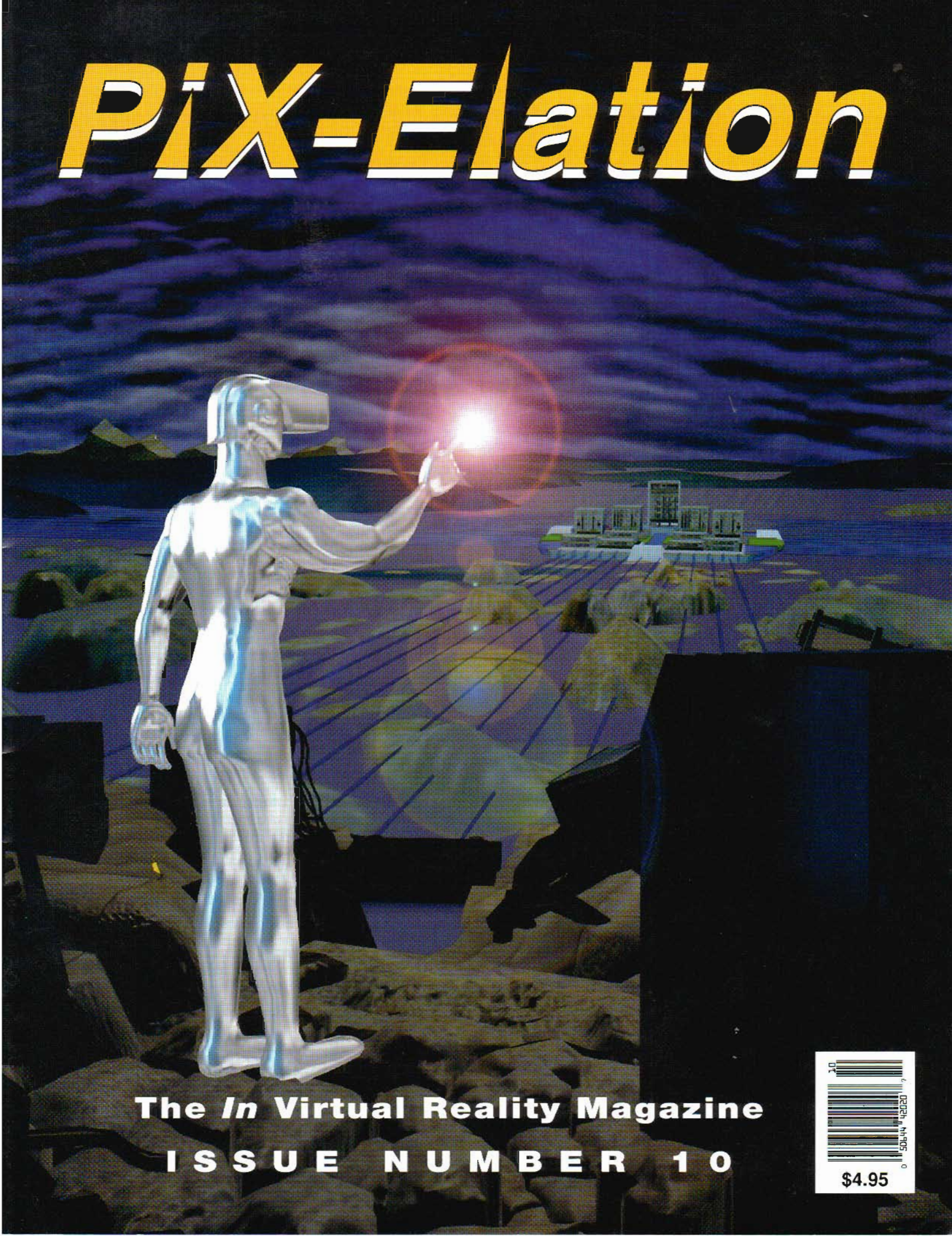
PiX-Elation



The *In* Virtual Reality Magazine

ISSUE NUMBER 10

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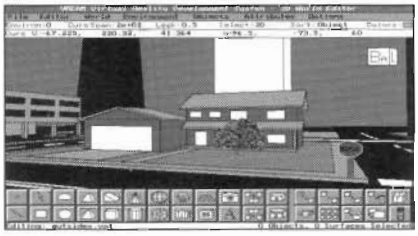
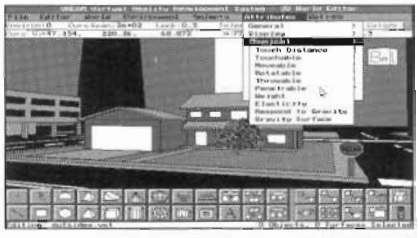
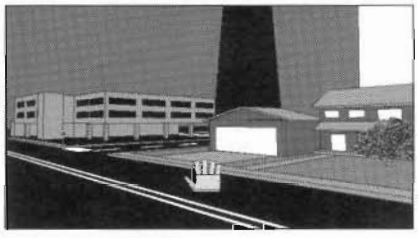


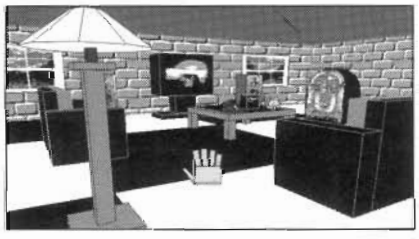
Create a Virtual World with the VREAM 3D World Editor.



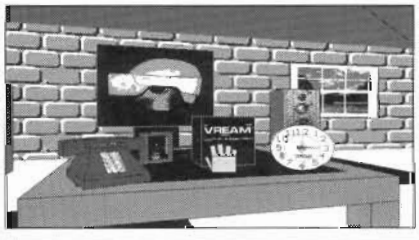
Make changes to the Virtual World with the VREAM 3D World Editor.



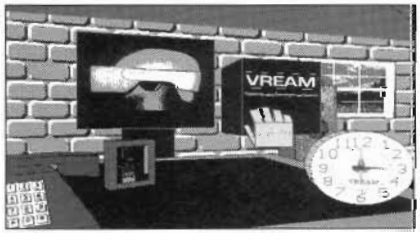
Enter the Virtual World with the VREAM Runtime System.



Roam freely through the Virtual World in real time.



Grasp objects in the Virtual World with the user controlled hand.



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VRASP — The **Virtual Reality Alliance of Students and Professionals** — is an international support network and educational forum dedicated to increasing public knowledge of virtual reality applications, and to furthering the development of VR technology as a whole. We are a not-for-profit organization founded in March of 1992. Our membership is global and diverse, and includes programmers, researchers, inventors, graphic artists, writers, promoters, filmmakers and philosophers.

VRASP encourages immersion, interaction, and information dissemination amongst our membership, as well as between people and technology. Each VRASP Cell holds educationally-oriented meetings and events at which VRASP members get to socialize "ftf," sharing their eclectic knowledge and cooperatively pursuing a future where Virtual Reality **is** a Reality.

We are also the publishers of **PIX-Elation** — this publication features VR industry news, product surveys, cyber-savvy columns, event and convention reviews, lecture transcriptions, industry networking, a calendar of upcoming VR-related events, and interviews with leading researchers, entrepreneurs, programming wizards, techno-artists, and proponents of "homebrewed" VR.

Cover

PIX-Elation cover art by Steve Speer. This sleek silver cybernaut traversed the networking environments of Cabletron Systems in an immersive, but non-interactive, VR experience produced by StrayLight Corp.

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CONTENTS

Within our VRASP!

Who are we? VRASP is the oldest and largest Alliance of VR enthusiasts. Our members are linked through PIX-Elation and the Internet. It is my hope that those purchasing this issue from newsstands around the world will become members as well.

Even if you haven't been actively involved in our meetings, projects or exhibits, you are still an important component of an organic body. There is a core group of volunteers who help with the daily maintenance of the whole; many are listed in the masthead, but anyone can get involved with just the teensiest initiative. We urgently need your help, especially now that membership is growing AND we're distributing PIX on newsstands AND developing and marketing PC VR products AND sponsoring the project uniVRsum AND exhibiting at all the major trade shows... and so on and so on!

We must do all of the above to stay on top of the information tides and industry opportunities. The surest way to learn about the technology is from within the industry; becoming an active participant will allow you to do just that. And if you are already in the industry, supporting our worthwhile endeavors really will benefit you in tangible and intangible ways.

What is within your VRASP?

Watch the Interface page for important postings and opportunities to become actively involved. Let us know where you are and what you are doing. Whether you're an industrial entrepreneur or a hardware hacker at a helmet company — if you do anything VR-related, we're interested! Send in your story leads, CC your press release, volunteer to be interviewed — we're always looking for that shifting Edge!

Our Archives are another area where you can contribute. Please (and we really mean that): Send in your VR-related photos, videos, magazine articles, newspaper clippings, graphic artwork, etc. All submissions remain the intellectual property (under copyright of) the contributor.

VRASP

The Virtual Reality Alliance of Students and Professionals
p r e s e n t s

PIX-ELATION

PIX-Elation is written primarily by VRASP members, all of whom are invited to submit their articles, graphics, and findings.

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The Director's Phlogiston

"That Funny Lil' Buzz In My Head"

by Paco Xander Nathan

We interrupt this broadcast to rant for a moment about Applied Media Theory - or "AMT," as it's known in the biz. The problem, you see, is that people have been wandering about the planet extolling the virtues of VR. Most of me finds that just peachy, but the left half of my brain keeps signaling an alarm. That funny lil' buzz in my head, taken along with regular doses of day-to-day work in computer-mediated communications, is positive proof of my aforementioned case of AMT.

In the old days, say, oh, about several thousand years ago, AMT didn't pose much of a threat. For starters, the AMA hadn't discovered it yet, thus it wasn't listed on insurance claim forms. Secondly, there weren't many kinds of media available, not even for the emerging Military-Industrial Complex. Basically, the only "permanent," codified communications medium was architecture. People built things. The shapes and spaces of those buildings communicated ideas and feelings, but they're not exactly "interactive." First off, any media project of consequence in those days generally cost a lot of slave labor. That is, you had to feed and train armies to conquer neighboring territories, etc. Secondly, a person typically had to buy into your belief-system to understand your building's communication. Face it, "MTV" would've sucked back then.

Thinking of how those lucky pyramid builders never worried about contracting AMT lead me to muse: "Hey, I wonder what the chart of Human Cost vs. Interactive Media Progress would look like?" Although my physician warned me this was one of the symptoms of an emergent AMT syndrome, I began collecting data.

Interestingly enough, a relation appears when you look at the data. It may just be my overly-enfevered state, but ... think about "theatre" as a communications medium: it's been around for thousands of years; people experience a form of "reality immersion" during plays; plus it's somewhat interactive. Furthermore, your typical Shakespeare production doesn't exact nearly as much human cost as a Mayan temple, either in stone transport or calendric tutelage. "Progress" ... more interactivity, more reality immersion, but what about "human" cost? Since a specific building tends to last longer than a play, the former enjoys greater marginal returns on investment.

Later in the History of the World, Gutenberg invented The Press. Then people got to have books in mass quantities and eventually newspapers, magazines and fishwrap of all sorts. "More progress," since people tend to get themselves immersed in textually-constructed realities even more so than in theatre or architecture ... but again another cost factor impedes the returns: reading engages more of your attention than say watching a Greek tragedy or wandering under the Eiffel Tower.

During the past hundred years, electronics engendered the birth of new media: radio, television, telephones, wire services, etc. Broadcast telecommunications reach the masses, and by throwing in a bit of digital tech (i.e. computers), we see the emergence of "Cyberspace." Somebody ought to play that intro tune from "2001" at this point, something that sounds bold and makes the adrenaline pour out of your grey-goo glands until you get all proud and weepy about the fine achievements of human progress. We've really done it now, folks. We've built machines to help create reality for us! No more slave labor, no more messy environmental toxins from the press inks, no more pimply teenage outcasts running about the stage in tights and feathered caps ... we've got computers to replace all that nonsense.

