

VIRTUAL WORLD DESIGN

Ann Latham Cudworth

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Preface

A BRIEF OVERVIEW OF THE CHAPTERS IN THIS BOOK

In this section, there is a brief overview of each chapter in this book, and the projects in it. A suggested skill level is included, to guide you in the choice and order of projects.

Chapter 1: Introduction to Virtual Worlds and Designing for Them

Beginner to advanced levels

Chapter 1 discusses the history of virtual worlds, how they actually work, and who uses them. How to prepare as a designer when tackling your first virtual environment project is discussed, as well as how to set up a virtual world for your own design usage.

Chapter 2: How to Use This Book and Start Doing Virtual World Design

Beginner level

This chapter shows you how to use this book, decide on the appropriate computer configuration, pick your world viewer, and access the additional content for the projects.

Chapter 3: “Build It Once”: Optimizing Your Design Workflow

Beginner to advanced levels

In Chapter 3, workflow, design practices, and protocols are discussed. The reader will follow through the process of setting up design studios of various sizes and configurations, all the while learning about the concept of “Build It Once” and how the design workflow can be optimized for maximum effectiveness across three platforms: Second Life, OpenSim, and Unity.

Project: Organizing your design studio with a “critical path” technique. In this project, you will look at your own design methodology and find new ways to streamline the process of project development.

Chapter 4: Concepts in 3D Design for Virtual Environments

Beginner to intermediate levels

Chapter 4 delves deeply into the aspects of 3D design and reflects on the qualities that make composition work in 3D, especially from a virtual world point of view. Aspects of compositional methodology, similarity and contrast, are displayed and discussed. Questions and developmental steps for initiating and refining a design are in the latter part of this chapter. Finally, the importance of education, serious games, virtual environments, and the design aspects of each are discussed.

Project: Designing a virtual classroom with a modular system. This project contains content for the creation of a virtual classroom, which you can do with your class, if you are a teacher. The parts are designed to be modular and provide you with an expandable system so that you can create many sorts of classroom configurations.

Chapter 5: Virtual Terrain and Designing Landscapes

Intermediate to advanced levels

Chapter 5 is about understanding the importance of terrain and its design in a virtual world. Aspects of real-world terrain design and landscaping are considered in the Wheely Island

project, which is the majority of Chapter 5. In the process of making Wheely Island, the reader is introduced to the concept of Design for All, all-access design for both the real world and the virtual world.

Project: Making Wheely Island, an all-access terrain. In this project, you will create a new terrain and landscape it for a wheelchair trail on a Second Life or OpenSim platform. This project is a comprehensive lesson in how to create terrain using a height map and relates that construction to the real-world design challenge of creating wheelchair-accessible landscapes.

Chapter 6: 3D Modeling, 2D Graphics, and Data Visualization

Beginner to intermediate levels

This chapter is about modeling with the inworld tools and prims (primitive objects), as well an introduction to designing with mesh models. Also discussed are methodologies for creating and utilizing textures, transparencies, and animated textures for efficient building and clarity of effect.

Project: Designing a data visualization environment: your 3D timeline or personal infographic. In this project, you will make a 3D timeline. 3D mesh model content for the basic milestones, like Work (briefcase) and Love (a heart), is provided, in addition to an info button, and a pushpin icon for adding points of interest. This project is designed to be open ended so that anyone can add their personal images, memory items, or web links.

Chapter 7: Color, Particles, and Sensory Spaces

Beginner to intermediate levels

In this chapter, many aspects of color are discussed, including color basic terminology, color mixing, period and culture-based color, and how color choices will impact the experience of virtual spaces. Particles and particle systems for Second Life and OpenSim-based virtual worlds as well are examined, along with how to design for their inclusion in the environment.

Project: Designing a colored light and particle effect. In this project, you will learn about color and how to use a basic particle script to create a color and light show within a virtual cocoon-like sensory space designed by Tim Widger. The goals of this project are to demonstrate the use of color with the creation of a prim-based structure containing a simple particle system and light sources. When you have finished this project, you will have an experimental space to test and observe color, lighting and particle effects.

Chapter 8: Lighting in Virtual Environments: Second Life and OpenSim

Beginner to advanced levels

Chapter 8 challenges the reader to think about and perceive 3D lighting in a new way. Starting with the fundamental structure of what lighting does in a virtual world, the chapter progresses through lighting methodologies, environmental lighting effects, shadows, and ambient occlusion. Types of lighting rendering are discussed as well as basic lighting setups like portraits, night scenes, and product shots.

Project: Lighting three basic scenes in Second Life and OpenSim. In this project, you will re-create and examine the structure of three basic lighting setups: a portrait, night scene, and a product shot.

Chapter 9: Cameras and Collaborative Spaces (the Ideagora)

Beginner to intermediate levels

In Chapter 9, the reader's attention is directed toward the importance of cameras in a virtual world and how they relate to storytelling, narrative, and social interaction. Aspects of

first- and third-person cameras are discussed, along with new interfaces driven by touch and voice. The concept of an Ideagora is introduced as a place where the old idea of a marketplace meets the modern idea of crowdsourcing and virtual spaces.

Project: Installing and personalizing an Ideagora for your team. In this project, you install the Ideagora content and set it up for media viewing. The content is customizable to suit your meeting or demonstration area needs.

Chapter 10: Virtual Goods and Design for Virtual Shopping Environments

Beginner to intermediate levels

Chapter 10 is about making a retail environment in a virtual world. Marketing in a virtual environment is demonstrated, as well as how to design your own virtual brand. Finally, the aspects of building your own virtual store and how that relates to all of the other aspects of the virtual environment are demonstrated.

Project: Designing and building a Pop-up shop. In this project, you will assemble a series of modular components to make a Pop-up shop in your region. The project will explore all the basic aspects of virtual retail, including how to set up the land for search engine optimization, building a Pop-up shop from modular components, and adding interactive elements to respond to your customers.

Chapter 11: Sound Design for Virtual Spaces

Beginner to intermediate levels

In Chapter 11, the aspects of sound, sound design, and accessibility (Design for All) are discussed in terms of how they relate to a virtual environment. Sound creation and sound editing are discussed, as well as how to plan for a soundscape in the virtual environment.

Project: Designing an audio-based role-play/gaming environment. In this project, you will create a sound-based game. This game is loosely based on the Norwegian fable of “Three Billy Goats Gruff” and challenges you to make a sound-based game enclosed in an environment that can only be navigated by following sound cues. This project will teach you about sound design, and a nonvisual approach to game design.

