

ARTISTS AND ISSUES

IN THE THEATRE

Theatre in Cyberspace

Issues of Teaching,
Acting, and Directing

EDITED BY
STEPHEN A. SCHRUM

i.e. VR:
Experiments in New Media and Performance

Lance Gharavi

The technical director sighed as she looked out over the empty seats of the theatre. The audience that had packed the house less than an hour before had left, leaving the scent of raincoats and perfume to mingle with the smell of musty upholstery that always seemed to linger in well-worn roadhouses like this one. It had been a successful run. They had sold out every night. By this time tomorrow they would all be on their way to Chicago for three weeks. Or was it Detroit? She couldn't remember. It didn't matter. The drivers knew, and she had more urgent business to attend to.

Striking the set.

She ambled down the aisle eyeing the Brobdingnagian scenery for the smash-hit musical that had broken so many sales records on Broadway. The soda cans as large as trash barrels, the mammoth railroad suspension bridge, the titanic chandelier now lying shattered on its side in one corner and behind it all, the gargantuan barricade that turned and turned like some nightmarish, Dickensian lazy-susan, all of it had to be in Chicago (or Detroit) the following evening. She glanced at her watch. They had twenty minutes before they had to be out of the theatre. She flirted briefly with the idea of grabbing a cup of coffee before strike but shrugged the idea off as she climbed the stairs to the apron. She'd had enough caffeine for one day. As she stepped onto a clear patch of stage, the spot where the helicopter landed in Act III, she heard a crunching sound. She looked down to see a pair of dark plastic glasses lying broken beneath her heel, apparently discarded by an audience member and missed by the ushers. She reached down to retrieve them and absentmindedly slipped them into the pocket of her jacket where they clicked against her own, identical, pair.

"Everything okay?" a voice said.

She looked up. It was the stage manager.

"Everything's fine," she smiled. "Let's pack it up."

As she walked backstage, the stage manager turned to his computer terminal. On the screen, a fully rendered color image of the set hung beneath the menu bar. He reached for the mouse and selected Quit from the file menu. The image on the screen vanished. Quickly, he punched through another series of commands, ejected a disk, and shut down the computer.

"Here you go," he said, handing her the disk. "Why don't you head out. I'll bring the computer."

"Thanks," she said, shoving the disk into her pocket with the two pairs of glasses. "Go ahead and pack it away. We won't need it for awhile. Chicago's got their own unit." She turned to go but paused to look out onto the stage.

The *bare* stage.

The set was gone.

She shivered slightly, cursing herself silently as she did so. She should be used to it by now, but it always gave her a mild case of the creeps.

"Oh, we'll need it," the stage manager said behind her.

She turned to face him. In her pocket, the scenery of the smash-hit musical rattled against the glasses.

"We're in Detroit tomorrow," he said.

The preceding story is a work of science fiction. What follows is not.

The story provides an example of the possible future applications of computer technology to the art of theatre and performance. Much of what is currently being done in the field of cyber-theatre involves techniques far more revolutionary than the projection of pixel-constructed representations of scenic elements that have already found their way onto the stage via more traditional avenues (i.e., actual construction).

Far from being limited to a single kind of endeavor or any single theory of theatre, performance, or presence, cyber-theatre has become, and is continuing to evolve as, a delightfully eclectic field of performance. In the early 1990s, Joseph Bates' Oz Project, a collaboration between the School of Computer Science and the Drama De-

partment at Carnegie-Mellon University, broke new ground in creating real-time, interactive, dramatic narratives. George Coates continues to dazzle audiences with his narrative collages of live actors, 3-D video, slides, computer animation, and real-time fractal generation. The Gertrude Stein Repertory Theatre has received a great deal of attention for their innovative work with Stein's *Dr. Faustus Lights the Lights*. This GSRT production integrated live actors with 3-D projected sets, remote actors interacting via video conferencing and chat windows, and animated characters created using Life-Forms software. The GSRT has since broadened their experiments, building a number of educational web sites dealing with aspects of international theatre and dance practices. Numerous groups and individuals have created interactive performances over the Internet using, among other things, CU-SeeMe video conferencing software. Text-based interactive productions in chat-rooms and MOOs—particularly the ATHEMOO—have pushed the limits of the Internet and expanded current conceptions of performance. At the Banff Centre in Canada, Brenda Laurel, Rachel Strickland, Toni Dove, Michael Mackenzie, and many others have been particularly active in creating interactive art and narratives using virtual reality and other technologies.

At the University of Kansas, designer Mark Reaney, has been experimenting with computer applications for the theatre since coming to KU in 1987. In the Spring of 1995, Reaney, in collaboration with director Ron Willis, brought to fruition *The Adding Machine: A Virtual Reality Project*. This production, perhaps the first of its kind, was an attempt to integrate an established script—in this case, Elmer Rice's expressionistic masterpiece, *The Adding Machine*—live actors, and virtual reality technology. This production spurred the creation of what was to become the Institute for the Exploration of Virtual Realities (i.e. VR), a group of individuals operating within the University Theatre at the University of Kansas and dedicated to experiments in new media and performance. Since the production of *The Adding Machine: A Virtual Reality Project*, i.e. VR has produced two other major experiments integrating traditional means of theatre production with virtual reality. Before launching into a description of these experiments, it seems appropriate to briefly discuss the nature of virtual reality itself.

