions of a few designers and programmers play a much greater role when fewer options are available. Additionally, limitations are also imposed by hardware and software constraints.

In addition to values and assumptions embedded in the design, inquiry and deconstruction of the design of a 3D virtual world may also yield much information
as to the types of learning opportunities that may be afforded through that world. Investigations into the educational uses of VR have shown that VR provides many unique educational opportunities that are not available outside of that medium. Along the same lines, the Internet, email, and the WWW have provided educational opportunities and options that were not available for learners prior to the more widespread use of these technologies. In order to determine whether and what types of advantages 3D virtual worlds might offer education, it is necessary to understand how the user is constructed by the affordances, limits, and functions of the design.

**Subjects of Research**

Currently there are nearly a dozen 3D virtual worlds in various stages of development. Of this dozen, I have used several of the following from one and three years: Active Worlds, Worlds Inc., OnLive! Traveler, blaxxun interactive, Sony Community Place, Interspace NTT, V-Chat, Talkworld, and Oz Virtual. This investigation focused on three 3D virtual worlds: Active Worlds, blaxxun, and OnLive! Traveler. These three were selected for a variety of reasons. First and foremost is the overall society of users that regularly participate in these worlds. It is difficult to get a clear sense of how a world is constructed and what is possible without being able to easily communicate with other users. Because I am fluent only in English, I had to limit myself to worlds with a large enough English speaking (and writing) population to interact and gather data. These three worlds have a sufficient user base to allow me to ask questions and observe interactions. The second reason was the overall ease of use and documentation. The third was overall availability of
the world and other users. In other words, worlds that were open and running and had a large enough user base to enable me to observe and interact with users. Only two of the worlds, Active Worlds and blaxxun, are user-extensible. Despite this fact, all three worlds present an interesting array of design features from which to investigate the impact of the design on the construction of the user.

Choosing to investigate only three of the possible 3D virtual worlds should not be construed as a judgment about any of the others. I found all nine of these worlds, as well as several other worlds not mentioned, to be intriguing and clever. There is much to be learned and discovered in any of them.

Data Collection

My investigations are based on long-term participation, observations, and informal interviews. While it is acknowledged that these methods of data collection are primarily subjective in nature, that does not preclude validity. Validity was established by way of triangulation of methods (Guba and Lincoln, 1989) of data collection.

Process

This study was conducted between the fall of 1996 and the fall of 1998, with additional information gathered during the writing (winter 1999). My initial research question was to investigate how the user is constructed by the design of a 3D virtual world. Letting the data drive the investigation proved a difficult route. Each of these 3D worlds underwent many changes during the investigation making accessibility
difficult at times. Additionally, user patterns often tended to shift as a result of changes. After initial explorations from the fall of 1996-1998, all three of these worlds became more or less stable (which is a negotiable term at best) and I began to look for patterns and categories within the data to get a sense how users are constructed.

**Constructing the User: Categories**

Categories of presence, representation, and embodiment evolved from participatory observations and interactions within the three 3D virtual worlds. These categories were liberally derived based on Huberman and Miles' (1994) variable-oriented and pattern-clarification strategies for identifying themes and patterns as well as a flexible application of their cross-case analysis. It should be noted that this investigation is exploratory in nature. The purpose of this investigation is to attempt to identify various design features and look at how they serve to construct the user.

In order to make sense of the vast, complex, dynamic, and interrelated features of these 3D virtual worlds, I looked for categories that extended across all three applications and encapsulated various design features. These categories are not comprehensive in nature, but rather are meant to serve as a means by which designers and educators can begin to examine how the design of these 3D virtual worlds serve to construct the user as well as some of the educational implications of the design.

It is acknowledged that technology and tools do not construct a user *per se*. Identity and sense of self are the composite of complex social, personal, and physical dynamics and are based in physical world experiences. While this analysis does look
at what the design allows and limits, the primary focus is on how various design
elements function with regards to presence, representation, and embodiment. It is
acknowledged that by nature, the design of 3D virtual worlds is not static, but rather
interactive and dynamic. It is at times antithetical to the design of 3D virtual worlds
to isolate some features or to view them out of context. Many elements overlap and
can and should be discussed from multiple perspectives. However, the purpose of
this investigation is not to critique or isolate features, but rather to look at how they
function within the context of the overall design. Once again, I feel compelled to
restate that this analysis is by no means comprehensive, but rather is meant to serve as
a window into how various features and dynamics interact.

**Presence**

Presence in everyday life has a twofold meaning. It may define the actual
physical state of presence, or it may be used to refer to the impression one makes in
their society. Both definitions to some degree are valid when discussing 3D virtual
worlds. In the subsequent analysis of the three applications, the discussion of
*presence* will include such features as issues of access (both hardware and software)
as well as access for multiple languages.

**Representation**

In a physical setting, when we refer to the term "representation" it is usually in
terms of a referent or something "standing in place for" an antecedent. In 3D virtual
worlds this is accomplished by way of several features. *Avatars* provide a visual
representation of a user. Issues of gender, culture, and ethnicity may or may not be expressed by means of this visual representation. Additionally, identity plays an important role in how the user is represented. These two features as well as communication and construction are examined in terms of how the design allows or prevents representation as well as how various features function to serve or provide representation.

**Embodiment**

In many respects, it may seem out of place to address issues of embodiment in a computer generated environment. Usually when we refer to embodiment it is tied to the physical or experiential realm. However, there is some evidence (Jeffery and Mark, 1998) which indicates that in some regards, users do project some of the physical behaviors maintained in a PW setting into 3D simulated environments by way of their avatar. It is for these reasons it is important to look at how embodiment is constructed in 3D virtual worlds.

In an article entitled "Constructing Social Spaces in Virtual Environments: A Study of Navigation and Interaction" (1998) researchers Phillip Jeffrey and Gloria Mark conducted a preliminary study into the similarities between behaviors displayed by users in physical and virtual worlds. Their study focused on the "norm of social positioning" (personal space, group space, privacy, social navigation, crowding and territoriality) within OnLive! Traveler (Traveler) and Active Worlds (AW) environments. Their investigation involved participatory observations. While social
positioning is most likely contingent upon cultural norms, there was evidence that users tend to replicate many of their PW behaviors of social positioning in the virtual world.

Of particular interest was the translation of non-verbal behaviors that users projected through their avatars. Within both AW and Traveler environments, Jeffrey and Mark observed that when they moved their avatar into another user’s perceived personal space, the reactions ranged from users verbal expressions of discomfort and shifts in the avatars positioning (backing up or moving away), to exiting the environment.

The results of Jeffrey and Mark’s study of group positioning, privacy, social navigation, crowding, and territoriality also indicate that users translate PW non-verbal behavior to the virtual environment. Though this preliminary study by no means claims to determine precisely why this happens, there is evidence that might support the idea that users, to at least some degree, regard their avatar as a form of digital embodiment of themselves.

Overview

The following four chapters are a review and analysis of how various design features serve to construct the user in terms of presence, representation, and embodiment. Three 3D virtual world applications are reviewed: Chapter Five focuses on Active Worlds; Chapter Six is a review of blaxxun interactive; and Chapter Seven covers OnLive! Traveler. Chapter Eight is a comparison and contrast of these applications. Chapters Five, Six, and Seven begin with the background information
about the 3D world, followed by an overview of the interface. Additionally, each chapter addresses the design features that serve to construct the user in terms of presence, representation, and embodiment. Chapter Eight consists of a comparison/contrast of these categories for all three applications.
CHAPTER 5
ACTIVE WORLDS

Circle of Fire's, Active Worlds (AW) is a 3D, user extensible, multi-user virtual world. It is also one of the most dynamic and sophisticated 3D virtual worlds online today. By downloading a free browser, users can explore worlds, chat with other users, build homes, and with limitations participate in a rapidly growing complex community of users. For a yearly fee, users can immigrate and become citizens enabling them certain privileges such as creating and maintaining a unique identity. Circle of Fire (COF) also provides AW servers, for users wishing to create their own worlds, along with Galaxies and Universes for groups wanting to develop outside of the AW Universe.

History

Active Worlds (originally named AlphaWorld) officially debuted on July 27th, 1995. World's Inc., a spin off company of Knowledge Adventures, created AlphaWorld. It was, according to AlphaWorld creator, Ron Britivitch, a "skunkworks (secret) project in KAW" but later grew to be one of the more competitive projects within the company (Britivitch, 1998). In 1997 AW was sold to
Overview

This section consists of a review of how various design features of the AW 3D virtual world serve to construct the user. The first section addresses the issue of presence and consists of a review of the design features that allow, constrain and function to construct the presence of users. Subsequent sections focus on representation, and embodiment. Many of the design elements are interdependent; it is difficult to separate them, or view them out of context. For these reasons, most of this investigation deals primarily with the AW browser, but when relevant, it includes aspects of AlphaWorld, other worlds, the AW server, or the AW universe. Each review is followed by an analysis of how each of these features serves to construct the user and the community. Following the review of categories is a discussion of educational implications of various features and how they relate to the learning. It should be noted that this review and analysis are not intended to be comprehensive, but rather to serve as a representative sample.

Interface

The AW browser is a stand-alone application that relies on propriety software utilizing RenderWare as a rendering engine. The Active World browser interface is comprised of four main windows (Figure 5.0). On the left is a tabbed and sizable window that allows users to choose from a variety of functions. The functions consist...
of individual windows for *telegrams, teleports, help, a worlds list, and a contact list.*

The left side of the AW browser is a built-in web browser. The center and most visually prominent window is the 3D-world view window. This window provides the means by which communication, presentation, and action take place. Beneath the 3D window is a textbox for communication.

![Active Worlds browser](image)

**Figure 5.0.** The Active Worlds browser.

At the top of the browser is a menu bar containing such menu items as *File, Teleport, View, Options, Show, Login, Avatar, Web, and Help.* By clicking on any of these, the user is given sub menus from which to choose from a variety of features

55
and functions. Many of the features such as *Teleport*, *View*, and *Avatar* are covered in depth in subsequent sections of this chapter. Under the *Options* menu, the user is presented with a submenu of choices: *Settings*, *Citizens*, *World*, and *Universe*. Under *Settings* is another submenu consisting of *Downloads*, *Privacy*, *Chat*, *Advanced*, *Performance*, *Disk Usage*, *Proxy* and *General*. These choices allow the user to configure AW to suit individual needs.

Beneath the main menu is the toolbar. This menu consists of icons for control in both the 3D-world environment and the web browser. The arrow keys allow a user to move back and forth between worlds and work similarly to Web browser arrow keys. The "eyes" icons allow a user to look up and down (to various degrees) and straight ahead. It is important to note however; that these commands control only the user's "camera" view and are not reflected in the actions their avatar. The next set of icons includes an "eye" and a movie camera. The eye allows the user a first person view (represented by their avatar) of a world, while the camera allows a user to view a world from a 3rd person perspective (orthographic view). The 3rd person view also allows the user to view "themselves" (their avatar) in a 3D environment. The next icon is of a person walking. By clicking on it, the user activates the 3D window and is able to move throughout a world. The final series of icons are buttons for the Web browser.

Beneath the icon buttons are a second series of buttons that control very limited actions and emotions expressed by the users avatar. These buttons vary from world to world and from avatar to avatar. They will be discussed more in depth in a subsequent section.
**Presence**

**Requirements**

AW requires a computer with a Pentium processor and 16MB of RAM (24 for improved performance). It also requires at least 50MB of disk space to run. AW will run with Windows 95/98 or NT 4.0, a 28.8 modem, and an Internet connection.

The AW browser and servers can be downloaded from the Circle of Fire's AW web site (http://www.activeworlds.com). From this page are links to AW web pages in several languages including: English (default), German, Spanish, French, Russian, Italian, Portuguese, and Norwegian.

Language plays another unique role in the AW browser. Currently the browser supports the following languages: English (default), French, Spanish, Italian, Portuguese, Norwegian, Danish, Dutch, and Finnish. Despite the various languages supported by the AW browsers, it is not uncommon to find many other languages including Japanese, Russian, Swedish and many others being used throughout the AW universe. Since many languages use the same alphanumeric system as is used in English, many more languages are used than are represented by the browser.

**Presence: Analysis**

The user's presence is constructed by way of the hardware, software, level of "know-how," and language. The user must have access to a Pentium driven computer, at least a 28.8 modem and have Internet access. In addition the user must possess the skills to be able to download an application and load it on a machine.
This means the user must also have the language skills to read the instructions or have access to a translation. For the most part, accessing information requires the user to have competent reading skills or have access to some form of translation.

Users are to some degree constructed by way of the language both in AW and in regards to the access to information about AW. COF is one of the few 3D virtual worlds to support as many languages as it does. It is interesting to note that although English is more often observed in some of the more commonly populated areas (GZs of AlphaWorld, The Gate, and Yellowstone), it is by no means the only language used. In fact depending upon the time of day and location, English may not be observed being used at all. In several worlds, English is rarely, if ever used. It is also important to note that while the browser supports several languages, most of the information contained in the integrated web browser pages is in English. Users still to some extent must have English language skills or have access to a translation. This may not be a problem for some users because AW has a large international population. However, users whose language skills are not sufficient in any of the dominant languages will be greatly disadvantaged.

Representation I

Avatars

The creators of Active Worlds define "avatar" as "the visual representation of people who are currently inhabiting the virtual environment. In an AW world, avatars serve not only as the visual representation of a user, but also as the "camera" into a 3D environment.
Within the AW environment, there are two types of users: citizens and tourists. Tourists are considered visitors to the AW environment and are limited in the privileges that are afforded. A citizen is a user who has paid a yearly registration fee ($19.95) and immigrated to AW. Among one of the privileges of a citizen is the option of choosing from a selection of avatars for visual representation. This choice of avatars varies in amount of selection and variety from world to world. For the most part, however, a general pool of avatars is provided to world owners by COF. Those avatars may or may not be available to users in other non-COF worlds.

In AlphaWorld the stable of avatars provided by COF predominately represent young male and female adults. With few exceptions the avatars represent young, fit, Western, Caucasians. There are more male avatars than female, and it is interesting to note that there is a greater range of body types, sizes, ages, and styles of male avatars than female. Within the selection of female avatars, there is little variety in size, weight, age, ethnicity, and race. Most of the female avatars represent young shapely women with either snugly fitting clothing or short dresses and high heels. There are also no avatars representing differently abled persons. There are, however, alternatives for users not wanting to be represented as humans or as a gender. These avatars include a bird and an alien.

Creating Custom Avatars

Within the AW user base, provisions for creating one’s own avatar are limited. By becoming a world owner, users are able to import their own specially created avatars into their worlds. This option only extends to those users granted
world-building privileges, but to a very limited extent, the ability to use custom created avatars does exist\(^1\), however, custom created avatars are not transferable from world to world.

**Communication**

Most communication in AW takes place via a text box located at the bottom of the 3D window (Figure 5.0). Similar to most chat applications, a user types in a message in the input box located at the bottom of the text box. The user’s unique name then appears beside their message in the dialogue box.

**Identity**

In real life, identity is often tied to some physical aspect of an individual. Appearance, features and voice are among the means by which we distinguish one another. In the AW environment, these physical cues are not available. Users are not recognized by audio voice, or by their appearance, instead they must rely on unique identities as the primary means by which they identify one another.

Each citizen of AW is granted a unique identity upon immigrating (paid registration). With a unique identity, users secure the rights to their own "name" or chosen alias. No other user may assume that name. In addition, users are also

\(^1\) It is important to note that creating an AW avatar is no small feat, nor one easily accessible to the novice user. Creating an AW avatar requires a basic knowledge of 3D concepts such as transform, translate, and rotate; hierarchy; texture; and polygons and vertices. It also requires that a user be fairly proficient with creating Renderware (RWX) objects. Finally, in order to activate fully a custom avatar, it is necessary for a user to specify transformations for corresponding and hierarchically arranged "body" parts and designate animation sequences (SEQ).
granted a citizen number. Both the user’s name and citizen number are attached to the user’s claimed land and buildings. This unique identity allows users to recognize and contact each other. Identity is established by the user’s name appearing over the top of their avatar. The user’s unique name appears over their avatar the first time they "speak" during a session. If the user wishes to remain anonymous or lurk, not speaking will insure anonymity.

**Contact Lists and Privacy; Telegrams and Whispering; and Mute**

Within the past year, AW added the contact list feature. A contact list allows a user to compile a list of other users' names in-world. Once a user has been added to another user's contact list, a red check mark appears beside his/her name whenever s/he is in-world. This permits users to find one another within the AW universe.

Once a user (who name appears on one's contact list) is in world, right clicking on the check-marked name activates a pop-up box which allows the user to select from a variety of options including *mute, send telegram, join, and remove*. By selecting *join*, one is able to join the selected user in whichever world they may be.

This feature allows users to find or contact one another regardless of whichever world either user is currently visiting. In addition to adding users to a contact list, a unique identity also allow users to send telegrams and to whisper to one another.

Although it is impossible to prevent users from adding other users to their contact list, it is possible for individual users to set various levels of privacy. The *Options-Settings-Privacy* sub menu allows a registered user the option of choosing
whether they will allow anyone who has added them to a contact list to join them. A user may also specify whether to allow only citizens on their own contact list to join them, or to allow no one to join them. Additionally, a user can specify whether they wish to verify all "join requests." Finally, one last command specifies, that if someone puts a user on their contact list, by default they will see which world that user is currently in, however, the user can specify that their whereabouts not be revealed and determine which level of privacy they wish to maintain.

Within AW, citizens may send other citizens short telegrams. The telegram receiver need not be using AW at the time, but must be a citizen. Telegrams may be sent between worlds, but cannot be longer than 255 characters and are stored for up to seven days.

To send a telegram, a user can either right click on another user’s avatar in the 3D window, or right click on a user’s name from the contact list. A text box appears for the user to type a message. To receive a telegram, within the chat dialogue box, the receiver will be sent a red text message from "the Operator" stating that there is a telegram (Figure 5.1). The user must then activate the Telegram window. The sender’s name will appear with a red star beside it (Figure 5.1). By clicking on the name, the user is able to read the telegram in the chat dialogue box. Additionally, by clicking on the sender’s name in the telegram window, the user is given the option of replying to the telegram.
Telegrams are handy for communicating with users in other worlds, however, for users wishing to conduct private conversations within the same proximity, COF has recently added a whisper feature. At the bottom of the text input box is a small area in which users can type in text and designate who they wish to whisper to. Beside the whisper input area is a pull-down menu with a list of other users whose avatars are in close geographical proximity to the user. In order to whisper, users must be in close proximity.

Identity also allows users to *mute* or add another user to their personal contact list. Once a user has spoken others can right-click on that user's avatar and select *mute* to eliminate any further messages from that user. A user is not notified when
another user has muted them. Any user can be muted whether they are registered or not. Muting a registered user will remain persistent until a user chooses to "un-mute" them.

**Representation I: Analysis**

For most users there is little opportunity for creating custom avatars. With the exception of world owners, users are confined to using one of the prefabricated avatars provided by an individual world. For visual representation, users must rely on avatars that may not reflect their personal values, culture, ethnicity, or physical bodies. In addition, avatars are not transferable from world to world, so there is little opportunity for the user to construct a personal representation or a sense of identity based solely on "appearances." In many respects, the types of visual representation the design affords impacts the way a user is constructed in the 3D environment. With regards to a unique identity, an AW identity brings both privileges and accountability. A unique identity allows users to establish both reliability and consistency in both the personal and social arena. Users can build, develop contact lists, send and receive telegrams. This is important for establishing a degree of trust among users.

Along with the privileges of a unique identity comes a degree of accountability. Within a system where users adopt alias identities a unique identity prevents users from impersonating one another. It can also be used to identify vandals. These aspects provide for a degree of self-governance among users.

The accountability established by a registered identity can also impose inverse limits on well meaning users. Once a user is registered and other users add him/her to
their contact list, any subsequent changes in their adopted alias will be reflected on the other users contact list. Initially this may not seem to impose limitations on how the users represents themselves; however, in an environment where users are free to re-construct themselves or develop alternate personae this can prove problematic. For instance one well known user "UserJohnDoe" with a fairly respectable reputation began logging on after midnight, discarding his usual moniker and adopting the name "NeedsSpanking." He was unaware that his name change was being reflected on all the contact lists of other users who had added his usual name. While accountability has many advantages in establishing a sense of trust and reliability for users, it also imposes limits in areas not often expected.

Within the AW environment, great value is placed on communication by way of the features that facilitate both communication and community. However, despite the focus on community several design features function to construct the user as autonomous citizens with a fair degree of self-governance. Features such the privacy option allows users to designate individual levels of privacy and control over personal information. Users decide for themselves when and how much information is appropriate to disclose and to whom. Unique identities provide users with security and control over their online and PW identities. Privacy and identity also grants both individual users and communities a degree of personal and social autonomy. The

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2 Another user relayed this story to me. All aliases have been changed to protect the online identity of the users.
addition of the *mute* command affords individual users a degree of social control and accountability without having to rely on world owners, Gods, or Wizards to maintain social order.