Chapter 12: Avatars and Nonplayer Characters

Beginner to intermediate levels

The avatar and its importance in virtual worlds are examined in Chapter 12. Design considerations for an avatar presence and how nonplayer characters can be used in design are discussed.

Project: Setting up a basic avatar in a virtual environment. Even with the increasing use of premade avatars in virtual worlds, the knowledge of how to set up a basic avatar is a valuable skill to have. In this project you will work with shape, body, and clothing layers on the standard avatar mesh body.

Chapter 13: Prototyping for the Real World in a Virtual Environment

Beginner to advanced levels

Chapter 13 dives into the prototyping methodologies available in virtual environments. Prototyping for math, science, military projects, architecture, entertainment, and gaming is discussed and illustrated.

Project: Prototyping a simple maze space, trying it in a virtual environment, and making a 3D print from it.

Chapter 14: Scripting Basics for the Designer

Beginner to advanced levels

Code writing or the creation of programming scripts in a virtual world is introduced in Chapter 14.

This is script writing from a design perspective and endeavors to show the virtual environment designer how to work with simple scripts and with a script writing specialist.

Chapter 15: HUDs in Virtual Environments

Beginning to intermediate levels

Chapter 15 concerns itself with heads-up displays or HUDs. Various types of HUDs and their design approach are illustrated and discussed.

Project: Creating a URL-giving HUD. In this project, you will create a simple three-button HUD that opens access to an external website while you are in a virtual world.

Chapter 16: Machinima in Virtual Worlds

Beginner to advanced levels

The basics of machinima, visual narrative, storyboards, camera use, editing, and an overview of the Phototools module in the Firestorm Viewer are included in this chapter.

HOW THE SKILL LEVELS ARE DEFINED IN THIS BOOK

For the purposes of categorizing the projects in this book by skill level, each skill category is generally described by the following broad qualifications:

Beginner skill level

6 months to 1 year of experience with a 3D modeling system (3DS Max, Maya, Blender, SketchUp, etc.) and 2D graphics program (Adobe Photoshop, GIMP [GNU Image Manipulation Program], etc.) and game-making programs like Unity.

1–3 months of active experience in an online virtual environment such as Second Life, OpenSim, World of Warcraft, EverQuest, and the like.

Intermediate skill level

1–2 years of casual experience (hobbyist or part-time user) with 3D modeling programs (3DS Max, Maya, Blender, SketchUp, etc.) and 2D graphics program (Adobe Photoshop, GIMP, etc.) and game-making programs like Unity.

3 months to 2 years of active experience in an online virtual environment such as Second Life, OpenSim, World of Warcraft, EverQuest, and the like.

Advanced skill level

1–2 years of experience on a daily basis with 3D modeling system programs (3DS Max, Maya, Blender, SketchUp, etc.) and 2D graphics programs (Adobe Photoshop, GIMP, etc.) and game-making programs like Unity.

2 or more years of active experience in an online virtual environment such as Second Life, OpenSim, World of Warcraft, EverQuest, and the like.

Please note that these are broad categories only; you may have a different skill level in 3D than you have in 2D. That should not dissuade you from trying a harder project. Always reach up and try the next-hardest level. Soon you will be looking back at a solid path of progressive skill enhancement.

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About the Contributors

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Illustrator **Michael P. Fulwiler** is a native Californian. He transplanted to New York City to choreograph experimental dance theater. While exploring 3D movement on early computers, he began to work as a freelance designer, which continues to this day. His current focus is working conceptually from design programs and attempting to bring that work to life using a variety of natural media. “Stimulate the imagination with concept, form, and color” (<http://www.kromaworks.com>).

Michael is responsible for the following illustrations, based on concepts developed by Ann Cudworth: Figures 1.1, 1.2, 1.4, 3.6 through 3.11, 4.1, 5.2, 5.16, 6.18, 6.22, 7.1 through 7.5, 8.1, 10.1 through 10.5, 11.1, 11.2, 12.1, 13.1, 15.6, 16.5, and 17.1.

1 Introduction to Virtual Worlds and Designing for Them

Education is not the filling of a pail, but the lighting of a fire.

—William Butler Yeats

1.1 WELCOME TO THE INFINITE VISUALIZATION TOOL, A VIRTUAL WORLD

Like the universe with its glittering galaxies floating over our heads on a summer night, cyberspace continues to expand, full of people like you creating worlds for exploration, entertainment, and learning. Within this three-dimensional manifestation of our collective imagination, you will find new ways of understanding time and space. Terrestrial and temporal identifiers become insignificant as you work with people from around the world. Unlike any visualization tool that precedes it, a virtual world in cyberspace provides you with a place where your creative concepts can be shared as a 3D form with the world, in any scale, at any time. Let your mind unfold to the possibilities of how a virtual platform works, and you will be rewarded with a new understanding of design and the human perception of it. Almost 2.5 billion people are in cyberspace worldwide [1], and according to KZero, the number of registered virtual world accounts has broken 1 billion [2]. Obviously, virtual worlds are here to stay, and they need people who will design and create content for them. If you are interested in becoming a virtual world designer, the virtual worlds that run on user-generated content (UGC), like the open grids created with OpenSim (OpenSimulator; http://opensimulator.org/wiki/Grid_List) or private membership grids like Second Life (<http://secondlife.com/>), are good places to start. Mesh model based content created for those worlds can also be used on game development platforms like Unity.

1.2 A SHORT HISTORY OF VIRTUAL WORLDS

Figure 1.1 is an illustrated timeline showing an overview of virtual world concepts and how the evolution of presentational devices has created the possibility of immersive virtual environments. This process started long ago, in our ancient world.