When *The Adding Machine: A Virtual Reality Project* was initially proposed and later accepted as part of the University Theatre's 1994-95 season, it raised many eyebrows and turned many heads on campus and later, as word of the production spread, around the world. The widespread notoriety of this project owes much to its innovative nature but also to its association with the term "virtual reality" and that term's ambivalent yet "sexy" status in contemporary culture. Fictional representations of virtual reality technology such as the holodeck on *Star Trek: The Next Generation* and the movie *The Lawnmower Man* frequently promote a utopian/dystopian ambivalence towards virtual reality while at the same time exploding the public's expectations far beyond the current capabilities of the technology. Media over-hype has reinforced this ambivalence by alternatively touting VR as the most significant technological discovery since the invention of fire and as merely a collection of disappointing graphics combined with nausea-inducing vertigo. Despite, or perhaps because of, the massive amount of media attention garnered by virtual reality, many people remain confused as to just what virtual reality really is. While working on *The Adding Machine*, I was frequently asked by curious students, "So, is the audience going to wear those helmet things?" Virtual reality helmets or head-mounted displays (HMDs) have become the cultural icons by which many people recognize virtual reality. Yet many other types of user interface devices, including polarized glasses, projection rooms, shutter glasses, and even video monitors, are used to access virtual environments.

Despite all the confusion, the question, "What is virtual reality?" is easily answered. Defining virtual reality is as easy as defining "theatre" or "performance." One has merely to open up the pages of any theatre or performance studies journal to realize that scholars and artists are constantly defining these terms. The difficulty lies in getting various parties to agree on a given definition and generating a definition that avoids the exclusionary imposition of sterile, reifying boundaries.

For better or for worse, it is generally accepted that virtual reality is necessarily computer related. That is, it depends on a computer to generate some kind of sensory matrix or artificial environment, even if that matrix or environment consists only of a single object or

shape.

Another defining aspect of virtual reality is its immersive quality. Immersion has little to do with the user's belief that they are actually in the computer generated environment (for one would certainly have to question the sanity of anyone who actually *believed* that they were skulking through the world of the popular and violent virtual-reality game, Doom) and more to do with the way in which they experience it. The user visually—and sometimes aurally and tactilely—experiences a virtual environment *as if they are actually in it*, that is, from a first-person perspective. In addition, they must also be able to interact in some way with the environment. The user must be able to make the environment respond to their actions in real time.

Most of those working in the field of virtual reality would agree that VR systems must be interactive. As Brenda Laurel notes, the term "passive VR" is necessarily an oxymoron (199). However, the term "interactive" is slippery and resists most attempts to converge upon an authoritative definition that classifies events, objects, and actions in either/or terms. For our purposes, it is perhaps more useful to refer to interactivity in terms of a continuum (either more or less interactive) rather than disjunctively (interactive or non-interactive).

Other aspects of virtual reality systems that must be thought of in terms of degrees or a continuum include: image complexity, the degree of detail in which the objects in a virtual environment are rendered; field of view, the breadth of the users visual scope within the virtual environment; and update rate, how quickly the computer can change the image in relation to the user's actions and changing point of view. These three aspects are closely related. An increase in the image complexity and/or field of view increases the amount of data the computer must manipulate in order to alter the image, and therefore slows the update rate.

The Beginning

In the early 1990s, designer Mark Reaney began designing scenery on his computer using a virtual reality software application called WalkThrough Pro. This application, designed by the Virtus Corporation, is a brand of virtual reality software used to create architectural designs that the user can "move" through. Designing sets

using WalkThrough Pro allowed Reaney to easily change and manipulate the elements in a virtual scenic model. Changes that would take hours to realize with a scale model are accomplished in seconds using this software. This technique also allows for quickly, easily, and accurately exporting a virtual scenic model into a drafting program to produce a blueprint, or to print out a wire frame drawing for a painted rendering. By the same token, drafting and drawings can be imported from other programs to act as templates for constructing a virtual model.

Another advantage to VR-assisted scenic design is that it allows the designer to accurately check sightlines. After completing a draft of a virtual model, Reaney can don his head-mounted display and view his scenery from the wings, from onstage, from above, or from any seat in the house.

Perhaps the most useful aspect of VR-assisted design is its communicative element. The designer does not merely show the director a painted rendering or model. He or she can invite the director and the other artists involved in the production to "walk through" the set and get a feel for what the final product will look like.

Though viewing a virtual model through an HMD is a convenient way to communicate the scale of a design, Reaney remained unsatisfied. In 1993, he experimented with projecting a life-sized image of a virtual set design onto a rear projection screen in the KU's Crafton-Preyer Theatre. The purpose behind the experiment was to give the director an idea of what the set would look like when it was built and placed within the confines of the proscenium arch. It was at this point that Reaney hit upon the idea of circumventing the process of building traditional scenery and using the projected virtual design as itself, a scenic medium.