Computers, machines engaged in acts of metaphor, serve as brilliant tools to help make communications "easier." They translate addresses, spell-check email messages, route and switch packets, render polygons and even monitor PowerGlove movements. Better, even more reliable forms of interactivity and reality immersion. (I've heard about a new technology called "teledildonics," we have a limited number of column-inches to play with here...)

In lessons from thirty-odd years of "RealLife" (tm), as differentiated from virtual space, I've found that true communication is rarely "easy." Invariably there are misunderstandings, unspoken agendas, hidden desires, mistaken identities, etc. - all problems which can and are exacerbated by the involvement of computers. This is what a person crazed by the onset of AMT will tend to say.

Which leads me back to my alarm over VR and that whole silly process of charting the progress of interactive media vis-a-vis some notion of the human costs involved. Because it strikes me that the progress of computer-mediated communications and computer-augmented realities imposes/engenders an asymptote for our collective futures. Increasing the interactivity and increasing the reality-immersion of a communications medium also tends to increase the human cost of one's "attention," exponentially.

Attention - do we have enough to go around? Have you felt hurried, over-taxed, frustrated by the demands of all those incoming phone calls, letters, bills, email, etc. lately? You will.

Speaking of "2001," this rant reminds me of a scene with Moon-Watcher confronting the Monolith in the veldt. A bone launched in gaping silence. Spiraling toward the sky. Juxtaposed in a flash with a million years as a bone-shaped satellite spirals in Earth orbit, monitoring signals from another Monolith on the Moon. Progress.

VR represents a key step forward on our asymptotic progress toward better media for communication and expression. We face many of the same media constraints as our temple-building ancestors. Our robotic slave-labor only lends the illusion of reduced cycle times. You will need to invest attention, exponentially proportional to the level of your gain in either communication or reality-augmentation. And that's going to be limited by your body, among other things. If you've never seen examples in which technological innovations are limited by bodily constraints, don't worry, you will.

Excuse me, these antibiotics aren't doing much for my AMT ... I'm gonna go hunt for some hyena bones to help get rid of this buzz in my head. Thanks for your attention.

HIGH VOLTAGE ENTERTAINMENT

BY

LAURENT SCALLIE

Ah, spring in New York city! Sunshine, smiling faces--and a new crop of virtual reality technology at the VR Entertainment Forum '94. The April 5 to 7 convention was organized by Stan Goldstein, president of Sig-Advanced Applications, and held at the Grand Hyatt Hotel. Stan hosted about 20 exhibitors and more than 40 speakers in 13 sessions. The Forum was attended by over 1,000 people and the event unveiled a number of interesting new projects and developments in technology. Entertainment is the first VR field to have its own convention because it's also the most profitable.

OK, so how do you make money in VR entertainment? According to Greg Panos, president of SophisTech Research and publisher of the Virtual Reality Source Book, at this stage of the industry, the formula for success is a long and costly process of simply gathering information and laying out comprehensive plans for development. I can only agree, having done so myself for the last two years. Once the groundwork has been laid, the company being able to market and package a content-based experience will be successful.

From start-up to military projects, from CAD to architectural companies, various enterprises are pooling their know-how and resources to develop and market VR entertainment systems. Being involved in this industry at the dawn of its explosive development is not only exciting but offers us the unique opportunity to guide its direction. An example of how we could influence the industry is in software development. A recurrent theme I found particularly important at all of last years' conferences was the call to reduce violence in VR products in favor of more adventure, competitive, sporting and even musical or educational experiences. Unfortunately, this call has gone largely unheeded in existing products. Panos said it will be interesting to look back on the history of the VR industry as it is unfolding around us. Indeed, we have some significant times ahead of us.

The sessions at VR Entertainment Forum '94 covered a number of important areas: general technical, marketing and financial considerations in VR entertainment; aspects of the Location Based Entertainment business; motion based simulation; the Virtual Reality Events and Trade Show; throughput and pay per play issues; interactive TV and VR market analyses, and the much vaunted union of VR and Hollywood.

Altogether, the event was a success, and besides providing a forum to meet some great people, I gleaned a lot of insight on what's going on in the field of VR entertainment. Here's a sample:

STAR TREK: THE ABORTED GENERATION

A big disappointment was the news of Paramount's decision to end its collaboration with Horizon Entertainment and Spectrum Holobyte for the development of their Star Trek project for LBE centers. Paramount will reserve the rights to its Star Trek project for some "recently purchased" theme parks, in the belief that the LBEs would have presented more competition than promotion for their parks.

CUTTY SARK: THE "VIRTUAL VOYAGE"

Not that this has left Horizon Entertainment, the world's leading VR operator, idle. President Andy Halliday and Product Manager Randy Sprout announced a major corporate VR "event" with Cutty Sark. "Virtual Voyage," as the event will be called, is to take the form of an 18-month promotional tour based on the epic story of Captain McCoy, well known in the Prohibition period of the '20s for the smuggling of "safe whiskey." It was not unusual for people to actually die from drinking the existing black-market offerings at that time. Santé! This "virtual McCoy" will visit 600 cities in the U.S., starting his journey in Chicago on May 14.

It is a winning concept, integrating corporate identity with a historical adventure

hero that people can identify with, and VR is the medium. Cutty Sark plans to support the tour with a major print advertising campaign as well as a products merchandising effort, to capitalize on "human billboard" advertising.

Following the success of its Bubble Yum promotional tour, which achieved four times its expected profit, Horizon has officially launched the VR corporate event as a successful advertising tool. The system used in the promotion was developed by Greystone Technology, Inc., a fast growing San Diego based software and systems engineering company. Virtual Voyage combines two N-Vision color HMDs, one Onyx per view point, a Polhemus tracking system and Crystal River 3D sound system. David Polinchock, president of CyberEvent Group, the largest VR special events company, is in charge of the tour. The development cost of the project has been set at around $1 million, which represents about 30 percent of the total budget of this promotional campaign. Horizon, which qualifies itself more as a marketing company than a high-tech development concern, is also putting together a team to develop new VR content. They've used VR in some of their 150 entertainment centers for some years and believe that their experience in this field would be invaluable in such development. In fact, more centers are planned using the new content but nothing is expected to be available for six to eight months. It appears Horizon is favoring platforms featuring motion-bases and HMDs. They have already demonstrated, at one of their centers, a proof of concept that was particularly well received, even though it was more of an interphase than proper content. This May's Meckler conference will hopefully yield more information in this regard.

Rock & Roll VR Theme Park?

An exciting project will follow on the heels of Peter Gabriel's "Mind Blender" music video, directed by Brett Leonard. This million dollar production was designed for the Iwerks Reactor (the portable motion-based theater). It made a tour of 63 cities in the U.S. Page Thompson of Marketing Entertainment Group of America, which supervised the project, is now thinking of the next step - a chain of 50,000 square foot theme parks with a whole library of rock & roll experiences, including passive and interactive attractions.The project aims to have 20 parks up and running within 10 years. To get the ball rolling, a $47 million private placement is planned for July of this year. If all goes according to plan, the first site should open by the end of 1995. Thompson confirmed the success of software-oriented urban entertainment centers such as the Luxor in Las Vegas or the Sony venue in Lincoln Square, a vindication of our belief in VR as the future of entertainment.

Zero to three Gs in half asecond...

VR320 Gundam Motion Simulator

Ian Bruce, president of First Person Simulations and speaker at the conference, unveiled his plans for a new virtual reality, multisensory-immersive motion platform as well as an associated VR center concept. The VR 320 Gundam is designed to simulate both pitch and roll trough, 360 degrees of rotation. Dual jacks raise the cockpit through 45 degrees of vertical elevation to create inertial simulation from 1/2 second of 0 Gs, to as much as +3 Gs of force. A low frequency, body resonance generator will compound the realism of weapons, explosions, and other effects in the simulations. But Ian Bruce pointed out that the emphasis of his company is on content. He explained that at any one time his centers will give a choice of at least six simulation titles. Ian is in negotiation with American and Japanese companies for licensing theme universes for LBEs around the U.S. and Japan. I know more than I can write but just watch for a surprise in regard to this story.

Virtual Sex: Beyond The Hype

A 'virtual sex' prototype in the form of a fully sensitized bodysuit has been unveiled by two German students and demonstrated in front of 300 people at its world premiere in Paris. The promotional photograph showed this to be the closest I have seen to the real thing since the innovative simulation in San Francisco's *Future Sex* magazine. The device enables users to fully interact over a simple telephone line, experiencing complete tactile feedback in real time. And when I say fully interact, I mean fully interact. S&M fetishists will be happy to hear that the system goes far beyond simple touch; pain, in the form of a 220-volt charge, can be administered by one user to another. My source suggested I call an insurance company for a quote.

Upcoming Greystone LBE Products

Following their successful development of experiences for Horizon, Chameleon and VOR and of the Pteranodon prototype, which was so well received at Siggraph last year, Greystone Technology, Inc., is currently working on two new LBE products; an interactive, single person motion-based experience to be delivered by August 1994 "Magic Carpet," and an HMD-based VR experience by October. "Magic Carpet" is a 3-axes motion platform similar to a jet-ski engine or a snowmobile. According to Michael Martin, director of Entertainment Projects, your body is in a forward position, knees on the platform and weight supported by your chest. Your face rests on a leather pad with openings for your eyes to see the display. Left and right controls are available for each hand. The overall feel of the product is very high tech. Looks like the motorcycle version of the "Lawnmower Man" motion platform! The initial content will be based on *Aladdin* the motion picture and features a tunnel-type game. A new seated VR system will be released by November. The goal is to create a modular configuration easily reconfigurable with new controls or new displays that minimize the hardware and maximize the flexibility.

The first experience will be an adaptation of the impressive Pteranodon ride. Three

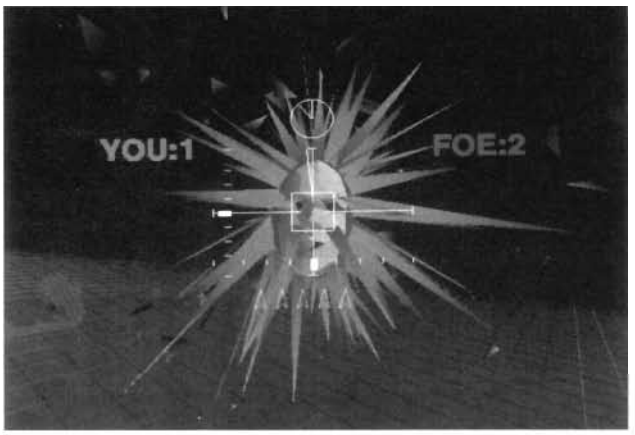
Barco projectors were used at SIGGRAPH '93 for the display interface. Here, the HMD gives a greater intensity in this fantasy world, being able to look at the wings of the beast, the top of the canyon and the whirlpool way below at the turn of the head. The product philosophy of Greystone is right on target, I think. They want to associate their motion-based platform to adrenaline-type experiences (no shoot'em up), and their HMD to more experiential software. Four new software releases are expected every year. We might also see Greystone VR centers in the future. Keep a very close eye on this company; they have the talent, the vision and the funding.

Virtual Tennis

David Polinchock, president of CyberEvent Group, Inc., is giving birth to the first Immersive Virtual Tennis tournament project. Based on HMD technology, two players will be able to compete on a virtual tennis court. The system should take to the road in the U.S. by the end of the year. Once finally developed, the system should also be available to LBE. At this point, it is unclear what hardware components will be utilized. It is exciting to see that over 10-sport experience VR projects are underway and one could ask: When will we have a virtual Gold's Gym?