1.2.1 VISUAL THEORY AND CREATION OF THE FIRST ILLUSIONS

Let's jump into an imaginary time machine and look at how historical concepts in philosophy and observations on perception can inform us about virtual reality and the virtual worlds it contains. What is it about perception and illusion that fascinates us? Perhaps when early humans noticed the effects of a flickering campfire on the painted animals that decorated their cave walls, they began to see a story in their minds. This imaginary story was brought into being by their primitive projection technology: firelight. As civilization developed, perceptions of reality and the attempt to describe it gave rise to philosophy, which gave rise

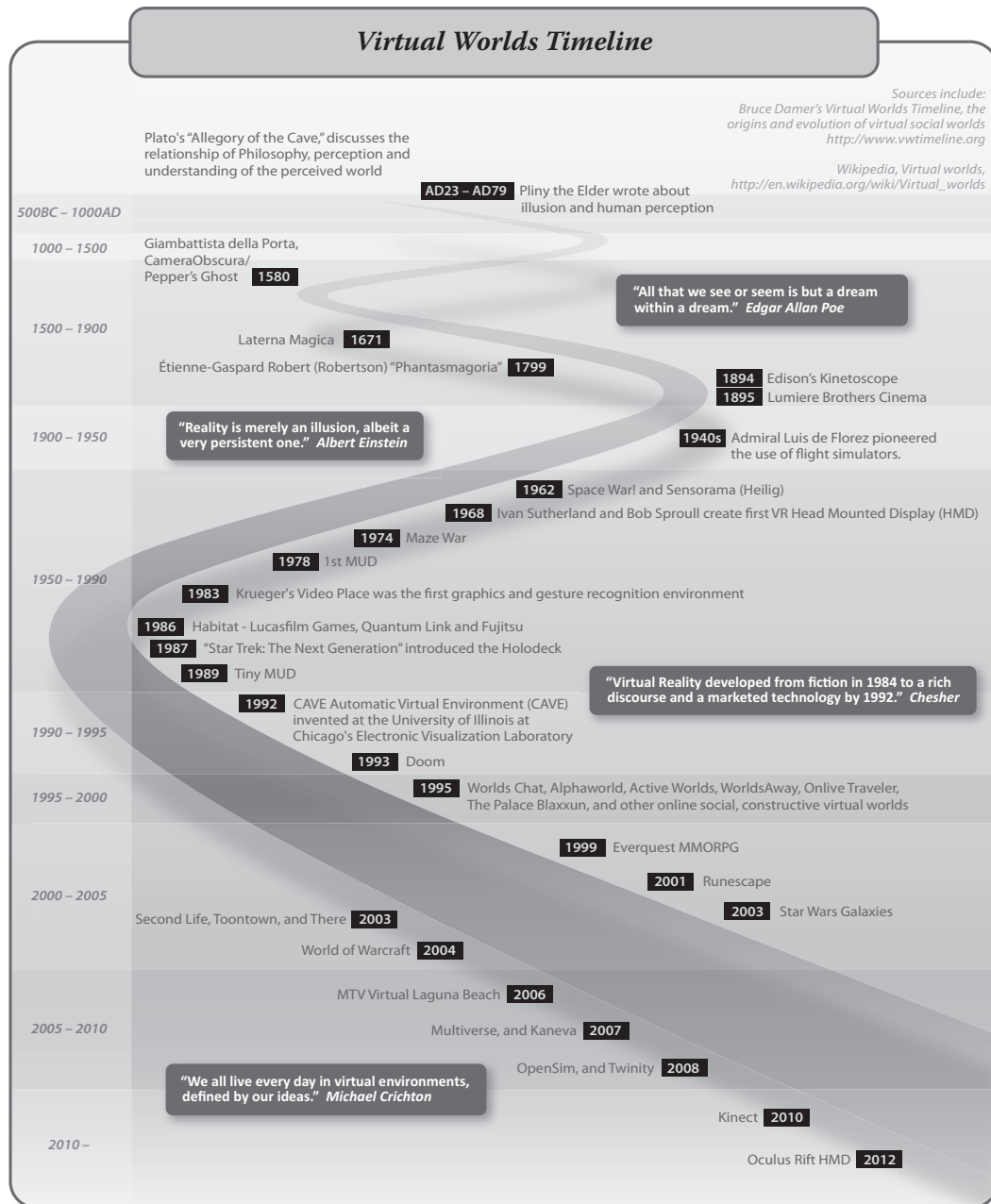


FIGURE 1.1 This timeline shows some of the key ideas, devices, companies, games and projects that have contributed to the development of virtual environments as we know them today.

to theories, experiments, and debate. Early concepts about the nature of reality and virtual reality may have started with Plato (approximately 424–348 BC) and Aristotle (384–322 BC). In his “Allegory of the Cave,” Plato constructs a model for reality and how it is perceived [3]. Within the allegorical environment of a dark, deep cave, he describes four kinds of individuals: prisoners, puppeteers, the released prisoners, and observers, all experiencing a different reality. The prisoners are chained to a bench and forced to watch a shadow play performed by the puppeteers, carrying shapes and objects back and forth in front of torchlights. The prisoners think that the moving shadows they see and hear are reality. The third group, the released prisoners, has been unchained from the bench and, as they make their way out of the cave and into the sunlight, they are beginning the process of acknowledging that the shadows on the cave wall are not reality. The observers are standing outside the cave and learning about the sun and how it lights the world.

Plato disagreed with Aristotle regarding how humans perceived reality; he believed that the true “Forms” of natural things or concepts were imperfectly understood by humans, whereas, Aristotle believed that systematic observation and analysis could lead to the human understanding of the “Forms” of natural things or concepts. [4]. Plato’s belief that our experience was only a shadow of the real and unknowable “Forms,” represents an interesting philosophical juxtaposition to the virtual reality we create today. In today’s world, we have another kind of CAVE (cave automatic virtual environment) for virtual reality. Invented in 1992, this CAVE is a virtual reality environment made from projected images on walls surrounding a person wearing a head-mounted display (HMD); it is not a holodeck yet, but it is approaching it.

Almost 400 years after Aristotle, Pliny the Elder wrote about the origin of painting, sculpture, illusion, and human perception in his book, *Natural History*, circa AD 77–79. You can almost imagine Pliny, relaxing on the patio of his villa in Pompeii, telling the story of how Butades of Corinth, seeing a line drawing his daughter had traced on the wall from her lover’s shadow, filled it in with clay and fired the relief to make the world’s first portrait [5]. Maybe later in the evening, Pliny would tell of the painting contest between Zeuxis and Parrhasius, two great painters of the fifth century BC. Smiling at the memory, Pliny tells you of how Zeuxis created a still life containing a bunch of grapes painted so realistically that the birds flew down from a nearby tree to eat them. Seeing that, Parrhasius invited Zeuxis to remove the curtain from his painting to reveal the image. When Zeuxis tried to do that, he discovered that the painting of the curtain was so realistic, that he was fooled into thinking it could be drawn aside. Pliny concludes with the account of Zeuxis ceding victory to Parrhasius, saying: “I have deceived the birds, but Parrhasius has deceived Zeuxis” [6]. As Pliny undoubtedly noted, the creation of realistic images fascinates us, and each successive development in the visual arts has been influenced by that fascination.