The type of skills and abilities requisite for communication also constructs the user. Text-base dialogue like that typically found in chat applications require the use to be able to weed through multiple-threaded conversations. Bandwidth, distance between users, and typing skills often cause some messages to be delayed, so resulting conversations often overlap and move simultaneously in different directions. Additionally, the lack of visual, verbal, and nonverbal cues typically used to signal turn-taking are not always easy to replicate in synchronous text-based dialogue. However, unlike face-to-face communication, with a text-based chat, users often have the option of scrolling back and forth through the text of the dialogue.

Though multiply threaded conversations may initially be difficult to follow, most users soon develop skills and strategies for following various threads. In addition, unlike the custom of face-to-face interactions, in a text-based chat, it is possible to conduct multiple threads simultaneously. The following example (Example 5.0) shows a conversation between three users. Within the dialogue is evidence that although there are three participants, at times four individual threads that are being discussed.
Example 5.0. An example of a conversation with multiple threads taking place between three participants.

Immigration Officer: Still under construction
MD: great background
Michigan: hello MD
Lindbergh: tank yew
Michigan: Lindbergh made the Backdrop
Lindbergh: actually
Lindbergh: I think that was Fryedds work
MD: really? What did you use. they're great
Lindbergh: I just modified it, for something new
Lindbergh: umm
Michigan: he used PSP5
Lindbergh: paint shop pro 5.0
Lindbergh: I like photoshop, but
MD: really? paint shop?
Lindbergh: this was pretty cool
Michigan: Change yor avatar MD to Static Lady
Lindbergh: yeah, lots of new stuff in it
Michigan: cool
MD: did you two create most of these?
Lindbergh: yeah
Michigan: yes
MD: this is beautiful.
Michigan: everything is original
Lindbergh: Michigan dies a lot of it
Lindbergh: ahhh
Lindbergh: does
Michigan: dies?
Lindbergh: thunk
Lindbergh: The color schemes are what I wanted
MD: who did the textures?
Lindbergh: maybe that time spent in Hopkins Hall was good for something, ha
Michigan: I did some, and Fryedd did all the rest for me
Lindbergh: Michigan, mostly
MD: Hopkins?
Lindbergh: I picked some out, off of the net
MD: who goes to OSU?
MD: I thought you were in aviation
Lindbergh: he changed that avatar
Lindbergh: haha
MD: that's why you're a bird
Michigan: hehe
MD: Michigan, what do you do at your college?
Lindbergh: gee, MD, I'm in everthing, you know that
Michigan: I am a lab tech, and sometimes keep all the Network Administrators out of trouble
MD: You Lindbergh, you're a renassance man (mind the spelling)
Lindbergh: mechanical, electrical, aviation, graphics, photography,
Lindbergh: yeah, my mom says so
MD: hehe
Lindbergh: i even repair my own cars, and everything else
MD: Michigan... you don't have to deal with faculty do you
MD: and ride a motorcycle... I remember that
Lindbergh: we try to stay out of their way, ha
Michigan: hell no, I walk the otherway, haaa
MD: hehe...
MD: and fix computers
Lindbergh: try to, anyway
Michigan: yup, I am mostly a software man
Lindbergh: they can be frustrating at times

The preceding example illustrates the complex nature of text based conversations.

Multiple threads overlap, are dropped, and resumed.

**Representation II**

**Building**

AW is a user-extensible system that allows users to claim property and build.

In the AW universe, several worlds have been designated for public building including AlphaWorld, Mars, Atlantis, Metatropolis, and Yellowstone. Because COF also allows for individuals to purchase their own worlds, world owners may permit certain users to build in their worlds. Where, how, and what a user may build is to some degree up to the discretion of the world owners. For the most part, users are limited to using pre-fabricated objects supplied by the world owners and may only build in select areas.

Within the AW universe, COF has designated several worlds in which users may build. To build in one of these worlds, a user must first claim property. Claiming property basically means covering an unoccupied area with an object representing ground covering. Once a piece of land is staked or covered by a user, no other user may build on that land, or above and below it. To build, a user merely chooses from a selection of pre-fabricated objects that exists in the object library. The
objects in the library range from a variety of building materials such as walls, doors, and windows to specific items such as televisions, glasses, and cars. To claim property, a user must select an existing object or a starter object by right clicking on it to activate the Object Properties dialogue box (Figure 5.2). Within the box, the user can view the object description, the object’s filename, and the action field. In addition, the user can identify the object’s owner (Citizen ID) as well as the date the object was last modified. The Object Properties dialogue box allows the user to copy the selected object and then if necessary, transform it into another object within the world’s selection of objects. The newly acquired object can be moved along the X, Y, and Z plane, as well as be rotated on the Y-axis. This allows the user to place several more basic objects together to build such things as houses, cars, and even small communities.

Figure 5.2. The Object Properties Dialogue Box.
In addition to building objects, users can also designate actions and triggers for objects. In the Action field of the Object Properties dialogue box, a user can specify the trigger (to initiate the action), the command (which describes that action to occur), and the arguments (to add further specifications to the action). For instance, a user can specify that when another user bumps into an object, a sound file will play. The three types of triggers include activate (when an object is left-clicked on), bump (when a user's avatar bumps the object) and create (when the scene is loaded). Multiple triggers maybe specified so an object may react differently dependent upon the actions of a user.

A user can select from a variety of commands. Some commands such as visible and animate change or alter the surface appearance of an object. The animation command also allows the user to specify whether the animation is masked or not, the images to be used, the number of frames, the frame playback rate, and the frame order.

Commands can also be used to specify or control an object's behavior. By specifying an object as solid, the creator can prevent other users from moving through an object (using the shift command). Additionally, objects can be specified as triggers that will affect the behavior of another object. For instance, a user might enter a cabin, and by passing through the doorway trigger the animation of a fire in a fireplace and activate a sound file of a crackling fire.

There are also commands that allow a user to incorporate the integrated web browser. By clicking on a specified object, the user activates a corresponding URL or
FTP site in the web browser. Additionally, builders can also specify the URL of images or video from the Web to be imported directly on objects within a scene. These options allow builders to import unique and personal artwork and images.

**Representation II: Analysis**

Initially it may seem a bit of a stretch to include the activity of building under the sub-topic of Representation. In the AW environment, users do not have the option to create a visual representation (avatar) of their own making, however, they can build and create homes, structures, and environments that are often reflective of their personal interests and culture. Within several of the COF public building worlds, users display a great deal of personal expression. The ability to import images, animate, and set triggers and actions provides users with a wide range of interactive tools to customize their constructs. Additionally, the ability to trigger a web page to load in the integrated web browser allows more options as users are able to integrate text and web support to enhance their environment.

Building within an AW environment is fairly accessible. Users need not have any background knowledge in 3D design and modeling, or knowledge in how to create and map textures for 3D objects. The building interface is straightforward and easy to master within minutes. Additionally, throughout AlphaWorld proper there are resources for not only learning how to build, but also for examining the types of objects and textures are available, animating textures, importing objects, and setting triggers and actions. The focus within the AW environment is on the building of a community by allowing users to create their own environment.
The relative ease of building also allows users to gain a sense of ownership within the worlds. Many users invest a great deal of time and energy in building, which is apparent in the types of constructs they create. For some users, to some degree building is an emotional investment they make in the community. In PW, we are often limited by income, and locale as to the type of house or structure we live in. Within the AW environment, users do not have the same type of PW limitations. Land is free, as are building supplies. Building in some sense becomes a type of representation not only in AW, but also a reflection of their PW interests as well a tool for their imagination.

Within the AW environment, great value placed on communication and community. AW is the most fully functional user extensible 3D virtual world available. The user extensible features allow users the opportunity not only to build and contribute, but too a large degree also helps to establish a sense of ownership within the community.

**Embodiment**

**Avatars**

As discussed earlier, an avatar is the visual representation of a user in a virtual environment. In AW, users are primarily restricted to choosing from a limited pool of avatars that may or may not represent them visually they way they wish to be represented, but this is often true in PW as well as in the virtual realm.

In addition to expressions of gender, culture, ethnicity, fitness, age, AW avatars also serve to embody users by displaying gestures, emotions, actions, as well
as serving as the users camera (or viewpoint) and navigation through the 3D environment. The following sections deal with each of these features.

**Gestures**

In an AW scene, the avatars present are rarely idle. Unless the user specifically alters their *Performance* settings, the avatars the user views in a scene will cycle through a series of actions and gestures. The gestures are not controlled by the user, but instead are pre-programmed animations which consist of such movements as the folding and unfolding of arms, looking from side to side, looking at a wristwatch (which may not be present), shifting weight, tapping a foot, and patting hair. Some facial gestures include blinking and winking. Users have no direct control over these gestures, but are limited in whether or not to display them on their own systems. Users have no control over the gestures their avatar displays on someone else’s system.

From the perspective of cultural kinesthetic or non-verbal behavior it is interesting to examine the implication of some of these gestures. In most North American cultures\(^3\) when engaging in a conversation with one another or a group, depending upon the context, looking at one’s watch, or looking from side to side might indicate boredom or impatience. Additionally, to wink at someone may imply a range of different meanings within the context of a conversation. While a user has no direct control over these gestures, the non-verbal behavior of the avatar may be in direct conflict to what is being communicated through the textbox.

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**Actions and Emotions**

Although most users seem to use emoticons common to many forms of text-based digital communication, users are able to command only a few emotions and actions of their avatar. The emotion commands might include such emotions as *happy* (the user's avatar jumps up and down), and *angry* (pointing and shaking hand). Actions that can be controlled by the user include: *wave, jump, fight, dance* (the macarena), *look, shove, point, fall* (only available with *Biker*), and *flap* (only available with *Bird*) and even skating and skiing. These actions are not reflected from the user perspective. In other words, the "camera" or first person perspective does not shift or alter in anyway while the avatar performs these actions. Only by shifting to the orthographic view is user able to view his/her avatar displaying these actions.

Although a user has limited control over displaying a range of actions, there are times when the scene viewed through the 1st person perspective changes to reflect avatar actions such as when a user moves through a scene using either the arrow keys or the mouse. More detailed information about this will be covered in the Navigation section.

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3 The use of the plural form is intended and serves to represent the wide variety of ethnicity and culture that constitute the United States.

4 Examples of emoticons include :-} for happy, :-( for sad, and :- o for surprise.
**Avatar Perspective**

In AW, the avatar serves two distinct purposes: it serves as a visual representation of the user and it serves as the camera by which the user views the 3D environment or scene. The "eye" and the camera icon allow the user to shift from a first person perspective to the orthographic or third person perspective. The orthographic view allows users to "see" themselves (or more correctly, their visual representations) in 3D space (Figures 5.3 and 5.4). This feature is helpful for choosing an avatar, building within the world, as well as positioning orientation. Short cut keys for first person and third person are *home* and *end* respectively.

On the icon menu bar is also a set of "eye" icons that allow the user to shift the pitch or the vertical angle of the camera in first person. The three icons represent up, down, and straight ahead. Like with the perspectives, there are corresponding short cut keys. Page Up and Page Down operate the camera pitch.
Navigation

In AW, an avatar represents a user as well as serving as the user’s camera in the 3D environment. In order for the user to move through simulated 3D space; it is
necessary for the avatar or camera to move. To move the avatar along the X and Z planes, a user can use either the mouse or arrow keypad. By moving the mouse forward and backward on the mouse pad, the user's avatar moves forward and backward in the environment. Moving the mouse left and right will allow the user to rotate the avatar along the Y-axis to face a new direction. Additionally, the right and left arrow of the keypad will also allow the user to rotate the avatar along the Y-axis, while the up and down keys are used to move the avatar. To move an avatar along the Y plane (up and down) is called flying. To fly (ascend), the user must press the plus key (+) and to descend, the minus key (-).

Both the Control (Ctrl) and the Shift key allow the user a greater range of options. Pressing control, while moving an avatar will allow the user to move more rapidly through a scene. Pressing the shift key while moving will allow the user to move through an object. Pressing shift while turning (using the left and right arrow keys) will allow the user to "slide" sideways. It is important to note that the shift key has limitations. World owners can specify whether to allow users to use the shift key as well as disabling the users ability to fly. This option prevents users from cheating during games and/or forces them to explore an environment more fully. In addition to gravity, there is collision. When a user's avatar encounters an object, the user must press the shift key in order to move through that object. World builders have the option of inactivating this option. It should be noted that there is no collision between avatars. Avatars are able to move through other avatars without any resistance.
Embodiment: Analysis

For most users there is little opportunity to create custom avatars for personal representation. With the exception of world owners, users are confined to using one of the prefabricated avatars provided by an individual world. For visual representation, users must rely on the use of avatars that may not reflect their personal values, culture, ethnicity, or physical bodies. In addition, avatars are also not transferable from world to world. It should be noted that plans are in process to allow users to create their own avatars (Roland, 1998).

The user embodiment is constructed not only by way of visual representation (avatar), but also by the avatar gestures, emotions and actions, navigation and perspective or camera as represented by the avatar. With AW, users cannot control the gesture cycles, nor are they represented from a first person perspective. The same is true of avatar emotion and action commands. There is little sense of physical embodiment analogous with that available in PW. With an AW avatar, users cannot look down and see their avatar's feet; they cannot control the arms and legs of their avatar or move their heads independent of a limited range of commands. AW does not allow the user to express much range of non-verbal communication. Other than through navigation and a few simple pre-programmed emotions and actions, users have no control over gestures. There are also limitations imposed by the viewer perspectives. While users can control the rotation of the camera (avatar) view along both the X and Y-axis, only rotation along the Y-axis is apparent to other users. For the most part, users are prevented from displaying much by way of non-verbal communication and they must rely on text to convey emotions. This reliance on text
might lead one to assume that the user is limited to text in constructing a sense of embodiment; however, the limited evidence provided by Jeffery and Mark's (1998) behavioral studies indicate that the ability to command and control gestures and to move body parts may not be as necessary for creating a sense of embodiment as one might assume. Embodiment to some degree in AW is relegated to the realm of navigation and proximity. The ability to "see" other users and to move around them is in part sufficient to construct at least a limited sense of embodiment for users. However, depending upon the purpose for which AW is being used, it may be important to question how the limits of embodiment imposed on the user might limit the types of experiential knowledge that may be gleaned from these environments.

**Educational Implications**

**Presence**

While AW does limit access by way of hardware requirements, as a relatively new technology, the AW developers have recognized and been responsive to notion that language plays an important role in creating environments for worldwide use. The AW browser supports several languages, and while this list is still relatively short, it does indicate that the AW developers recognize that a virtual world encompasses languages other than English. The availability of multiple languages provides some interesting opportunities for language learning both in the PW classroom, and as outside support for learners acquiring a second or foreign language.
**Representation**

In keeping with the current focus on inclusion and diversity in the learning environment, it is important to address how any educational medium supports or inhibits inclusion and diversity of the participants particularly in collaborative learning environments.

With regards to diversity, AW is problematic in the ways the design limits users ability to control representation. The COF supported avatars present particular bias towards young, fit Western Caucasians. Additionally, the lack of overall body, shapes, sizes, race, ethnicity and degrees of able-bodiedness, particularly among the female avatars, is seen as problematic for a learning environments that seeks to be inclusive of all students.

In addition to limitations of avatar representation, it is speculated that AW would probably not be suitable for visually challenged students. Although no tests were conducted, without the use of real-time audio for communication, AW provides few opportunities for visually challenged learners.

Despite some limitations, AW does have the potential of offering educational opportunities that are not easily replicable in the PW classroom. For distance education, AW probably provides many opportunities for educators and students to create their own learning environment inasmuch as users can purchase their own worlds. The ease of building features allows world owner to easily adapt their environments to suit the needs and objectives of their learners. The integrated web browser also allows users to customize their worlds or environments to suit their
needs. Triggers both in-world and in the web sites, can greatly enhance interactive learning. Even without purchasing a world, users still have the option of building within one of the public worlds. This provides many opportunities for customized settings without the cost of setting up a world.

One area that deserves closer scrutiny is how AW might be intended for use. It might not be suitable as the primary medium for a lecture/discussion style class. Differences in typing skills may disadvantage some students. Additionally, differences in written language skills might also serve as an impediment for other students. Granted in a PW classroom, differences in communication skill advantage some students over others, however, the PW classroom also offers a wider range of avenues for non-verbal communication. Although there is indication that AW does offer a degree of embodiment within the design, it does not allow for the variety and complexity of non-verbal communication as is available in a face-to-face setting.

One example of some of the difficulties that arise in using AW for a discussion/lecture style class is illustrated in an excerpt from the Avatars98 Conference. In this excerpt (Example 5.0), one of the primary programmers of AW (Roland, 1998) is holding a question and answer session about the development of AW. This session was very popular and many were in attendance, however, the medium proved a bit difficult for a clear exchange of questions, answers, and ideas.

There are already many educational initiatives within the AW universe ranging from informal AW training for new users, to using AW as a distance education medium for university level courses. The flexibility afforded by AW
makes it suitable for a variety of subjects including foreign/second languages, science, communication, language arts, as well as many others.

While it is important to address weakness in such areas as diversity and inclusion, it is important to note that AW is an emerging technology and in a constant state of revision. Informing designers of the weaknesses is part of the process of insuring that emerging technologies include the type of design features that support the needs of all learners.

Example 5.0. An example of multiple-threaded conversations during a question and answer session.

Roland's Question and Answer Session

Roland: hey BB do you want to moderate the questions? :)  
LC: LOL - questions start firing now?  
Bluesclues: I like the multiple object paths.... I'm far to lazy to make enough objects to build an entire world. 
Sy: Roland, please tell us about gravity! 
Tescos: yeah www.thepalace.com 
TertiaryTad: hmmm 
Roland: hmmm..gravity....what about it? 
Oddor: telegrams crossing universes Zac 
TertiaryTad: i had a question actually:() 
Sy: Give us a little history, whose idea was it? 
Zac: that would be perfect for interaction !! 
Ulyssee: I think it was a big improvement to the worlds 
Mortality: Isaac Newton I believe 
zg: very useful to have gravity 
Roland: gravity ...as I recall...that was total spur-of-the-moment 
FooFooDrink: sure your in bold, he gets pivked first 
FooFooDrink: pivked 
Oddor: how does gravity work and what keeps the planets aligned ? 
Roland: I added it one night when I was fooling around with collision detection 
TertiaryTad: :) 
freeze: gravity gives you the sense of the space 
Roland: we liked it so much we decided to keep it :) 
Etnas: <<< 
Wanderer: flogisten keeps the planets alive, right? 
Ulyssee: To me it made a big difference:-) 
tourist: brilliant! 
LukenLaura: i only want to know about outgoing telegrams, Roland... are we going to see them? 
"yellowfin": ,A,:A, 
Sy: it was a totally new experience for me and at first I admit - hated it... 
Zac: cool .... is there any possibility of having collision detection apply to avatars ??

5 All names, with the exception of Roland's, have been changed to preserve users' online identities.
Enabling Learning

Though at this time AW does have a few problematic features, AW does have much educational potential worth exploring. The communication features such as a unique identity, telegrams, mute, and contact lists allow provide great opportunities for collaborative and cooperative learning. Within this decade, educators have begun to focus on how collaboration and cooperation can enhance the learning process. Advocates of collaboration from a socio-constructivist perspective view knowledge as a social activity rather than as an individual cognitive process (Vygotski, 1978; Lave and Wenger, 1991). Within the socio-constructivist paradigm, great value is placed on collaborative learning because it provides opportunities for groups of learners to learn from each other by adopting new roles, offering multiple perspectives, becoming peer tutors, and taking on projects and tasks that would be difficult or impossible for a single learner (Johnson and Johnson, 1996). AW provides a means for learners to converse and construct in a collaborative environment and is well suited because of the types of design features it affords. Unique names provide both trust and accountability necessary for a collaborative learning environment, yet at the same time allow for users to adopt a new personae or role that might not be available to them in a PW learning environment. In Bruckman's study of MOOSE
Crossing, she noted the importance of learners being able to re-define themselves in the learning environment (Bruckman, 1997; Dede, 1995). Several of the design features in AW such as mute, whisper, and privacy allow learners the ability to self-govern which in turn provides more learning opportunities about how to work with groups of learners.