Home VR Projects

Mark Long, president of Zombie Virtual Reality Entertainment and formerly of the David Sarnoff Research Center, is now working on developing VR home entertainment systems on 32-bit and 64-bit platforms. According to Long, at least five companies will introduce a PC-based HMD for less than $1,000 this year. But he believes that HMDs will be obsolete by the end of the decade. However, Zombie contracted Animatek International, a software company based in Palo Alto and Moscow, to develop the first VR game with HMD on personal computers. Available the first quarter of '95, "Ice & Fire" will be the first experience available on PC and Mac with CD Rom. Also on the home VR front, Warren Katz of MAK Technologies, a company specializing in network protocol, explained that his firm intends to use the same DIS protocol used for the SIMNET project in home VR applications. At the Forum, Katz announced a partnership between CyberGear and Continental Cable/PSI to develop their first home VR product: a biking exercise application. Cambridge has been chosen as the site for the prototype. A local health club as well as local homes will be networked together on the same system, although the quality of the visuals will depend on the computing station at each location. The demo is expected to be operational by July or August '94. MAK is also working on the "Newtonian Protocol" that will feature force and tactile feedback information in real time.



StrayLight's new Cyberton game Wing-Nuts

True Stereoscopic Video from Monoscopic Sources

Using an innovative software approach, B.J. Garcia, Ph.D., from Automated Medical Products, has developed DeepVision, a real-time image processor which synthesizes stereo video by extraction of spatiotemporal cues from the input video stream. The result is a processor capable of real-time conversion from monocular source video into stereoscopic imagery. Dr. B.J. Garcia referred us to his technically detailed article in Volume 1 of the third issue of "Virtual Reality Systems."

New PC Dedicated VR Graphical Card

Synthetic Images exhibited an interesting PC board. Designed to process and render virtual worlds, "Reality Blaster" is capable of 60,000 texture shaded polygons per second with 200 instantaneous moving models (>1K in scenario). With multiple boards, it can be used in a single PC for full speed stereo 3D imaging. "Reality Blaster" could also be used, under certain restraints, to dramatically decrease the rendering time of traditional computer animation.

Wireless Tracking Technology

Nowadays, tracking is very much associated with wires and magnetic trackers on one's body. Well, a new technology using LCD cameras and, in most cases, associated with wireless reflectors, may be a more convenient solution for some applications. At the conference, three companies shared the result of research programs as well as existing products. Ken Kline, from Optimum Human Performance Center, presented an application capable of creating a three-dimensional picture of any golfer's swing accurate within one-hundredth of an inch. The company's technology is also used to create natural motion file for video games. Back in the exhibit area, United Technologies Adaptive Optics Associates demonstrated a turn-key camera tracking product. Jacob Segan from AT&T shared his research for some applications without the use of reflectors. Applied to a video telephone, the system will enable you to localize your body's contour and display it in the center of the screen, allowing you to move freely. VR is all about an easy and natural interface, so I think this technology fits well into this philosophy.

New VR Experiences

StrayLight and Reality+ introduced new games for their respective platforms. Tony Asch, president of StrayLight, which has CyberTron units installed around the world, including two at Disney World in Orlando, is adding to the library of experiences a fully networkable third title: "Wing-Nuts," a shoot'em-up type game. Andrew Adrion, president of Reality+, unveiled a car race experience. Constant introduction of new experiences are crucial for LBEs but I would like to see more creativity invested in the development of their content.

Iwerks Funding

No one need introduce Iwerks nowadays. After eight years, the brainchild of Stan Kinsey and Don Iwerks leads out-of-home

simulation entertainment. From their traditional motion-based theaters to their new Virtual Adventure VR system with its first experience "The Lochness Expedition," Iwerks has grown from a 'garage' company setup, with money injected by its founders, to their recent and very successful first public offering. The fresh acquisition of Omni film and the opening of the first Cinetropolis facility mark a milestone in the growth of Iwerks. At a time when many start-up companies in the VR entertainment field are at the stage where Iwerks was eight years ago, the story of how Iwerks got started initially would be most welcome.

Stan Kinsey and Don Iwerks became friends when working at Disney. They saw an empty marketplace and therefore an opportunity in out-of-home simulation entertainment. Stan, more in charge of the vision and the business side, left Disney at age 31 to do his market study. This was in 1986. Don Iwerks, the technical wizard, the engineer in charge of the design of all pieces of equipment at Disney, quit a year later at age 56. At this age, and with this level of specialization, the risk factor was probably greater for him. At this 'garage stage,' with two engineers and a secretary in Burbank, they thought that with $30,000 each and a contract in hand they would be able to launch the company. After endless delays, they were at a point where they had each put up to $200,000, meetings with venture capitalists were their daily occupation, the majority never understanding the marketplace and some even refusing their meeting. At that time, most venture capitalists were in Silicon Valley closing computer deals. One of their main concerns was the fact that the company had to rebuild its customer base each year. With still no contract on hand and no money to pay the next payroll, Stan gave a deadline to their only prospective customer and a 20 percent discount on the project, warning him that after this date they would not be able to dedicate the focus of the company to this project but to another customer contract. By midnight, the contract was signed and the deposit paid! Further, the concept of the business evolved by including recurring revenues in leasing films to their customers and in operating their own "Cinetropolis" centers, including four of their proprietary technologies. At that stage, tired by the negative reactions of venture capitalists, they turned to personal investment. Finally, a venture capitalist decided to invest after a 20-minute interview. $1,500,000 was invested in exchange for 15 percent of the equity. $600,000 followed in '88, $1,000,000 in '89 and $10,000,000 by Itochu/Toshiba in '92. The concept of Cinetropolis created the need to go public. You should know that while they were looking for $20 million, the first public offering raised more than twice the money. Iwerks plans to open 30 Cinetropolis theme parks around the world, each generating a minimum of $10 million. The group, including the purchase of Omni Film in Florida, now has 230 employees.

MAXXING THE STUNT MASTER

by Charles Lovett

Editor's note: The manufacturer, Victor Maxx, has just developed a version of the HMD for use with the IBM PC.

The Victor Maxx *Stunt Master* is a Virtual Reality Head Mounted Display (HMD) set intended for use with the *Super Nintendo* and *Sega Genesis* home videogame units. Currently available for around $200, the Stunt Master set includes the color, monoscopic HMD, a tracking tube and clip, an AC adapter, a Sega Genesis cable assembly, a Super Nintendo cable assembly, and a manual.

As the manual suggests, Stunt Master is ideal for use with certain types of games; particularly vehicular simulations with first-person or rear-view perspectives, and any other games with eye-level perspectives. The manual also includes installation and operating information, as well as hints and troubleshooting help (although no technical information of any kind is included).

Recently I secured a Stunt Master for possible adaptation to a PC-based VR application, and proceeded to reverse engineer this device. Although I felt some disappointment with the HMD's performance, in the interest of garage hackers everywhere I have here recorded the details of my exercise.

NOTE: these illustrations are preliminary, and may be subject to further analysis, correction, or modification.

DISASSEMBLY

My first objective was to disassemble the unit in order to discover its makeup. Here's how to do it: there are four assembly screws located on the bottom half of the unit which must be removed. After removing these screws, gently pry/separate the top and bottom halves of the unit apart. The Printed Circuit Assemblies (PCAs) and the interface cable are snugly secured in place (PCAs are tacked in place with an RTV-like substance to the molded in-place card guides) — be careful not to damage or dislocate these. It will take a lot of patience and mechanical dexterity to disassemble the unit - and even greater dexterity to reassemble it once you're done.

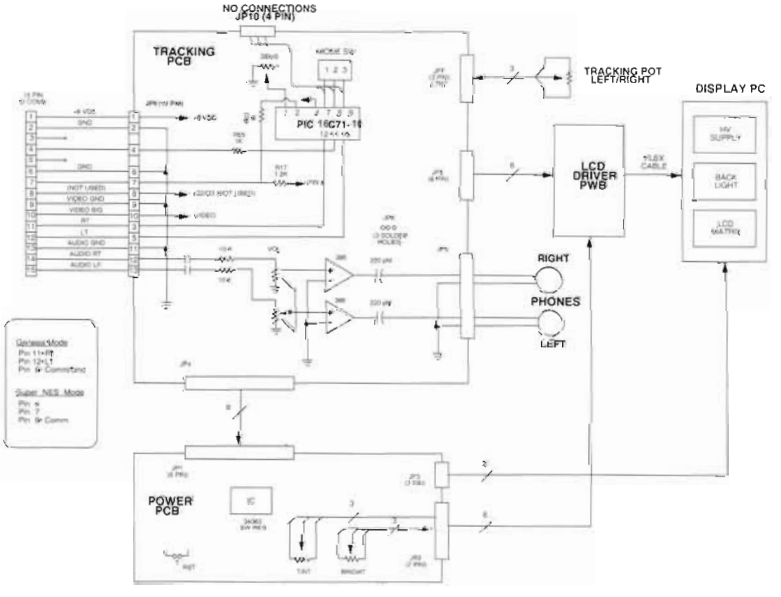


Figure 2 Block Diagram, Victor Maxx HMD

Once the unit was disassembled, I proceeded to investigate and analyze the various PCAs, and traced the wiring and signals to the external 15-pin interface cable. The results of this analysis and wiring/signal trace is presented in the next section. Additional sections present possible modifications and interfacing options for this HMD to IBM-PCs and compatibles.

PCAs IN THE HMD:

The HMD is composed of the following printed circuit board assemblies:

1. Audio/DSP (tracking) board containing two LM386 1/2 watt audio amplifiers: one each for the left and right audio channels and a PIC16C71-16/P microprocessor (16 MHz crystal) which is used for the tracking function.

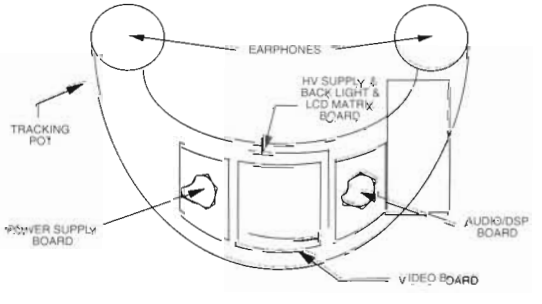


Figure 1- Board Arrangement

2. Video board/LCD driver containing the LCD video electronics.

3. Display board containing the high voltge supply, backlight, and LCD matrix.

4. Power supply board containing a KA34063A switching regulator IC.

5. Two earphones.

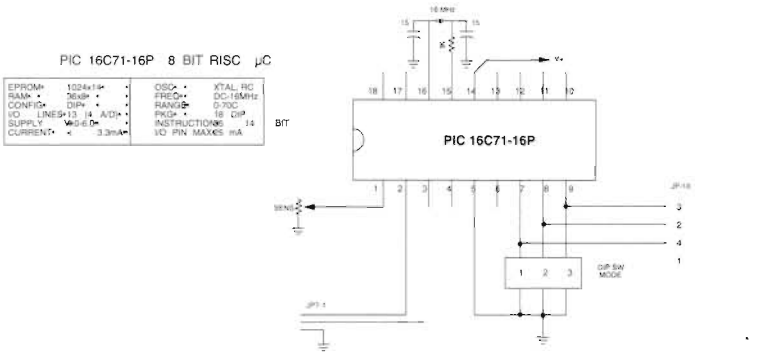


Figure 2A PIC 16C71-16P Microprocessor

6. Tracking pot.

The controls included on the Victor Maxx include the following:

- Volume (on tracking board)
- Sensitivity (on tracking board)
- Mode switch, 3 position (on tracking board)
- Tint (on power board)
- Brightness (on power board)
- Reset (on power board)

Tracking and Interface Modifications:

In its present form, the interface used in the Victor Maxx HMD for outputting X (horizontal) information via the tracking pot and tracking microprocessor circuitry was developed mainly for interfacing to the Sega Genesis or Super Nintendo joystick/controller ports using the respective interface cables supplied. The mode switch on the HMD selects either the Sega Genesis or Super Nintendo tracking mode. The tracking tube and clip is attached to the tracking pot and clipped onto the user's shirt so that as he/she turns left or right it also moves the tracking pot. Rather than attempting to interface the tracking circuitry, a simple solution would be to replace the present tracking pot located on the right side of the HMD with a standard value pot used in the PC joystick (although one could try the present pot), connect 3 wires to this pot, and run a separate cable out to an interface box. This interface box would allow either the normal use of the joystick or the use of the modified tracking pot for X position (left-right) via a selection switch. Although the normal PC joystick pots use 2 wires, 3 wires should be run from the modified tracking pot in case the wires have to be swapped (i.e. use the wire from the center terminal of the pot and one of either ends — you will have to experiment to determine which one). The normal PC joystick pots are wired to pins 1 and 3 (position 1), pins 6 and 8 (position 2), pins 9 and 11 (position 3), and pins 13 and 15 (position 4). Experimentation will be required to determine which is the X position and which is the Y position pot. A second tracking pot could also be added for the Y position (up-down). See Figure 6 for a possible set-up.