1.2.2 TROMPE L’OIL, PHOTOREALISM, AND THE PROJECTED IMAGE

In the centuries from AD 1000 to 1700, great painters and sculptors discovered more ways to make illusions. Trompe l’oeil was invented, and images that could create 3D spaces in our mind’s eye filled churches and mansions. The tools to create those illusions involved the scientific analysis of perception and optics by Alhazen Ibn al-Haytham (965–1039), the observations of Leonardo Da Vinci (1452–1519) and others. In 1580, Giambattista della Porta perfected the camera obscura and another device that eventually became known as Pepper’s ghost [7]. Pepper’s ghost is named after John Henry Pepper, who popularized it in 1862 from a device developed by Henry Dircks. This ancient device finds everyday use in the television studio as a teleprompter and occasionally makes an appearance in a stage show or fashion video when they want to include the animated image of someone in the performance space.

Projected reality began with the magic lantern (mid-seventeenth century); its invention is credited to both Athanasius Kircher and Christiaan Huygens. Étienne-Gaspard Robert (Robertson) and his “phantasmagoria” (circa 1799) used the magic lantern to great theatrical effect with complex shows involving moving projectors, live voices, and elaborate arrangements of curtain masking and projection screens. In one long-running show, staged in the crypt of an abandoned Parisian monastery, he succeeded in creating the virtual reality of a supernatural world in the minds of the audience. As an eyewitness describes: “In fact, many people were so convinced of the reality of his shows that police temporarily halted the proceedings, believing that Robertson had the power to bring Louis XVI back to life” [8]. Once the lens and a reliable source of illumination were worked out, moving images and the cinema were soon to follow.

1.2.3 THE BIRTH OF CINEMA, ELECTRONIC SCREENS, AND THE START OF IMMERSIVE 3D DESIGN

On December 28, 1895, the Lumière brothers did something that changed our perception of reality again. In the first public screening of commercially produced cinema, they showed 10 short films at Salon Indien du Grand Café in Paris [9]. Later that year, one film in particular captured the public’s imagination: *L’Arrivée d’un Train en Gare de la Ciotat* (“The Arrival of a Train at Ciotat Station”). By setting the camera intentionally close to the tracks, they captured a dramatic image of the train as it progressed diagonally across the screen, from long shot into close-up shot. There were many other creators of motion picture devices at the time, including Thomas Edison with his kinetoscope (circa 1891), but the Lumière brothers are credited with being the first to see the potential for cinema and modern filmmaking. They went on to develop and establish many of the filmmaking techniques and cinematographic methodologies that are still used today.

Many of the modern imaging devices have long histories. The ancient Romans, in their time, created wonderful mosaics. They also created a conceptual model for the functioning of a computer screen—the concept of producing an image from many small colored dots, tiles to them, pixels to us.

At some time at the end of the nineteenth century, photographic manipulation began to appear; the Maison Bonfils Company connected four aerial photographs to create a panorama of the city of Beirut, Lebanon. Another step toward illusionary immersion was made and is now shown in the 360-degree panoramic stereographic projections stitched together from dozens of images and seen all over the World Wide Web today [10].

1.2.4 COMPUTER-CREATED 3D SPACE AND EARLY VIRTUAL WORLDS

The war years gave virtual reality and the means to create it a big boost. Admiral Luis de Florez (1889–1962), who fought in both World War I and II, pioneered the use of flight simulators to save pilots’ lives. Military usage of virtual reality and training simulations continues to this day and now includes the use of virtual worlds built on OpenSim platforms and others [11]. In 1962, Morton Heilig built the Sensorama device. It was described by a witness this way: “The Sensorama was able to display stereoscopic 3D images in a wide-angle view, provide body tilting, supply stereo sound, and also had tracks for wind and aromas to be triggered during the film” [12]. Shortly afterward, Ivan Sutherland, working with Bob Sproull, developed the first HMD (head mounted display) and called it the “Sword of Damocles” because of the great elongated cable and arm hanging above the head of the wearer. With this device, they opened the door to full-immersion virtual reality [13].

Meanwhile, haptic devices were being developed at the University of North Carolina’s Haptics Research Department; in the late 1960s through the early 1980s, devices like Grope I, II, and III and the Sarcos Arms were created there. At the AT&T labs, Knowlton’s virtual push-button device was built. It projected a virtual graphic of symbols on a half-silvered screen above the hands of an operator using a keyboard, effectively combining the virtual with the real [14]. More developments in virtual reality physical feedback (haptic) interfaces started to happen in the 1980s. The Sayre Data Glove (developed at the University of Illinois with a

National Endowment for the Arts grant) lead to the Mattel Power Glove. Thomas Zimmerman, Jaron Lanier, and Scott Fisher met at Atari and later worked on the VPL glove [15].

At the same time, virtual worlds were being created in computers and in the early versions of the Internet. In 1974, Maze War was created, an early ancestor of the first-person shooter game; this included the first appearance of avatars, game space maps, and a first-person 3D perspective within the game space [16]. By 1978, the first MUD (Multi-user Dungeon) arrived. Known as the “Essex MUD” and played on the Essex University (UK) network, it ran until late 1987 [17]. The Essex MUD was a text-based game, creating a “constructivist” approach to virtual reality by allowing the players’ imagination to construct the virtual world as they role-play with others online. Also notable was Krueger’s Videoplace, created in 1983. It was the first graphics and gesture recognition environment [18].

1.2.5 GAMING AND VIRTUAL WORLDS

By 1986, Lucasfilm Games, Quantum Link, and Fujitsu had opened “Habitat” [19]. This was a significant step toward creating online gaming communities in virtual worlds. The imagination of the public and the appetite for immersive virtual worlds was stimulated by the appearance of the holodeck in *Star Trek, the Next Generation* (1987) [20]. MUDs were reinvented with the appearance of TinyMUD in 1989. This codebase, which created a socially oriented MUD, was based on player cooperation rather than competition and opened the door for socially based virtual worlds [21].

The early 1990s saw the invention and construction of the first CAVE at the University of Illinois in Chicago (1992). In the CAVE, all the technologies that had come before it were combined into one powerful device, creating intense immersive experiences. Still active today, the CAVE has video images projected in stereoscopic 3D. When they are inside it, visitors wear an HMD containing stereoscopic LCD (liquid crystal digital) shutter glasses to view the environment. Sensors collect information about the location and body position of the visitor and adjust the projection fields accordingly [22]. In 1993, Doom started the craze for gamers’ first-person shooter games, creating the foundation of a gamer subculture, and was played by over 10 million within the first 2 years of its appearance. Full of graphic violent imagery, Doom has been named one of the 10 most controversial games of all time by Yahoo Games [23].