The Adding Machine

In late 1993, Reaney, and director Ron Willis, began searching for a script that would provide a context within which virtual environments and live actors could be integrated. They quickly realized a number of elements that would be important in choosing a script for this experiment. Since the VR technology could swiftly and easily accommodate changes in locale, it seemed appropriate to choose a play that demanded multiple scene changes. In addition, since virtual re-

ality allows for the creation of fantastical environments with unique physical laws, Reaney and Willis decided that it was necessary to choose a non-realistic play. As Reaney commented, "We are looking for either a well-established, canonical script or one that was written ten minutes ago for the specific purposes of this production." Both Reaney and Willis were anxious that the production avoid the stigma of gimmickry. They wanted a play that would be impacted by the use of this technology, a play that would allow them to explore the expressive and interpretive capabilities of VR, "without falling victim to either not needing [VR] in order to do the play or just having VR as a display gimmick." After many plays were considered and discarded, they finally settled on Elmer Rice's *The Adding Machine*.

The Adding Machine, a classic example of early American expressionism, was a perfect choice in more ways than one. The play's eight scenes span eight distinct locales. There is much that is fantastical, including two scenes that take place in the afterlife. The expressionistic flavor of Rice's play suggests that even the scenes that take place in an earthbound bedroom could take on a surreal quality that is handily accomplished using VR as a scenic medium. Yet what is most striking about Reaney and Willis's choice of plays is its delicious irony. *The Adding Machine* follows the adventures and misadventures of one Mr. Zero as he attempts to cope with life and afterlife in a dehumanized universe. Rice skillfully articulates a fear of humankind's dubious place in an increasingly mechanized society. In the second scene, Zero, who has worked as an accountant for the same company for twenty-five years, loses his job and is replaced by a machine. It is easy and perhaps a little alarming to appreciate the irony involved in using Rice's play as a springboard for introducing the powerful, new technology of virtual reality into the live theatre.

While still in the process of selecting a script, Reaney and Willis invited me on board the project as an assistant (or "general factotum," as Willis referred to me). In early meetings, we discussed various ways of mounting the production. Eager to maintain the conceptual purity of the VR medium we decided against using certain non-real-time media such as prerecorded video and taped computer animation sequences. We also chose to forego using any traditional scenery or even furniture as the static nature of a chair, table, or wooden cube would be unfavorably incongruous with the fluidly

changing virtual environments.

While Reaney began to assemble the virtual elements of the production, Willis was busy attending to what William Gibson's cowboys might refer to as "the meat thing"—that is, the organic part of the production: the human actors. The early rehearsals of *The Adding Machine* looked and felt much like rehearsals for any traditional production. Under the energetic guidance of Willis, the actors explored the given circumstances, objectives, and various physical and vocal techniques necessary to create vivid characterizations and a coherent fictive world. Much of the work was focused on assimilating the expressionistic style that Rice's text seemed to demand, a style foreign to many of the young actors raised on a steady diet of realism. "There is no subtlety here," warned Reaney at the first rehearsal. "If you are subtle, you will be lost in the set. We are not painting with little brushes. We are painting with rollers... Remember that at the beginning of the show, people aren't going to be looking at you. They came to look at the [VR], not at you. You have to drag their attention back to you."

One of the handicaps Willis faced early on in the rehearsal period was a lack of scenic reference points. Unlike many traditional production procedures where the scene design is finished by the first rehearsals, the designs for Reaney's virtual environments took the form of a process that lasted through final dress. The first few weeks of rehearsals were conducted without any technological augmentation whatsoever. As a result, neither the actors, nor Willis had any clear idea as to the nature of the virtual environments that would be projected behind them, the ways in which they could interact with them, or even, in some cases, whether they would be performing their roles on or off stage.

This state of affairs was not as debilitating as it might otherwise sound. The absence of any preordained environment allowed the actors enormous freedom to invent, explore, and experiment. Reaney attended rehearsals regularly and took much of the inspiration for his designs from observing the ways in which certain scenes were evolving. This created an unusual and rather backwards relationship between the actor and the design. Unlike more traditional production methods, where the actors must tailor the action of a given scene to fit with the given circumstances of the scenic elements, Rea-

ney could tailor his designs to coincide with and complement the action of a given scene as it was evolving in rehearsal.

It is important to note that all elements of this production occurred in real time. With the exception of the music, nothing was pre-recorded. The point of view within the virtual environments was improvisationally manipulated every night by the person we dubbed the VED (Virtual Environment Driver). By monitoring the live actors on stage, the VED was able to freely interact with them, adjusting for their movements and fluidly and expressively manipulating the world around them.

The production of *The Adding Machine* took place in the University Theatre's large proscenium theatre. The audience sat on the stage on a set of steeply raked platforms facing the house. In front of them, a specially constructed stage and an enormous rear projection screen blocked the view to the house. The characters in Rice's fictive world were enacted by live actors working in front of (and occasionally behind) the projection screen that acted as a display for Reaney's virtual environments. In order for the projections to be seen clearly, the light on stage had to be kept to a minimum. Fourteen-foot high towers placed in each of the wings supported follow-spots that provided most of the lighting for the live actors. The stage itself was covered with dull, black carpeting to help prevent light from reflecting onto the projection screen. There was no "actual" scenery of any kind nor were there any "actual" props. Two additional projection screens placed on either side of the main screen at a 45-degree angle displayed 3-D slide projections that augmented the virtual environments projected on the main screen and served to increase the audience's sense of immersion. The area behind the screen looked, quite frankly, more like Mission Control than the backstage of a traditional theatre. The computer and video effects were controlled by five different computers, eight monitors, two video mixers and various other electronic paraphernalia arrayed along a set of tables placed directly behind the projection screen. High atop a platform behind these tables, two theatre quality projectors and projector pads sent the stereo images from the main computer onto the projection screen. The projectors were polarized in such a way that one projector projected the right-eye image, the other, the left-eye image. During the production, the audience wore polarized glasses that served