One could opt for not using the tracking circuitry or modified pot arrangement, using instead an ultrasonic tracking device such as the one found in the PowerGlove (information on howVRASPian Doug Faxon builds a headtracker from a Power Glove appears on pages 244-250 of Linda Jacobson's Garage Virtual Reality). Additionally, *Logitech* sells a 3D headtracker for $999, as well as a 3D Mouse for the same price.

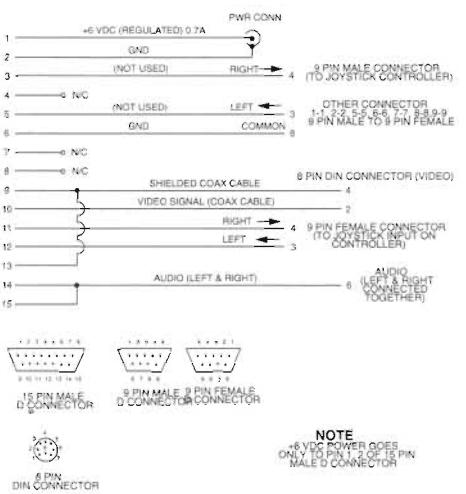


Figure 3 Adapter Cables: Genesis

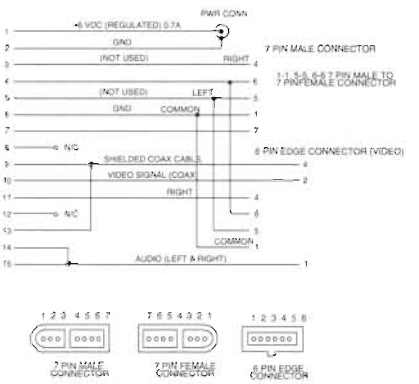


Figure 4 Adapter Cable: Super Nintendo

Optics Modifications:

The Victor Maxx utilizes an inexpensive Fresnel Lens as the only optics structure between the viewer's eyes and the LCD screen. The so-called "immersion experi-

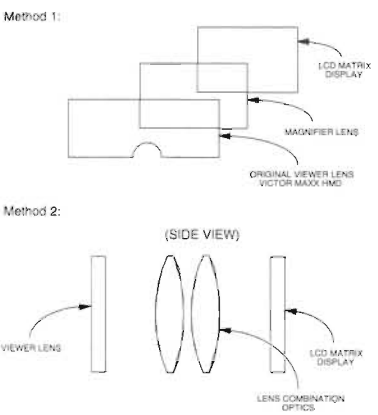


Figure 7 Possible Optics Modifications

ence" provided by this simple approach could be modified/improved. The image appears rather small, and could possibly be improved by including a magnifier lens (Fresnel) between the LCD screen and the viewer Fresnel lens (as shown in Figure 7). This of course would increase the pixelization effect somewhat, but might increase the immersion effect. Other optical configurations could be tried, such as using various lens combinations (possibly including mirrors and prisms). I have not yet tried any of these approaches, but mention them here as possibilities.

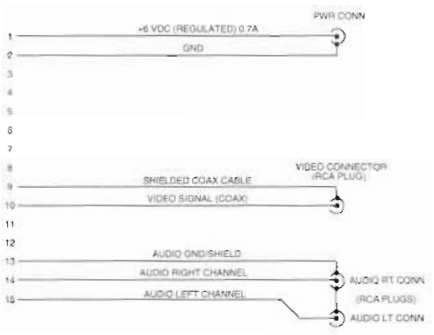


Figure 5 Cable Assembly HMD/VCR

Audio Interface:

The audio output of Sound Blaster Pro and ASP 16 cards is in stereo (mono if you have one of the original Sound Blaster cards versions 1.0, 1.5, or 2.0). However, you can tie the HMD's left and right audio channel inputs together (pins 14 and 15 on the external 15 pin interface connector), to the sound output of the Sound Blaster card and use pin 13 for the ground return via a mini 1/8 inch jack. (If you notice, a similar approach was used for tying the right and left channels together in the Sega Genesis and Super Nintendo adapter cables.)

Use a standard 1/8 inch mini stereo jack with cable and an interface box with a switch for selecting either the HMD earphones or the external speakers for use with the SB Pro or ASP 16.

NOTE: The output of the Sound Blaster cards are 4 watts per channel — these will overdrive the inputs of the LM386 audio amplifiers in the HMD. One option exists on the SB ASP 16 which allows the selection of line output instead of the 4W SB audio amps (see the SB manual). A second approach is the possibility of using series-attenuating resistors in each audio channel (or use L or T pads). My own approach involved selecting the line option output from the SB card with an external computer speaker system and a switch box. The switch box could be used to select either the computer speaker system or the HMD audio channels.

Video Interface:

The video interface presents a more difficult challenge. The video input to the Victor Maxx HMD is NTSC composite video. The video output from most PC video boards is VGA (or perhaps CGA, EGA, or mono - depending upon your particular display adapter). A video interface box will be required to convert the output from the particular video board to the composite NTSC video signal; in most cases, a VGA-to-NTSC converter will be required.

As an alternative, one could point a video camera at the computer display screen and send the camera output directly to the composite video input of the HMD — this would eliminate the need for a VGA to NTSC converter. Other options for the VGA-to-NTSC converter include purchasing one, building your own from supplied plans, or even designing your own. There are several VGA to NTSC converters presently on the market; these include the *PC-Video Converter, VGA to TV Elite, Pro CT/TV Plus*, PC to *Video Converter Box* or even perhaps *Game Blaster* which is a new inexpensive PC to TV Video Converter.

For example, the Game Blaster includes the Game Blaster adapter, Y-cable, power supply, S-VHS cable, AV cable, software, manual, and three games (*Jetfighter II*, *Spectre Challenger*, and *Prince of Persia*). The software installation disk creates a batch file (*TV.BAT*) which automatically loads the TSR driver to start the VGA-to-TV conversion. The Game Blaster driver transforms the VGA frequency to NTSC frequency and the monitor, if attached, will become distorted for viewing purposes.

The October 1991 issue of Radio Electronics (page 33), presents an article on how to build a PC-to-TV converter. This converter uses the MC1377 RGB/NTSC encoder and a specialized custom ASIC chip, the HD440072 sync generator.

Lastly, of course, you could design your own using the MC1377 RGB/NTSC encoder chip. The difficult part would be designing the sync generator circuitry, as the NTSC sync is different than the VGA sync (horizontal and vertical sync). NTSC has a 15.7 kHz horizontal sync and a 60 Hz vertical sync. VGA generally has a 31.5 kHz horizontal sync and a 70 Hz vertical sync. The VGA horizontal and vertical will vary somewhat depending upon display resolution, monitor, and video adapter board.

A special thank you to Paul Ruel for editoral assistance.

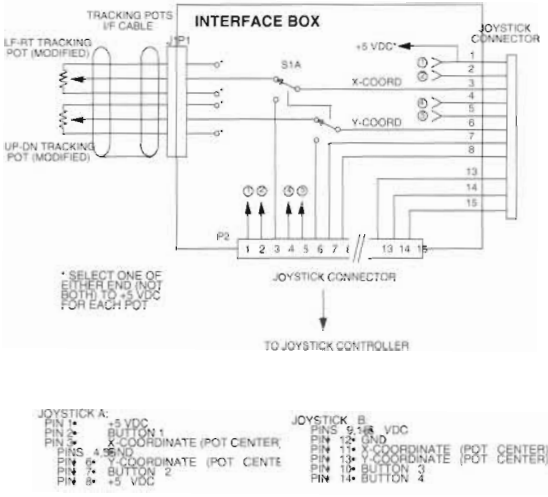


Figure 6- Joystick Interface Box

TABLE I. Victor Maxx HMD PCAs/Connector J6

1. Victor Maxx HMD PCAs

* Tracking PCA (board No. PA-2421 Rev A)
* LCD control/display driver PCA
* LCD display PCA (LCD matrix, HV supply, backlight)
* Power PCA (board No. PA-2422 Rev A)

2. Tracking Board PCA Connector JP6

Pin#	Color	15-Pin Ext	PWA Destination
1	Blk	1	+6 VDC (measured 6.7 VDC no load)
2	Wht	2	Ground (6 VDC return)
3	Brn	11	(Goes to pin 12 of microprocessor)
4	Red	4	(Goes to R25 1K resistor to pin 11 of microprocessor)
5	Orn	12	(Goes to pin 10 of microprocessor)
6	Yel	6	Ground
7	Grn	7	(Goes to R17 and R23 1K register to pin 2 of microprocessor)
8	Blue	8	Not used (goes to Q2 and Q3 which is not installed)
9	Shield grd	9	Video ground
10	Ctr cond	10	Video signal (composite NTSC)
11	Vio	13	Audio ground
12	Gry	14	Audio right channel
13	Lt blue	15	Audio left channel

TABLE II. External 15 Pin Interface Connector

Pin#	Function
1	+6 VDC supply, 0.7A
2	Ground (6 VDC return)
3	Right directional input from joystick
4	
5	Left directional input from joystick
6	Ground (common from joystick)
7	
8	
9	Ground shield on coaxial cable
10	Video composite signal (center conductor of coaxial cable)
11	Right directional output from HMD
12	Left directional output from HMD
13	Ground (audio)
14	Right channel audio
15	Left channel audio

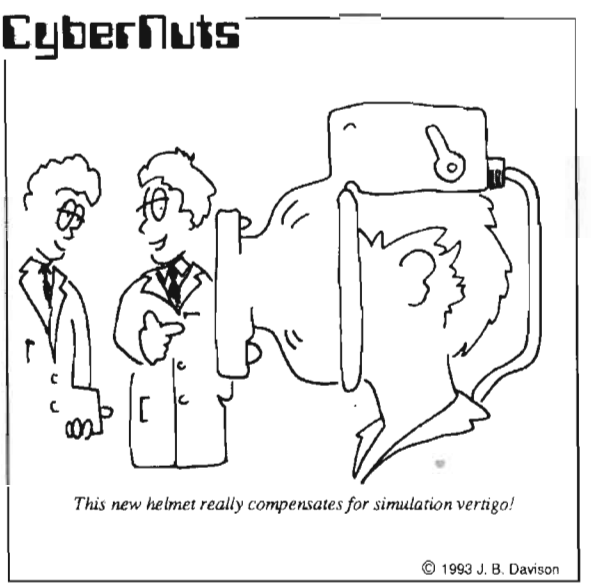


TABLE III. Tracking PCA Information

1. Integrated Circuits:

Qnty	Part No.	Description
2	LM386	Audio amplifier, 8 pin mini-DIP, 1/2 watt low voltage. One each for the L and R channels.
1	PIC16C71-16/P	Microprocessor, 18 pin, 16 MHz crystal

2. Connectors:

Connector	# of Pins	Description
JP10	4	Mode switch extension (no connection)
JP5	6	LCD
JP9	4	Left and right speakers
JP4	8	To power board
JP7	3	To tracking rheostat
JP8	3	No connector pins, just solder holes
JP6	15	To external 15 pin female connector

3. Controls

Control	Description
Volume	5 lead stereo pot (1 lead ground)
Sensitivity	3 lead, goes to microprocessor
Mode Switch	3 position DIP switch
	Switch 1 goes to pin 7 of microprocessor
	Switch 2 goes to pin 8 of microprocessor
	switch 3 goes to pin 9 of microprocessor

TABLE IV. Remaining PWAs

1. Power PWA

ICs: KA34063A 8 pin mini-DIP switching regulator

Connectors:
- JP1 9 pin Goes to tracking PCA
- JP2 6 pin Tint and brightness controls, goes to LCD driver board
- JP3 2 pin Goes to LCD display board

Controls:
- Reset pushbutton
- Tint (pot)
- Bright (pot)

2. Display PWA

- LCD display matrix
- High voltage module
- Backlight

3. Driver Board

Circuitry: control circuitry for inputting a composite NTSC signal and outputting signals for driving a LCD matrix display.
Connector: flex cable which connects to the LCD matrix display board.