The mid-1990s ushered in a wave of online, socially based, constructive virtual worlds; among the most popular were, Worlds Chat, Active Worlds, and WorldsAway [24]. Although it seems impossible these days, these worlds functioned on a dial-up connection. In 1995, the ban on commercial usage of the Internet was lifted, and a home-based connection to more sophisticated games became possible. Eventually, broadband cable and Internet connections became available, paving the way for increased popularity of online gaming and virtual worlds [25]. EverQuest and Runescape were early members of the online virtual world MMORPG (massively multiplayer online role-playing game) category [26]. Soon, large, established games and entertainment franchises like World of Warcraft and Star Wars created their own virtual worlds [27]. Also in the early 2000s, the virtual worlds of Second Life and There combined social connection with user-generated content that could be bought and sold in the virtual world market [28,29]. As the midpoint of the second decade of this century approaches, increasing interactivity and immersion is being interwoven into the online home-based experience of virtual worlds. Many game makers and virtual world developers are striving toward creating an open game, one without levels or barriers that creates a compelling story through the emergent play of its visitors [30]. In 2007, OpenSimulator (or OpenSim, the abbreviation used in this book) arrived and started the creation of a system of virtual world grids, the foundation of a 3D Internet. This software, based on the Second Life protocols, does not seek to be a copy of Second Life; it seeks to expand the virtual worlds’ Metaverse and provide connectivity among them all [31]. Kinect for Xbox 360 has been hacked to capture real-time motion tracking, and the Oculus Rift HMD holds promise for eager customers

looking for immersive visual feedback in their virtual worlds [32]. There is undoubtedly much more to come, and for you, a designer of virtual environments, great challenges await.

1.3 HOW DO THEY WORK?

The best way to understand a virtual world is to visit one. There are hundreds of public virtual worlds online that allow access free of charge or through a subscription. A list of the most popular virtual 3D worlds includes Active Worlds, Minecraft, OpenSim-based worlds, Second Life, and The Sims Online.

Essentially, virtual worlds are persistent 3D spaces defined inside of a computer program running on a server. When you log out of one, the place still remains, it is “persistent,” cycling through its daily settings and hosting other visitors to its location. Figure 1.2 shows the generic structure shared by most user content-generated virtual worlds such as OpenSim and Second Life. As you can see, even this bare-bones description is fairly complex. When you want to enter this world, you start with the viewer (or client) interface. This is a program that you download and run on your computer. For the purposes of this book, the Firestorm Viewer was selected since it is the most popular one and provides a customized setup for use in OpenSim as well as Second Life.

Assuming that you have set up an avatar account previously with whatever virtual world you would like to visit, let’s look at the process of entering a virtual world.

After you have launched the viewer and logged in to your avatar account, your user name and password are verified by the login service, and if the account is valid, the avatar’s last location or home location coordinates (x , y , z) are found on the land map of the world. The login service coordinates with the viewer so that the avatar can view the region it is entering and tells the simulator (sim) to expect an incoming avatar. Once the avatar starts to appear, you can see the landscape on your screen and your avatar standing on it. You are now in the simulator, and it is busy telling the grid service that you are there and that all the simulators around your location should share their data with your avatar and viewer so you can look over at them. There is lots going on in the simulator; it is the central backbone and a switchboard for information being sent to and received from your avatar. The simulator is also running lots of calculations in its physics engine to help objects and your avatar have realistic physics, like keeping your feet on the ground, providing solid walls and open doorways, letting coconuts from the nearby palm tree fall with a soft thump and roll around. The simulator is also keeping track of the objects in your inventory as well as the other assets in the region. This includes information about who made the content you see, who currently owns it, and what kind of permissions they have to modify it, sell it, or give it away. As you build stuff, especially large items like buildings or mountains, the simulator talks to the map database in the grid service, and that updates the look of your sim on the land map, which is shown in the viewer. The simulator also relays information to other servers and services that keep track of who owns land, especially if it is divided into parcels. It relays information about the lists of your friends and groups, what your social/privacy settings are, and other sorts of details regarding your environment and affiliations.

In 2011, a group of fearless explorers called the Alchemy Sims Builders set off across the Metaverse in search of more space and land they could call their own. They settled in on a server maintained by SimHost (<http://www.simhost.com>) and established the Alchemy Sims Grid (ASG), a 16-region grid accessible via the hypergrid (grid.alchemysims.com:8002:triton). Most of the content and pictures taken for this book were made on this grid, which runs OpenSim 0.7.5. In Figure 1.3, you can see what the “back end” of the system looks like on a computer screen. As you can see there are 17 windows open all the time; 16 of them are for the various regions on ASG, and 1 is for ROBUST, which coordinates the whole grid. Having a system like this gives you the god-like power to make quick and dramatic changes to your terrains, create avatar accounts and such. It also requires that you exercise responsible behavior and dedication to maintaining the persistence of the grid. At least once a month, there are server updates that shut the server down, so you will

