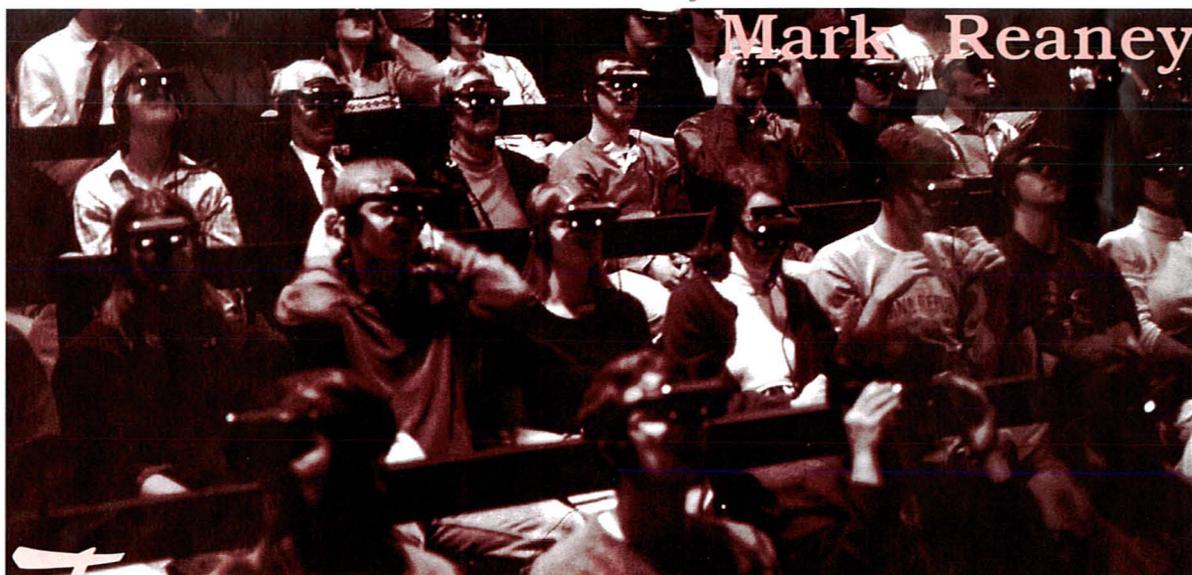


Virtual Reality sprouts

WINGS

by

Mark Reaney



The University of Kansas' Department of Theatre & Film and the University Theatre is conducting a series of experimental theatre projects dedicated to examining the potential of virtual reality technologies in live theatre. Our projects have progressed from laboratory work to the development of practical VR scenographic tools¹, to fully mounted VR/theatre productions.² Each experimental project inspires yet another. And, in the past year we have begun to see other production groups repeating our techniques and further developing them. Because of the growing interest, and in order to better organize our efforts, we have formed the Institute for the Exploration of Virtual Realities or i.e.VR.

A recent production of Arthur Kopit's *Wings* incorpo-

rated VR technology by presenting scenic elements as virtual worlds composed of disjointed, fractured images and sounds. Through VR, we sought to devise an exciting and innovative method of communicating the main character's chaotic state of mind as she suffers a stroke and fights for recovery.

By immersing an audience within these scenic worlds we hoped to make the experience immediate and powerful. Rather than resting comfortably in the role of observer, each audience member would experience Emily's ordeal personally. As in any traditional production, we can build an empathy with her by seeing how she reacts to her situation. But with an immersive presentation, we can also empathize directly by experiencing the conflicts in her perceptions and the resulting

fears and trepidations.

The focus of the *Wings* project, which for us was the next progressive step in our experimentation, was to improve the audience's sense of immersion within the fictive world. Immersion in various forms is an important aspect of both VR and many types of theatre. It is an area where the two fields work similarly. VR simulations and theatrical works are increasingly effective when barriers between the spectator and the simulations are reduced.

THE INTERFACE

For our earlier production of *The Adding Machine*, the virtual scenery was presented to the audience through rear-screen projections. The projections were real-time computer graphics and they appeared to be three-dimensional because of 3-D glasses worn by the audience, and yet the actual method or presentation was not much different from other productions using rear-projections. It was a conscious decision to give the first merger of theatre and VR a more theatre-like appearance. For *Wings* however, we were committed to create a work that had the components of a more stereotypical VR experience. The plan was to fit each member of the audience with the trademark of virtual reality technology, a head-mounted display.