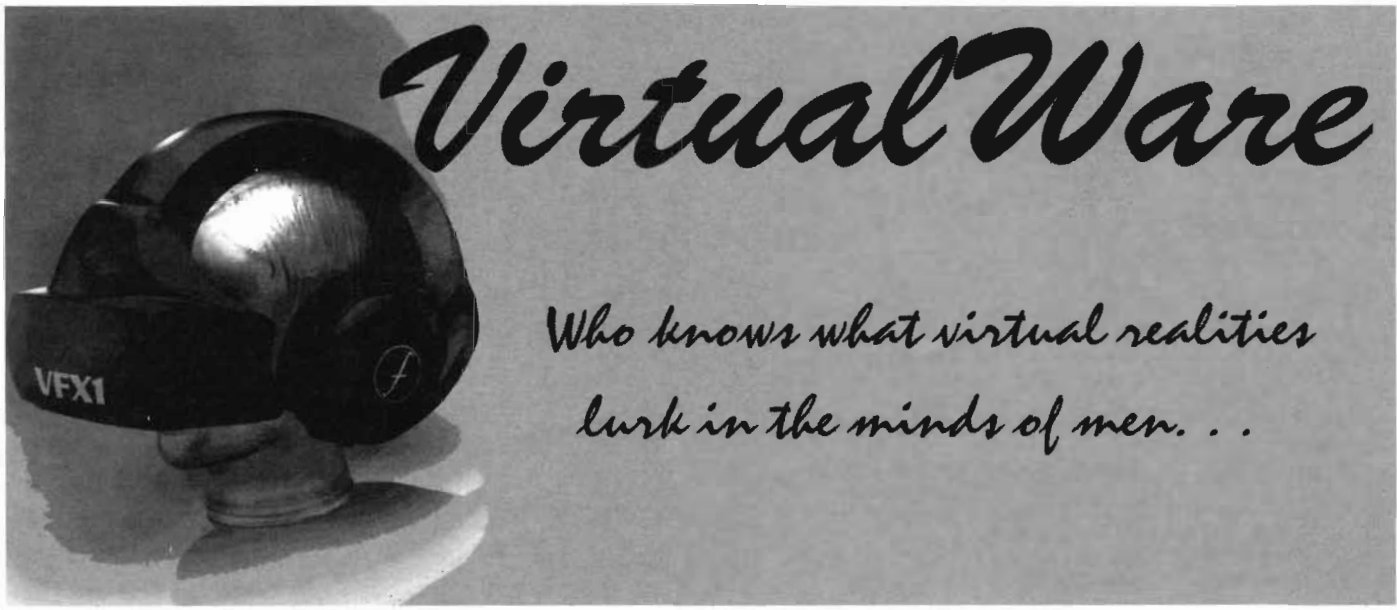
TABLE V. Miscellaneous Information

1. Earphones

Left earphone wires: black and brown
Right earphone wires: red and orange

2 Tracking Pot

Black wire: top of pot
Brown wire: center
Red wire: bottom of pot



4/94 Synthetic Images, Inc. announced the Reality Blaster™ RB-1000PC. This ISA compatible PC board provides advanced VR similar to mainframe and high-end graphics workstations' capabilities. The board can hold an entire dynamic virtual world, rendered in 24-bit color at 60,000 textured/shaded polygons per second in VGA or NTSC format. Translucency, transparency, flat and smooth shading, and texture mapping are all performed onboard against a database holding 25K-400K polygons. There can be hundreds of moving models, and 1Mb of subdividable texture map is available. 3-D output is available via an optional daughterboard, or a second board. Other options provide compatibility with Sun™ and Stereographics CrystalEyes™ glasses, and LEEP™ projections. Host PC applications interact with the board through a 'C' API. Pricing starts at $2.5 K
Contact: Lee Slater (407) 282-7740

4/94 Forte Technologies Inc. projects the release of the Forte VFX1 Head Mounted System for October. The device prototype which premiered last winter weighed in at 3 lbs and featured a pair of 35k color pixel 0.7 inch LCDs and a 46.4 degree horizontal field of view. Its selfcontained head-tracker system provides yaw, pitch and roll coordinates. 3D sound can be obtained through Advanced Gravis UltraSound™ board, or mono through standard PC sound board. The real production unit will weigh only 1.5 lbs and have a flip up visor with the capability to retrofit as better LCDs become available in the future. Projected retail price is $1K.
Contact: Peter Matthews (716) 427-8595

4/94 Superscape VR plc previously known as Dimension International Ltd. goes public on the London Stock Exchange. Over 5 million shares issued resulted in a market capitalization over 10 million pounds. Superscape will send Bob Lowe to the US to continue the expansion of the firm.
Contact: Maggie Templeman +44 494 483674

4/94 Division Inc. continues to market their new dVISOR, an active matrix TFT LCD Head Mounted Display for under $6K. Field of view is 105 degrees horizontal and 41 degrees vertical in this stereoscopic entry into the growing field of affordable HMDs.
Contact: Charles Grimsdale 1-800-877-8759

4/94 Wexner Center for the Arts presents electronic games defining the realms of art and technology. Softworlds Inc., has developed interactive/digital art for the Wexner Center (and the New Museum of Contemporary Art, New York City) as an effort to expand the use of computers in art, and challenge traditional artistic views.
Contact: Darnell Lautt (614) 292-0330

4/94 KATrix Inc. develops adaptive systems and keyboard alternatives. KATrix's NeurRule™ Intelligent Agent Development System uses rule-based control, and neural net libraries to allow game designers to match game difficulty levels to player ability. The CyberKAT is KATrix's hand held keyboard alternative which is designed for input in conjunction with HMDs.

5/94 Liquid Image Corp. lowered the price of MRG 2 to $3.5K. This award-winning HMD features remarkable durability, 84 degrees of horizontal field of view, and 65 degrees vertical. Liquid Image also introduced the MRG4. This less expensive model is designed for demanding environments. such as arcades, and retails for $2.2K.
Contact: Shannon O'Brien (204) 775-2633

5/94 General Reality Co. Introduces CyberEye™, a low-cost HMD for professional applications. Highlights include high resolution, minimal distortion, cost, minimal eyestrain, and comfort for prolonged use. Prices start at $2K.

General Reality and Avatar Partners realeased the first prototype of their "DIVE belt". This battery powered wireless unit transmits tracking data to desktop workstations, and relays audio, video and power to the CyberEye™. The team hopes to make the final version more durable, and incorporate stereoscopic video at HDTV resolution to meet US Army Simulation, Training, and Intrumentation Command specifications.

Contacts: Arthur Zwern (General Reality) (408) 289-8340
Peter Rothman (Avatar Partners) (408) 338-6460

General Reality's CEO sports divebelt and HMD

5/94 Cabletron Systems premieres world's largest VR theater at Networld+Interop. An audience of up to 26 experienced an immersive animation world through individual MRG2 HMDs. The technology for the event was developed by StrayLight Corp. Cabletron presently employs the theater to demonstrate their MMAC-Plus switching hub's capabilities.

Contact: Michele Jachim (603) 337-1079

5/94 Velocity introduces Spectre VR CD. This action/arcade game includes over an hour of live-action video, and a world editor which allows players to create their own worlds within the game. CD version suggested price is $69.95.

5/94 Immersion Systems, Inc. announces development of Meme, a system of operating modules storing data and code for use in networked multi-user worlds. Currently available as an alpha release for DOS, it supports Logitech Cyberman and shortly the Soundblaster.

Contact: Marc de Groot (415) 641-VR4U

5/94 Sense8 makes their flagship product WorldToolKit v.2 available for Sun SPARCstations. Its features were optimized for use specifically on the Freedom Series (TM) 100 and 3000 graphics accelerators manufactured for Sun by Evans & Sutherland. This will offer an affordable upgrade and result in increased speed and performance of VR applications comparable to more expensive platforms.

Contact: Kim Machado (510) 631-1017

Divison HMD on display at Montpellier

Stop allowing your VR press releases to lurk in the shadows! Send your product announcements to PIX-Elation / ATTN: VIRTUALWARE, PO Box 4139, Highland Park, NJ 08904-4139

VR SPARKS EDUCATION

by Eben Gay

Imagine shrinking to microscopic size and experiencing cell biology first hand. Imagine experiencing the parts of a cell not as static stains on slides, but as dynamic interactive objects. Imagine building a cell by hand and seeing it function. The Cell Biology Virtual World that ERG Engineering, Inc. built for The Computer Museum in Boston makes it possible.

This experimental virtual world for teaching cell biology is part of a project to test whether immersion in a virtual world makes a measurable difference in how well people learn scientific information. ERG Engineering, Inc. worked closely with David Greschler of The Computer Museum to design this world. We chose cell biology as the virtual world to test because it involves complex spatial interactions and is inherently three dimensional. In this virtual world, the user brings a child to life by building a neuron, a muscle cell, and an intestinal cell.

Each user experiences one of the following versions of the world: immersive (head-mounted display, hand-actuator, and two trackers), nonimmersive (displayed on a monitor, controlled with a joystick), or passive (videotape). By giving the same test to all users, we can determine how the different interfaces affect the user's ability to learn.

The immersive and nonimmersive versions allow the user to learn through discovery. The user moves around the virtual world, building each cell by picking up virtual organelles and placing them in the empty cell. 3D animation and spatially located sound are liberally used to make the world rich and informative.

This project is partially funded by a grant from the National Science Foundation and in addition we were fortunate to recieve many other donations and contributions.

The Three Interfaces

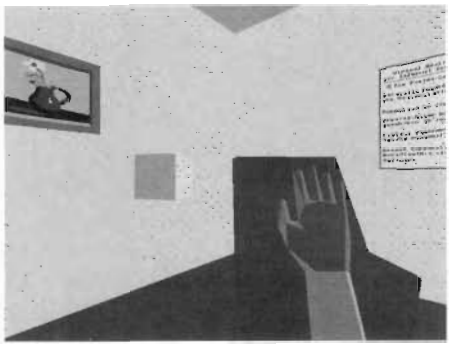
The fully immersive user enters the cell biology virtual world by putting on a head-mounted display and picking up a hand tracker. The interaction with the virtual world is very simple reach out and grab objects, walk to where you want to put them, then let go. The physical motions of reaching and walking in the real world are mapped directly into motions of the virtual hand and viewpoint in the virtual world. There are no gestures to learn or virtual portals or other devices to learn how to use. Even so, we have found that most people need to experiment with picking up virtual objects and with moving in the virtual world before they are ready to learn about biology. For this reason, when they enter the cell biology world, they start in the "grab-and-carry room".