Along with communication, AW provides the opportunity for learners to not only construct their identities and roles, but also to construct their 3D environment. The availability of building within a world provides educators and learners the means to self-define the context of the learning environment as well as the opportunity to learn by interacting with objects within the simulated environment. While more research needs to be done of specific technologies like 3D virtual worlds, studies of VR environments reveal that immersive environments allow learners to interact with data or knowledge representations that are not possible to replicate in the PW (Dede, Salzman, and Loftin 1996; Byrne, 1996; Osberg, 1997). While AW may lack all of the multi-sensory experiences available to learners in immersive environments, there are growing possibilities for representing and interacting with abstract representations through the availability of building within the worlds, and by importing custom made objects into an environment. While interacting with objects is fairly limited at this time, recent developments with AW bots may offer more options for both learners and designers.

Along with possibilities for representation of data, the availability of building may also enhance learning by providing more opportunities for engagement. Within the constructive paradigm, knowledge in not the transmission of ideas, facts, and
theories, but rather learning and knowledge are viewed as a process of construction.
Activities that allow learners to create, problem-solve, make decisions, and reflect
enhance engagement and learning. The availability of building features in AW
provides countless opportunities for constructivist activities dealing with both
concrete and abstract representation of data and ideas.

Summary

All in all, AW constructs the user in a variety of ways. First of all the
presence of users is in many ways determined by the affordances and limitations
imposed by the hardware, software, and computer skills of the users. Additionally,
presence is also constructed by the languages supported by both the browser and by
the instructions for downloading both the application and instructions. While the
browser does support several languages other than English, it should be noted that the
information contained in the Help section of the integrated web pages is in English.
This to some extent prevents some users from fully participating in the environment.
The users' representation is constructed by their status (citizen or tourist) because of
the privileges that accompany paid registration. Registered users are able to maintain
a unique identity, build contact lists, send telegrams, and build in several worlds.
These privileges allow for accountability, trust, and a means of personal and culture
self-expression. Registration also allows users to select from a wider range of avatars
than tourists. Unpaid users are restricted to either a male or female tourist. However,
it should be noted that the stable of avatars provided by COF is limited in the culture,
age, ethnicity, and body sizes. For the most part they seem to reflect Western values.
Limitations of representation are particularly apparent in the body size, age, and clothing styles of the female avatars. Finally, users are constructed by way of the degree of embodiment provided by the AW application. While the avatar gestures or pre-programmed animation cycles do help shift the users' focus back to the 3D window, they also present non-verbal messages that may not be consistent with what the user is trying to convey. Additionally, the limited range of actions and emotions restricts users in what they are able to express via their avatar. And while other users are able to view these visual actions or emotions, the movement is not reflected in the first person perspective of the user.

Despite some limitations, a review of the design affordances and limitations of AW indicates that it may provide many interesting opportunities for both distance learning and as a supplement for PW learning environment.
CHAPTER 6

blaxxun interactive

blaxxun interactive is an international company that offers a variety of products and services for networked interactive communication. In the realm of virtual worlds, blaxxun has been most noted for the development of online virtual worlds 2D and 3D clients, servers, and online communities. In addition to the variety of 2D and 3D clients and servers, blaxxun has also provided applications for online promotions (Bacardi, Carazza, CBS SportsLine, and Janet Pool), online shopping (Canal+ and NTT Data), online services (Bank Austria, Bank City, and BMW), and online teamwork (IBM Canada and Deutsche Telekom). In the field of 3D virtual worlds, blaxxun is best known for the ongoing development of online communities. These communities have ranged from the blaxxun Home World, to the European based Terranet Café, and most recently have expanded into the user-registered, user-extensible world, Colony City.

Currently\(^1\) blaxxun's Contact 4.0 is the latest client software for accessing blaxxun 3D virtual communities. Contact 4.0 is a browser plug-in that allows for 3D multi-user communication. Features of the plug-in include "support for VRML and

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\(^1\) This information is currently based on applications available as of February 10, 1999.

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Viscape\(^2\), chat, avatars, message boards, object trading interaction with agents and more." This review will focus on the use of Contact 4.0 in blaxxun's first user-extensible community, Colony City.

**History**

In 1995 blaxxun interactive (formerly Black Sun Interactive) launched the first VRML based 3D virtual world. The international company with offices in both San Francisco and Munich was founded in response to a growing need for interactive communications (www.blaxxun.com). Their focus was to develop and provide a medium or tools which would provide "a shared interaction in three dimensions and real-time" for a variety of needs such as online shopping, CSW, and advertising. PointWorld was the first of their many online worlds. At that time the browser used to access the 3D multi-user world called CyberGate was a stand-alone program (Damer, 1997). Subsequent versions of their 3D virtual world browsers are now a series of plug-ins and a Java application that runs in either Netscape Navigator and Internet Explorer (Damer, 1997; Wilcox, 1998).

**Colony City\(^3\)**

In June 1998, blaxxun launched a futuristic virtual community called Colony City. Colony City, unlike the other blaxxun virtual worlds is a cluster of colonies that are part of a democratic, user extensible virtual world. Within Colony City, users

\(^2\) Viscape is a 3D web browser which relies on their proprietary SVR format (Viscape, 1999).

\(^3\) Subsequent to this review, Colony City has now evolved into CyberTown.
who become members can not only chat, but they can claim homes, hold jobs, earn money and participate in the democratic governance of the community. By becoming a citizen (free of cost at the time of this writing) a user gains a unique identity, and can claim a home in one of the hundreds of communities.

Colony City was created specifically for the purposes of facilitating online community. In order to immigrate or become a citizen of Colony City, users must first register. When they register, they select a unique name (identity) and a password. In order to access Colony City users must input both their name and passwords. In addition, users accumulate points by logging in once a day. Points serve as the basis for the economic system of Colony City.

Because Contact 4.0 relies on VRML as the underlying technology for the 3D visual environment, a world or communities such as Colony City is relegated to individual VRML scenes, so each world does have limits. Within a blaxxun scene, the world is flat and it is possible to fall off the edges. Therefore, though Colony City is conceptually one community, it is comprised of a series of VRML scenes that one travels between.

Overview

The following consists of a review and analysis of various design features of blaxxun's Contact 4.0 within the context of Colony City. It is important to note that Contact 4.0 is not synonymous with Colony City, however, in order to review and analyze a 3D virtual world application, it is necessary to view it within the context of
an active community. For that reason this review and analysis focuses on both Contact 4.0 and Colony City. Unless otherwise noted, the various design features discussed will be attributed to Contact 4.0.

Interface Overview

Contact 4.0 is a series of frames imported within either the Internet Explorer or Netscape Navigator Web browser. While the arrangement of the frames may vary from world to world, the most common composition consists of a top menu bar, a left or right-sided column and three additional windows (Figure 6.0). The first and most prominent is the 3D window into the actual world. Beneath the left side of the 3D window is the text chat box, and on the right is a tabbed window with a menu consisting of People, Places, Sessions, Options, and Help.
Figure 6.0. Contact 4.0 in Colony City.

The 3D window is a basic VRML site with the addition of 3D avatars. The text chat box beneath is a traditional chat window that consists of a dialogue box and an input box. At the top of the dialogue box is a tab, that indicates whether the user is engaging in public conversation or is engaging in a private or whispered conversation with another user.

Within the tabbed window, a user can select from a variety of menu items (represented by icons): People, Places, Sessions, Options, and Help. The People window allows users to view a list of who is currently in a world (Figure 6.1). Within this window is a list of the nicknames of the users currently in that world, as well as a
corresponding list of their interest. Along with the users’ nicknames, are the names of any bots residing in the world. Along side each user's nickname or identity is an icon of a small figure. The color of the figure indicates whether the name belongs to an actual user or a bot and whether the user is using a 3D or 2D browser. Additionally, the color indicates who is in conversation at the present time.

Figure 6.1. A list of users in Colony City.

The window for Places provides the user with a list of available worlds (Figure 6.2). In addition, the list also indicates how many users are currently in that world. To the left of each world is an icon of a door. An icon of an open door indicates the world the user is currently visiting.

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4 A bot is a virtual robot.
Sessions provides chat logs of the public and private conversations a user has participated in while visiting a world. Conversation logs are listed by name of the individual. Additionally, there is a log of all public conversations. To the right of the log list is a corresponding column listing the file size in kilobytes.

The Options window provides submenu items: About blaxxun Contact, Avatar Library, Body Language, Chat Macros, Firewall Configuration, Language, Personal Data, and Voice. Several of these submenus will be discussed in greater detail in subsequent portions of this chapter.

Presence

Requirements

blaxxun Contact 4.0 recommends a Pentium 133 machine with 32 MB of RAM, a 28.8 modem, a 3D graphics card, and a sound card; however, it will run with a minimum of a Pentium 90, 16MB of RAM, and a 14.4 modem. Contact also requires Windows 95, 98 or NT, Internet Explorer or Netscape 3.0 or higher.
Contact 4.0 can be downloaded free of charge from the blaxxun web site (http://www.blaxxun.com). Although blaxxun interactive is an international company, the instructions and information contained on the blaxxun web site are in English.

Currently, Contact 4.0 only supports three languages: English (default), French, and German. Despite the limited array of languages supported by Contact 4.0 individual communities may or may not support various languages.

**Presence: Analysis**

The blaxxun community of Colony City is one of the latest in a relatively long line of virtual communities offered by blaxxun. While Contact 4.0 is the latest client developed by the company, in the past blaxxun has offered a variety of 2D and 3D clients for use with their communities. Although these products are no longer publicly available, many users continue to use them. It is not uncommon for a user who does not meet the requirements for Contact 4.0 to rely on a client that is suitable to their system. Therefore, presence is a somewhat nebulous construct in Colony City. Some users with older 2D clients do not have an avatar to represent them in the 3D environment; however, they do participate via the text dialogue box.

For the most part, English is the language of wider communication. Although the browser does support both French and German, the user must either have English reading skills or have access to a translation in order to access the information for downloading Contact 4.0 and *immigrating* and accessing information about Colony City. Users, who do not have language skills that allow them to participate, may be
limited in their ability to fully participate in the economic and governance system of Colony City. In many respects, although the browser may be amenable to languages, the user is often at the mercy of the language used by the community.

**Representation I**

**Avatars: Library**

Within a blaxxun community such as Colony City, users have a wide range of options from which to choose in order to represent themselves visually within the 3D environment. Users may select from a variety of blaxxun fantasy and realistic looking avatars or borrow from other avatar selections other than those provided by blaxxun. The third choice allows users to the option of using custom made avatars.

By selecting *Avatar Library* from the *Options* panel, users can view and select from a library of avatars provided by blaxxun and other blaxxun world providers. From the existing libraries, users can choose from the following categories: blaxxun fantasy, blaxxun realistic, and Zapa Digital Arts avatars. The largest category is the blaxxun fantasy avatars, which provide a wide variety of fantasy human-like and non-human avatars. Out of the blaxxun realistic category, users have the option of choosing from four female and four male avatars. This small selection represents predominately young and fit, Western, Caucasian adults. The Zapa Digital collection includes a small variety of fantasy humans and non-humans. Although few of the avatars represent ethnic groups, the avatar library appears to focus more on fantasy
characters rather than focusing on more photo-realistic version of humans. This emphasis on fantasy is further reinforced by the overall visual appearance of Colony City.

**Creating Custom Avatar**

blaxxun allows users to import their own avatars to use. Many users take advantage of this option by either creating their own or by importing avatars created by other users. blaxxun also provides documentation in the form of VRML codes and instructions as well as providing a basic avatar which users can adapt. Because blaxxun is a VRML world, it is somewhat necessary for users to have some basic knowledge of VRML in order to alter and customize their individual avatars.

In addition to the instructions provided by blaxxun for creating an avatar, users can also use graphical VRML editors. Specifications and instructions for including programming for gestures are available through the blaxxun web site.

The latest beta version of the VRML editor, Spazz3D, has recently added a blaxxun *Avatar Wizard*. By using the graphical 3D editor, users can create objects and worlds, as well as texture, color, add animations. Once an avatar (VRML object) had been created, users can use the *Avatar Wizard* to add gestures, reduce file size, and ftp the avatar onto their server. The availability of the VRML editor Spazz3D has resulted in a greater diversity of avatars in Colony City.
Identity

Previously blaxxun offered a variety of communities for users to interact. Within most of those communities there were no unique identities, however, Colony City requires users who immigrate to register a unique user name. Within Colony City, no other user may use that name.

Within the 3D environment, because neither users' names nor dialogue appear above their avatars' heads, it is somewhat difficult to identify another user. Instead, by moving the crosshair cursor over an avatar, the nickname of the avatar's user is listed at the bottom of the web browser window. This is one of the few ways users can identity one another in the 3D environment. Also, because many users are still relying on older versions of blaxxun 2D software, within a Colony City setting, there may be many users who are not represented in the 3D window, however, they may still acquire unique identities and communicate with other users via the text dialogue box.

People

Selecting the People submenu from the right-side tabbed window allows users to view a list of names of all other users currently visiting that particular scene. Because Colony City is comprised of a series of VRML scenes, users can travel between various scenes by selecting from the Places menu. Once a user has selected a place, selecting the People submenu will allow him/her to view a list of other users.
Users need not scan the 3D environment in order to identify other users, but merely check the *People* submenu. It is not possible to prevent one's presence from being revealed.

In addition to the users' identities is information about which browser (2D or 3D) a particular user is using. Listed among the list of users are the various bots currently residing in the scene. A small green icon signifies a user, whereas bots are identified with a small yellow icon.

**Personal Data**

The *Personal Data* form allows users the option of making some information such as first and last name, URLs and interests about themselves public. Users are not required to submit any information other than a nickname, but they have the option to disclose more information if they choose. To view another user's personal data, users select a name on the *Peoples* submenu and their personal data (if given) is revealed.

**Communication**

Most communication with Contact takes place via a detachable text dialogue window. Users can specify the font and size for reading dialogue and have the option of locking and unlocking the scroll bar.
**Private and Group Chats**

Users in a blaxxun scene may conduct private chat sessions with another user or participate in small group chats. By selecting another users name from the People sub-menu, one user may invite another for a private chat. A chat request may be rejected or terminated at anytime by any of the participating users.

**Muting**

Contact allows users the option of muting another, and once a user has been muted, no further messages will appear from that user until the mute command has been lifted.

**Representation I: Analysis**

blaxxun's Contact is one of the few 3D virtual world applications that allow users to import their own avatars. What is most surprising is that a great many of the custom made avatars observed during the duration of this investigation did not resemble humans, but instead seem to reflect a variety of interests and serve more as a means of visual expression. The few humans that are represented rarely seem photo-realistic, but rather characters from cartoons and such. Personal expression seems to play an important role in how users represent themselves. Many users appear to change avatars regularly to reflect the changing seasons and holidays, while other users' avatars reflect their culture, interests, and even represent differently able-bodies.
In Colony City, users not only have unique names and identities, but are also identified according to their jobs and amount of points they have accumulated. Within the text dialogue box, each user who enters and scene is announced. Every time a user "speaks" that user's name, job title, and accumulated points are listed.

Within the 3D window, users' names do not appear above their heads. Placing the cursor over an avatar can reveal the identity of other users. That user's identity is then listed in the web browser status bar. A list of all the users and the client they employ (2D or 3D) appears in the People window beside the dialogue box. This tends to draw the users' attention from the 3D window to the dialogue box. In addition, some users, who are using older 2D versions, are not present in the 3D window, but are still able to communicate via the text dialogue box as well and being represented in the People submenu. Focus is often drawn to the text dialogue box and away from the 3D window. Overall, there is relatively little movement of avatars within a scene. This could be attributed to some of the limitations of VRML. In the case of Colony City and Contact, the design of this community and how it constructs the user presents an interesting dilemma; users have a great deal of freedom to represent themselves visually, yet because of other competing design factors, the focus often tends towards the text dialogue box.

Within a blaxxun community, there is a great focus on community. All users currently visiting a site (Place) are listed in the Peoples menu which prevents users from lurking because their presence is known. For that reason, users are constructed as being part of a community.
The communication opportunities for users are somewhat limited because of the languages supported by the browser as well as the users' general written communication skills. It is not enough to simply have a browser that is in a particular language. In order to interact in an environment such as Colony City, the user must have basic skills in that language in order to participate in the community.

In addition to language and communication skills, it is also important that users be able to follow the multiple conversation threads in the text dialogue box (see Chapter Five for a more in-depth discussion.) Conversations may be difficult to follow because within the text dialogue box along side of each user's conversational text, is the user's identity, job title (if they hold one), and the number of points they have accumulated in Colony City. While this gives other users immediate information as to another user's job, status, and experience, it is somewhat confusing to read (Example 6.0). The fact that the text dialogue box can be unlocked from the browser and scaled, as well as user's being able to select both font type and size, does help to some degree, however, it is still sometimes cumbersome to follow conversations.

Example 6.0. A Conversation in Colony City⁵. (Note: My avatar was a Christmas tree.)

Michele, welcome to City Plaza. Please note that visitors can only watch the chat!
Igggy [105]: Sakes, yep thats right, from leicester in england
Michele [190]: hi
[Block Deputy] smith [225]: LOL I think I see a Christmas tree.
Igggy [105]: Hi Michele
Sakes [401]: hi Michele, do ayoy enjoy video games???
[Block Deputy] smith [225]: Hi Michele.

⁵ All aliases have been changed to protect the users' on-line identities.
Michele [190]: hi
Sakes [401]: i got someone to join the city, that i know irl
Michele [190]: I'm the tree...past season
[Block Leader] Gareth [845]: What I miss???
Igggy [105]: Friend or foe?
[Block Leader] Gareth [845]: Smoking or NON
[Block Leader] Saint69 [535]: not much gareth
Sakes [401]: i told them about the city, didn
Sakes [401]: 't i???
Igggy [105]: I'm off to look around the city for a bit, back soon!
[Block Leader] Saint69 [535]: drank or drunk
[Block Deputy] smith [225]: Michele.....not making fun of it.....just suprised
Sakes [401]: i am hungry
to see one.....better hope the dogs don't come out.
Sakes [401]: i am hungry
Sakes [401]: and i have no food
[Block Leader] Saint69 [535]: eat Sakes
Sakes [401]: ok
[Block Leader] Saint69 [535]: lol
Pesky [70]: Hello Saint69

Although within Colony City users are not able to lurk, there are some
features that allow for privacy and control. A user is able to request and abort private
chats anytime. Additionally, the user also has control over who they wish to mute.
None of this information is public. In other words, when several users wish to engage
in a private chat, other users are not aware. The same is true of muting; other users
are not aware when one user has muted another, nor does it affect their ability to
receive messages from other users. In terms of how this works to construct the user,
for the most part the user is given a degree of personal autonomy in determining who
they wish to communicate with, however, they have no control over whether their
presence is known. With the People list, users cannot lurk with anonymity, but they
are given some control over who they wish to communicate with.
**Representation II**

**Building**

For the most part, user-extension or building within the blaxxun worlds is limited. Within Colony City there is a limited availability for users to build homes. In order to build a home, users first select a neighborhood. The user is then presented with a 2D map illustrating all of the homes and available homes within that neighborhood. A user can visit the home of any other user by selecting that user's home from the 2D map.

To claim a home, a user must find a free (unclaimed) home. After selecting a free home, the user is given a choice of several pre-fabricated homes from which to choose. Presently users are not able to customize their homes, however, subsequent plans are in the works to allow for this option.

**Representation II: Analysis**

For the most part, the user is not constructed by their homes, but by their role within the community. Building is not an act that allows users much by way of personal expression. Most of the pre-fabricated homes represent more Western design and values (Figure 6.3).
Figure 6.3. A series of Colony City homes.

**Embodiment**

blaxxun's Contact 4.0 allows users a great deal of freedom and control over their visual representation. Unlike most other 3D virtual world applications, Contact 4.0 allows users many options for selecting and using avatars. Users can select from
the blaxxun library, other libraries that supply blaxxun avatars, or create their own avatar. Needless to state, there is a great deal of variety in the types of visual representation found in a Colony City scene.

**Gestures, Actions, and Emotions**

For the most part, blaxxun Contact 4.0 avatars do not cycle through animated gestures, but instead remain stationary in a setting. However, the blaxxun avatars have a limited standard selection of emotions and actions from which a user may opt to display. These range from hello and goodbye, likes and dislikes, agree and disagree, frowns and smiles. Though the facial expressions do not vary, physical gestures are used to reinforce the desired gesture or emotion. Often these actions are fairly similar and are sometimes hard to distinguish between. For instance, happy and hello are usually represented by either the waving of the avatar's arms (as in a greeting) or an overall bowing. The differences between happy and hello are more the degree of the action rather than the type of action performed. All actions and emotions are reinforced by way of a simple statement describing the action in the text dialogue box. Without the accompanying text, it is difficult to interpret these actions and movements and the corresponding emotions they are supposed to display.