The head-mounted displays (HMDs) that were employed were unique in design. I-Glasses!, made by the now defunct Virtual i-O Inc., use a system of half silvered mirrors placed at an upward facing angle before the user's eyes. A small LCD screen is mounted horizontally above each eye facing downward, much like the bill of a cap. When the on-stage actors are brightly illuminated they can be seen through the nearly trans-

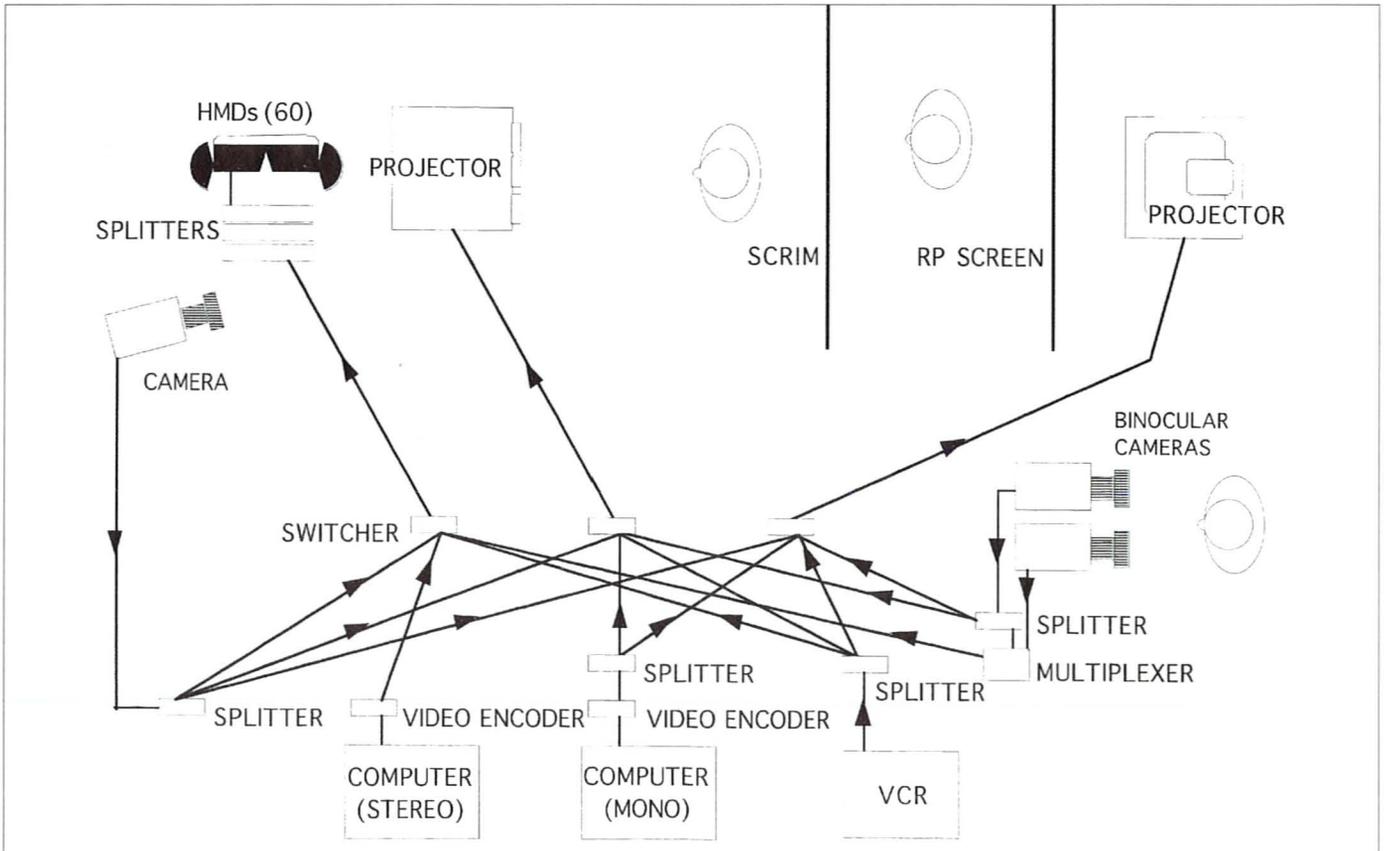
parent mirrors. When the stage lights are dimmed and the LCD's are bright, the images in the LCDs are seen reflected in the mirrors. By manipulating the illuminate levels on stage and in the HMDs, the wearer is able to see only the actors, video images alone, or video superimposed over the view of the stage. Because the video images were stereoscopic, the virtual objects seemed to occupy three-dimensional space in front of the viewer. By carefully controlling the stereo parameters of the images, the objects could appear to be next to, before or behind the actors on stage.