The nonimmersive user has to learn how to maneuver by moving a 3d joystick (a Global Devices 3D Controller) and pressing the space bar to pick up objects. The movement has been partially limited so that the user cannot tilt or roll, as this tends to disorient the users. These users also start in the "grab-and-carry" room so they can practice maneuvering before they try to build cells.

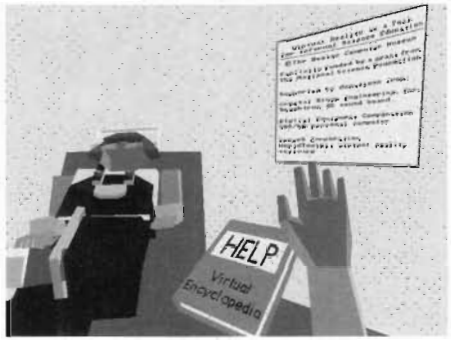
The passive user watches a video tape that was made from the audio and video as seen by a fully-immersed user. The raw video was professionally edited for better presentation to the passive viewer. Certain details were removed, such as the grab-and-carry room, which is not relevant to a passive user. Other elements were reordered . The information is the same and the flow is similar to what a nonimmersive user experiences.

World Description

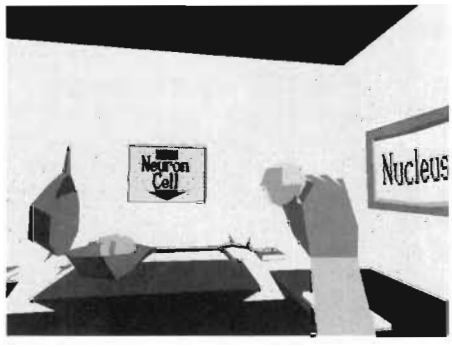
The grab-and-carry room contains an empty chair and a small cube that is spinning in mid-air. The cube asks to be carried to the chair.



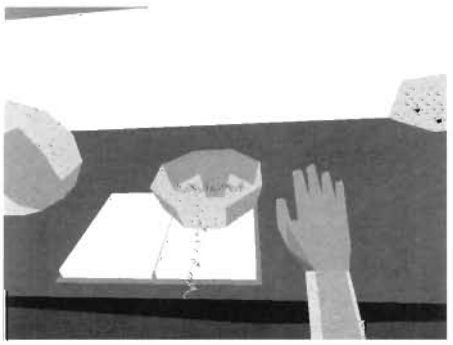
When the cube is put on the chair, it disappears and is replaced by a limp child. The child explains that he needs neurons to think with, muscle cells to move with, and intestinal cells to digest food for energy. Then the child asks the user to grab the child's arm or leg to make a muscle cell, grab the stomach to make an intestinal cell, or grab the head to make a neuron.



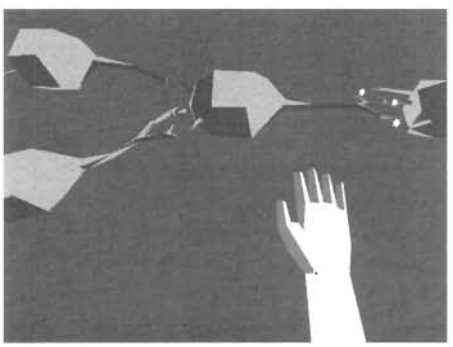
When the user grabs a part of the child's body (such as the head), the user is drawn into a room containing an empty cell for that part of the body (a neuron). Around the room are tables of organelles such as mitochondria, muscle fibers, and a nucleus.



When the user enters the room, the cell explains what it does and what it needs. (For instance, the neuron generates electrical signals that jump the synapses to other



When the cell is complete, it asks the user to grab its top to start an animation. When the user grabs the top of the cell, the cell closes and the room disappears. The cell is surrounded by its neighbors and they go through an animation showing how the cell functions in the body (for instance, sparks jump from neuron to neuron).



When the animation completes, the user returns to the child room and the child thanks the user ("I can think now!"). As each cell is completed, the child becomes more animated. (After the neuron is done, the child's head wakes up and watches the user alertly.) When all the cells are built, the child tells the user "I feel GREAT!" and the world exits with a fanfare of digitized trumpets.

Project History

The goal of the study is to determine what contribution virtual reality can make to people's understanding of scientific concepts. Specifically, is there a measurable benefit to using an immersive environment (head-mounted display) over a simple flat-screen display? Does the feeling of "being there" affect the learning experience?

The following list of desired characteristics drove our choice of virtual world:

- The learning task should be three-dimensional so that the 3D characteristics of the virtual world are relevant to the problem.
- The world should be dynamic and interactive, should incorporate 3D animation, and should use stereo or 3D sound. It should not be a simple walk-through.
- The problem should be compelling so that the participant has a reason to participate.
- The task should be structured so that we can quantifiably test for results. A database should be designed that will hold the test results and aid us in interpreting them.
- The system should automatically collect as much of the database information as possible, and there should be an automated method for updating the database.

A cell biology virtual world was chosen because it met the above criteria, and we had the expertise to implement it. Cell biology virtual worlds that we considered include: DNA/messenger RNA/protein synthesis that happens in a cell, studying aerobic and anaerobic reactions that fuel a muscle, and controlling a macrophage as it is scavenging foreign objects as part of the immune system. We decided on the child and three types of cell virtual world because it is very basic cell biology (what are the parts of a cell?), the differences between cells is fundamental (the shape and contents of a cell vary according to its function), and the user can make a direct connection between the contents of a cell, the function of the cell, and the action the cell performs for the body.

We took advantage of the medium to provide context to the information at many different levels. The organelles interact with each other and provide specific functions for the cell. The cell interacts with its neighbors and provides a specific function for the child. All the levels, from microscopic to macroscopic are integrated with a succession of interactions and animations to make it clear how the parts make up the whole.

Throughout the cell biology virtual world we use digitized voice spatially located with a Beachtron 3D sound card so that the virtual objects appear to be speaking. This allows the user to locate the source of a sound, even if the user is not looking at it at the moment. We use different people's voices, both children and adult, to give individuality to different objects within the world.

The world is extremely dynamic. We used animation, motion, sound, and user interaction to make that experimentation a rich experience. We designed the interactions so the user will learn from all their actions, whether or not it is a "correct" action within the context of the task.

The world is designed to accommodate different learning styles. The user can experiment and see what happens, or the user can go the "books" to find out what is needed and how the parts work.

Both "left brain" verbal thinkers and "right brain" visual thinkers are accommodated in the virtual world. The objects are presented visually, described verbally, and labeled with signs. The functions of the organelles are presented with animations and described verbally.

The Project Process

We ran the project in two phases: an initial open ended test and a final quantified test.

The purpose of the initial phase was to find out whether our assumptions about how to build a virtual learning system were correct. We started testing in December of 1993, picking randomly from the visitors coming to The Computer Museum. They were asked questions about their computer and biology background before using the system. After their experience in the cell biology virtual world, there was a fairly open feedback discussion. After testing over 100 people, we found that we were on the right track, but that some characteristics of virtual teaching systems had unexpected ramifications.

One advantage of a virtual experience is the immediate feedback that the world provides for any user action. The corresponding disadvantage is that the cartoon world is sufficiently different from the real world that the users are flooded with sensations and don't remember lists of facts over a long period of time.

Our original world had required the users to learn what the organelles were, build a cell, test it to see if it worked, and if it did not work then add or remove organelles. We found that people forgot the organelles' functions if they did not get feedback until much later when they tested the cell. We modified the world so that when users added an organelle (such as a nucleus) to a cell, it would immediately tell them what the organelle did and whether the cell needed it or not. This improved the learning experience because the feedback on what organelles do and whether this cell needed them is immediate. It also reduced frustration because it was now impossible to build a non-functional cell (incorrect organelles remove themselves while explaining why they are not needed) which dramatically reduced user frustration due to confusion over why an incorrect cell would not work.

Pass/Fail

We are currently in the second, quantified, phase of testing. By June we were half done with the testing. We expect to be completely done by August. In this phase, the users fill out written tests before and after the cell experience. These tests are designed to find out both how much the users have learned about biology and how they feel about the learning experience. The test results are being entered in a database so we can run detailed analyses on them.

The constraints on the space we have for testing and the equipment available to drive the virtual world have required us to do the testing sequentially. The immersive testing was done first, then the nonimmersive testing. The passive testing will be done last.

Some interesting and unexpected results have come out of the project.

The users of the fully-immersive system have shown much less "simulator sickness" than we expected. The Vrontier Tier I head mounted display is very blurry and the world update rate on the 50 MHz 486 PC can be as low as 5 updates per second. Low update rates mean that the user moves but the image takes a while to catch up, so there is a discrepancy between what the user's ears and muscles are telling the user's brain and what the user's eyes are telling the user's brain, which can cause the user to reach for the airline sickness bag... It takes a typical user about 1/2 hour to finish building all three cells.

We feared that many people would become ill long before they finished building the cells.

We have found that some people are affected by the system, but not as many as we expected. In particular, even some people who have had bad experiences with immersive v.r. systems in the past often tolerate this world much better. We suspect that this is because the virtual motion is tied to the user's physical motion (to walk over and get a virtual object you physically walk over and reach and grab). This contrasts with most virtual experiences which have a "point to fly" style interface, which might compare more closely with an airplane ride or boat ride, both of which cause motion sickness in some people.

We have found that the blurriness is a big problem, and the users often need to sit down afterward until their eyes adjust. If we were to do the test over with one of the new head mounted displays that has higher resolution and better optics, we expect that this problem would be significantly reduced.

Reach Out and Touch Someone

Another interesting result comes from the shortcomings of the immersive system's display of depth information. There are several ways that people tell how far away objects are in the real world. One is by the parallax between the left and right eye views of the world. This works only when objects are fairly close, and as much as 30% of the population is not able to tell depth this way. Another is by knowing how big an object is (such as a coffee cup), so that if it appears to be really little, it must be far away. Another is by moving sideways and seeing how the different objects in the world move relative to each other (near objects will move a lot, distant objects not much). Another is by seeing where the objects' shadows fall (if one object's shadow is in front or on top or behind another object, that helps to indicate where the objects are relative to each other). Finally, people can reach out and touch things to find out where they are.

Unfortunately, the cell world is too complex for the 50 MHz 486 PC to be able to calculate both left- and right-eye views in a reasonable time (we are already down to 5 frames per second for just one view). So our system presents the same view to both left and right eyes, so the users cannot use parallax to judge distance.

The objects that we are using are internal cell structures (golgi complex, mitochondrion). Most people do not have any idea how big they are, so the users can't tell how close or far away objects are by their relative size.

The virtual reality software is not able to generate shadows in real time, so there are no shadows to help the users judge distance.

In fact, the only two ways that are left are moving sideways so that nearer objects move against the background, and reaching out to touch objects.

Even the reaching out is a bit more difficult. In the real world, you feel an object when you touch it. In our virtual world, your hand sinks into the object and turns purple! This is not quite the same...

The most effective way of picking something up in our virtual world is to start with your hand close to you and between you and the object. Then reach out until your hand either goes into the object or you are reaching as far as you can. If you are reaching as far as you can, and you have still not touched the object, then you are far from the object and need to walk forward. Some people take to this

immediately and some people just cannot learn it. Most people take a little time to adjust and then are fine.

We suspect that if we had left- and right-eye views that the depth discernment would be less of a problem.

Loss of time sense is an interesting phenomenon of the virtual world. Users consistently and drastically underestimated how long they spent in the immersive environment. They think it took 5 to 10 minutes when it actually took 15 to 30 minutes. We suspect this is related to their being saturated with input from the virtual world.