The action performed by a user's avatar is also not reflected from a first person perspective. In other word, the actions displayed by the avatar are not reflected in the user's camera view.
**Avatar Perspective and Navigation**

Contact users have the option of both first and third person perspectives. By clicking in the 3D window, a user can press "a" to toggle between first and third person. The third person perspective allows users a back view of their avatar. Like most virtual worlds, the blaxxun avatar serves as a visual representation of the user as well as serving as the camera by which a user views the scene.

As with most VRML scenes, Contact users have a variety of options for navigating and viewing a scene. By right clicking in the 3D window, users are presented with a choice of viewing and navigational options by way of a small menu which includes *walk, slide, rotate, examine, fly, pan, and jump*. In addition, users can select whether to activate the *collision* and *gravity* features, *straighten up, set,* or *zoom out*. Though many of the features are fairly similar, there are subtle differences. For example, *walk* simulates the type of motion paths most analogous to PW (movement along the X and Z axis), whereas *rotate* allows users the full degree of motion rotating on all three axis. Also, like most VRML browsers, the user can select from a variety of preset viewpoints that have been established throughout the scene. These preset viewpoints allow the user to move quickly from one pre-determined viewpoint to another.

Another option provided is a small dashboard that appears in the 3D window that allows users to "steer" or navigate through a scene (Figure 6.4). By using shortcut key commands, users can toggle through the various navigational and viewing options without having to first open the navigation menu. Additionally the arrow keypad can be used to move through a scene.
Embodiment: Analysis

Embodiment is an interesting domain to unravel with Contact 4.0. In many respects, the affordances and limitations of the design are conflicting in nature. While the design does allow users to import their own custom made avatars, the overall design of the interface often distracts attention from the 3D window, thereby downplaying the overall sense of immersion. For the most part, users remain relatively static in the environment, yet when talking to one another, there does appear to be a fair amount of adherence to the same non-verbal styles found in PW conversation, inasmuch as users participating in a conversation tend to move toward one another. However, some users have no visual representation and they seem to lack no opportunity or be in any way excluded from participating with other users.

The 3D window is relatively small when compared to the overall space afforded to the interface. This in turn downplays the 3D environment. Navigation
within the world is not necessarily intuitive, as users must select from a variety of ways to navigate through a scene. While right clicking in a scene presents the user with a variety of navigational styles (walk, slide, jump, etc.) it is also somewhat distracting to have a pop-up menu appear within a scene. The use of shortcut keys can eliminate this, but there are other visual barriers that inhibit embodiment. The dashboard in some respects puts a barrier between the scene and the users. Visually it is not necessarily distracting, but is connotative of a car or airplane dashboard, giving the impression that one is watching the scene or action through a window. Turning off the dashboard does alleviate this to some degree.

The lack of names of other users is also a bit of a distraction. In order to identify another user within the 3D window, users must position the cursor over an avatar, then check the Web browser's status bar located at the bottom of the browser. This in effect forces the user to shift attention between three sections of the interface: the 3D window, the text dialogue box, and the browser status bar.

Like other 3D virtual world applications, Contact does little to represent the user in terms of gestures, emotions, and actions. The only movement represented through the first-person camera is when the user navigates through a scene. This is not uncommon.

Overall, embodiment is contradictory construct with Contact 4.0. While there is a great deal of user control over the way one wishes to be represented, various design features work to impede a greater sense of embodiment.
Educational Implications

Presence and Representation

In keeping with the current focus on inclusion and diversity in the learning environment, it is important to address these issues when discussing any educational medium and particularly important for collaborative learning environments.

One particular feature that blaxxun provides that is important for the educational use of a 3D world is the ability for users to create their own avatar. Since this option became available, there has been a proliferation of users creating their own avatars. What is most interesting is that few users have chosen to represent themselves in a photo-realistic fashion, but rather create a wide range of fantasy characters and inanimate objects to serve as a visual representation.

Blaxxun’s Contact 4.0 provides some interesting opportunities for education, however, the severe limitations of user-extensible features for building may somewhat limit some aspects of using it in conjunction with Colony City.

In addition to the lack of user-extensible features, Contact 4.0 is also limits language access. Like other text-based worlds, both typing and language skills may be problematic for some users. The following (Example 6.1) is an excerpt of a logged conversation of a user trying to get information about HTML from several users. Like other text-based worlds, typing, language skills, and multiple conversation threads prove to hinder this user’s progress.
Example 6.1. Learning HTML

Welcome to City Plaza. Please note that visitors can only watch the chat!
babycakes[120] : are you talking to me?
[Block Leader] Bruizer [1040] : i laways have 2 or 3 backup plans.
[Club Owner] boner [1905] : why is it that all the websites i find with tutorials
[Neighborhood Deputy] GoodGuy [1115] : Bruizer. we have teh most homes of teh hoods in Entertainment
DIGITAL [75] : brb
[Block Leader] Bruizer [1040] : who?
[Club Owner] boner [1905] : tell me what i already know
[Block Deputy] Washington [335] : Do you need a house?
[Club Owner] boner [1905] : smacks Bruizer
[Neighborhood Deputy] GoodGuy [1115] : the the the
[Block Leader] Bruizer [1040] : gets back up
[Club Owner] boner [1905] : lol
[Club Owner] boner [1905] : i didn't smack you that hard
[Club Owner] boner [1905] : geee
babycakes[120] : hehe
pugsley [5] : is there anyone single
smoothlady [0] : Hi DIGITAL
[Block Leader] Bruizer [1040] : i didn't see it coming and tripped again
[Club Owner] boner [1905] : Bruizer do you do html
[Neighborhood Deputy] GoodGuy [1115] : somebody keeps moving me "h" and "e" keys around
[Block Leader] Bruizer [1040] : Yup sure do BONER
[Club Owner] boner [1905] : lol
blewisl [63] : hi
babycakes[120] : you're staring to flirt with the guys again...
[Neighborhood Deputy] Southernbelle [1020] : Hiya everyone
pugsley [5] : you need to
blewisl waves hello to Washington
babycakes[120] : hiya belle
[Club Owner] boner [1905] : Bruizer do you know any good websites that would teach me the tags
[Club Owner] boner [1905] : i have been to four now
[Club Owner] boner [1905] : and ain't learn shit
pugsley [5] : come to daddy butthead
[Neighborhood Deputy] Southernbelle [1020] : (((hugs)) to my friends
[Club Owner] boner [1905] : all i keep finding is what i already know
[Club Owner] boner [1905] : hugs belle
babycakes[120] : *hugs* belle
Zaara [225] : hi
[Block Leader] Bruizer [1040] : Hmmm.... not off hand. i used to have a dictionary of the tags but have no idea where i found it.
[Club Owner] Numbers [958] : Hey BONER.....Go to Goecities and like make a web site real quick and look at all their tools.
[Club Owner] boner [1905] : hmmm
blewisl waves hello to Zaara
Contact 4.0, like most of the 3D virtual worlds observed is still in
development. During the time this investigation was conducted, many changes took
place. Subsequent to this investigation, Contact 4.0 included a type of real-time
voice. While users did not speak into microphone, an audio component was activated
which allowed the browser to "read" aloud dialogue. While this initially seem to
offer some possibilities for visually impaired users, on closer inspection, this feature
lacks suitability inasmuch as only the dialogue is read without the identification of the
user. Additionally it was found that this feature does not fare well with languages
other than English.
Enabling Learning

All in all, while Contact used in the context of Colony City does not have as much flexibility for building or for supporting many languages, it may provide some unique opportunities for education. Colony City is a study unto itself about community. It is one of the few 3D virtual worlds to incorporate an economic system, maintain a daily newspaper, and define jobs and roles for users. While Colony City limits opportunities for users to create within, it certainly offers a great view into a developing community that might suit a variety of subjects.

At this time it would be impossible for an educator to control the community of participants within Colony City which prevents it from being a suitable educational environment for children, however, blaxxun plans to launch an educational world for children and teenagers in the fall of 1999 (Nagler, 1999). Without having seen this world, one can only speculate about the features it may contain, however, if blaxxun also allows users of the educational world the option of using their own custom created avatars, this educational world might prove a most interesting educational medium. As evidenced by Bruckman's (1997) work in MOOSE Crossing, the availability for young learners to self define themselves or their "characters" in a virtual environment provides not only a chance to experiment with various roles, personae, and perspectives, but also serves as a mirror of that learners emerging sense of self.

Within a constructivist learning environment, the ability to take on other roles and in turn develop multiple perspectives greatly enhances the learning process. One of the goals of a constructivist learning environment is to find activities that support
"dialogical interchange and reflexivity" (Duffy and Cunningham, 1996). By allowing users to self-define their representation in the 3D environments, allows potential learners opportunities to try new roles and varying perspectives.

**Summary**

blaxxun Contact 4.0 used in the context of Colony City constructs the user through various features. Hardware, software, and general computer skills limit who is present in the environment. The user is also constructed through the types of languages supported by both the browser and the world. While Contact supports three languages, Colony City only provides information in English. Users wishing to participate fully in the Colony City environment cannot rely solely on the browser, but must also have English skills or access to a translator to take full advantage of Colony City.

In addition to presence, the user is also constructed by how they are represented within the environment. Contact is one of the rare 3D virtual world applications to allow users to import their own avatar. In addition, blaxxun also provides instructions for creating avatar or importing avatars created using other applications. Currently registration in Colony City is free to all users, although users are still granted unique identities. The People menu provides users with information about who is currently visiting a particular scene, however, there are no provisions for users wishing to lurk in a scene. While all the public dialogue in a scene, is listed in the dialogue box, users do have the option of maintaining personal and small group chats outside of the public forum.
Embodiment with Contact is limited. However, overall much of the attention is shifted to the text dialogue box while the 3D environment is not too active. It is somewhat cumbersome to identify other users in the 3D environment; and since some users continue to use various versions of older blaxxun software, not all users are represented within the 3D environment. These reasons coupled with the static or lack of animation cycles for the avatars, shifts attention more toward the text dialogue and not to the 3D environment.

Blaxxun does offer some interesting possibilities for use as an educational environment. While Colony City may not be a suitable choice for young learners, it may hold some options for mature learners.

Despite limitations imposed by the design of both Contact 4.0 and Colony City, blaxxun has created an interesting and amazingly dynamic community with much to offer.
CHAPTER 7
ONLIVE! TRAVELER

In early 1996, OnLive! Technologies launched a beta version of OnLive! Traveler. OnLive! Traveler is the first VRML browser to support real-time voice communication between multiple users in a 3D environment. By speaking into microphones, users speak to one another in a real-time 3D-chat environment. In addition to real-time chat, ambient sounds also help enhance the scene or setting. Traveler is best known for its "talking heads." Unlike many 3D virtual worlds, in a Traveler environment, avatars consist of only heads. These heads range from fantastical masks and characters to animals.

During the development of OnLive Traveler, the decision was made to initially use only heads because "the designers wanted to establish a human-to-avatar bond" (Wilcox, 1998). According to Traveler designer Steve DiPaolo the goal was to establish a sense of telepresence by "bind[ing] the real person at the computer with his or her virtual avatar in cyberspace" (as reported by Wilcox, 1998). As a result of this goal, Traveler avatars have life-like facial gestures (blinking eyes) along with lip-syncing motion that accompanies real-time voice communication.
Traveler worlds run on various servers, and the worlds are not user-extensible inasmuch as users are not able to build or contribute to a world.

**Overview**

This following section reviews how several design features of Traveler serve to construct the users' presence, representation, and embodiment. This investigation will focus primarily on the browser, and when relevant will include aspects of worlds or settings. Because many of the design elements are interdependent on the setting to provide a context, it is difficult to separate them and counter-productive to view them out of context. Following each review will be an analysis of how each of these features serves to construct the user as well as a discussion of the educational implications of the design. It should be noted that this review and analysis are not intended to be comprehensive, but rather serve as a representative sample.

**Interface Overview**

Traveler consists of a main browser and several detached windows. The main browser window is a 3D VRML world where most of the interaction and communication take place (Figure 7.0). At the top of the 3D window is a menu bar consisting of the following items: *File, Edit, View, Locate, Portals, Favorites,* and *Help.* Directly beneath this bar is a series of shortcut icons. The *File* menu allows users to set a default opening *start space,* as well as travel to other start spaces. A *start space* is the ground zero point in which users descend into individual worlds.
Figure 7.0. The OnLive! Traveler Browser.

The Edit menu allows users to customize their avatar as well as adjust the settings for their browser. Subsequent sections of this chapter will deal with the customization features of the avatar menu. The Settings menu allows users the option of adjusting the volume for ambient sound, sound effects, and voices. The Microphone menu allows users the option of either manually setting the microphone controls or of using the Microphone Training Wizard to conduct a microphone sound check of both user levels and background sound. The Text Message menu allows users the option of receiving text messages from other users.
The *Locate* menu provides a selection of various means by which a user can locate other users within the scene as well as checking the population of other worlds currently running on a server. By selecting the *List of Who's in this Space* option, a second window is launched that provides users with a list of who is currently visiting that scene. From this menu, users may send text messages to other users, send email, view other users web sites, and the personal profile of other users (Figure 7.1).

![List of who's in this space](image)

Figure 7.1. List of Whose in this Space menu.

In addition to viewing a list of other users, the user can also view a 2D map of the space to identify clusters of users as well as view a list of other scenes currently running from the server (Figure 7.2).
Presence

Requirements

OnLive! Traveler 2.02 requires a Pentium computer, Windows 95 or NT, 16 MB of RAM, a SoundBlaster 16 or compatible 16-bit sound card, an Internet connection (minimum-28.8 modem), either Netscape or IE 3.0 or higher, and a microphone.

Because Traveler allows for real-time voice, users are not restricted by the same limits imposed in an all text-based environments. Any language can be spoken in a Traveler setting, however, the browser and most downloading instructions are in
English. A user must either have the English language skills or have access to a translator in order to download and launch the Traveler browser.

**Presence: Analysis**

The user's presence is constructed by way of the hardware, software, level of "know-how," and language. Traveler requires a fairly sophisticated computer and peripheral equipment. The user must have access to computer with a Pentium processor, at least a 28.8 modem, Internet access as well as having both a soundcard and microphone. Because most of the downloading instructions are in English, the user must possess the language and "know-how" skills to download the application and load it on a machine. Additionally, the words on the Traveler browser menu are in English, so the user must have basic skills in English.

Traveler is one of the few applications that permits real-time voice communication. Users are not restricted by fonts, alphabets, or characters. They may speak in any language they choose, once they have made it past the initial language barriers of downloading the applications. While users are free to use any language they wish, it should be noted that there is a limit of 20 users per world and Traveler does not enjoy the wide user base of AW and blaxxun. English is the predominate language used in most of the worlds. This could be attributed to the fact that American companies and universities maintained most of the Traveler worlds accessed for this investigation.
**Representation**

**Avatars**

The avatars used by Traveler are by far the most unique and in many ways the most reflective of the user in any 3D virtual worlds. For the most part the avatars consist of floating heads. Traveler is also one of the few virtual worlds that allows users to customize their avatars.

**Library**

Traveler provides two libraries of avatars from which users may select: Standard Avatars and Traveler Avatars. The Standard library includes a variety of fantasy-like avatars, while the Traveler library includes the three categories of animals, people, and fantasy.

When Traveler is first launched, a user must select an identity or alias by filling in the *Known as* box of the opening avatar menu. Next the user must select a base avatar from either the Standard or Traveler library (Figure 7.3) and with restrictions, may alter the avatar’s appearance by selecting *Appearance* from the window tabs.
Figure 7.3. Selecting a base avatar.

Within the *Appearance* properties box the user may select from two areas of options: color and shape. From the *color palate*, a user can drag and drop a color into various polygons to customize the avatar’s coloring. From the *shape option* and through the use of a sliding scale, a user can transform the shape of the avatar by stretching or squashing. All of the changes can be viewed real time in a small display window (Figure 7.4). These options, though limited allow users to customize their avatars.
Figure 7.4. Customizing a Traveler avatar.

**Custom Avatars**

With the permission of world owners, it is possible to use custom created avatars; however, creating a Traveler avatar requires knowledge of 3D design. Additionally, the only instructions found during this investigation require the use of 3D Studio Max. Overall, custom created avatars are not very accessible to create or use.

**Identity**

There are no unique identities with Traveler; however, users do have the option of filling out a user profile for information about themselves.
Communication

What is most unique about Traveler is the availability of real-time voice communication. Users whose avatars are within close proximity are able to speak to one another by pressing the control key and speaking in a microphone. In turn, other users whose avatars are near the speaker will hear the speaker's voice. This allows users to speak with one another and converse in groups with relatively little delay.

In addition to real-time voice conversing, users also have the option of communicating with one another via a text chat box. This text box is used for one-to-one conversation and unlike text-based environments, does not include all of the text conversation within a setting or radius. It is used primarily for private communication, or for users having trouble with their microphones.

Users wishing for privacy have several options. They may move to a world that is less inhabited, mute the other users, or move into a personal space.

Representation: Analysis

For the most part, features within Traveler avatar libraries allow for a large degree of customization for altering the base avatar. Users are, however, still restrained because the avatars do not represent entire bodies, but only heads.

Since there are no unique identities with Traveler, there is little accountability. Trust to some degree can be predicated on voice recognition and vocal qualities. In some regards, it could be said that identity is most closely tied with the physical body with Traveler, much more so than with 3D worlds limited to text-based
communications. So, while there is no mechanism that designates unique identities for users, both the visual reinforcement of a user's avatar, and chosen alias, combined with voice recognition serve as the means by which identity may be maintained. It should be noted however, that users are able to alter the pitch of their voice with Traveler.

In many respects, communication is tightly tied with identity in Traveler. Vocal communication and voice recognition is one of the primary means by which users are able to verify claims of identity. Real-time voice provides users with a physical means of communication and representation. While users do have the option of sending text messages, there is no means by which conversations are logged or recorded. This eliminates the option of re-reading a conversation. Real-time voice also imposes some of the same difficulties of communicating in the PW of users interrupting and speaking at the same time. Additionally, at times there are problems with users broadcasting music by putting a speaker next to their microphone. While there are communication difficulties with Traveler, they are some of the same difficulties encountered in the PW. Overall, the user representation is constructed more tightly based on PW constraints.

The use real-time voice shifts the focus almost entirely into the 3D environment. Since there are no scrolling text-dialogue boxes to read, users are not forced to shift their gazed between the 3D window and the text dialogue box, but rather attention is more easily focused and maintained in the 3D window.
**Embodiment**

**Avatars**

The Traveler avatars are unique. While most of the avatars mainly consist of heads that users customize, there are several features included in the design and operation of these "talking heads" that are quite ingenious.

**Gestures**

Because Traveler avatars are mainly limited to heads, it might seem as though the role of gestures would be limited to non-existent, however, that is not the case. Unlike AW or blaxxun avatars, Traveler avatars actually mimic or lip-sync facial gestures when users speak through their microphones. According to Bruce Damer (1998), this is accomplished by way of Traveler’s ability to compress the voice data, find vowels, append the appropriate avatar mouth movements, and send the combined data to another user’s machine, where it is decompressed and played back. The facial movements are actually predicated on Travelers ability to identify vowels. Overall, this gives the impression that the avatars (or users represented by the avatars) are speaking directly to one another.

**Actions and Emotions**

Users are limited by the options for visually expressing emotions. Users may select from one of the five emotion icons at the top of the browser, users can command their avatars to express a very limited range of emotions.
Avatar Perspective and Navigation

The Traveler avatars, like with most other 3D virtual world avatars, provide both the visual representation of a user, and serves as the camera or window to the 3D environment. With Traveler, users have great freedom of movement. By using either the mouse or keypad, users can move forward, backward, rotate along the x and y-axis, fly and sink, or slide from side to side.

Traveler worlds are somewhat unique because although typically worlds are not very large, and like most VRML scenes, they have edges and limits. In most worlds users cannot move beneath the floor. Additionally, when a user’s avatar encounters a designated solid object or another avatar and collides, there is a collision sound and the avatar bounces off the object or avatar simulating collision. This is reflected from the first-person perspective of the user as well. It is not uncommon to be speaking with another user, when suddenly a user is bumped half way across the scene. From the user’s perspective, this action is similar to being bumped or pushed in the PW.

This feature has caused some trouble in Traveler worlds. According to Bruce Damer (1998), in the past small groups of users, or "headbangers" made a practice of sneaking up on unsuspecting users, encircling them, and bumping their avatar back and forth. While it is a bit disconcerting and disorienting, it is also quite humorous.