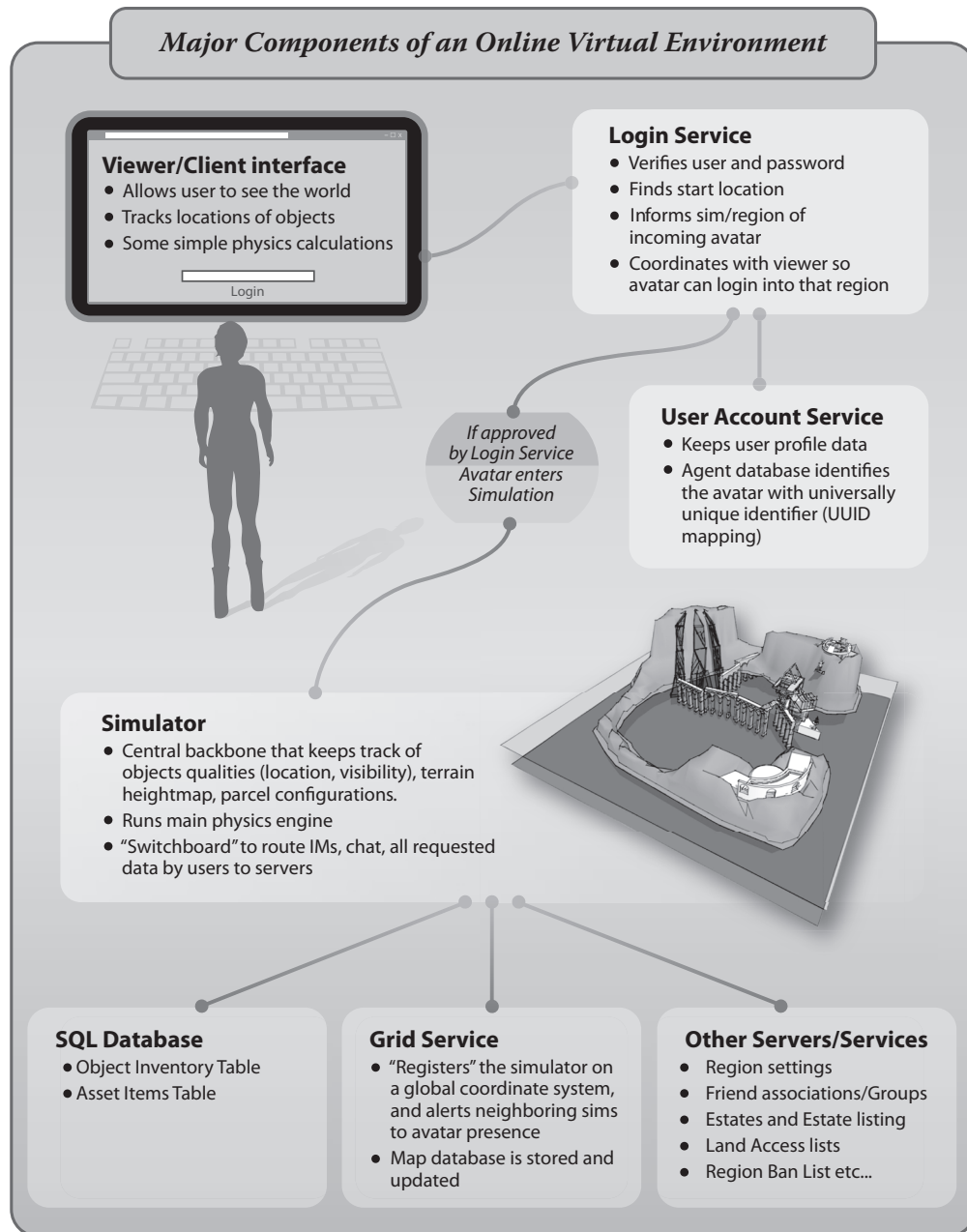


FIGURE 1.2 This is a diagram showing the major components of an online virtual environment, and how these components interact to bring the virtual environment experience to the user.

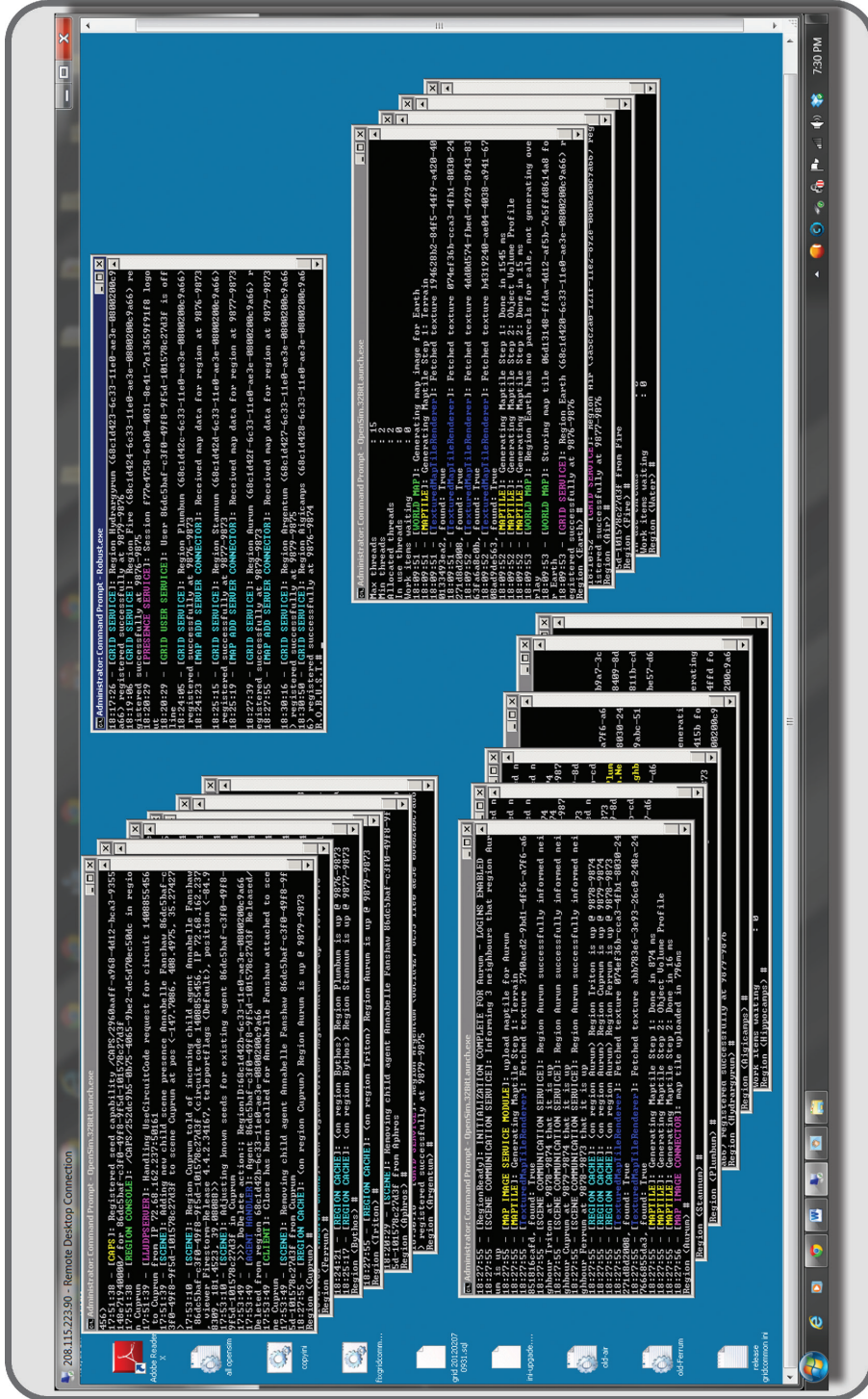


FIGURE 1.3 This is a screen grab of Alchemy Sims Grid server shown via a Remote Desktop Connection login. On the screen are 17 command line windows, one each for the 16 regions of the grid, and 1 for the ROBUST. (Redesigned OpenSimulator Basic Universal Server Technology) program that manages them. Alchemy Sims Grid can be reached via the Hypergrid address of grid.alchemysims.com:8002:triton.

need to know how to restart everything. This is especially true if you share the simulator with other people or have it attached to the hypergrid. They may have plans to build something that day, and if the simulator is down because of the updates or upgrades, that becomes frustrating. Furthermore, never forget that this is alpha software right now, so many weird and unpredictable things will happen. You will need to be diligent in backing up content and reminding the other users on your grid to do so as well.