People seem to enjoy the immersive version much more than the nonimmersive version. Immersive users will put up with the graininess of the head-mounted display, struggle to grab objects without stereo vision, and spend 15 to 30 minutes to fully build each of the three cells (neuron, intestinal, and muscle). Afterwards, as they are sitting until their eyes adjust, they tend to say "That was Great!" Nonimmersive users, after spending time to build the first of the three cells, tend to say "Enough, I get how this works," and rush through building the other two cells.

We are looking forward to finishing the testing so we can take a look at the "real" results of the study!

Interactive System Configuration

Hardware:

486/66 PC

SPEA Fireboard graphics board

Crystal River Inc's Beachtron 3D sound board

Polhemus Isotrak II magnetic tracker (immersive system)

Vrontier Tier 1 HMD (immersive system)

hand-held actuator (immersive system)

Global Devices 3D Controller (joystick for nonimmersive system)

Walkman-style tape player speakers.

Software:

virtual world models, sound, and v.r. program

PharLap TNT DOS-Extender

Sense8's WorldToolKit virtual reality software

Crystal River Inc's Beachtron sound software.

VATS

Part 2: Groping in the Light

Duncan McElroy

Danfoe arrived for work a few minutes early, so he decided to catch up on some reading. He put his hand up to the Braille screen and read the raised dots as they scrolled by under his fingertips. He'd left a message for himself the day before to read the cover story of the latest Environment Weekly. Why hadn't he read that yet? He called it up. The headline slithered by and reminded him why he'd put it off for the fourth time in as many days.

RIVER-FILL CALLED COLLABORATIVE URBAN ART

He slumped back in his chair, disgusted, and sunk his hands deep in his trouser pockets. Something was down there, at the bottom of his right pocket with the subway tokens and three-year-old lint, something a lot like one of those miniature playing cards. He fingered it idly, and five seconds later it spoke to him. It reminded him that just three blocks away was a man waiting to stick a billion tiny probes in his head and maybe, just maybe, give him back something he'd spent his entire adult life learning to live without.

Even today, thirty years after the childhood trauma that ensured he would never again have to watch the horrors of an often cruel world, Danfoe could still see in his dreams. In the safety of slumber, he strolled through the magical forests of his youth. The tall conifers towered above him, casting the soft moss and pine needle-strewn ground into the safety of shadow. Seated between two enormous roots at the base of a pine tree, he found entire worlds amongst the fern leaves, spider webs, and gently rolling mists that shrouded and wrapped him like a blanket. And should he now allow himself to believe that a computer might allow him to return there?

No. Hell no. That was crazy, stupid, weak thinking. How could he allow himself to even consider Burt's insane proposal? How would it look for a blind man, who everyone assumed was a Jack if he wore dark glasses, to take part in an experiment that would probably go far beyond the best trip any punk had ever been on? That would be a major life blunder. Everything he'd worked so hard for; his marriage, his job, the respect of his peers, could all be gone in a flash. No good. And then, of course, there was the danger. Who were these people? How could he possibly trust them?

Still, Danfoe was tempted. He thought of Anna and what it would mean to share her world, to be able to see her and to finally gaze upon the face he knew only through his fingertips. That alone was worth the risk, wasn't it?

These thoughts tumbled through his head for the rest of the morning and he got absolutely nothing done. Before lunch he checked out sick and went for a walk.

There was a park behind his building where he often went for a stroll. But today Danfoe went out the front door, onto Viscer Street, and walked very slowly along it for exactly three blocks...

"You will black out when we turn the power on. This is nothing to be alarmed about. It gives the MERK a chance to make a map of your neural network so it can optimize your experience."

"If I could see, you would all have very reassuring smiles on your faces, right?"

"Just relax, Mr. Drake. You're in capable hands. I have here a unique device, the very first VATS

helmet. Inside it are several billion microscopic, self-guiding probes which will collectively seek out your every neural intersection and pathway.

"To put you at ease, I invite you to first place your hand inside. A small subset of the available probes will pass painlessly through your skin and locate the nerves in your hand. In this way, we can simulate for you a sampling of tactile and proprioceptive sensations, but this won't begin to hint at the richness of the full experience should you decide to go on. It's up to you, Mr. Drake."

Danfoe put his hand out. At first he felt only a slight tingle, which very well may have been his own imagination. Then a rush of sensations coursed through his hand at such a speed that he could hardy attach a name to any of them. But they were all recognizable, and utterly convincing. He found himself flinching repeatedly.

The sample ended abruptly and the room went quiet. Danfoe rubbed his hand cautiously. He felt no pain or numbness, in fact, nothing unusual at all.

"Well, Mr. Drake?"

"Alright. Let's do this."

The helmet came down on his head, and soon Danfoe felt the tingling sensation again, right inside his brain this time.

"Where to, Danfoe?"

"Some place with a lot of trees. Peaceful, quiet, that kind of thing."

"I know just the place. Enjoy yourself, Mr. Drake. We'll see you shortly."

They hit the power and—

Danfoe found himself standing on soft ground, a gentle breeze caressing his face and hands. His eyes were closed. He couldn't summon up the courage to open them, yet. But there was a strange warm glow on the other side of his eyelids. Sunlight, perhaps. A promising sign.

Danfoe knelt down and felt the ground. He ran his hand over the soft moss. He crumbled some of the rich, moist earth between his fingertips and raised them up to his nose. The soil smelled clean and healthy, abundant with life-giving nutrients.

Amazing. Off to his right, a bird called out. Was that a cardinal? He turned his head. Some instinct, some reflex buried but not lost in the early chapters of his childhood, took over at that moment, and his eyes fluttered open.

Danfoe gasped as he looked about him and saw... everything. He could see all of it. Not one exquisite subtlety of form, texture, proportion or color was denied him. He saw trees, birds, sunlight, leaves, drops of moisture, insects— the beauty of it all surged through him and he couldn't take it in fast enough.

To his left was a small pool. The moment he saw it an idea hit him like a grand piano and his heart thumped so hard his eyeballs hurt. He rushed to the edge of the water to gaze upon his own reflection and saw... a man he didn't know. Where was the child in those rugged features? What had happened to little Danny Drake? Suddenly it was all too much. Too much joy, too much beauty, too much water over the dam. He sobbed and couldn't seem to get a hold of himself.

Just then he felt a hand on his shoulder, and he leapt up with surprise. Standing in front of him was a young woman with short blonde hair and the most curious expression on her face.

"What's wrong? Are you alright?"

Danfoe hardly knew what to say. "I... Yes, I'm fine. I'm a little emotional at the moment. You see, I've been blind."

"Oh, I know just how you feel," she said reassuringly. "You think you know yourself, then one day you wake up and, wham! You realize you're a self-centered asshole or something. It's OK, though. Admitting it is the hardest part, you know."

Danfoe looked at her in amazement. She smiled at him like they'd been friends for years.

"What's your name?" she asked.

"Danfoe."

"Mine's Ashley. Nice to meet you Danny."

ααα

At seven o'clock, Danfoe awoke with a start to the sound of Mozart's Eine Kleine Nachtmusik. The opening strain tumbled into his bedroom with all the exuberance of an avalanche of puppy dogs. Out! Of Bed! And off to Work You Go! He threw a pillow at the wall, as if in a vain effort to discombobulate the conductor, who of course wasn't there.

Danfoe buried his face in Anna's soft, warm bosom, ignoring the call to arms. Her heartbeat was steady, strong and reassuring. No seventeenth century up-and-at-em was going to tear him away from that without a struggle.

Eventually, he rolled to the edge of the bed and out of the safety of his warm nest. Danfoe stumbled over to his closet and pulled out the accoutrements of adulthood. He snapped, zipped, buttoned and tucked his starched and pressed multi-layered armor into place and trudged off to work.

For twenty minutes Danfoe allowed himself to get lost in his latest story, the pros and cons of edible food packaging, while his mechanized walking stick swept out a safe path in front of him. It tugged him left then right. It pushed him to a halt at each curb while the camera on the end watched for the walk signal, then pulled him along again when it was safe to move. It navigated the city streets for him, retracing the last route he'd taken with it. So complete was Danfoe's faith in its accuracy that he probably would have followed it straight into the river fill if it decided to take him there.

He snapped, zipped, buttoned and tucked his starched and pressed multi-layered armor into place and trudged off to work.

And had Danfoe not been so absorbed in his story, he might have noticed the man behind him with the Sim-Monocle tucked neatly into his left eye socket, the fingers of his right hand discreetly drumming encoded messages into the pressure-sensitive plate hidden in his lapel.

Normally it was easy to know if you were being followed in the city. Especially

if you were blind. The frantic, breakneck pedestrian pace encouraged by a city that was equal parts productive and dangerous meant that everyone moved faster than Danfoe did. If he heard the same footsteps lingering behind him for more than a second or two he became suspicious. At the moment, however, he was too involved to notice.

What Danfoe would never know was that his body convulsed violently for the first three minutes he was in the machine.

When the stick lurched him abruptly to a halt and beeped twice to indicate that they had reached their destination, Danfoe snapped out of his musings. This was not his building. By the sound of the nearby overpass and the unique combination of city odors, Danfoe quickly figured out what had happened. The stick had taken him back to Neural Relaxation Technologies.

Danfoe broke the cane over his knee, gathered the two halves together, and then broke them again. No one seemed to notice this little outburst except for four agile fingers which abruptly ceased their frantic, precise tapping and hovered pensively over their lapel. Danfoe cursed himself for being such a fool. He told himself he should turn around, march straight down the block and put the whole thing behind him forever. Except for one thing, that's exactly what he would have done.

Danfoe could resist the temptation to revisit the forests of his youth. He could resist the lure of being temporarily if artificially sighted. As for Ashley, well, he wasn't sure if she was a breakthrough artificial personality or just the strangest person he'd ever met, but he could live without talking to her again. And least tempting of all was the money they'd offered him to come back on a regular basis as an experimental subject. No, there was an entirely different reason why Danfoe found himself unable to walk away from NRT and just get on with his life:

Burt Mupperwilk had the bushiest goddamn eyebrows Danfoe had ever seen in his life.

ααα

"That's the worst you've ever heard?"

"Ahem. So then she says to me, "Well Burt, at least if you ever go bald you can comb them straight back right over the top of your head and gather the ends up in a nice pony tail.""

"That is terrible. Ever had them trimmed?"

"Sure. In college. Then a girlfriend told me I had such a huge, ugly forehead that I actually looked better with the damn things in full bloom."

"Same reason people grow shrubs in front of their houses."

"Yeah, thanks."

And so the conversation went as the boys at NRT helped Danfoe into the VATS. As the helmet came down and the metallic haze of a billion microscopic probes engulfed and penetrated his skull, the tingling began to seep into his brain until his every synapse and neuron was purring blissfully at the hands of its own private masseuse. Danfoe knew what was coming next, but he felt no trepidation this time. They threw the power on and he blacked out.

What Danfoe would never know was that his body convulsed violently for the first three minutes he was in the machine. Burt Mupperwilk checked his watch and frowned.

"Ninety three seconds longer than last time."

One of his colleagues threw him a nervous glance. "Think he's gonna fry?"

Burt shook his head nonchalantly. "Nah. He seems strong. Don't forget, he's got the thickest, most stable Neural Soup we've seen."

"Maybe. I want to watch him closely this time. Help me with the equipment."

But Burt wasn't listening. He'd suddenly become perplexed by something and was staring off into space.

"Burt, what's up?"

He turned around slowly.

"How the hell did he know I've got bushy eyebrows?"

ααα

Ashley could hardly contain her excitement at seeing Danfoe again. She'd honestly believed him when he said he'd never be coming back, but she sat and waited for him anyway. What else was she going to do? It was lonely being the only Cog in the Exotic Realm Network.