Embodiment: Analysis

The construction of embodiment is one of the most interesting aspects of Traveler. Given the fact that most of the avatars with Traveler are heads,
embodiment may seem limited. However, that is not the case. While there are no limbs, or even torsos, Traveler in many ways provides a more of an embodied experience than most other 3D virtual worlds. The use of real-time voice, coupled with the ability of the software to interpret voice data and translate it into vocal movement adds greatly to the user’s sense of embodiment by allowing users to see and hear one another. In addition to the real-time voice, the use of such features as collision reinforced with sound effects provides a sense of physical awareness that is rare to 3D virtual worlds. In some sense, there is a kind of physical accountability that comes with the simulation of physical resistance and impact. Though a user has no impact on the simulated physical environment, there is consequence to colliding with a solid object or another user.

In addition to the real-time voice and collision feature, Traveler also reinforces a sense of embodiment by how shifts in perspective and collision are reflected in the user’s perspective. While it is not unique that navigational motion is reflected, it is unusual that collision and impact is reflected. In the PW, when we are jostled or bumped, we know not only from the physical impact, but also visually. While Traveler does not yet have the capacity to register impact physically by way of physical body sensors, it does allow users to register visual changes.

One last aspect in which Traveler constructs the user’s sense of embodiment is by the overall lack of the text-dialogue box. Instead of users having to continually shift focus between two windows, most of the action and communication is situated in the 3D environment. This greatly enhances not only the sense of embodiment, but also the sense of being present in that environment.
Educational Implications

Presence and Representation

With any potential educational medium, it is important to address issues concerning the diversity and inclusion of all learners, but is particularly important for collaborative learning environments.

Traveler offers a great amount of freedom and control over user representation. While users are limited to a selection, this selection does not represent any particular bias toward types of representation. For the most part, the avatar selections are fantasy type and users are able to customize both color and shape which is particularly important with regards to learners controlling their own representation as well as supporting diversity in the learning environment.

While Travelers allows for a great degree of control over visual representation, the lack of user-extensible features limits some of the potential use as a learning environment. Users are not able to build or add to an existing world. This lack of user-extensibility limits the types of activities of a potential learning environment to that of interacting with other users and objects in the environment.

Enabling Learning

Out of the three worlds, Traveler offers the greatest level of embodiment. The field of education is only beginning to explore the notion of experiential cognition and learning. We know from studies of the educational use of VR that experiential learning allows for a type of knowledge construction similar to the way we perceive...
and learn from our PW environment. According to VR researchers, Meredith Bricken and Chris Byrne, "VR eliminates the traditional separation between user and machine, providing more direct and intuitive interaction with information" (1995). While Traveler lacks many of the multi-sensorial features of VR technology, it does provide a strong degree of experiential embodiment rare to 3D virtual worlds. This experiential embodiment, though admittedly limited, provides a greater sense of presence or "thereness" (Nairmark, 1990) because of such features as collision, gravity and degrees of freedom of perspective. A sense of presence or "thereness" may increase learners' engagement while helping to situate them in the learning environment (Winn, 1993). Traveler comes the closest to replicating the level of experiential embodiment of immersive VR, yet Traveler also allows for multiple users in one environment and allows for communication between those users. With further development, OnLive! Traveler could integrate the best aspects of immersive VR with the availability for learners to communicate and collaborate.

Although no tests were conducted, Traveler also offers some limited potential for students with visual impairments since communication takes place primarily via real-time voice. Additionally, when avatars collide, there is a consistent sound activated to reinforce the simulated collision.

While Traveler does offer some potential for education, it is also important to address some of the limitations. In terms of lecture/discussion styles classes, Traveler offers an interesting mixture of sometimes conflicting design features. While it does
allow for real-time voice, and does offer a relatively fair degree of embodiment for users\(^1\), discussions may still prove to be problematic due to the lack of non-verbal communication that is usually afforded in a PW environment.

**Summary**

OnLive! Traveler constructs the user in a variety of subtle and surprisingly simple ways. Like other 3D virtual worlds, the hardware, software, and general computer skills construct presence of users in Traveler. Because the browser only supports English, the user must have basic English reading skills or have access to a translation. No support for non-English language was found, however, once users access a world, because of the use of real-time voice instead of text-based dialogue, users have great freedom to speak with one another in any language.

In addition to presence, the users are also constructed by how they are represented within the environment. While users are most often limited to selecting an avatar from an existing library, they do have the option of customizing their avatars. Because Traveler accesses various worlds located on various servers, there is no mechanism that allows users to register unique names. While this might initially seem to cause some problems and confusion, the combination of real-time voice and the customizable avatars help establish trust and accountability among participants.

Embodiment is one of Traveler's strongest features. Though the avatars are limited to only heads, the combination of design features function together in such a

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\(^1\) It is noted that degrees of embodiment are relative in virtual worlds and by no means is meant to imply that the type of embodiment found in virtual worlds parallels the PW.
way as to construct a sense of embodiment unmatched by any other 3D virtual world. The real-time voice and animated lip-syncing greatly enhances the users sense of communicating directly to other users. In addition, both collision and gravity help to reinforce a sense of place and space. Despite the lack of user-extensible features, and persistent identities, OnLive! Traveler is one of the most fascinating and unusual 3D virtual worlds currently available and may offering some interesting opportunities for education.
CHAPTER 8

A COMPARISON AND CONTRAST OF ACTIVE WORLDS, blaxxun's CONTACT 4.0 IN THE CONTEXT OF COLONY CITY, AND ONLIVE! TRAVELER

Three-dimensional virtual worlds are complex applications. They construct the user in many ways and on many levels. In order to gain a fuller understanding of how these applications work, it is important to look at them in relation to one another. While looking at how design features of individual applications serve to construct the user within the context of that world, it is also informing to compare features across different applications. The following analysis is a comparison and contrast of the various design features of Active Worlds, blaxxun's Contact 4.0 (used in the context of Colony City), and OnLive Traveler. This analysis focuses on those features that serve to construct the user in the same categories used in chapters four, five, six, and seven: Presence, Representation, and Embodiment. Because the focus of this research is on the use of 3D virtual worlds for educational purposes, each analysis is followed by a discussion of the educational implications of the findings.
**Presence**

AW, Contact 4.0, and Traveler are approximately equal in the prerequisites for hardware, software, and general computing skills. All three require Pentiums, Windows 95, 98, or NT, at least at 28.8 modem, and Internet access. Traveler has the additional requirement of both a SoundBlaster compatible sound card and a microphone. None of the three applications offer Macintosh versions. In addition to the hardware requirements, users must be able to download these applications and load to their machines. While all three applications currently offer free versions, AW does require users to pay an annual fee of $19.95 to register. Contact 4.0 users wishing to access Colony City must register in order to interact with other users, however, registration is currently free¹. Traveler is currently free for downloading and does not require registration.

**Language**

AW provides the greatest documentation and browser support for non-English reading/writing users. Indeed, there is a sizable non-English population with many cultures represented. AW has a history of supporting a variety of language-based worlds. Prior to users being able to purchase their own worlds, both Worlds Inc.² and COF supported several language worlds (German, French, Russian, and Mundo Hispanico). Overall, AW has a history of facilitating and supporting non-English environments.

¹ As of February 15, 1999.
² Previous owners of AW.
blaxxun's Contact 4.0 offers limited support for language other than English. Unlike AW, information for downloading can be found only in English and German. The Contact 4.0 browser supports French and German (as well as English). blaxxun interactive is a German based company and also has a history of supporting a variety non-English worlds such as "Virtual Paris", however, overall Colony City has not attracted the diverse non-English using population of AW. In most Colony City settings, English continues to serve as the language of wider communication.

OnLive Traveler is no longer under development. English is the predominate language spoken and no non-English version of the browser were found at this time.

Conclusion

All three applications permit and prevent users from being present. In terms of hardware, software, basic computing skills and language AW and blaxxun have an advantage over Traveler. Neither requires as much hardware, and they provide support in several languages. AW supports the many more languages than blaxxun. While AW does require registered users to pay a small fee, there are provisions where world owners can provide full access to designated users. Also, the lack of registration with AW only disables some of the features, not all. Many users participate daily in the AW universe without registering.

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3 Recently OnLive! Traveler was purchased by Electric Communities. It is not known whether they will resume development of Traveler.
Presence: Educational Implications

While users are just beginning to explore the unique educational opportunities afforded by these 3D virtual worlds, it is important to note that for widespread educational use the potential is somewhat limited by the hardware requirements. In addition to the hardware, users must be able to download applications or have access to someone who is able. This is not a difficult task, but may intimidate students with little computer experience.

AW by far offers the greatest support for languages other than English. One need only spend a short time in any of the major COF worlds to quickly see how AW has fostered in international following. Indeed, there are communities where English is rarely used. AW offers many exciting possibilities for foreign language learning. Many of the language-based worlds offer a contextually rich environment reflective of various cultures and countries. These worlds hold many possibilities for authentic communication between language learners and native speakers of a target language.

While blaxxun's Contact 4.0 also allows some opportunities for authentic communication for language instruction, the lack of user-extensibility (customizable building) limits users from constructing culturally reflective and diverse settings. Additionally, the community itself is not designed for educational purposes, and while it may support activities, it would probably be most difficult to use Contact as a primary learning environment.

Traveler offers some admittedly limited, but interesting opportunities for foreign and second language learning support. The real-time voice feature provides opportunities for students to speak with native speakers of a target language.
Representation

Avatars

All three 3D virtual worlds handle avatars in different ways. For the most part, AW and Traveler users must select an avatar from an existing library of avatars. The Traveler avatars represent a variety of cultures, animals, and fantasy characters. Additionally, users can customize their avatars by easily changing the colors of various polygons as well as squashing or stretching the shape. It should be noted though that the Traveler avatars are basically limited to heads. While the AW avatars do contain entire bodies, the COF library is fairly limited. Gender, age, ethnicity, culture, body size, and physical abilities reflect the values of Western culture. Additionally, there is no mechanism by which users can customize an avatar to reflect their interests or values.

Overall Contact 4.0 provides the greatest degree of personal representation by way of avatars. While users may select from various libraries (blaxxun as well as others), they may also import their own avatar. Various users have also created avatars for public use. One group who created publicly assessable avatars even provided an avatar in a wheelchair. Additionally, users wishing to create their own avatars have that option. blaxxun provides instructions for those users comfortable with VRML. For those users not comfortable with VRML, there are other options such as graphical VRML editors. One such editor, Spazz3D, provides an avatar wizard that converts a VRML file into a blaxxun avatar.
Identity

Both AW and Colony City (used with Contact 4.0) require users to register in order to gain a unique identity. While AW charges a small fee, Colony City is currently free of charge. Traveler does not have provisions for unique identities. Users may use any name they wish. While there are many privileges that come with a unique identity, there are some limitations. With AW, name changes are reflected on other users contact list. This may impose some limitations on users whom for whatever reasons wish to explore different roles. Despite this limit, unique identities establish both a sense of trust and accountability. Because it is difficult to rely on visual recognition of users, unique identities are often the only means by which users are able to recognize one another.

Communication

Contact 4.0 and AW rely solely on text dialogue as the primary means of communication. Contact 4.0 is only beginning to delve into the use of real-time voice and at the time of this writing, real-time voice was not functioning at a sufficient level to comment upon. The reliance on text-based communication imposes limits on many users in terms of language and typing skills. However, there are also advantages to text-based dialogue. Both AW and Contact 4.0 allows users to create a log of conversations. This allows users the chance to save a conversation to review at a latter time. There are some disadvantages to text-based communications because it may be difficult for some users to follow the multiple threads that one must be able to sort through to follow a conversation. While most users seem able to adapt, most
likely those users who are not able to adapt merely stop participating. Multiple threads of dialogue also allows users to maintain two completely different conversation threads with one person. This is difficult if not impossible to do with real-time voice.

While Traveler does provide a feature to allow one-to-one text based conversations, for the most part communication takes place using real-time voice. There are both advantages and disadvantages to this option. One advantage is users are not forced to continually shift attention between two screens; resulting in a greater sense of "thereness" (Naimark, 1990) because users are speaking directly to one another. This is an advantage for users who are not adept at handling multiply threads of text dialogue. Real time voice also allows for more authentic communication. When users are angry, or excited, these feelings do not have to be described, but are displayed vocally. Additionally, users wishing for authentic spoken communication, such as the case with language learners, have that option with Traveler. There are also many disadvantages of real-time voice. In face-to-face communication, body language plays an important role in signally turn-taking and overall negotiation. Because the Traveler avatars are limited to only heads, there is no mechanism for representing body language. Large group conversations can easily become a muddle of voices. Additionally, because the voice data must travel through modems and telephone lines, conversations can be come halted and difficult to follow because of time lapses.

All three 3D virtual worlds provide users with the ability to mute other users as well as pass personal messages or whisper to other users. Contact 4.0 also allows
small group chats, whereas with both AW and Traveler users usually move their avatars to a less crowded area to engage in small group conversations. While the act of moving an avatar may seem to be an imposition, it also adds greatly to a sense of place and space. Additionally, AW also allows users the option of sending telegrams to users in other worlds, or to send telegrams to users who are not currently logged on. This greatly enhances the construction of community among users while at the same time preserving individual rights of privacy. Users do not have to rely on email or give out personal email addresses or ICQ numbers, instead, they can send asynchronous messages within the AW universe.

**Building**

AW by far provides the greatest support and flexibility for building. The act of building in AW in many ways becomes a means of personal and cultural representation. The availability of building privileges also enhances the sense of community among users. Building various structures becomes a source of pride for many users. It allows users to impact the worlds and gain a sense of investing in the community. To build in AW, users need not possess any special skills in 3D modeling, but instead, they merely select from an existing library of objects and adjust them the way they choose. While to some people the existing library may seem limiting, according to Bruce Damer, building with AW objects is in many ways

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4 ICQ is an Internet tool, which allows users to create contact lists of other users. ICQ informs users when a user on the contact list is online. Users can chat, send files, URLs, etc. ICQ numbers are unique numbers that help establish a unique identity for a user.

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similar to how many individuals build homes in the PW. Damer (personal communication) argues that in the PW, when someone needs a new door, typically they measure the doorframe, and then go to a hardware store and purchase a suitable door from a selection. With the exception of a few carpenters, rarely would someone measure a door, buy the lumber and build a door. According to Damer, users skilled in 3D-object modeling are analogous to the rare carpenter who actually builds the door. For most purposes, the pre-fabricated door suits our needs.

Along these lines, it is important to note that while users are limited to using the object library, one short foray into one of the public-building worlds reveals amazing creativity and ingenuity users display in creating structures and environments that reflect their interests, personalities, and culture. Additionally, though users may be somewhat limited in by the selection of objects, they also have a great deal of freedom to import images, animate, add sound, and trigger web pages.

Colony City does provide users with the availability to own a house, however, these houses are pre-fabricated and predominately represent Western culture. Users cannot customize their homes, though blaxxun is working to provide that option.

**Conclusion**

Overall, all three applications hold interesting options and provide for varying degrees of user input. Contact 4.0 allows the greatest flexibility for visual representation (avatars). Traveler also offers some flexibility, whereas in AW, the user is allowed very few options or control over personal representation.
While both AW and blaxxun allow users a unique identity there are advantages and disadvantages to having one. Overall the registration systems provided by both Colony City and AW do more to enhance the construction of community by insuring a degree of trust and accountability among users.

The opportunities for communication vary in all three applications. There are parallel advantages and disadvantages to both text-based communication and real-time voice. Text-based communication does have the added benefit of allowing users to create logs of conversations. Out of all three 3D virtual worlds, AW is by far the most innovative application when it comes to user extensibility. The availability of building rights and privileges in many ways over shadows most of its shortcomings. One need only spend short time visiting one of the public-building worlds to see why the addition of this feature makes AW one of the strongest 3D virtual worlds currently available.

**Representation: Educational Implications**

All three 3D virtual worlds have various strengths and weakness in the applicability for educational use. The user visual representation in AW is somewhat problematic because of the limited avatar selection. Potential learners are limited to using a prefabricated avatar, which may or may not represent the values of the learner. One of the greatest strengths of blaxxun’s Contact 4.0 is that users are able to use their own avatars. This in turn would give a learner the opportunity to create a representation consistent with his/her values. Traveler provides an interesting
compromise. The avatars are not photo-realistic. There is an ample selection of fantasy-types to choose from, and the learner has the opportunity to alter their avatar.

All three 3D virtual worlds offer varying degrees of persistence of identity. Unique identities contribute greatly to both trust and accountability, both of which are important in developing learning communities. While Traveler does not provide unique identities per se, the real-time voice features can serve as a means of identification.

All three provide ample means of communication, however, AW does allow for a wide variety of avenues with text-chat, telegrams, whisper, mute, and contact lists. Additionally, users are able to some extent control various aspects of communication. The degree of flexibility in various communication features is an advantage in terms of educational use. Within the AW environment, learners are afforded a strong degree of privacy and protection while at the same time are provided avenues for collaboration.

One important consideration is that in text-based 3D virtual worlds, learners must possess both the typing and language skills in order to communicate. While it could be argued that there are parallel restrictions in a PW classroom, in a virtual environment, learners lack much of the non-verbal means of communication afforded to them in the PW.

One area that also deserves note is the user-extensible features a virtual world allows. In this respect, AW is by far the strongest application. Not only can users build within several of the public building worlds, individual world owners can select
designated builders within their worlds. Additionally, there are provisions for user to
own and control their own worlds, which would allow potential educators to insure
protection of the learning environment.

**Embodiment**

**Avatars**

All three 3D virtual world applications provide varying levels of embodiment.
Though embodiment is tightly tied to the user's avatar, for the most part it is not
dependent upon which avatar a user selects. AW avatars gestures provide an
interesting study into the advantages and disadvantages of animated gesture cycles.
The AW avatars are rarely idle. When viewing a crowded AW setting, the use of
animated gestures add motions, movements, and gestures that are parallel to those
displayed by crowds in the PW, enhances the environment by adding a sense of
human presence. These animated gestures also serve to draw the user's attention
back to the 3D window. Despite these advantages, there are some drawbacks to
animated gesture cycles. The non-verbal communication, displayed by the AW
avatars may be inconsistent with the message users want to communicate. There
have been several incidences where novice users where observed attempting to
override or explain that they could not control what their avatar was communicating
non-verbally.

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Examples of comments include, "I'm not really bored, it's just my avatar", and "stop looking away". Other researchers in the area of 3D virtual worlds have made this observation as well. During an interview with Bruce Damer, he also commented on this feature, however, I could find not written documentation to support the observations.
While Contact 4.0 does provide animated gesture cycles, users with custom made avatars have experimented with the use of animation. For the most part animation was used not to replicate human gestures.

Traveler offers some interesting parallels to gestures. The application of lip-syncing to make an avatar appear to be talking is quite uncanny. The addition of this feature greatly enhances the sense of presence in an environment. While the lip-syncing is not always an exact match, it does come close enough to matching sound and lip movement to give the appearance that the avatar is talking.

None of the three applications offer a very intuitive way to project emotions or actions. All three applications provide few options for users to choose from.

Both Traveler and AW offer the most intuitive interface for displaying perspective and navigation. While Contact also allows users to navigate and shift perspective via the arrow keys, the mode must be selected from either a pop-up menu, or by knowing the correct short-cut key commands. In addition, the navigation dashboard that rests at the bottom of the Contact 4.0 3D window visually distances the user from being in the scene. The dashboard at times re-enforces the idea that users are viewing the 3D world through a window. Though the dashboard can be turned off, a small red button does remain in the scene to allow users to re-activate it.

One feature that does play a strong role in establishing a sense of embodiment is Traveler's use of both gravity and collision. Users are not able to drop below the ground of a scene. Additionally, users are able to experience collision from a first person perspective. As the taking heads move through an environment, they gently (and sometimes not so gently) collide with objects and other users.
Conclusion

Overall, Traveler provides the greatest sense of embodiment, which is somewhat ironic because the avatars consist of mainly heads. Despite the lack of a representative body, the talking heads do provide a great sense of embodiment because of the lip-synching, collision, and gravity.

Embodiment: Educational Implications

Initially embodiment may not seem to be a very important issue for the educational use of 3D virtual worlds. However, that may not be the case. While most 3D virtual world applications are far from providing the complex embodiment of the PW, there is indication that users do bring some of the PW behaviors in the virtual realm (Jeffery and Mark, 1998). Where embodiment becomes very important for an educational environment is the degree of non-verbal communication an application affords or limits. Granted none of these applications come close to providing the non-verbal information afforded in a PW classroom, they may offer more than is afforded in some forms of distance education (Web-based and one-way video). While Traveler provides the greatest degree of embodiment, it should be noted that both blaxxun and AW have made strides in the area. Embodiment is rich and complex, difficult to compress over narrow bandwidth.

In any discussion comparing the educational implications of these three 3D virtual worlds, it is important to state that these are emerging technologies. There
is a great deal of ongoing development. One of the most important contributions they offer the field of education is a mirror to watch and analyze how we perceive and construct our PW.