as an interface to these projections, separating the polarized images appropriately to create the illusion of three-dimensionality. A makeshift green-screen room in one of the wings sported a video camera and acting area screened off from the audience. As actors performed in this space, the signal from the camera was split and then fed into a pair of video mixers that edited out the green background leaving the image of the actor intact. (This is similar to the way television weather persons interacts with their maps.) At certain moments during the show, the live images of these actors were mixed with the images of the virtual scenery, fed through the projector pads and projected onto the screen in such a way that the actors captured on video appeared to exist within the computer-generated, virtual environment. In addition to the "video agents," *The Adding Machine* featured "Dead Earnest," a completely computer-generated "virtual agent," that was manipulated in real-time.

We learned that the virtual scenery for this production functioned in a number of ways: as a representation of the character's actual surroundings; as a representation of a given character's psychological state from moment to moment; and as a representation of the shifting action of a scene. In scene two, for instance, the virtual scenery initially serves to represent Zero and Daisy's actual surroundings, that is, the office where they work. As Zero and Daisy work, their actions are mirrored by two actors working behind the screen. These actors cast 3-D shadows onto the screen which appear to the audience as the strangely life-like shadows of Daisy and Zero themselves. As the two begin to daydream, the point-of-view zooms back a considerable distance so that the office appears to be a tiny model in an enormous void. This not only illustrates how the characters have stepped away from their immediate surroundings to fantasize about the future and ruminate on the past, it also gives focus to the pair of shadowy alter-egos that continue to operate in "real world" office mode. Later in the scene, as the Boss informs Zero that his services are no longer needed, the figure of the Boss grows to terrifying dimensions until his laughing face all but fills the screen.

Did this experiment work? Indeed, it did. Rice's text was not lost in a barrage of technological muscle-flexing, but rather, illuminated in a highly ironic fashion. The audience accepted the integration of live and "virtual" actors, they saw meaning in the expressively mo-

ble scenery, and the production team discovered ways to capitalize on the technology without sacrificing the excitement and the essence of live theatre. Many of the most gratifying comments we received from audience members took the form of glowing praise for the live performers. They commented favorably on the broad physicality of the actors and the coherent narrative that they created within such an episodic play. Some even suggested that the production could stand on its own without the integration of computer technology. These comments seemed to imply that the audience identified *The Adding Machine* as a vivid, coherent, and synergistic performance rather than a mere display of computer gimmickry. Despite all the hype surrounding the technological aspects of this production, the virtual elements supported but did not eclipse the most important parts of the performance: the characters and the story.

This is not to downplay the significance of the innovative use of computer technology in our production of *The Adding Machine*. As we discovered in this experiment, virtual reality is not merely an element to be tacked onto a traditional theatre production in place of "actual" scenery. Rather, it opens broad new and unexplored vistas for the director and designer, vistas that require not merely a different set of technical skills and terminology, but an entirely new paradigm of thought, a new way of conceptualizing design, space, movement, spectatorship, interaction and many other aspects of theatrical performance. Thomas W. Loughlin, associate professor of theatre at the State University of New York at Fredonia, commented, "I recall sitting [in the audience of *The Adding Machine*] and thinking, 'Wow...what they did at the University of Kansas is equivalent to the introduction of stage lighting'" (Cage, 18). Such an enormous shift in conceptual frames is a process that does not occur quickly or easily. Our curiosity about the nature and direction of such a shift formed much of the impetus for our further explorations.

The Adaptation of Play

At the beginning of the following academic year, Mark Reaney and I began to discuss plans for future experiments. Though we had neither the time nor the resources to create a project as ambitious as *The Adding Machine*, and did not wish merely to replicate former projects on a smaller scale, we wanted to branch out and test new

technologies, interfaces, and ways of applying our present capabilities. One of the experiments we wanted to attempt involved integrating 3-D video into virtual worlds and allowing the audience to interface with these by means of our head-mounted displays. These head-mounted displays, manufactured by Virtual i-O, have the unusual advantage of allowing the viewer to see a 3-D-mediated image such as a virtual world or video while, at the same time, looking through that image to a live performer. All that is required for an object or live performer to be visible through the HMD is that the object or performer be sufficiently illuminated. As I was, at the time, learning to create virtual worlds using the Virtus WalkThrough software, Mark and I agreed that I would direct and design such an experiment.

As I began to look for plays to which I could apply this new technology, a number of factors influenced my choice. It was obvious, due to time and resource limitations, that a short play, or perhaps a scene from a longer play, would be appropriate for this experiment. Because we have continued to consider this technology as more usefully applied as a scenic medium to certain less-realistic styles of performance, the field of choices was narrowed significantly. As I have a certain affinity for the works of Samuel Beckett, I began to sift through some of his shorter plays in the hope of finding a work that would resonate to the application of virtual reality technology.

Beckett seemed a particularly apt choice not only because of his non-realistic style and the brevity of some of his later work, but also because of the way in which he frequently plays with the ideas of "presence," "absence," and "apparent presence." Because it relies heavily on electronically mediated images, this presence/absence continuum also plays a vital role in the performance text of almost all forms of cybertheatre. Connecting Beckett with virtual reality and thereby juxtaposing the unique problematization of presence that each generates, seemed a logical—not to mention, fascinating—direction for exploration.