1.3.1 SO MANY WORLDS, SO LITTLE TIME

There are many kinds of virtual worlds and the grids they contain; as a designer, you should visit as many as possible to see what the grid “culture” is and how things are organized. Another excellent way to keep up with virtual worlds is to follow blogs like New World Notes (<http://www.nwn.blogs.com>) and Hypergrid Business (<http://www.hypergridbusiness.com>) and set up some Google alerts about virtual worlds and virtual design so you receive links to all the latest news in your e-mail.

1.4 WHO USES VIRTUAL WORLDS AND HOW THEY USE THEM

The topic of virtual worlds and who uses them is always under exploration by researchers. Rutgers University conducted an online survey about worlds with UGC (user generated content) and posted some of the initial results (<http://player-authors.rutgers.edu/>). If you are new to virtual worlds, you would probably like to know how other people use them. An alphabetical set of thumbnail reports about how they are used in various sectors and some specific instances of each is listed below.

1.4.1 ARCHITECTS/LANDSCAPING DESIGNERS

Architects and environmental designers like Jon Brouchoud (<http://jonbrouchoud.com/>) and David Denton (<http://www.daviddenton.com/>) utilize virtual worlds like Second Life and OpenSim and the gaming platform Unity. In these worlds, they work with prototyping building designs, building site planning, and developing 3D models of both real and virtual worlds.

1.4.2 ARTISTS/PAINTERS, SCULPTORS, DANCERS, ACTORS

The number of artists/painters, sculptors, dancers, and actors working in virtual worlds is huge. There are many performing arts groups in Second Life and OpenSim, and the creation of spectacular scenery and performance spaces is standard fare. Linden Endowment for the Arts (<http://lindenarts.blogspot.com/>) provides grants for full-region builds to artists and creators on a regular basis. In general, the folks in this category use virtual worlds for design planning, performance, environmental art, sculpture, game design, and gallery displays.

1.4.3 ENGINEERS/MEDICAL PROFESSIONALS

Ever since their beginnings, Second Life, OpenSim, and Unity have displayed virtual versions of engineering problems, chemical modeling, medical models of the human body, and medical care facilities. Pam Broviak is a licensed civil engineer (state of Illinois) who utilizes virtual worlds for engineering training. Currently, she is working on developing virtual builds to simulate the layout and performance of civil engineering designs and plans, educational environments to teach civil engineering concepts, and a virtual learning and reference environment for local government. Other members of this category use virtual worlds for physical engine studies and structural 3D design.

1.4.4 DESIGNERS, SET DESIGNERS, INTERIOR DESIGNERS

Richard Finkelstein, (<http://www.rfdesigns.org/>), a professional set designer and set design teacher, uses virtual worlds for prototyping real scenery, teaching set design principles, and designing scenery for virtual performances. Other set and interior designers use virtual worlds for space planning and color studies.

1.4.5 SCIENTISTS AND MATHEMATICIANS

Scientists like Andrew Lang (<http://journal.chemistrycentral.com/content/3/1/14>) have used virtual worlds like Second Life to demonstrate the structure of molecules for chemical models. J. Gregory Moxness (<http://theoryofeverything.org/MyToE/>) uses virtual worlds to demonstrate models of E8 math, making the conceptual visible and beautiful.

1.4.6 TEACHERS IN PRIMARY, SECONDARY, AND GRADUATE SCHOOLS

Teachers in primary, secondary, and graduate schools quickly recognized the value of virtual worlds. Jokay Wollongong (<http://www.jokaydiagrid.com/about/>) started with Second Life and now has branches of her educational virtual worlds in OpenSim and Minecraft. Jokaydia, her grid in OpenSim, is made for teachers and their classes in grades K–20 and shares resources across the grid. Since 2009, Kenneth Y. T. Lim (<http://voyager.blogs.com/about.html>) has developed the Six Learnings curricular design framework, which has been used to inform the conceptualization, design, and development of a series of lessons that leverage the affordances for learning with the use of immersive environments in the Singapore school system. Teachers use this “Six Learnings” program in Singapore with virtual worlds to help students deepen their knowledge of and to examine their intuitions about local environments, as well as to prototype their creative works and to plan the productions and staging of dramatic performances.

1.4.7 TRAINERS AND THERAPISTS

Virtual worlds are invaluable for training, simulations, and therapy. Silicon Valley Media Group’s First Responders Simulator utilizes them to create training and practice scenarios for disaster workers and emergency response teams. SVMG, headed by Cynthia Stagner, also develops simulation environments for hazardous occupations, in fields such as utilities, law enforcement, and industrial manufacturing. Other trainers use them to teach languages, practice acculturation for military deployment, and teach military strategy. The therapists working in virtual worlds find that the results are comparable to or better than a real-life meeting with their clients, as they counsel them on motherhood, post-traumatic stress disorders (PTSDs), and even weight loss. Patti Abshier works in Second Life to assist counseling professionals who provide counseling using virtual worlds. Other uses are role-playing for cognitive therapy, technical systems training, and medical training.

1.5 VIRTUAL ENVIRONMENTS FROM A DESIGNER’S POINT OF VIEW

What are the challenges to a designer on a virtual environment project? In some ways, they are exactly the same challenges of a designer in the physical world.

The primary challenge is to keep the client happy by helping define and present his or her message and supporting those efforts within a positive working environment including you and your team. A happy client is a flexible client, and a flexible client will give you the design latitude you need to be creative.

The secondary challenge is to be professional in your demeanor and work ethic. This means that you have taken the time to learn your craft and the working rules involved with your community, and that you strive to maintain the highest professional standards possible.