Built-in stereo headphones gave us a unique opportunity for sound design. Just as the video component rendered a view of Emily's visual perceptions, the headphones allowed the audience to experience her auditory world. Because the earphones did not completely cover the ear, HMD sounds could be layered over the speech of the live performers. Additional speakers in the house created another layer of audio to the mix.

Like some of our earlier projects, this experiment was partially sponsored by the USITT. Thanks to a generous grant from the USITT's New Initiatives Fund, additional support from KU's College of Liberal Arts and Sciences, and equipment loans from Virtual i-O, we were able to equip an audience of sixty with these HMDs.

The images that comprised the virtual scenography were created in several ways. The primary source was real-time computer generated images. Using a Macintosh computer and Virtus WalkThrough Pro software, we created virtual environments that could be navigated by a crew member in real-time. This software is capable of outputting video in stereoscopic mode and so is ready-made for use in the HMDs.

The second image source was offstage actors that ap-



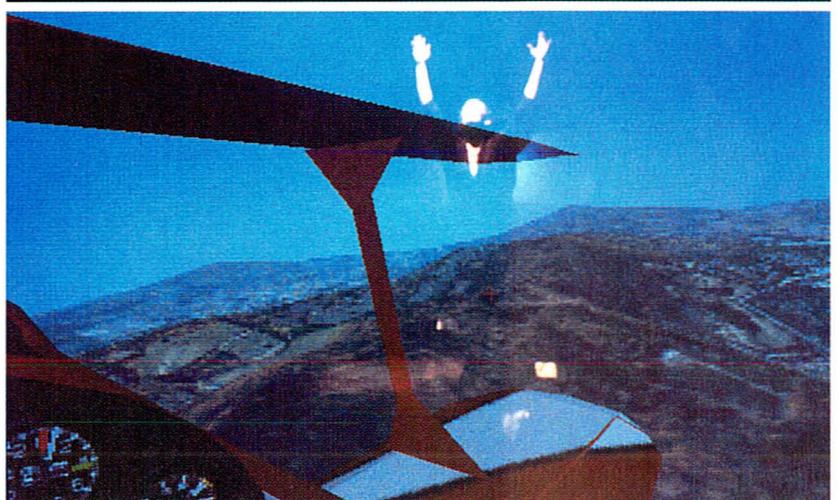
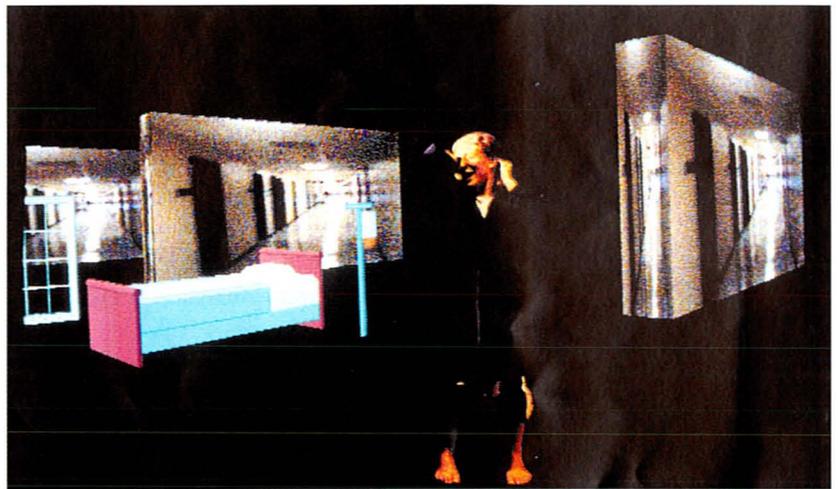
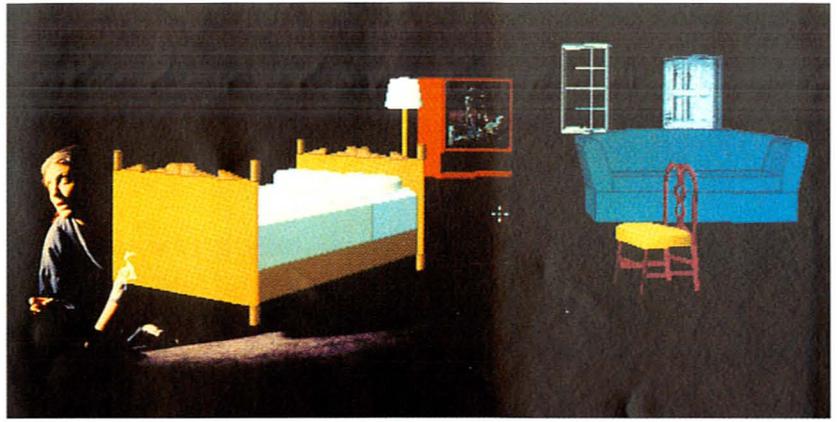
peared as ghostly images superimposed over the on-stage actors. To achieve this effect a pair of binocular-mounted video cameras were placed off-stage left. These two cameras were mounted on a single tripod about three inches apart. The two video signals were time-synced, then electronically combined into a single stereoscopic video signal that could be fed to the HMDs. Through the use of this device we were able to see images of doctors and nurses, friends or relatives as Emily would see them. Being three-dimensional, they seemed to occupy the stage with her. But, being translucent, they may have been a hallucination or a memory.