I finally decided on Beckett's *Play*, a short work first produced in Germany in 1963. The play contains three human agents, a man and two women. Each of these characters is trapped in one of three urns set side by side. Only their heads protrude. Throughout the play, characters speak in response to a piercing spotlight that illuminates

them one at a time. This spot takes on the role of a fourth agent, interrogating these captives and commanding them to speak. Billie Whitelaw commented on her experience playing one of the women, saying, "I think that *Play* is a quartet, not a trio at all. The light is a very positive part, a very frightening part.... It was an instrument of torture" (Knowlson, 86).

In "traditional" productions of this work, the urn actors are live and the agent of the spot is merely a technological device. If there is any sentient agent behind the movement of the spot, such an agent is usually not visible. In my adaptation of *Play*, what I did essentially was to reverse this, making the spot a live agent and the man and two women technologically mediated agents, thereby highlighting the active role of The Spot. The characters in the urns were viewed by the audience as 3-D video images within a virtual environment. The spectators could then look through these images to witness my actions as I took on the role of The Spot. The images in the HMDs thus appeared to be superimposed over my body. The agent that manipulated the environment and demanded the characters to speak was now a ghostly but live human agent occupying a dim center stage.

As I was contemplating this new experiment, I often reflected on the role of the VED and the way in which the real-time virtual environment occupies a position of agency within the performance text. That is, since the movement of the environment is not pre-recorded but improvisationally manipulated by a sentient Driver who causes the virtual environment to interact freely with live agents, the environment becomes, in a sense, an additional agent. In *The Adding Machine*, the VED and his computer were backstage, hidden from view. The audience watching the display of computer wizardry on the screen had no substantive way of being sure that the virtual worlds were not merely pre-recorded computer animations. For this experiment, it seemed appropriate to avoid hiding the VED and the mechanism by which he or she operates. In so doing, the VED would become a more obviously active member of the performance text. The audience would be able to witness the VED manipulate the environments in real time, interact spontaneously with the other live agents, and perhaps most significant, the audience would be able to bear witness to the living presence of this additional agent.

But what other ways could the living presence of the VED impact the performance text beyond merely serving as proof that the computer images moved in real-time? By bringing the living body of the VED before the audience, he/she becomes a part of the performance text, while not necessarily occupying a position within the fictive world. Like the conductor of a pit orchestra in an opera, or perhaps like the *koken* in a Kabuki play, the VED's body and influence on the performance text is evident though no status of fictive agent is necessarily conferred. In my adaptation of *Play*, I went one step further by placing the live body of the VED at center stage as a fictive persona, thus creating a character that the audience read through the lens of the mediated world of the agents in the urns.

Due to limited availability of time and equipment, the audience for this experiment was limited to six people, five of whom were University faculty. The audience was seated in a small room facing a long table illuminated by spotlights. A confusing array of computer and video equipment covered almost every available inch of the table's surface. Before the play began, Reaney assisted his fellow audience members in donning the Virtual i-O HMDs. After an extended silence during which the audience became used to wearing these devices, I, as The Spot, entered from a door behind the table. My hair was disheveled and gray. I wore a dark, baggy suit, white shirt, and walked with a tired gait. After a few moments of fiddling with the equipment, I sat down behind the table and began to manipulate the virtual world. Superimposed over the desk, the equipment, and The Spot, the audience saw the 3-D virtual environment. Before them lay a wide open plane. In the distance, a gigantic gray urn towered above them, its top hidden by the edges of the virtual point of view. On the horizon of this twilight world, the setting sun (not animated, but a photographic image of a real-world sunset) suggested the imminent onset of night. The point of view began to change as the audience seemed to move slowly towards the base of the enormous urn. However, before the audience reached the base of the urn, they became seemingly weightless, rising far up into the atmosphere until they hovered just over the lip of the urn. As they moved forward, they looked down from the vertiginous height to see a collection of objects lying deep in the cavernous bowels of the urn. Facing forward again they began to sink down into the urn until they came to

rest on a small square platform floating in space. All around them, identical square platforms hovered in a grid pattern that vanished into the distance. In front of them, on three separate platforms, stood three gray urns, smaller cousins to the monstrous container in which they stood. After a few moments, the 3-D heads of the man and the two women faded into view over the urns. After a moment of silence, the three began to speak. As each one spoke, the others vanished, only to reappear in turn to resume their lonely monologue. Just before each change of speaker, The Spot hit a button on the computer, seeming to banish the present character and command another to appear and speak. At some point in this ritual, the heads faded away, though their voices continued as the audience again flew up and stopped at a point high above the urns to face a four-sided pyramid. As the audience flew around the pyramid, they viewed short, black and white QuickTime movies of the characters on three of the sides of the pyramid. The movies showed each of the characters looking away from, and occasionally into, the camera lens. Intercut with these movies were a few frames of the characters with their faces electronically distorted and writhing in pain. On the bottom side of the pyramid was a short movie of The Spot intercut with a brief, distorted, and colorized image of him laughing wildly. At last, the audience returned to their previous position in front of the urns and the heads faded back into view, never stopping their litany. As the characters began to repeat the entire sequence again, their heads and voices faded out until they vanished completely. The Spot sat slouched in his chair, staring at his computer screen in silence. After an extended pause, he rose and slowly left the room. As the lights came up, the play ended.