**Constructing the User**

Overall it is difficult to do little more than generalize when assessing how the user is constructed by a particular 3D world; however, some generalizations can be made. While each of the 3D virtual worlds in this investigation have limits and opportunities. Though many of the design features in all three worlds seem parallel, how they function within the context of the individual world sometimes alters the way users are constructed.

**Contact 4.0/Colony City: Central Community**

With Contact 4.0 used in conjunction with Colony City, the focus is on a more central community. Anytime a user is in-world, their identity is listed in the Peoples list. Lurking is not an option. One is always part of the community. Additionally, the act of claiming a home reinforces the community. Users are not able to create or customize their environment, but merely choose whether to participate and to what degree. While users are free to use their own avatars, it is difficult to recognize individual users by sight. The users attention is still drawn to the text dialogue box. The text dialogue box lists each users name, job, and points each time a user "speaks," this in turn once again reinforces the sense of the user being member of one central community.
Active Worlds: Personal Autonomy

Active Worlds also construct the user as a social being, however, there is a noted shift in emphasis. Users have a great deal of control over their privacy. If they choose not to "speak," no one may know they are present. While AW does stress the importance of community, it does not require the allegiance to one central governing body, but rather encourages users to develop their own communities. Throughout the AW universe, both in the public-building worlds and in individually owned worlds, are examples of small communities of users who have collaborated on creating and adapting an environment to reflect their own cultural and personal values and priorities. While AW is a medium for social interaction, it is one in which the user to a great degree sets the limits and parameters. It allows for a great deal of personal and small group autonomy within the larger community of users.

OnLive! Traveler: Experiential Embodiment

OnLive! Traveler is one of the few 3D virtual worlds to focus primarily on embodiment. Nearly all aspects of the design serve in some way to support experiential embodiment of users. In many ways, Traveler does not construct the user as part of a community due to the fact that there are no unique names or features to support persistent identities. There are also few provisions for building community such as contact lists, dialogue logs—or histories, and building privileges. This is not
to say that community has not developed among Travelers users. However, the focus is on a more temporal, "in the moment" experience, rather than on long term community development.

Summary

A comparison of the three 3D virtual worlds reveals that in terms of presence, all three require roughly parallel hardware, software, and overall know-how, however, both blaxxun and AW do offer information in languages other than English. While AW offers the greatest variety of language browsers, users are still limited to English in terms of "help" files and support.

All three virtual worlds displayed various strengths and weakness in the way users' representation is constructed by way of avatars, identity, communication, and building. While AW offered the greatest support for user-extensibility, the avatars proved problematic. blaxxun offered the greatest degree of user control of representation, yet offered very limited opportunities for building. Traveler does not allow users to build, yet does provide a great deal of flexibility in avatar control. The communication features offered by both AW and blaxxun's Contact 4.0 where fairly similar, but with varying degrees of user control. Traveler was the only virtual world in this investigation to employ the use of real-time voice and out the three virtual worlds provided the most interesting study of how embodiment can be constructed and supported in the 3D virtual environment.
It should be noted that this review is neither comprehensive nor exhaustive. There are many ways to investigate a world and all three of these 3D virtual worlds provide an interesting study into the design and development of computer mediated environment.
This chapter presents two case studies of Active Worlds used for informal and formal education. The first case study (informal) focuses on an RWX object-modeling class offered online, in-world through Active Worlds University. The second case study (formal) focuses on the use of Active Worlds for an undergraduate business computing course offered through the University of Colorado–Boulder College of Business.

Magine’s Virtual Class

There are many similarities between the evolution of virtual and PW communities. Just as education is often a priority of PW communities to ensure continual growth and survival, it is also important for the evolution of virtual communities. Within the Active Worlds universe there are various groups and members who have taken on the task of providing training and education for both novice and experienced users. Formal groups such as the Titan Guild, the GateKeepers, and the Active Worlds School and University provide users with
information ranging from how to navigate to such specialized training as advanced object modeling. The following is an investigation of a RenderWare object-modeling course offered by the Active Worlds University.

**History of Active Worlds University**

In 1997 an EFL teacher, Lucretia Borgia (a.k.a. Mandee Tatum) along with another AW citizen (Wascally Wabbit) created the "Objects d'ActiveWorlds Community Object Bank" to provide a library or database of new objects for citizens to build with. Soon it became apparent there was a serious lack of users who actually knew how to create RenderWare objects. Lucretia contacted Circle of Fire (COF) and requested that a training facility be constructed to teach citizens how to create objects. Though COF supported her idea, they lacked the resources to provide this and suggested that she take on this task.

After advertising in several of the AW newsgroups, Lucretia organized public meetings and soon a core group of builders and designers emerged to volunteer their time, talent, and energy to help build an educational world.

The Active Worlds University (AWU) was launched in early 1998. At that time, the main group split into four divisions covering four main curriculum areas: Graphic Arts, RWX (RenderWare) Modeling, Advanced Building, and AW Technology. Members of the core group took on responsibility for the various divisions. They recruited additional help to further expand these four areas.

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1 English as a Foreign Language (EFL).
2 Registered users of AW.
The building phase took five months to complete with an estimated 65 volunteers. Instructors were recruited by and from the four groups. Because of the nature of the subjects and medium, no one teaching methodology was established, instead it was decided that each instructor should determine how and when to teach his/her classes. The assumption is that a teaching methodology suitable to the medium will evolve through "trial and error" (Tatum, 1998).

AWU is now offering their fourth session of classes⁴. The classes they offer include: Intro in Paint Shop Pro, Intro to Graphic Arts, Intro to RWX Modeling, Intro to Avatars, The AW SDK, Bot Technology, and a variety of advanced building classes.

My investigation took place during Session 2 (September 12- October 29, 1998). I enrolled in the Intro to RWX Modeling class taught by Magine. The class met each Tuesday evening from 10:00-12:00 PM VRT⁵.

Magine's⁶ Class

Overview

When I initially enrolled in this class, I had not intended to use it as a case study for my research. Because of the informal, volunteer nature of AWU, I had doubts as to the reliability of both the instructors and students. Within the first twenty minutes of the class, I realized the error of my assumptions. The following is an

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³ The core group includes Idal, Lara, Indigoflight3, Grimscale, King Tex, Magine, Carre, Tckaija, and Aule.
⁴ The fourth session was held January 16 - February 26, 1999.
⁵ Virtual Reality Time.
account of data gathered from interviews and participatory observations of the course and instructor from Sept 12 through October 29, 1998.

Prior to our first class on September 12, 1998, the course instructor, Magine, sent email messages to each class member introducing herself and establishing the class schedule. She also provided students with the precise coordinates\(^7\) where our class was to be held in AWU as well as the URLs of some materials and resources that would be used during the course.

**Instructor: Profile of Magine**

Magine is a "timeless and ageless" programmer who first began using AW in 1996. Toward the end of 1996 she began teaching herself how to create objects by writing RWX files. She has had no formal training in 3D design and modeling, nor has she had any formal experience or training as a teacher. Session Two was the second time she taught the Intro to RWX Modeling class for AWU.

**The Class Profile**

The class took place on the "outdoor" patio of the Falling Waters RWX Student Union in AWU (see figure 9.0). The building, created by Carre, is loosely based on the architectural style of Frank Lloyd Wright. The compositied world

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\(^6\) Magine wished to preserve her anonymity. For the purpose of this investigation, she is referred to only by her AW identity.

\(^7\) Coordinates are used to determine exact locations within a world. They enable users to teleport directly to a location without having to travel by foot.
background consisted of serene green fields framed by a pre-dusk sky with several white clouds. Overall the images and sound files (of gently rustling water) conveyed a sense of serenity that did not distract from the class.

Figure 9.0. The Falling Waters RWX Student Union.

The class was conducted on Tuesday evenings from 8:00-10:00 PM or 10:00-12:00 PM VRT\(^8\). There were approximately 15 students that seemed to attend class regularly. Most of them arrived early or on time, and with few exceptions, seemed to conduct themselves as they might in a traditional face-to-face classroom. The conversation before class started was similar in nature to the small talk and introductions that happen in a PW class.

\(^8\) VRT or Virtual Reality Time is an AW time-zone construct, which prevents a privileging of one time zone. Since the user base is worldwide, the use of VRT attempts to eliminate confusion with time zones.
According to Richard Ferraro (1996), RenderWare is "a real-time 3D graphics library." It's an API that consists of a 3D geometry and rendering engine used to display a 3D scene. The AW browser uses RenderWare (RW) to create the 3D scenes (worlds). To do this, the AW browser relies on RenderWare scripts (RWX files) to define the objects in the 3D setting (Magine, 1998).

RWX objects are composed of a series of coordinates that define vertices of an object. These vertices along with other information subsequently define polygons. Within the file, additional attributes are defined for an object such as surface, texture, and color. The following example (Example 9.0) is the script used to create a blue polygon (Figure 9.1).

Example 9.0. An RWX script for a simple blue polygon.

```
ModelBegin
  ClumpBegin
    Vertex -0.40 -0.40 0.40 #1
    Vertex 0.40 -0.40 0.40 #2
    Vertex 0.40 0.40 0.40 #3
    Vertex -0.40 0.40 0.40 #4
  MaterialBegin
    Color 0.00 0.00 0.90
    Surface 0.40 0.40 0.40
    Polygon 4 1 2 3 4
  MaterialEnd
  ClumpEnd
ModelEnd
```
Figure 9.1. An RWX blue polygon.

The curriculum consisted of an introduction to RenderWare and a discussion about the role RenderWare and RWX objects play in relation to AW. The first class started with the basics of 3D modeling in which Magine covered such topics as the 3D coordinate system, the basic structure of an RWX text file, polygons, surface normals, vertices, translation and rotation, using geometric primitives, followed by a short discussion of RGB color.

In the second class Magine covered such topics as shading and lighting (the ambient, specular, and diffused commands) and more detailed information about coloring objects. Subsequent classes involved more detailed explanations of previous material as well as applying a texture to an object.
Delivery

Magine started the first class by explaining (by way of text) RenderWare scripts and RWX objects and how they functioned in Active Worlds. She then quickly moved into an overview and explanation of 3D modeling concepts and features such as polygons, vertices, and the 3D axis and coordinate system.

Within the "outdoor" patio of the Falling Waters RXW Student Union, Magine had created a small sign that was a link to several webpages of the RWX objects she was using as examples. By clicking on the sign, students could access those pages within their integrated AW browser. This allowed students to follow the actual written code while she explained some of the concepts. In addition to the codes, Magine also provided visual demos to support her lecture. When she discussed polygons and vertices, she loaded visuals to represent each concept. The following example illustrates the unique interplay between the text dialogue delivery (Example 9.1), the use of visuals within the 3D environment, and the integrated web browser. (Figure 9.2). Example 9.1 is a log of the dialogue between Magine and her students. Figure 9.2 illustrates how she used both dialogue and webpages in the integrated web browser to introduce and reinforce the concepts she was teaching.
Example 9.1

transformbegin and transformend are like brackets that limit the effect of translate, rotate and scale commands, to the area between the "transformbegin" and "transformend"

so if you only wanted to rotate part of the model,
you would put,

rotate 0 0 1 90 # (or whatever)
cone 1 .5 8 # or whatever
transformend

...like that :)

ok what's [sic] that cone command?

the cone command is a graphics primitive command...you weren't here last time? :)

Yes I don't understand the cone command either

ok,

is that like the triangle command?

you can look these up in the nvapi.hip, but a quick summary is...

cone <height> <width> <number of sides>

oh vertex....

so "cone 1 .5 8" would be a cone that was 1 high, .5 wide at the base, and had 8 sides

What is "scale"?

scale is another command like translate or rotate, but it is used to change the size of things

This is probably a really stupid question but how do you get a cone to have 8 sides?

Cause there's no such thing as a circle. Curves are made up of small sides.

Nave, remember that everything here is made out of polygons :) there are no curved surfaces, really

let me show you what I mean....

please Magine I can't seem to picture it

now here are our famous graphics primitives :)
In addition to the unique style of delivery, teaching 3D concepts within a 3D environment provided students with the opportunity to explore concepts of 3D modeling from within a 3D environment. For example, when Magine discussed surface normals of a polygon, students were able to move around a polygon to see how only one side was visible. When she discussed the 3D coordinate system, she presented an axis and moved vertices around (Figure 9.3). Students were able to move their avatars within the 3D environment around the axis.

9 With the exception of Magine, all AW identities have been changed to protect the in-world anonymity of the students.
During the first class Magine explained the basic coding for creating simple RWX objects such as a cone. Students were able to not only view the cone, but also move through the lines of code step-by-step as she explained, and later manipulated the coordinates. During the first class session Magine covered RWX primitives, translation, rotation, scaling, RGB coloring, creating a more complex object out of simpler geometric primitives, as well as the basics of lighting for surfacing objects. Throughout her presentation she provided both the text version of the RWX code as well as 3D visual examples of how the code looks when loaded into the AW browser.

Subsequent classes began with a review of the previous class followed by some time for students to ask questions and present some of the objects they had created. Each week she covered an area of RWX objects more in-depth such as lighting (e.g., the diffuse, specular, and ambient commands), RGB coloring, and
applying textures to objects. Throughout each of these sessions Magine continued to provide both text and visual examples for her demonstrations.

Reactions

I was surprised the first evening of the class when I realized that Magine intended to teach the class lecture-style. It's not a style that at first seems suited to AW. Although her lectures often turned into discussions and questions/answer sessions, her teaching style actually worked well with the AW medium. She provided both visual and textual support for each concept and feature she presented. Not only could students view the coding and ask questions, but they could also move around in a 3D environment to view the various objects and features she discussed. When for instance a student would ask a hypothetical question about the shading or coloring of an object, Magine would load both the orginal version and a version in which the hypothetical or proposed changes were made so students could view the changes in real time and receive feedback during class.

Though Magine has no formal training as an educator or in 3D design, she chose a style and method that worked well with this medium. When I questioned Magine as to why she choose this method of teaching, she stated that this was the way she would have liked to have learned this material. Most of the teaching material she used was developed and refined during her first session teaching for AWU. She presented the material in a clear manner that both seamlessly integrated the web browser and the 3D environment. Magine was open to questions and had an easy rapport with the students.
The overall atmosphere of the class was more interactive and informal than might occur in a physical setting. As concepts and topics were introduced and explained, students freely asked questions of the instructor and of each other. For the most part, most of the students seemed interested in learning the material and respectful of both the instructor and one another.

Student Examples

During the week as students created objects, they mailed them to Magine. At the beginning of each class, Magine would load the objects for the rest of the class to view and offer feedback. Because the objects had to be loaded to the host server of AWU, students were not able to load nor view objects in an AW environment prior to class unless they had access to another AW-world. However, students enrolled in a course at AWU are given permission to build within specified areas AWU. Once an object is loaded, students have the opportunity to use their newly created objects.

Resources

Magine provided a variety of resources throughout the class. She made good use of the AW integrated web browser by supplying links within the classroom environment to web pages of RWX codes for dozens of objects. As she presented a new concept, she drew her examples from the codes. Additionally, she also provided 3D visual support to illustrate her examples (Figure 9.2). Prior to the first class, Magine also supplied all the students with URLs for additional resources. These resources included RWXMod (an RWX modeler), RW DLL, Textpad, Texmap, a
help file for RenderWare API, and a DOS command-line utility she wrote to alter
RWX files. She also provided the name of a well-known book about RenderWare.

Findings

The Learning Environment

Active Worlds provided many unique opportunities that are not necessarily
possible in a physical learning environment. First of all, it allowed individuals who
are interested in creating more advanced objects the opportunity to learn in a helpful
supportive environment. With the exception of 3D games, RenderWare is not
necessarily common for 3D design, and more technically advanced citizens interested
in creating objects have often relied on commercial software creating objects. This
class also provided citizens with an opportunity to meet with others who share an
interest in creating RWX objects.

Another unique aspect of using AW as a learning environment is the features
built into the browser. Users have the option of logging an entire session, which
provides a transcript of the entire class. The class log is helpful for those who want or
need to review the lecture and discussion. Another feature that AW provides is the
ability to send and receive telegrams. This gave more hesitant learners a comfortable
means to seek further clarification from the instructor or other students without
interrupting the class.

AW also provides a scalable integrated web browser that appears on the right
side of the browser. All of the text files Magine used in her teaching were provided.
Students could click on a linked billboard within the class to access text examples.
Finally the most interesting aspect about using this medium for informal education is the community support and opportunity for collaboration that is involved with the AWU endeavor.

**Situated Learning**

In addition to many unique learning opportunities, Magine's class was also an interesting sample of situated learning. Situated learning is based on the model of situated cognition in which "knowledge is contextually situated and is fundamentally influenced by the activity, context, and culture in which it is used" (McLellan, 1996). According to Brown, Collins, and Duguid (1989), traditional schooling has made a practice of separating what students learn from how it’s used. In one of their articles entitled, "Situated Cognition and the Culture of Learning" (1989), Brown, Collins and Duguid, provide several examples of how an idea or concept is abstracted and taught in isolation of how it is used. One example includes the teaching of vocabulary and the importance that context plays in learning new vocabulary. According to Brown, Collins, and Duguid (1989), most people learn vocabulary in the context of normal conversation; and at a surprisingly rapid pace of 5,000 words a year by the age of 17. However, vocabulary taught in many classroom is "almost useless in practice" because it is taught in isolation by using the dictionary definitions and one or two sample sentences. Vocabulary words are taken out of the context of normal conversation. In their example, Brown, Collins and Duguid, illustrate their

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10 McLellan attributes this idea to Brown, Collins, and Duguid (1989).
point by showing several student sentences in which the target vocabulary word is used, but it is either incorrect, or used completely out of context. While the dictionary definition might lead a student to believe they had used the word correctly, the fact that they learned the word out of context prevented them from understanding the word. According to Brown, Collins, and Duguid,

> Learning from dictionaries, like any method that tries to teach abstract concepts independently of authentic situations, overlooks the way understanding is developed through continued, situated use. This development, which involves complex social negotiations, does not crystallize into a categorical definition. Because it is dependent on situations and negotiations, the meaning of a word cannot, in principle, be captured by a definition, even when the definition is supported by a couple of exemplary sentences.

Situated learning takes the context into account. Knowledge is both situated within a context and culture and developed through ongoing authentic activity.

One interesting idea promoted by Brown, Collins, and Duguid (1989) is the notion of conceptual knowledge as a tool. The implication of this is that tools are something we understand when they are used and used within a context. They are not always understood when taken out of context or inactive. According to Brown, Collins and Duguid (1989) conceptual knowledge functions similarly to tools inasmuch as,

> They can only be fully understood through use, and using them entails both changing the user’s view of the world and adopting the belief system of the culture in which they are used.

Magine’s class provided the opportunity for users to learn about 3D concepts in a 3D environment. Students were able to move around and experience new concepts in a
way unique to this medium. For example, when Magine discussed polygons, she not only explained (by text) what they were, but she also supplied visual support by presenting a polygon. That in itself is not unusual, however, when she discussed such aspects as surface normals and explained how the polygon only had one visible side, students had the opportunity to move around the polygon and see that the back was not visible. When she presented the axis, students were able to move around the axis and place their avatar somewhere on it. Magine created small balls along the corners of a polygon to illustrate the concept of vertices, allowing users to gain a fuller understanding of how vertices are delineated in an RWX object. Granted, some of this could be accomplished in a traditional modeling class and probably by using commercial 3D software. However, what was unique to this medium is that students could see themselves and others (via a representative avatar) moving around an axis or in relation to an object. This provided some of the novice modeling students more options for learning collaboratively and in a situated context.

Magine’s class offered an unusually context rich environment for not only learning how to create RWX objects but also for learning about 3D modeling concepts within a 3D environment. Students had the experience of exploring many concepts through first hand experiential cognition (McLellan, 1996). Additionally students had the opportunity to learn about these concepts within a context-rich setting as active participating members of the AW culture. Learning was not separated from context or from process and function. Students were able to learn first hand from Magine, other students, and most importantly, by being situated in the context of the environment.
Limitations

Just as there are opportunities that are singular to this medium, there are also limitations and disadvantages. Off and on throughout the class was a student who was disruptive to the class. The student’s outbursts and style indicated to most of the more experienced users that this individual was perhaps an over zealous adolescent bent on displaying an expertise. For the most part, this student was tolerated, but at one point Magine announced to the class that she was "muting"\textsuperscript{11} him. Though there are "kick and ban"\textsuperscript{12} features built into various worlds, they are not always used.

In addition to an occasional troublesome student, it should be noted that due to the nature of computer supported communication, the pacing of the course seemed a little slow. Variances in modems, distance between users, and even typing skills tend to slow the level of interaction. Though Magine was successful in the style she chose for delivery, there were times when the delivery lagged.