A third camera served as another image source. This camera and its operator were positioned behind and above the last row of audience. This camera was focused on the stage and like the other video sources could be fed into the HMDs. A single camera was used at this position because being so far from the playing space, stereoscopic methods would have been ineffective. As Emily's identity becomes fractured and she loses the sense of herself, images from this camera allowed us to superimpose another image of her over herself. By panning the camera we could make the ghostly Emily move to either side. By zooming it became smaller and seemingly more distant or appeared in immediate close-up.

This unique staging dramatically reinforced the moments when the character referred to herself in the third person and added new implications to those moments when she talked to herself. For the director, a new method of blocking a scene was discovered. Through this device actors can be brought into extreme close-up, adding poignancy to a scene. The same character can also be pushed into the distance to illustrate alienation or emotional distance. In one scene Emily was flanked by a pair of doctors but seems unaware of their presence. In that scene the camera zoomed in until Emily was isolated in the image seen in the HMDs. Therefore the "reality" held for the doctors but in the shared mind's eye of Emily and the audience, she was alone.

The final image source was videotape that held some prerecorded image from the other sources and some footage that was shot on location at the area hospital and airport. By pre-recording some sequences we were able to capture some special effects and intricate blocking that would not have been possible in live performance. Location shooting allowed us to experiment with the use of realistic, cinematic images. The video recording also had the practical application of providing continuous video images while the computer operators switched to a new virtual environment.

Opposite page: a diagram of the virtual reality equipment for Wings. This page: four scenes from the play, as audience members would have viewed them through the I-Glasses! head-mounted displays—(top to bottom) Emily during the onset of the stroke; fractured hospital scenes; memories of Emily's aviatrix days; and the closing "wing-walking" scene.



With all the pieces in place, our environment of Emily's mind was composed of five layers or realities.

While there were a variety of possible image sources, the presentation of those images also had several facets. The playing space was divided into upstage and down stage portions by a black scrim. This scrim not only allowed actors to appear and disappear from Emily's consciousness, but it was used as a projection screen for a three-gun video projector mounted above the audience. Upstage of the playing space, a rear projection screen was placed. Behind it, a second video projector, this one an LCD pad, was positioned. Since these projectors could not utilize the stereoscopic video signals being sent to the HMDs, another computer was needed to run virtual environments in a monoscopic mode for them. Video signals from the rear-of-house camera and one of the two binocular offstage cameras could be relayed to the projectors with no loss of clarity.

With all the pieces in place, our environment of Emily's mind was composed of five layers or realities. In the first, live actors could appear in the down stage playing space and made to appear and disappear through manipulation of light. This layer was inhabited primarily by the actress playing Emily although other characters used it in those moments when she is most aware of her surroundings. The second layer was the

area behind the scrim in which characters appeared independently of the first layer. This was used mostly as dimly seen characters in the hospital flit in and out of Emily's perception. The third layer was the HMDs. Here strong images were superimposed over the entire scene. This layer was used extensively as it was the most powerful illustration of Emily's mental state and best brought the audience into rapport with her. Projection on the mid-stage scrim provided the fourth layer. This frontal projection also covered the actors in the down stage area, wrapping them in the images. This layer was used to reinforce the HMD images and to introduce new images of its own.

The last layer was the rear projection behind the entire playing area. This layer could also be used to reinforce other layers, but it could also be used to depict more traditional backgrounds. This was useful in later scenes in which Emily's awareness of her surroundings becomes more clear.

Of the five layers, three relied on the five video image sources. These were: a computer which rendered virtual worlds stereoscopically, a second computer which depicted virtual worlds monoscopically, offstage cameras, a rear-of-house camera, and a VCR. By using video splitters and switches, any of these sources could be sent to any of the three video layers. The selection of video sources for each layer required additional equipment and crew.