At the beginning of the process that led to the realization of these images, it seemed vital to manifest the urns as a central image, an image of both death (the urn as a container of the ashes of the deceased) and birth (the urn as a womb-like vessel containing life). Beckett's text suggests that the characters in *Play* occupy some sort of after-life or extra-worldly life. In my design, I wanted to further propose that the three urns and their occupants were merely a single manifestation of a reoccurring formula. This idea was suggested in the design by the Russian-doll-like nature of the urns themselves; urns within urns within urns, an infinite progression of the same rit-

ual of interrogation. The idea was further reinforced by the grid of platforms within the giant urn. This seemingly endless set of platforms marching out into the distance not only suggests infinity, but the existence of a countless number of vacant lots waiting to be occupied by identical urns.

The process of creating the video images of the two women and the man was at least as long and involved as constructing the virtual world itself. Though it would have been possible to create and manipulate the video images of the actors in real time, limitations of time, equipment, and personnel required that the performance of these characters be pre-recorded on video tape. To record their performances, I set the actors in a line in front of a large green screen. In front of them, a long green flat masked their bodies from the neck down. The actors faced a pair of video cameras mounted side by side in close proximity to one another. The signal from each of these cameras was fed through a video mixer that combined the two images and fed them into a VCR where they were recorded on an ordinary video tape. These pairs of images would later be decoded by the HMDs in such a way that the actors would appear three-dimensional.

Each actor was shot individually. They spoke all of their lines as though performing a long monologue while I recorded each performance on a separate videotape. Once all of the dialogue had been recorded, I painstakingly edited the tapes, chopping them up and pasting them back together in the order in which they appear in Beckett's text. With that finished, I now had a tape of the actors' heads vanishing and reappearing in a field of green while they spoke the dialogue.

During the experiment with the audience, I used a video mixer to edit out the green background (the same technique used in our production of *The Adding Machine*) and place the images of the actors over the image of the virtual world in such a way that the actors heads seemed to protrude from the mouths of the three urns. Using a lever on the video mixer, I could then fade these heads in and out at will while their voices continued to play through the headphones attached to the HMDs.

Was the experiment a success? I believe it was. The primary purpose of the experiment was to discover if integrating 3-D video, 3-D

virtual worlds, and live performance with an HMD audience interface was even possible—at least given the equipment we had on hand. My personal goals vis-a-vis the experiment were twofold. The first objective was to gain experience working with this medium. By serving as designer, director, technologist, technician, and even actor, I was able to view this experiment from multiple perspectives, gaining experience and insight that would prove valuable in future experiments. My second goal was to create an aesthetically valid event and to explore new ways in which this cyber-technology can be used to illuminate a dramatic text.

Following the experiment, I had the opportunity to discuss the event with the faculty members in attendance. From their responses, it was clear that they made meaning from the interplay of the various theatre languages, both live and electronically mediated. They commented in positive terms on how the media worked together to create a unique and captivating fictive world. Many of their comments pointed out some characteristics of this new interface that were not previously evident. For example, they could choose to shift their focus from the characters in the urns by looking through these electronic images to the live actor in front of them and vice versa. The ease with which they did this depended largely on the amount of light focused on the live actor. In addition, they found that, by simply moving their heads, they could control the spatial relationship between the live actor and the objects within the virtual world. Finally, they spoke excitedly about the possibilities of this new technology and its applications to live performance.

Reaney and I were pleased with the outcome of this particular experiment and, together with director Willis, used discoveries made therein to inform our next big project. In December of 1996, i.e. VR produced another major experiment as part of the University Theatre's regular season. Combining many of the technological elements used in the two previous experiments, this project focused on illuminating the play text of Arthur Kopit's *Wings*.

Kopit's script contains many of the same elements that made *The Adding Machine* such an ideal play for this method of production. The play follows the journey of the elderly former wing-walker and pilot, Emily Stilson, as she struggles to cope with the experience of a massive stroke and the resulting brain damage. The audience shares

this journey with Emily and witnesses numerous fantastical occurrences as they move through time and space experiencing a series of realities that have been turned on their ear, broken apart, and thrown back together.

Much like the *Play* experiment, this project integrated live performance, virtual reality, 3-D video, and a live audience equipped with head-mounted displays. However, unlike *The Adding Machine*, in which much of the designer's creative energy was aimed at generating discrete, expressionistic, and mobile locales in which the action of the play could unfold, the performance text of *Wings* consisted of a series of montage and layering effects. These overlapping and intermingling realities interacted as Emily struggled to bring "consensual reality" back into focus by separating and re-compartmentalizing hallucinations, memories, and momentary glimpses of her actual surroundings that had exploded and fragmented in her mind forming a dizzying and confusing maelstrom of disparate images.

Our production of *Wings* used an amalgam of the different technologies utilized in *The Adding Machine* and the adaptation of *Play*. As in *The Adding Machine*, the actors performed in front of a rear projection screen that displayed technologically mediated data. They also performed in front of and behind a black scrim that served as a second display screen. Much as in the adaptation of *Play*, the audience wore Virtual i-O HMDs to gain access to additional data, both visual and aural. The audience was able to see through the images in the HMDs and observe the performances of the live actors. Though the audience could clearly hear the dialogue spoken by the actors, some of the dialogue and nearly all of the music and sound cues were piped directly into the earphones on the audience's headsets.