Summary

All in all, Magine’s RWX object modeling class provided an interesting and insightful look at how AW can and is used for educational purposes. There were many surprising discovered uncovered during this investigation. First and foremost was the

\textsuperscript{11} The "Mute" feature allows a user to mute another user. The muted user will continue to be able to communicate with any other user that has not "muted" them.

\textsuperscript{12} "Kick and Ban" is a common term in MUDs and MOO environments where a Wizard or user with official status can terminate another user's access for a period of time, or may terminate their account.
interesting choice of lecture/discussion-style classes. It was initially thought that this would not be a viable approach, however, over all the style was quite suitable for the AW medium. Additionally, Magine's class was extremely well organized and she made great use of various features afforded by AW such as the integrated web browser, the dialogue logs, and of course, the mute option. This investigation reveals is that AW used in the right context provides many unique learning opportunities that are not easily replicated in the PW. Additionally, Magine's class proved to be an interesting example of situated learning. While there are many unique opportunities, there were also some limitations such as pacing, and troublesome students. Despite the limitations, overall Magine's class proved to be an enjoyable and thought provoking educational experience with much to offer anyone interested in learning about 3D modeling and RWX objects.
BCOR: The University of Colorado–Boulder: Business Computing 1000

As the Internet and WWW becoming more of a common presence in education, the field of distance education has expanded with the technologies that allow for virtual interaction. During the past five years the WWW has become not only a tool for education, but also a medium in which education both formal and informal is being conducted. Now with the emergence of 3D networked environments educators are beginning to examine and explore the use of these environments for both classroom and distance education. One such case is University of Colorado–Boulder College of Business' creation of a distance education course using AW as a classroom interface.

Background

In 1997, Dr. David E. Monarchi, of the University of Colorado–Boulder’s College of Business, led a group of undergraduate students (Dan KeKalb, Michael P. Miller, Rich Mogull, Marc Nelson, Mike Turner, and Jessica Witter) in developing an
on-line version of a business-computing course. The course Monarchi choose for this
innovative endeavor was a well-established undergraduate course called Business
Computing Skills 1000 (BCOR). BCOR is an entry-level, three credit hour, required
course for undergraduate business administration students in the College of Business
and Administration at the University of Colorado--Boulder (UCB). BCOR "focuses
on the development of business computing skills while introducing important
concepts and principles related to working smart in a networked worlds" (UCB

The on-line version of BCOR, developed by Monarchi's team, is a
multifaceted online course management system for distance and distributed education
that allows students to access the course by way of the WWW, NetMeeting, and
through the 3D virtual world, Active Worlds.

I first encountered BCOR while exploring various worlds within the AW
Universe. At that time there were several groups experimenting with the use of AW
for educational purposes, however, to my knowledge there were no attempts at using
it as a primary medium or environment for formal instruction. After some initial
exploration, I contacted Dr. Monarchi in an attempt to gain more information. He
was more than forth coming with information, enthusiasm, and assistance. In May of
1998 I attended a presentation about BCOR at the UCB as well as interviewed
Monarchi and several members of the design team. The BCOR initiative was most
impressive because of the thoroughness in which the design team approached their
project and collaboration among the team members during the design, production,
and implementation. As a professor, Monarchi seemed refreshingly respectful of his
design team and made a point of crediting not only much of the production, but also
crediting many of the ideas to individual team members.

Much of the information contained in this case study was collected from
ongoing participatory observations from April through December 1998. The BCOR
team generously allowed me to participate during part of the fall semester in 1998 by
allowing me access to restricted areas. I was able to experience the process by which
students submit assignments, receive feedback, attend help sessions, and participate
in the student forums (threaded discussion groups). Additionally, I was able to
interact with several other students in the BCOR immersive environment via AW, as
well as "speak" with the TA on duty (Michael P. Miller) in the virtual TA office.

Design Team

Dr. David E. Monarchi is not led the development team in the design and
production, but also serves as the professor for the on-line version of BCOR.
Monarchi has been at the UCB since 1972 and during his tenure, Monarchi has taught
courses ranging from database design to AI programming.

Members of the BCOR design team include: Dan KeKalb, Michael P. Miller,
Rich Mogull, Marc Nelson, Mike Turner, and Jessica Witter. Michael P. Miller
serves as the course coordinator. During a portion of my investigation the
development team also included Miah Adams, Heather Morgan, and W. Ed Shappell.
Class Profile

As previously state, BCOR is a required core business course for beginning students in the Business Administration program at UCB.

Curriculum and Materials

The curriculum of BCOR covers a wide range of business-related concepts, skills, and applications. The concepts covered include computer security, information systems, communication, multimedia, and basics of computer hardware and software. Along with these concepts several applications are presented: Microsoft Word, Excel, Access, and PowerPoint, along with basic HTML and the WWW. The course also includes such skills as email, threaded discussion lists (forums), web browsers, and the 3D virtual world, Active Worlds.

The materials for the course consist of one textbook, Discovering Computers: A Link to the Future, World-Wide Web Enhanced Complete, of the Shelly Cashman Series. Additionally, there are several workbooks including Microsoft Windows 95: Introductory Concepts and Techniques; Microsoft Internet Explore 4.0: An Introduction, Course Technology; Microsoft Word 97: Complete Concepts and Techniques; Microsoft Excel 97: Complete Concepts and Techniques; Microsoft Access 97: Complete Concepts and Techniques; and PowerPoint 97: Complete Concepts and Techniques. In addition to the textbook and workbook are a series of interactive labs on CD-ROMs also from the Shelly Cashman Series.
The assignments consist of weekly exercises designed to give knowledge and basic skills of several applications. These assignments range from editing resumes to PowerPoint presentations. In addition to individual assignments, students are also required to participate in group projects. The group projects cover various technology related concepts and are designed to allow students to work collaboratively with these concepts, integrating their newly acquired skills in networking, word processing, and creating spreadsheets, databases, web pages, and PowerPoint presentations.

Students are permitted to move through the assignments as quickly as they choose, however, there is a minimum schedule students must meet. This prevents student from lagging behind and delaying their partners during group projects.

Delivery

BCOR is a non-synchronous course. There are no class meetings either in a physical classroom, on-line, or in-world. While much of the BCOR content is provided on-line, additional materials such as student labs are provided in the various course workbooks. All information including the syllabus, on-line forums, help, and resources are available from the BCOR web site and also accessible through the BCOR virtual world. In addition, students are able to submit assignments, review grades, and receive feedback about assignments online. While there are no formal lectures in either a traditional classroom setting, or via the Web, there are ample provisions made for assistance through email, NetMeeting, within the AW environment, and through the on-line forums. Additionally, for students in the Boulder area, there are weekly help sessions provided by the BCOR team.
In addition to the materials and resources afforded in the web site, students are provided with instructions for downloading various applications such as AW. The COB computer lab also provides all of the applications necessary for the course.

Overview of Investigation

Background

As previously stated BCOR can be accessed in a variety of ways. Students wishing to use an all 2D web based version and/or use NetMeeting have that option. This report and analysis will be limited solely to the use of AW as a medium and educational environment for BCOR. In addition, this report will not attempt to address or critique the curriculum, but rather the scope will be limited to the way in which AW is being used as a formal distance education environment. The on-line version of BCOR is not merely an on-line course, but rather an on-line integrated course-management system. To do Monarchi and his design team justice; one could easily devote an entire dissertation to BCOR. This online course management initiative is amazingly complex, dynamic, and rich in research opportunities. However, due to nature of this investigation, this review will focus solely on the use of AW as an educational environment and medium by looking at three areas: the use of the 3D immerse environment as an interface and context for the course; the BCOR 3D Virtual Syllabus; and the Virtual Computer.
The University of Colorado–Boulder's Virtual Campus

Setting

Upon launching the University of Colorado–Boulder's AW world (ucbcob01), one is transported to the UCB Virtual Campus. The setting consists of an open landscape framed with a composite background of mountains similar to those that frame the city of Boulder. At GZ, there are a series of billboards that serve as links to other UCB sites and worlds that contain other courses offered by the COB. One of these billboards serves as a link to the BCOR site (Figure 9.5).
Directly to the west of GZ is a large translucent map of the Virtual Campus (Figure 9.5). Within the map are links to various courses and sites within the COB virtual campus. By clicking on one of the green flashing lights, one is transported to the respective locale within the virtual campus system. In addition to the various in-world links, the integrated web browser also provides links to various sites within the virtual campus.
Please select a teleport destination zone, or feel free to explore wherever you wish.

- BCOR 1000 Zone
- Virtual Course Syllabus
- INF 2020 Zone

Figure 9.5. The Virtual Campus Map.

**BCOR 1000**

By selecting BCOR 1000 from any one of the various links, one is immediately teleported to GZ of the BCOR 1000 site. This site serves as the virtual organizational framework for the course as well as provides resources for the various assignments and group projects.

**Setting**

Upon teleporting to BCOR, students land in a spacious plaza surrounded by several open-air buildings. Immediately to the north of GZ are two billboards: one
welcoming students to BCOR 1000 and the other listing "virtual" and real life office hours of the TAs.

Surrounding the plaza is a TA office, several streets, buildings, and bus stops. This setting serves as the virtual interface and to some degree, the context of the course. Several of the buildings represent the various applications covered in the course. There are buildings for Microsoft Word, Windows 95 and Internet Explorer, Excel, Access, and PowerPoint (Figure 9.6). Each building contains one room that contains resources and materials for aiding students learning that application and completing a particular assignment associated with the application. Additionally, at the rear of each application building is a door that leads into a small plaza. Each plaza contains billboard links to the group project associated with a particular application. For example, along Microsoft Lane a student can visit the Microsoft Word building. Within the Microsoft Word building is a series of signs with links that trigger web pages within the integrated browser (Figure 9.7). The links include the MS Work homepage, MS Word 97 Tips & Tricks, MS Word Support, and New Features. Clicking on any of these signs within the 3D environment will activate the integrated web browser to load the corresponding web sites. These resources provide additional assistance for students who are learning to use MS Word.
Figure 9.6. An aerial view of BCOR 1000.
Figure 9.7. The inside of the MS Word building.

Directly behind the MS Word building is a small plaza that provides topic and resource materials for the first BCOR project (Figure 9.8). Additionally, there are links to webpages that allow students to review examples of projects, submission requirements, and other supplemental information about Project One.
Integrated Web Browser

A great deal of this AW virtual version of BCOR is dependent upon the use of the integrated web browser. While the 3D world provides the interface, the web browser provides much of the content, examples, and serves as the means by which student submit work and receive feedback. In addition to the corresponding content material provided for BCOR, the web site provides a private student area and discussion forums. To access the secure student area, the student must be enrolled in
BCOR, and have a username and password. After accessing the password controlled area, the student has a variety of options from which to choose including: submitting an assignment, viewing grades, updating student information, accessing their group project area, the class roster and an area for taking midterms and final exams. In addition students can also contact the instructor and offer complaints or suggestions about the software (Figure 9.9).

Figure 9.9. Accessing the secure student area through the integrated web browser.
TA Office

Directly south of GZ in the BCOR plaza is the TA office. A billboard posted in the central plaza lists the hours that a TA will be in attendance in both the physical offices (in the College of Business at the University of Colorado Boulder) and in the virtual office in the BCOR virtual site.

Due to the embodiment limitations of actions users are able to exert over their AW avatars, it is difficult to use the traditional methods of maintaining control and signal turn taking. In a physical setting, students traditionally raise their hand or signal by gesture and the instructor calls upon them; however, this type of control is not yet available with the AW avatar. Despite these limitations the BCOR design team created a system that allows for questions and answers. Students in need of assistance must queue their avatar at entry of the TA office. To ask a question, students must wait until their avatar is at the front of the line. This also gives students the opportunity to learn from each other's questions.

Findings

The Learning Context: Situated and Anchored

BCOR provides an interesting study of both the structuring of information, and the presentation of this information in a 3D environment. The BCOR site illustrates the structure of the course by use of individual buildings and plazas. Each building contains web-based resources for that particular application as well as a link to the course syllabus. To the rear of each application building is a small patio with
links to instructions for the group project, student examples, as well other resources related to the project. This patio can additionally serve as a meeting place for group members to meet, discuss, and collaborate on group projects. Each group member has access to the same resources and can refer to them as needed. Students have information on a need to know basis in an environment that is supported both visually and through text.

The BCOR site provides not only a place for students to learn, but it also provides a context that draws on learners' real-world knowledge. Most American undergraduate students are familiar with attending classes in various rooms and buildings. The BCOR site draws on these real-world experiences as an organizational strategy for the content and resources for the course. Learners move from assignment to assignment by moving from building to building. Streets and avenues guide their way and provide cues for learners to orient themselves in the 3D environment. Additionally, learners have the opportunity to designate a "place" to meet and collaborate for group projects. This design strategy allows learners to move from the "known," (e.g., streets, buildings, and rooms) to the unknown.

By using the 3D environment as an underlying structure for the learning activities, the BCOR team has created a "place" or more specifically a context for learning. Learning is "anchored" in a context supported by a 3D environment that is both familiar and engaging. "Anchored" instruction is an approach to instructional design in which "instruction is situated in engaging, problem-rich environments that allow sustained exploration" (Cognition and Technology Group at Vanderbilt, 1990; 1992). While students are developing various business computing skills, they are also
developing strategies and skills for collaboration and cooperation necessary for working in a networked business environment.

The BCOR site is also an interesting example of situated learning. According to the course description, the focus of the course is on "the development of business computing skills.... related to working smart in a networked worlds." Students have the opportunity to learn about concepts by using them. While the various visual constructs such as places, buildings, and rooms provide anchors that for instruction, they also provide a rich context for situating knowledge.

The BCOR Virtual Syllabus

Within University of Colorado—College of Business Virtual Campus map is a link to the BCOR Virtual Syllabus. The Virtual Syllabus is a 3D environment, in which students can interactively move or "walk" through the BCOR syllabus. Unlike traditional syllabi most often used in courses, the virtual syllabus marks a departure from traditional methods of accessing information by providing a uniquely, dynamic and interactive model for representing information.

Upon landing in the main entry of the Virtual Syllabus, students encounter a series of objects fixed against a barren landscaped framed by a composite background of dusk (Figure 9.10). The objects include a telephone, a scroll, a bookcase with books, a light bulb, a telescope, and a clock. Each of these objects represents various features of the course syllabus; for example, the telephone represents Contact Information; the bookcase—Course Resources; Clock—Course Timeline; Telescope—Course Overview; Scroll—Assessment; and the light
Corresponding with the 3D environment is a web site that explains the philosophy and purpose for the virtual syllabus as well as providing supplemental information. By selecting an object or the corresponding link on the web page entitled "Map of Virtual Syllabus;" the user is immediately transported to that 3D object's corresponding resource site. Unlike a traditional syllabus, this version is designed to allow students to interact and walk through information.
Figure 9.10. The entry of the Virtual Syllabus.

Example of the Virtual Syllabus: Resources

Upon selecting the bookcase resource site, the user is transported to an open field with a bookcase (Figure 9.11). This is where the Course Resource section of the virtual syllabus begins.
Directly south of the bookcase is a gated pathway, which leads the student on a path through the various course resources. While traveling through the gated pathway, students encounter a series of objects placed on small pedestals. Clicking on an object activates the web browser allowing students to read about the various resources for the course (Figure 9.12). These objects include a disk, a book, a padlock and key, an in/out box, a computer, a notebook, and a final book.
Figure 9.12. The Course Resource pathway.

The *disk* for example activates the integrated browser to access the *BCOR 1000 Software Download Site*. From the corresponding web site students can download copies of some of the software used for the course (Figure 9.13). The first *book* encountered in the pathway, supplies information about the forums available to registered students. By clicking on the web link, the web browser loads the web page with the student forums. These enables students to experience the forums first hand directly from the virtual syllabus. The *padlock and key* represents information about the secure student area of the BCOR site. By selecting the corresponding link,
registered students are able to directly access the secure student site and access all of
the information contained within that site. The In/Out box represents example
projects. From this page are links to the web site, which enables students to view
examples of any of the four group projects. Each of the objects represented function
in a similar fashion. This is only one of the six major areas that construct the Virtual
Syllabus. In addition to the Course Resources (bookcase), students may at any time
transport back to the main entry of the Virtual Syllabus and select another aspect of
the syllabus to explore.
Findings

Contextualizing and Re-thinking Information

In the opening paragraph of *Envisioning Information*, Edward Tufte states, "Even though we navigate daily through a perceptual world of three spatial dimensions...the world portrayed on our information displays is caught up in the two-dimensionality of the endless flatlands of paper and video screen." What Tufte is so eloquently commenting on is the prevalence of perceptual information to be reduced into 2D representations. Tufte further argues that "escaping this flatland" and finding new ways of presenting complex data is essential but becomes more difficult as
information becomes more abstract. The BCOR Virtual syllabus is an interesting attempt to break with the manner course information is traditionally presented. While the Virtual Syllabus is probably not exactly what Tufte had in mind when writing of "escaping flatland," it does represent an innovative re-thinking of how course information can be presented. The Virtual Syllabus is an interesting attempt at presenting information as an interactive 3D environment. Instead of looking over a syllabus, students move through the syllabus and gather information as they move along. While one might be reluctant to deem it as a 3D representation of information, it most certainly is a nice example of 3D hypermedia. By traveling through the environment, students learn about and experience the various components of the course first hand. This version of the course syllabus integrates the material, resources, with the mechanics of BCOR. Instead of students reading or scanning a piece of paper that contains course information, then trying to apply this information to the 3D environment, the Virtual Syllabus provides an experiential means for learning about the course.

The Virtual Syllabus is an interesting re-thinking of how 3D environments can be used to present information within a contextually rich environment. The value of re-thinking or re-envisioning information is that it provides learners with new or alternative heuristics for how information can be presented. Offering alternative heuristics enables learners not only by providing them with more avenues to access information suitable to the learning styles, but it also provides learners with a models and motivation for developing new heuristics for their own work.
**The Virtual Computer**

Embedded within the Virtual Map of the Virtual Campus is a link to one of the most remarkable sites within the BCOR environment, the Virtual Computer. The Virtual Computer is a 3D large-scale animated representation of a computer in which learners can access and move through to learn about the inner workings of a computer and monitor. By clicking on the Virtual Map link, users are immediately transported to GZ of the Virtual Computer site.

Upon arriving in the Virtual Computer, a sound file of a computer hums softly in the background as the objects and images load. As the environment quickly emerges, a short distance from GZ is what appears to be a life size model of a computer keyboard. In the integrated web browser information about the Virtual Computer appears.

The Virtual Computer contains a life-like scale model of a computer (Figure 9.14) in which learners are able to move and interact. Clicking on various objects within the 3D computer actives a corresponding web page with detailed information about that object and how it functions within a computer. For example, when a user clicks on the Central Processing Unit (CPU) the corresponding information is loaded into the integrated web browser.
Most of the objects are in some way animated and by clicking on an object also triggers the animation. For example, the CD-ROM drive opens and closes when the user clicks on the drive button. This gives the user not only a visual means of identifying the object and its role within the computer, but also a representation with which the user is likely to have encountered this object in the PW computer.

Users also have the opportunity to explore the Virtual Computer in a more systematic way. On the introductory web page that loads when a student enters the Virtual Computer is a map. By selecting the image of an object in the web page, the student's avatar is teleported to the corresponding object within the virtual computer.
This allows students the option of exploring the information both interactively and through a more structured text presentation.

**Findings**

**Choice and Perspective**

The Virtual Computer is one of the most innovative and creative explorations of the use of 3D environments for educational uses to date. It provides learners with information and explanations about a computer by way of traditional text and 2D images, but also allows learners the rare chance to glimpse inside a computer and move through the inner workings.

There are several advantages for learners using this environment to learn about the operations of a computer. First of all, it is externally paced. Unlike video or animation presentations, the learner determines his/her own pacing through the environment and corresponding materials. This environment also allows for the learner to view the information from multiple perspectives. Research into the educational use of VR, argues that providing means of multiple perspectives may aided learners in constructing mental models as well as constructing procedural knowledge (Winn and Jackson, 1999).

In a presentation I attended May 1998 at the UCB, Monarchi discussed some of the reasoning for using a 3D environment for his on-line version of BCOR. According to Monarchi, universities are full of students who are successful in traditional means of information representation. He pointed out that the reason we were all in attendance is because we were to varying degrees successful in accessing
information by way of text, diagrams, and 2D images. During the presentation, Monarchi asked the interesting question, who is not here? The point Monarchi made is that by supplying learners with a greater choice of tools to access information, we include those learners whose strengths lie in other methods of accessing information. According to Monarchi, the use of 3D environments provides educators with "alternative ways to present concepts" and learners with a greater choice of tools for understanding concepts and ideas.