Altogether, the control booth was very crowded. In addition to the usual stage manager, light board and sound operators there were two computer operators, a VCR op-

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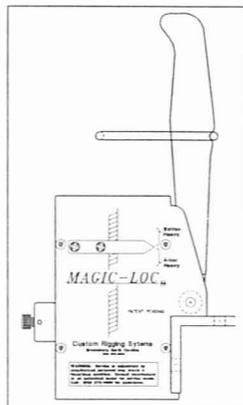
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erator, and two operators working the video switchers for the projectors and the HMDs. Control of the HMDs also included a video fader that let us manipulate the relationship between HMD images and the view of the live actors. In order to insure that all the operators could view the stage, a platform had to be built in the booth for the control stations in the second tier.

This variety of media required a new style of scenography. Early in the process it became evident that in addition to an increased sense of immersion in the fictive world, this system afforded a great deal of flexibility in how the scenic elements could be presented. To take advantage of this flexibility we purposely avoided making hard and fast decisions about what images would be presented in each layer at any given time. Instead we designed virtual environments, edited video and chose camera angles that would be generally appropriate for a section of the play. Then, during rehearsals, we were able to try different combinations, mixing and matching video sources with HMDs and projectors. As rehearsals progressed, we found options that worked better than others and a set deal was formed. However, several scenes remained in an improvisational form. The chaotic scenes wherein Emily first experiences the stroke and later relapse gave our stage manager and crew a chance to improvise a new matrix of images with every performance.

THE EFFECT

After the audience received brief instruction on wearing the HMDs the performance began. The character of Emily was dis-

covered sitting on a chair in the down stage playing space, reading a book. The ticking clock skipped a beat, the reading light behind the scrim suddenly disappeared, Emily seemed to be in some distress and then calamity followed. The stage plunged into darkness and the HMDs and projectors began showing fractured scenes of Emily's house, cars, hospitals, ambulances, flashes of color, abstract objects, remembered places and strange faces. At that moment, the audience was launched into Emily's role, experiencing disorientation as she did. With her, they waited through the suspense and confusion.

For the next hour and a half, the story played out through interlaced images, sometimes restricted to the electronic means, often played by live actors alone, but mostly through a combination of these elements. The response to the use of HMDs was encouraging. People were fascinated by the experience. They seemed particularly enthralled with their ability to visually compose the scene by moving their heads and thereby the images in the HMDs.

Throughout every performance people could be seen moving their heads slightly to create new relationships be-

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tween the computer generated images and the view of live actors. In post-performance talk-back sessions they confirmed how much they enjoyed being able to "play director." At the beginning of the performance these movements were self-conscious but as the play progressed the audience became more adept with the new technology and the act of finding an interesting composition of images became fluid and natural. In many instances scenes were designed to steer the audience toward a particular composition. Images that were going to be superimposed over live actors were created to include areas of black through which the live action would best show up. Other scenes were designed so that shifting the HMDs made little difference. Rapidly moving virtual worlds afforded little time or reason to adjust the scene.

Although audiences were generally pleased with the HMDs, most performances saw one or two members of the audience remove them for some period. When asked, the reasons varied. A few found the HMD uncomfortable, possibly due to incorrect adjustment. Others found the experience too intense and wanted a respite. And some were curious to see how the production appeared without the

HMD's mediation.

As usual, WINGS has raised issues that will need to be addressed in yet another production. Each experiment forges a new link in the growing chain of understanding, i.e. VR will continue to test new methods and new technologies in an effort to increase the power of live-theatre. Our next production focuses on the immersive qualities of scenic spaces composed of photo-realistic computer renderings. *Telsa Electric* by David Fraser is the vehicle for the experiment. It was performed February, 1998 in the University of Kansas' William Inge Theatre. ♦

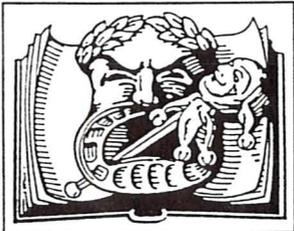
NOTES

1. "The Theatre of Virtual Reality," *TD&T*, Spring 1993, Vol. 29 No. 2, p. 29-32.
2. "Virtual Scenography: The Actor, Audience, Computer Interface," *TD&T*, Winter 1996, Vol. 32 No. 1, p. 36-43.

Mark Reaney explores the use of virtual reality technology as a tool for designing stage sets. For more information on the work of i.e.VR visit Mark's website at www.ukans.edu/~mreaney. (Photos in this article are by the author.)

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