The production of *Wings* was staged in the University Theatre's blackbox theatre. The space was arranged in an end-staging format. In the audience, rows of HMDs hung on railings behind each row of seats. Due to space and equipment limitations, each performance could accommodate no more than sixty audience members. The audience sat facing a small stage that stood only a few feet beyond the front rows. The protagonist, Emily, remained in this space—which we referred to as "space A"—for nearly the entire length of the performance. Occasionally other characters would enter this space to interact with Emily. These few instances of direct interaction usually

occurred during the most intimate exchanges between Emily and the hospital staff. These exchanges also coincided with Emily's more lucid moments, moments where her mind turned outward to the external world rather than inward to her personal mental landscapes.

A black scrim hung directly behind space A. This scrim served as one of the visual displays for computer and video generated images. Behind the scrim was a second playing space for live actors: space B. As Emily occupied space A, patients and members of the hospital staff often moved into and through space B, interacting indirectly with Emily as though she were in space B with them. This sort of indirect interaction usually occurred when Emily was less able to focus on or communicate effectively with the external world. Emily's experienced split between the Cartesian dualism of mind/body was enacted through the indirect interaction between spaces A and B. At these points, Emily's "body," visible only to the characters of the hospital staff, was "located" in space B, while her "mind"—and the actual body of the actor portraying Emily—sat or stood in space A. An illustration of how this interaction worked may be useful here. At one moment during the play, a nurse entered space B and offered a tray of food to the invisible "body" of Emily. Down stage, in space A, Emily's "mind" reacted in disgust and frustration, flinging her arm up into the air as though knocking away the offered tray. At this point, though upstage in space B, the nurse screamed as the tray leapt from her hands as though knocked away by Emily's swinging arm.

Obviously, it was necessary to light the actors in space B from behind the scrim. Such lighting, of course, made the scrim transparent. Yet this transparency was resisted somewhat by 2-D computer and video images projected on the front of the scrim in such a way that the audience members were made to read the actions of the actors in space B through the projected images on the scrim. Upstage of space B stood a rear projection screen that displayed still more 2-D computer and video images. In those few moments when the scrim and the rear projection screen displayed the same images, it was clearly evident that the r.p. screen images were the exact reverse of the scrim images thus suggesting that the two sets of images, whether interpreted as literal visions of the external world or as metaphorical realities, were not merely simple replications of one another.

There were thus five visual layers or "realities" that the audi-

ence could witness simultaneously. The fields that displayed this visual data were (in order from the closest to the most distant from the audience): the head-mounted displays, space A, the scrim, space B, and the rear projection screen. This deep layering of live and technologically mediated visual elements created for the audience a series of "realities" that overlapped and were superimposed on one another, each vying for attention in the crowded *mise en scene*. The audience, by choosing to focus from moment to moment on one "reality" before shifting their focus to another and then another, themselves experienced a sensorial state analogous to Emily's mental state wherein numerous disparate realities struggled for centrality.

To further complicate matters, each of the three technologically mediated display devices or fields (the HMDs, the scrim, and the r.p. screen) could, at any given moment, display visual data from one of five different sources. The first such source or aspect was a video camera that stood above and behind the audience. This camera was focused on the stage—almost always exclusively on Emily—and sent out 2-D, real-time video images of the action from a perspective unavailable to any audience member.

The second source, located backstage left, was a pair of video cameras mounted side by side. These cameras transmitted real-time 3-D video images of actors performing backstage before a black curtain. We had deemed the green-screen technique used in *The Adding Machine* and the adaptation of *Play* unnecessary in this context and therefore chose to forego this device.

The third and fourth sources were a pair of computers that transmitted 3-D images of real-time movement through virtual worlds. Each computer was operated by a different VED who manipulated the point of view within each world and changed worlds between scenes.

The fifth source was a pre-recorded video that displayed movement through virtual worlds, segments of the patients and hospital staff performing various functions, a sequence of planes at an airport, and even footage from a computer flight simulator. This source, the only non-real-time visual aspect of the show, was used to augment the real-time virtual worlds transmitted by the two computers—that were limited by the speed with which they could switch

from one world to the next—and to make available certain video images that would have been very difficult or impossible to reproduce in real-time.

These sources were all connected to a central switching station. The two crew members running this station controlled which sources were sent to specific displays from moment to moment. For instance, the crew member in charge of sending signals to the HMDs would watch the play, switching the signals from computer to computer to camera to video tape, etc. There were very few set cues for these "distributors." Rather, much like the maneuvering of the VEDs, the work of these distributors was largely improvisational and eminently likely contingent upon the moment to moment action of the live actors.

Designing the virtual worlds for *Wings* required a somewhat different approach than that used in the previous two VR experiments. Unlike *The Adding Machine* and the adaptation of *Play* wherein the virtual worlds represented actual, though often fantastical, environments occupied by the physical or spiritual bodies of the characters, the virtual worlds in *Wings* often represented an inner, psychological space. There were only a few moments in *Wings* when Emily experienced her literal location within consensual reality. Rather, she experienced time and space in a psychic locale, a mental landscape that was constantly moving, shifting, flowing, and jumping. Equilibrium was achieved only for brief periods before Emily flew or cut away to another psychic locale. These psychic spaces often consisted merely of shards of images: a half-glimpsed face distorted beyond recognition, a bird flying by, a windsock flapping in the breeze, or a brief view of hospital equipment streaking by.