The tertiary challenge is to understand the needs of people, how that affects the accessibility of a virtual world, and the principles of Design for All.

1.5.1 DEFINING THE JOB OF A VIRTUAL ENVIRONMENT DESIGNER

At present, there is no union or guild of virtual environment designers to codify the job description or set the working practices, but you will probably want to have those defined in any letter of agreement you have with a new client. A good definition to include in your paperwork would be the following:

The virtual environment designer shall be responsible for the creation of the following: (1) creative concept representations, including sketches, models, and descriptions that pertain to the client's stated list of requirements for the environment; (2) subsequent rough preliminary 3D models and iterative progress representations as the design process progresses; and (3) the final environment in a virtual space, including all of the following items: terrain, landscaping, buildings, scripted objects, lighting, and sound elements.

You may also want to add in avatars and other kinds of special objects like vehicles if that is what you want to design and the client has requested it.

1.5.2 BEING A DESIGNER "IN THE KNOW"

As a designer of virtual environments, you should be well versed on the differences and similarities of various virtual platforms. One of the first questions to your client should be: "How many virtual worlds do you want to see this environment on?" If you have been designing for a while, especially if you started before early 2008, you are probably aware of the options provided by OpenSim and Unity. Each platform has created a paradigm shift in design thinking for virtual environments, and as a "metaversal" designer, you need to be aware of that. Figure 1.4 is a schematic drawing displaying some of the differences between Second Life, OpenSim, and Unity in terms of terrains, inventory backup, and content creation. A designer who is "in the know" plans for these differences so that if the client decides to change platforms, the designer is ready to go with it.

1.6 DESIGNING IN A PREEXISTING VIRTUAL WORLD OR MAKING ONE YOURSELF

The decision about where to build your first design for yourself or a client should not be taken lightly. There are many options, so you will need to do your homework regarding what these can provide and match them to your project's needs. Essentially, there are two basic categories: (1) prebuilt grids (or hosted grids) that allow you to have land regions, modify terrain, and create content that is hosted on someone else's server and (2) "do-it-yourself" virtual worlds that you install, run, and build on your own server or computer. Let's look at these and some examples of each.

1.6.1 PREBUILT GRIDS/HOSTED GRIDS

The category of prebuilt and hosted grids includes the "full-service" grids like Second Life (<http://www.secondlife.com>) and over 200 OpenSim-based grids, such as 3rd Rock Grid (<http://3drockgrid.com/>),

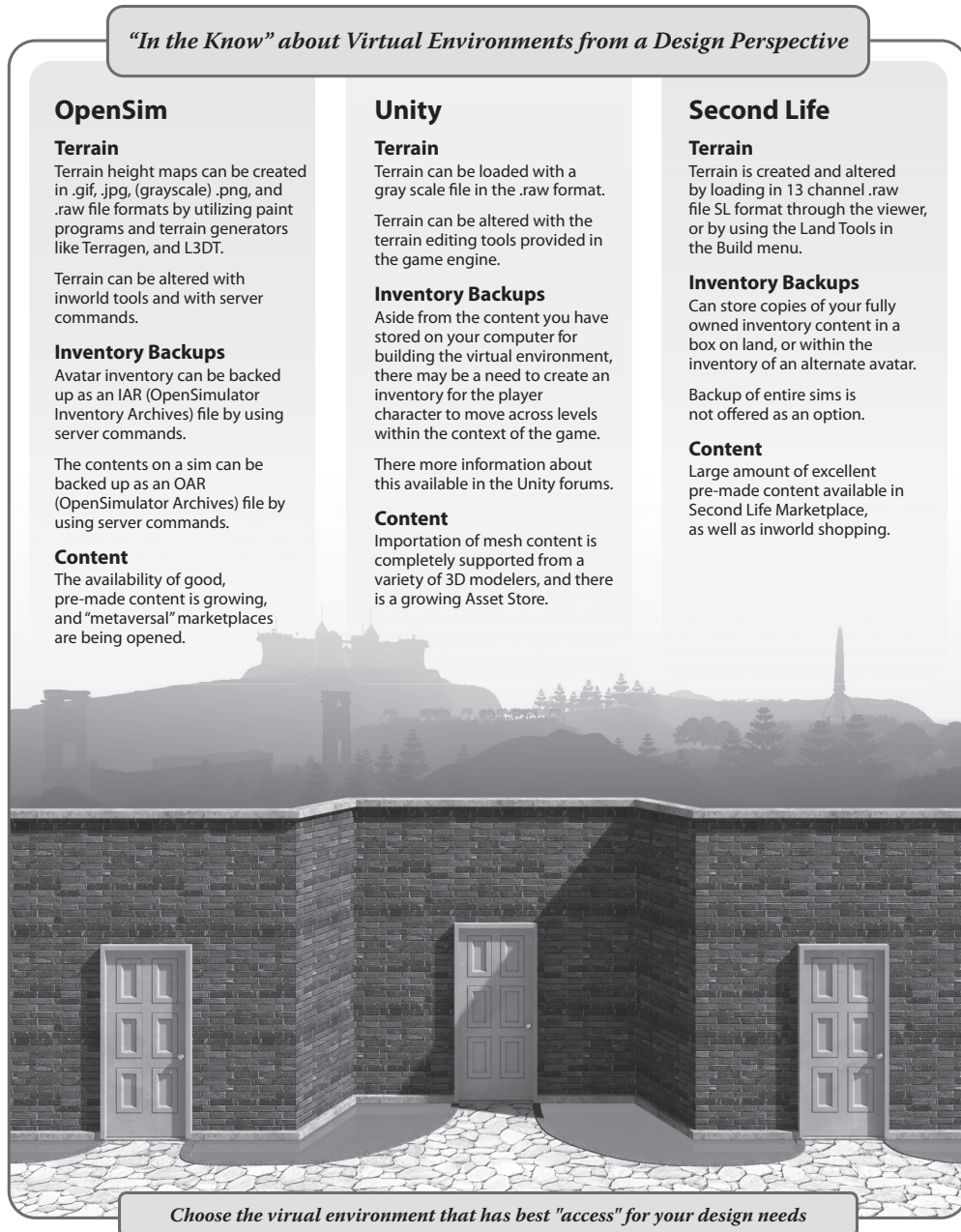


FIGURE 1.4 A diagram comparing some of the key features of 3 popular online virtual environments available for a designer to utilize. Two of them, OpenSim and Unity, are free to download and use. Second Life charges fees for membership and land usage.