Monarchi's challenge is consistent with many of the findings coming out of the research concerning the use of VR for learning. The Virtual Computer provides learners with a means to access information in an experiential manner consistent with situated learning (Brown, Collins, and Duguid, 1996). Learners come to know the world through their interactions and first person lived experiences. This is not to say that learners do not construct meaning by way of text or more traditional media; however, studies in the area of constructivism support the notion that "first person experiences account for a great deal of our activities in the world and our learning about it" (Winn, 1993). The use of a 3D virtual world is one means by which learners have first-person access to concepts and information that is not always easily replicated or accessible in the PW.

In an article entitled "A Conceptual Basis for Educational Applications of Virtual Reality", William Winn states

Immersion in a virtual world allows the same kind of natural interaction with objects that participants engage in in the real world. If cognition is non-symbolic and learning intimately tied to action, then it is through interaction with the virtual
world that knowledge is constructed.

In the Virtual Computer environment, learners are not schooled, or taught about the computer, instead they are provided with an environment that supports the construction their own first-hand knowledge of a computer and how it operates.

Limitations

My investigation into the BCOR course provided an interesting anecdote about the limitations of representation in an AW environment. For BCOR, many of the COF stock avatars were made available for student use, however, as it has been noted previously, for the most part, these avatars represent young, fit, Western Caucasians. As a participant I was restricted to using one of those avatars. One day while observing some interactions, a student greeted me in the following manner (Example 9.2). I presumed this student to be male based on the avatar used. I also presumed him to be approximately 18-20 years of age based on the population of students and his overall manner.

[Example 9.2\textsuperscript{13}]

<table>
<thead>
<tr>
<th>MD:</th>
<th>hi</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCOR Student:</td>
<td>what's up baby?</td>
</tr>
<tr>
<td>MD:</td>
<td>...not much...are you in this class</td>
</tr>
<tr>
<td>BCOR Student:</td>
<td>oh yeah</td>
</tr>
<tr>
<td>MD:</td>
<td>it's very interesting!</td>
</tr>
<tr>
<td>BCOR Student:</td>
<td>I just like it because I don't need to go to a class!!</td>
</tr>
<tr>
<td>MD:</td>
<td>hehe...that's a good point</td>
</tr>
<tr>
<td>BCOR Student:</td>
<td>thanx</td>
</tr>
<tr>
<td>MD:</td>
<td>are you in Boulder right now?</td>
</tr>
<tr>
<td>BCOR Student:</td>
<td>yep, and you?</td>
</tr>
<tr>
<td>MD:</td>
<td>Ohio...</td>
</tr>
<tr>
<td>BCOR Student:</td>
<td>what the hell are you doin' there?</td>
</tr>
<tr>
<td>MD:</td>
<td>taking this class</td>
</tr>
<tr>
<td>BCOR Student:</td>
<td>I'm confused?</td>
</tr>
<tr>
<td>MD:</td>
<td>I'm sort of taking this class from ohio</td>
</tr>
</tbody>
</table>

\textsuperscript{13} This example has been edited to protect the identity of the student.
BCOR Student: what do you mean by sort of?
MD: did you turn in the first assignment?
BCOR Student: yeah I turned in Word project one and two about three days ago.

During this brief interaction, I humorously noted that it would be highly unlikely for this student to have greeted me with "what’s up baby?" in the PW as I am most likely considerably older than he. Nor would he probably have used the phrase "what the hell are you doin there?" in a face to face conversation. Granted, this assessment is highly projective. I do not know this student, nor if this student was in fact a young male. However, based on long term interactions and observations in the AW environment, these were my impressions of the student. It is not uncommon for users to make some assumptions about other user based on the visual representation of one’s avatar. While my example is humorous, it is not intended to trivialize the need for diversity in representation. In an era when the field of education is recognizing the importance of diversity and multiculturalism in learners, it is important for designers, and teachers to be sensitive to a learner’s right to control and/or feel represented in an environment.

Summary

The BCOR on-line course provides an interesting and insightful look into how one group approached distance education. The incorporation of AW certainly adds more than one dimension to this course. The BCOR team used the 3D environment to great advantage inasmuch as it served as an interface to the course. Both the use of resources (3D and the Web) provided great context, as well as supporting
collaboration. Additionally, the site also provides a means by which students are situated directly in the context of the learning environment. The innovative Virtual Syllabus and Virtual Computer are both thought provoking because they an alternative heuristic for how information can be presented to allow for a greater variety of learning styles. Overall, the AW version of BCOR has been an interesting and insightful experience into exciting possibilities in on-line distance education.
SUMMARY, DISCUSSION, AND RECOMMENDATION

Summary

Within the past ten years, the field of education has been greatly impacted by the Internet and more lately by the WWW. Computer mediated communication and hypermedia are not only influencing practices within the classroom, but they are also expanding the classroom. While distance learning is not by any means a novel idea, the Internet, WWW, and emerging technologies such as virtual worlds are allowing educators and learners the opportunity to re-envision the learning environment.

Three-dimensional virtual worlds are an emerging technology, which offer a variety of tools for interactive collaborative learning environments. These applications offer users the ability to communicate and collaborate in real-time 3D environments. Although little research has been conducted into these environments and their use in education, there is a body of research for investigators to draw from in the areas of text-based virtual worlds, virtual world design, educational VR, and educational games and simulations.

Studies in the design and educational use of MUDs, MOOs, chat, and 2D graphical chat environments argue for the educational potential of these types of technologies. Additional work in the area of virtual world design adds much to our
understanding of how these worlds can and should be constructed. Studies in the areas of the educational use of VR provide most interesting insight into the unique opportunities that 3D environments offer in terms of experiential learning. Some of the more critical studies into the educational use and value of computer games and simulations revealed some of the most relevant findings pertinent to an investigation into the use of 3D virtual worlds for educational purposes in terms of representation of ethnicity, race, and gender.

This study into the educational use of 3D virtual worlds was conducted to investigate the two following questions:

1. How is the user constructed by the 3D virtual world?

2. What are the unique learning opportunities provided by these worlds?

Part one of this investigation provides both a history of virtual worlds, as well as a review of related literature. Part two addresses the question, how is the user constructed by the 3D virtual world, by examining of the more popular 3D virtual worlds: ActiveWorlds, blaxxun interactive’s Contact 4.0 in the context of Colony City world, and OnLive! Traveler. The focus of the study is on the affordances and limitations of various design features and how they function. The underlying methodology employed was Grounded Theory Methodology (GT) which was chosen due to the relative lack of prior research in the area of 3D virtual worlds. Consistent with GT, no a priori theory was offered, but instead theories were derived from data collected through long-term participatory observations and formal and informal interviews. Categories were liberally derived based on Huberman and Miles’ (1994)
variable-oriented and pattern-clarification strategies for identifying themes and patterns. These categories include the design features that serve to construct the user in terms of presence, representation, and embodiment.

The findings of this investigation reveal that although all three worlds offered many design features which on the surface might seem roughly parallel, the way they function within the application serves to construct the user in different ways.

Part three of this study addresses the question, what unique learning opportunities do these worlds provide? This investigation consists of two case studies of how AW was used as a medium for both informal and formal education. The first case study, Magine's class (informal), examines an RWX object modeling class offered through the ActiveWorlds University. The second case study focuses on a beginning level business-computing course (BCOR) offered through the University of Colorado–Boulder's College of Business.

The findings reveal many unique learning opportunities were presented by the use of AW as an education medium. Both Magine's class and the BCOR course provided an environment rich in context necessary for situated learning. In addition, findings reveal that AW also allowed for a greater variety of tools to support various learning styles, particularly a greater variety of visuals. It was also found to support the notion of experiential learning supported by more traditional immersive forms of VR.
Discussion

Findings from part two of this study indicate that 3D virtual worlds serve to construct the user in various ways. While many of these worlds may offer parallel affordances and limitations by way of design features, it is how these features function within the context of the world that determine and construct the user.

Active Worlds

Many of the features and types of support of ActiveWorlds serve to construct the user as a more autonomous agent. The lack of a central governing body coupled with the provision of allowing users to build and add to an environment, allows users to define their own communities.

ActiveWorlds and Learning

Because these worlds are relatively new, there is little research about them, however, research into MOOs by both Bruckman (1998) and Riner (1996) support the importance of user-extensible features such as the ability to build within a world. Research by Gigliotti (1993; 1995) further supports the importance for user-extensible features through her notion of plasticity. According to Gigliotti, "a virtual world should be moldable, flexible, pliable." This notion of plasticity or user-extensibility holds relevance for learning. Within a constructivist paradigm, action and learning are intrinsically tied together. Learners construct knowledge by acting upon and with their learning environment. AW allows for many opportunities for individual and groups of learners to construct.
One of the more problematic features observed with AW was the limits and lack of user control over avatars. Users were limited to selecting an avatar from a pre-defined library. While world owners have the option of creating avatars for their own world, avatars are difficult to create and require knowledge of 3D modeling as well as the appropriate software. While stock avatars are provided by COF to world owners, with few exceptions, these avatars represented young, fit Western Caucasians. Additionally, there were more males with a greater variety of age and body types than females. These limitations perpetuate values that may not correspond with those of the user. Similar findings in the area of educational games by both DeVaney (1993) and Miller-Lachman, et al (1995) support the importance of questioning how the user is being represented and what values are being perpetuated through the design.

While the lack of user control over avatars was seen as problematic there were other aspects of representation where the user maintained a great deal of control. Users could choose their own unique names and control over the amount of information they wished to reveal, including whether to make their presence in a world known to others. Users also had the option of whispering and sending telegrams, and muting other users. The availability of unique names does aid in the development of communities because it aids in both creating trust and accountability among users (Stone, 1997).
Within the social-constructivist paradigm, learning is viewed a social activity (Lave and Wenger, 1991). AW allows for learners, locale or spatially distant, to communicate by way of and collaborate while still maintaining some control over their virtual and PW identity.

**blaxxun interactive: Contact 4.0 in the context of Colony City**

While it was revealed that the focus of ActiveWorlds is on personal autonomy, many of the same type of features in blaxxun's Contact 4.0 in the context of Colony city serve to construct the user as a part of a centralized community. Features such a *Peoples* list and worldwide dialogue serves to create a central community. This is further reinforced by the economic system of jobs and points. This focus on community is in many ways supported by the individual work of both Morningstar and Farmer's (1994) studies of "Habitat," and Pavel's (1995) recollections of "LambdaMOO." In both Habitat and LambdaMOO, providing environments that supported interactions facilitated the focus on community.

**blaxxun and Learning**

One of the main strengths of blaxxun's Contact 4.0 revealed in this investigation was the provision of allowing custom created avatars. While findings reported similar limitations of avatar gestures, actions and emotions consistent among all three virtual worlds, Contact 4.0 did allow for users control over their own visual representation. The result of this allowed for a much more diverse representation, including a rare occurrence of an avatar in a wheelchair. One of the more interesting
notes is for the most part, avatars were not photorealistic images of the user, but instead users choose to represent themselves as a variety of fantastical characters and other assorted objects.

In a virtual environment, avatars become a type of projection or personification of self. Evidence supporting this notion comes from diverse studies into MUDs and MOOs. Both Turkle (1996) and Stone (1996) have looked at the social construction of self in a computer-mediated environment. Evidence of the value and connection users' feel towards their representation (avatar) can be found in the works of Dibbell (1994) and Bruckman (1997). Although these studies primarily focus on text-based representation, many of these notions can to some degree be supported by Jeffery and Mark (1998) investigation into how users project PW physical behaviors onto their avatars into virtual worlds.

The control over visual representation is particularly important when addressing the use of 3D virtual worlds for education. In an era of cultural diversity, it is important that learners have control over how they are being represented. Bruckman's (1997) investigations in MOOSE Crossing illustrates the importance allowing learners to self-define and at times experiment with new roles and personae. The ability to representation may further add or enhance learners' ability to view problems and issues from multiple perspectives. Within a constructivist framework, multiple perspectives and diversity and control over representation are important components for the learning environment.
OnLive! Traveler

OnLive! Traveler is in many respects very different from Active Worlds and blaxxun's Contact 4.0. While all three offered somewhat parallel design features, Traveler was the only application out of the three to include real-time voice. The results of this investigation revealed that the inclusion of real-time voice, along with such features as avatars with lip-synced facial motions, collision and gravity, and degrees of freedom in motion and rotation from the first-person perspective served to greatly enhance aspects of physical embodiment. Unlike both AW and Contact 4.0, the focus of Traveler was not so much on the community or the personal autonomy of the user, but instead on creating an environment that supports experiential embodiment.

Traveler and Learning

One of the most interesting aspects of Traveler is the way in which the user is represented. For the most part (dependent upon the world) the user is required to select from an existing library of avatars. While there are limits imposed on the user's choice of visual representation, there is a degree of freedom built into the design because users can alter both the color and (with limits) the shape of their avatar. This does allow for a degree of freedom over representation.

Traveler does not allow for persistent or unique identities. While several studies (Stone, 1997) indicate the need for unique identities for establishing both trust
and accountability in a community, it could be argued that within a Traveler environment, unique identities are constructed not by a user’s unique name, but by vocal qualities.

While Traveler lacks most of the sensorial input and feedback of more traditional immersive VR, it does offers the opportunity for users to collaborate within the environment. It could be argued that the availability of communication allows for a greater degree of emotional or intellectual engagement. In *Virtual Realism* (1998), Michael Heim addresses this issue with his discussion of presence. Heim argues that immersion is not the result of sensorial input, but rather the result of humans interacting with one another in an environment.

Heim's argument is particularly relevant to a discussion of 3D virtual worlds as learning environments. Although Traveler provides a sense of physical embodiment unparalleled by other 3D virtual worlds, it does not come close to matching the "telepresence" (Dede, 1995) or sense of immersion one might experience in some VR environments. While Traveler and other 3D virtual worlds may lack multi-sensorial immersion, these worlds do provide ample opportunity for emotional and intellectual engagement. Within the constructivist continuum, engagement both among participants and with environment is important for any educational medium.

**Three Dimensional Worlds and Learning**

All three of the 3D virtual world applications to varying degrees offer interesting opportunities for learning. Within this decade, educators have begun to
realize the potential for learning collaboration and cooperation afforded for learners. Within the social-constructivist paradigm, learning is regarded as a social activity (Lave and Wenger, 1991). The 3D virtual worlds discussed in this investigation allow for learners, locally or spatially distant, to communicate by way of either text (AW, and Contact 4.0) and by way of real-time voice (Traveler) and hence, collaborate.

In addition to the communication afforded by these three applications, each 3D virtual world also allows users to interact with both other users and objects in a networked immersive environment. Within these environments to varying degrees, learners are able to construct, impact, and interact with symbolic representations and data first hand which is in many ways more consistent with how learners engage and learn in the PW (Winn, 1993). Knowledge construction is not limited to the presentation of abstract concepts, but instead is tied to action (Winn, 1993; Dede, 1995).

**Magine's Class**

Magine's RWX object modeling class proved to be an interesting study in how 3D virtual worlds can be used for distance education. Prior to participating in the class, it was assumed that AW would not be a suitable medium for a lecture/discussion style class, however, the findings revealed within limits, it was a suitable environment and in some respects offered many unique advantages. The findings revealed that AW provided an opportunity for locally dispersed learners to learn about 3D concepts and RWX object modeling in a collaborative community.
Studies of the educational use of MOOs support the educational value of interactive collaborative environment provided by chat type applications. Both Bruckman (1997) and Riner (1995) note the importance of collaboration in the development of critical thinking skills among learners. Additionally, Bruckman stresses the importance of collaboration in the construction of "knowledge building communities" (1997).

It addition, findings revealed that Magine's class via AW provided an environment that promoted situated learning. Both McLelland (1996) and Winn's (1993) individual work in closed VR environments supports the notion that simulated environments such as those found in some educational VR applications provide both a context and a first person perspective for learners. One of the main tenets of situated learning is that abstract concepts emerge by providing a context in which learners can construct their own knowledge. Magine's class provided both chances to collaborate in a "knowledge building community" as well as providing a rich context in which to learn about 3D concepts and object modeling.

**BCOR 1000**

Although this short investigation does not come close to addressing all of the complexities of the BCOR 1000 course, there were several significant findings that will hopefully provide avenues for further investigation. Congruent with the findings of Magine's class, the use of AW for the BCOR 1000 course provided both a rich context for situated learning, as well as the necessary collaboration for knowledge construction among learners. However, what is additionally noteworthy about BCOR 211
were findings that addressed the often overlooked aspects of experiential knowledge (Winn, 1993). While BCOR did provide conventional avenues for students to access material, it also provided a unique re-envisioning of that material as well. Within the field of education differences in learning styles is a loaded topic and often little understood, however, it is generally acknowledged that learners construct knowledge in different ways. What BCOR does is acknowledge the difference among learners and learning styles and attempts to present learners with both choice and control over how they wish to access material.

Recommendations

Three-dimensional virtual worlds are relatively new technologies, which to varying degrees combine some aspects of both interactive chat environments such as MUDs and MOOs with the 3D spatiality of VR environments. Because they are new, little research has been conducted in their use for educational purposes. The purpose of this investigation was to provide preliminary research into how the user is constructed by the virtual world, as well as to investigate what educational opportunities they might provide as learning environments. Based on the findings the following recommendations are offered for the areas of development, practice, and further research.
Recommendations for Development

Object Manipulation

One of the strongest advantages of 3D virtual worlds is the graphical simulation provided. Both Magine’s Class and the BCOR course illustrate the importance a visual environment can offer for providing a context and a wider variety of tools for learners. However, for the most part potential practitioners and learners are limited to using objects or environments that are to varying degrees prefabricated. While AW allows for a certain amount of interactivity by way of triggering events, animations, sounds, and Web pages, there are few opportunities for users to actually manipulate objects within the world. For instance a user cannot pick up an object and rotate or move it. Additionally, with the exception of AW, there are few provisions for users adding to an environment. This is an important consideration given these worlds potential in terms of providing a rich context for learning, particularly for fields such as science.

Multiple Platforms

All three of these 3D virtual worlds were windows based and require at least a Pentium processor. For developers interested in greater widespread use for educational purposes, it is important that the be available on multiple platforms so as not to exclude potential learners from access.
Recommendations for Practice

Selection of the Learning Environment

One factor that became evident from observations is that these worlds construct the user in different ways. Although design features may on the surface appear parallel, they are not. This needs to be taken into account when approaching the use of 3D virtual worlds for education. It is important to identify the needs and hoped for outcomes of the learning environment, and then select the appropriate virtual world.

It also became obvious during this investigation that the resources of the learners need to be taken into account. Both typing and language skills are an important part of the experience. This should be taken into consideration so as not to disadvantage any potential learners.

Recommendations for Future Research

Learning Styles

Few researchers outside of educational VR have taken on the topic of experiential learning. For this reason, more research needs to be conducted into how and what constitutes experiential learning. Additionally, more research needs to be conducted into the effectiveness of 3D virtual worlds in providing environments for situated and experiential learning.

Learner Attitudes

Throughout this investigation, little attention was focused on learner attitudes. While most of the learners encountered in both Magine’s Class and BCOR reported
positive attitudes about both the style of learning and the environment, no negative case samples were actively sought. Further research in the area of learner attitudes need to be conducted.

**Assessment**

One of the most valuable assets these worlds may offer is both the rich context and variety of learning tools they provide to students, however, it is important that when offering alternative tools for students, that there likewise be alternative means of assessment. For example, learning environments that allow for more experiential learning also need to provide more experiential means for assessment. For this reason, further research needs to be conducted in the types of assessment that might be appropriate for experiential and collaborative learning environments.

**Conclusion**

Three-dimensional virtual worlds are interesting and dynamic environments which offer much potential as both supplemental learning environments and for distance/distributed education. They provide for experiences that are not always possible to replicate in the PW classroom as well as offer a collaborative setting for situated and experiential learning. However, further research needs to be conducted as these worlds continue to develop. While this investigation focused on how the design served to construct the user for Active Worlds, blaxxun interactive, and OnLive! Traveler, there are many other 3D virtual world applications to explore. The findings of this investigation revealed that although many of the design features were
parallel in all three virtual worlds, they serve to construct both the user and the community in different ways. A criterion for both design and application needs to be devised to help guide developers and practitioners in the use of 3D virtual worlds for education.

The field of education is only beginning to deal with the impact of the WWW. As new technologies emerge it is important that educators who work with instructional technologies educate themselves and delve into them. The term "educational" is so often flouted as a marketing strategy for various types of technology. In order to insure that new applications and technologies meet the claims of their developers, both practitioners and researchers must be willing to investigate. This investigation revealed that 3D virtual worlds do offer interesting potential for collaborative, constructivist learning. In conclusion, beyond all practical and educational opportunities these worlds may hold, one of the most important contributions 3D virtual worlds offer the field of education is a mirror to watch and analyze how we perceive and construct ourselves.
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