In one brief sequence in which Emily struggled to identify a confused jumble of memories and images, the HMDs displayed a virtual world that consisted of a series of photographic images from her past. The virtual point of view moved backwards, crashing through these images so that at first, each photograph appeared highly pixelated, a seemingly random mix of colors. Slowly, as the point of view moved away from the image, the colors resolved themselves into an identifiable picture of unknown people and places. Yet just as the image clarified itself, the point of view crashed through another image and the journey from pixelation to resolution began again. Such a performative environment enacted Emily's own struggle to separate

and identify the fragments of her own confused memories.

In a scene that took place in the rec-room of the hospital, the HMDs displayed a virtual model of this literal rec-room. As the scene progressed, Emily's mind began to wander. At this point, the point of view within the virtual world moved through the rec-room and into a landscape that consisted of enormous images of cockpits, plane crashes, and hovering biplanes, all floating in an endless black void.

One of the discoveries we made while working on the adaptation of *Play* was that, while using the Virtual i-O HMDs as interface devices to augment live performance, it was necessary to include areas of black, empty space into each virtual world. Since it often proved difficult to see live actors through bright images in the HMDs, we placed the objects in each of the virtual worlds for *Wings* within a black void. This not only suggested the sensation of flight as the point of view moved through an environment of objects that seemed to float in the blackness but also provided blank areas within the HMDs' field of view that the audience could use to frame the live actors.

The audiences' ability to place the live actors in relation to images within the HMDs lent a certain interactivity to the production. By simply moving their heads, the audience could change the spatial relationship between the live actors and the images displayed on the HMD screens. The relatively narrow field of view afforded by the Virtual i-O headsets also allowed the audience to move their heads to look under or around the tiny display screens and view the actors without looking through technologically mediated images. The audience was thus constantly engaged in actively composing the visual relationships of elements in each scene and generating their own individual performance texts.

From the point of view of the production team, this sort of limited interactivity proved to be one of the most interesting and advantageous aspects of using the HMDs as interface devices, an opinion confirmed by our discussions with many audience members. The intriguing possibilities these HMDs bring to our experiments suggest that further projects utilizing these devices within a theatrical context are called for—this despite the rather intrusive and cumbersome nature of the equipment on an audience member and a certain reduc-

tion of the "community feeling" of attending a live theatre event, an inevitable side effect of the immersive qualities of the HMDs.

It has become evident that virtual worlds which operate as environments for the actors themselves take on a quality of agency. Creating active "environment-agents" that will interact with the behavior of human agents in ways that usefully amplify the performance text pushes the creative modes of director and designer towards one another. The designer must approach the design as a director approaches the actors, pushing it towards kinetically enacting the dramatic action. Likewise, the director must approach conceiving of the action in terms of a fluidly mobile architecture. Rather than merely replicating the methodologies or reusing the same technologies utilized in previous experiments, we will continue to explore new and different interface devices, hardware, and software in addition to actively pursuing new ways of conceiving and designing virtual worlds as performance spaces as well as spaces that perform. Exploring ways in which audiences, actors, and new media can interact within a live theatrical context is i.e. VR's primary mission, a mission that continues to challenge, fascinate, and teach us with each new project.

Works Cited

- Cage, Mary Crystal. "Actors Joined by Computer Imagery in U. of Kansas Production." *The Chronicle of Higher Education*, 30 June 1995: 18+.
- Knowlson, James. "An Interview with Billie Whitelaw," *Journal of Beckett Studies*, No. 3, Summer 1978.
- Laurel, Brenda. *Computers as Theatre*. Reading, MA: Addison-Wesley, 1993.

tion of the "community feeling" of attending a live theatre event, an inevitable side effect of the immersive qualities of the HMDs.

It has become evident that virtual worlds which operate as environments for the actors themselves take on a quality of agency. Creating active "environment-agents" that will interact with the behavior of human agents in ways that usefully amplify the performance text pushes the creative modes of director and designer towards one another. The designer must approach the design as a director approaches the actors, pushing it towards kinetically enacting the dramatic action. Likewise, the director must approach conceiving of the action in terms of a fluidly mobile architecture. Rather than merely replicating the methodologies or reusing the same technologies utilized in previous experiments, we will continue to explore new and different interface devices, hardware, and software in addition to actively pursuing new ways of conceiving and designing virtual worlds as performance spaces as well as spaces that perform. Exploring ways in which audiences, actors, and new media can interact within a live theatrical context is i.e. VR's primary mission, a mission that continues to challenge, fascinate, and teach us with each new project.

Works Cited

- Cage, Mary Crystal. "Actors Joined by Computer Imagery in U. of Kansas Production." *The Chronicle of Higher Education*, 30 June 1995: 18+.
- Knowlson, James. "An Interview with Billie Whitelaw," *Journal of Beckett Studies*, No. 3, Summer 1978.
- Laurel, Brenda. *Computers as Theatre*. Reading, MA: Addison-Wesley, 1993.