A hundred times she'd told herself it wasn't worth it. Even if he did return, why would he come here again? There were millions of other locales he could visit, why go to the same place twice? But there wasn't a chance of finding him out there. All she could do was wait and hope. Ashley was starting to feel like Vladimir, or Estragon, when Danfoe finally flicked into existence not ten yards away. Some Godots were worth the wait.

"Danny! You came back!"

Danfoe turned around, startled, and stood there blinking while his eyes got used to the light (an admittedly unnecessary yet altogether convincing part of the simulation.) He was a little embarrassed. Ashley bounced up and down with excitement and glee. It was all the poor girl could do to keep herself from running up to Danfoe and hugging him.

...he wasn't sure if she was a breakthrough artificial personality or just the strangest person he'd ever met...

Danfoe felt obliged to explain his return.

"I, uh, I think I left my wallet here the other day. You see it?"

Ashley burst out with loud, delighted laughter.

"Come on, it wasn't that funny," he scolded her.

"You don't know what it's like here," she said, calming herself. "The Flats don't have a sense of humor like that. I mean, sure, they tell jokes. Like really bad stand-up. But they aren't sophisticated enough to be spontaneous. It's so nice to finally talk to another Cog."

"Flats are what, artificial denizens?"

"Yup. Painfully two-dimensional."

"You called me a Cog."

"Oh. Yeah, that's like in Cognizant. You're aware. Sentient. You have organic beginnings and an intelligent mind."

"Oh, I see. So which are you, Ashley?"

She smiled at him. "What do you think?"

Danfoe liked the way that rolled off her tongue.

"I'm pretty sure you're the genuine article, but I've been fooled before."

"If you're still unsure after thirty seconds, you've got your answer. Come on, I'll show you. There's a small village nearby. Flats make themselves obvious almost instantly, you'll see."

They strolled down the path through the forest, a little awkwardly at first. They knew each other about as well as they knew the dark side of the moon, and yet, being the only two Cogs in the PERN, they couldn't help feeling a little like long lost siblings. Fortunately, there were no awkward silences. They both had far too many questions burning holes through their craniums. Danfoe started to voice one when he stumbled on a root instead.

"First day with the new feet?" Ashley chided him.

"First day with the new eyes, actually."

Ashley looked at him funny. "What do you mean by that?"

"You remember the other day, when I told you I'd been blind? I meant that literally. I was traumatized as a child. My brain panicked and shut the lights off. Then it couldn't find the switch again."

"But here you can see. No wonder you came back."

"Actually, there's a little more to it than that." Danfoe became serious. "I think this may be a kind of therapy for me. When they took me out of the machine the other day, I opened my eyes and I swear, just for a second, I could see this guy's face. He had the biggest, bloomingest damn eyebrows I ever saw. I thought maybe I'd just imagined it, so I asked him just now. Turns out he's in Guiness."

"So, you figure the more time you spend here, the more your eyes will work in the real world, until eventually you can see all of the time."

"Yeah, maybe," Danfoe admitted. "So what's your story?"

Ashley shrugged. "Grew up too fast. I was bored and disillusioned."

"So you come here?"

"It's escapist, I know. But everyone is so guarded out there. Too many machines and false ambitions. I swear, the world man has created for himself to live in is more hostile than anything mother nature ever cooked up. It affects everyone. There's still a glimmer of truth in most people, but it's like a distant, fading star."

Danfoe liked the way that rolled off her tongue. "I had a professor once who said that any adversity could be made bearable if one were to succeed in writing the perfect poem about it."

"Sure. Anyone who suffers enough can write." Ashley sighed. "Anyway, the village is just ahead. Let's go meet some Flats."

The two fell silent as they walked along.

The village was clearly intended to be medieval. The roads were narrow and bumpy, not suitable for any form of transportation more complicated than a horse. The buildings were ramshackle in a contrived sort of way, but nevertheless looked comfortable and inviting the way they snuggled into the ground, roofs pulled down low against the cold and wind.

They passed a few farmhouses on their way to the center of town. Dirt gradually gave way to cobblestones as they reached the square, and a large tavern loomed above them, wrapping them in its long, late afternoon shadow. It was reminiscent of Tudor architecture: a lot of timbers and knee braces, most of them exposed to the exterior.

The atmosphere of the village might have made Danfoe feel like jumping on a horse and going off in search of the Holy Grail, but the Flat standing in front of the tavern made it seem more like he was stepping into the Children's Television Workshop. The merry innkeeper stood sporting a droopy red cap and pitch-stained wool clothing. Ashley and Danfoe walked up to him and smiled noncommittally.

"Hi, I'm Penchant. Welcome to my tavern, the Rustic Stump!"

Danfoe smiled. "That's an interesting name."

"Yes. Before this tavern was built, there was a single tree in the middle of a clearing on this very spot. The tree was cut down, but the stump has been preserved as a giant table inside, hence the name."

There's still a glimmer of truth in most people, but it's like a distant, fading star.

"Actually, I meant your name is unusual, Penchant."

Ashley couldn't resist. "Do you find you have an inclination or strong liking for certain things?"

"Yes!" Penchant perked up, removing his red cap for dramatic effect. "I like to drink and be merry. Come inside and sit by the fire with me and tell me your tale!"

Penchant's hair, no longer restrained by his cap, was now sticking out in all directions like a schizophrenic mop screaming at itself. It didn't make sense. Not the mopishness per se, but the complexity of it, the realism. As a slight breeze kicked up and played sumptuously in the tempestuous tufts on the innkeeper's head, Danfoe

couldn't help but notice the discrepancy between the exquisite physical detail lavished on this moron's person and the shallowness of personality accorded to him. Surely it was possible: attitude, spontaneity, complexity, and imagination. Could these really be dramatically more difficult to simulate than a dynamic, seeable, touchable and utterly convincing physical body? What the hell, Danfoe thought. Why not ask?

He didn't feel the nausea, he smelt it. His throat watched the bile course by, his eyes heard the agonized gagging and retching...

"We'd like to see your tavern, Penchant, but let me ask you something else first."

"Very well stranger. What would you know?"

"Well, this is all very nice, don't get me wrong. But let's be honest for a minute. When Ashley and I leave this place, there won't be anyone to see it anymore, right? So just like that tree falling in the woods, you might not make any sound when you talk. In fact you won't talk at all. You and every detail of this village will break down into bits and bytes and get stored away until the next time a Cog comes along to perceive it all. My question to you is, if you can look so real, why the hell can't you act like a real person?"

There was a long, long pause during which the merry Innkeeper could manage nothing more than to keep his Mr. Rogers smile firmly fixed to his face.

"Hi, I'm Penchant. Welcome to my tavern!"

Danfoe turned to Ashley and smiled. "OK, I give up. Should we grab a bite?"

Before she could answer him, Danfoe was suddenly overcome by a feeling of intense disorientation. He reeled and stumbled. Ashley caught his arm but couldn't prevent him from dropping to his knees. She was talking to him but he couldn't make sense of it. Familiar words carried no meaning as they drifted in and out of his spinning cranium. All the colors around him blurred into a single meaningless contortion of texture and depth. Then something squirmed deep inside him, a sickening feeling like his backbone was trying to writhe free from his body like an anaconda out of an old wet-suit. Like an x-ray lighting up in the dark, he became intensely aware of his entire central nervous system. It was as if only his spine and brain stem had physical substance, and the rest of his body was mere illusion and fantasy draped and hung on that bony neural coat rack like so much tinsel on a Christmas tree.

Danfoe shook to the core of his being. He was vaguely aware that he was screaming, but the sound only mixed with the barrage of sensory input assailing him. He couldn't even distinguish between sights, sounds, and feelings anymore. It was all the same and it was all much too much.

He threw up violently. Everything about it was wrong, mixed-up, screwed-up. He didn't feel the nausea, he smelt it. His throat watched the bile course by, his eyes heard the agonized gagging and retching, and his ears felt the convulsions in his abdomen, reaching deep into his duodenum before finding anything worth disgorging.

Danfoe felt like he was dying. Was this death? Or something worse?

ααα

The VATS operators at NRT bustled excitedly about Danfoe's convulsing body like so many boys watching a fish on the beach, flipping and flopping away the last moments of its life.

"He's experiencing sensory misalignment," one of them stated with detached clinical curiosity.

"Looks like grand-mal to me," said another. "We've got to shut off a couple of senses before his brain goes into isolation shock."

"Relax," scolded Burt. "He'll last."

"At least let me knock out his tactile and proprioceptive sectors. That will stop the convulsions."

"No. There's no need. They always circle the drain a few times before going down for good. I say leave him alone for now. He'll pull through."

The technician threw up his hands in disgust and walked over to a window. It was dark outside, overcast, without a single star to brighten up the lightless city.

"We've got to shut off a couple of senses before his brain goes into isolation shock."

"He's going to lose it, just like all the others."

"He's already lasted twice as long as any of our other subjects."

"So what? We aren't learning anything new."

"That's enough," Burt warned. In the strange laboratory light, his eyebrows looked oddly intimidating, the same way kids look when they frighten each other at slumber parties by shining flashlights up their faces. The technician's verbal protests resigned themselves to silent contempt and he turned once again to gaze out the window.

Something was happening down on the street below. Movement, some of it human, some of it machine, flitted in and out of sight in the soupy darkness. Whoever was down there was being very careful not to make a sound. The technician turned around slowly.

"Burt. Something's going down."

An explosion rent the night and shook the building all the way up to NRT's tenth floor laboratory. Leaving equipment clattering and adrenal glands furiously pumping in its wake, the thunderous burst scurried away, echoing ever more faintly as it faded into the farthest corners of the city.

At that exact moment, in that second of silence before any of the VATS boys could react with what was sure to be a blur of frenzied activity, Danfoe's convulsions ceased. The machine was still running.

(to be continued)

TEXTBASE VIRTUAL REALITY

BOOK REVIEW

This Month: A review of La Réalité Virtuelle (Grigore Burdea and Philippe Coiffet, Hermes, Paris 1993), by Derrick de Kerckhove, McLuhan Program in Culture and Technology, University of Toronto

La Réalité Virtuelle is the French edition of Grigore Burdea and Philippe Coiffet's book on Virtual Reality. Because it was meant to appear simultaneously in English, French and Japanese, and because it involves the collaboration of a French scholar, one might expect that it be more than a mere translation of the English original. And thanks to the occasional mention of a European or Japanese research centre, the book does succeed in carrying off a slight global feel. This global feel is important for two reasons. The first is that VR should not be considered, like television, an industry dominated by American interests. The second reason, somewhat more subtle, but vital to consider, is that VR - because it is based on sensory biases - is bound to become very culturally sensitive in the coming years.

La Réalité Regionelle

Still, the overall effect of the book is to highlight the dominance of US research - as witnessed in the bibliography and the overwhelming presence of over 65 US-based labs in the very useful list of 80-odd labs provided next to the index. Had this list been exhaustive, one would simply have to recognize that Americans are in the lead, if not to say *in control of*, current research in VR, but this is not necessarily the case. While I was gratified to find references to two Canadian centres, I was somewhat surprised - given the presence of a French collaborator and Burdea's evident interest in tactility, not to find a word about A.C.R.O.E., Claude Cadoz' remarkable tactile simulation lab in Grenoble, or about the Santa Anna Force Feedback Research Centre at the University of Pisa, to mention only two well-established centres where extremely refined research on touch has been going on for almost a decade.

But let's not quibble too much over regionalism. The book has some excellent information for readers who are not quite "into VR" but are ready to take that route, and are looking for a better initiation than the hype usually encountered in such books. Even VR professionals will benefit from the richness of detail provided on issues about which they think they know all there is, because it all seems so intuitive, so rationally transparent. In reality, VR technology is extremely complex, and the book demonstrates this fact without being boring - not a small accomplishment for two "techies."

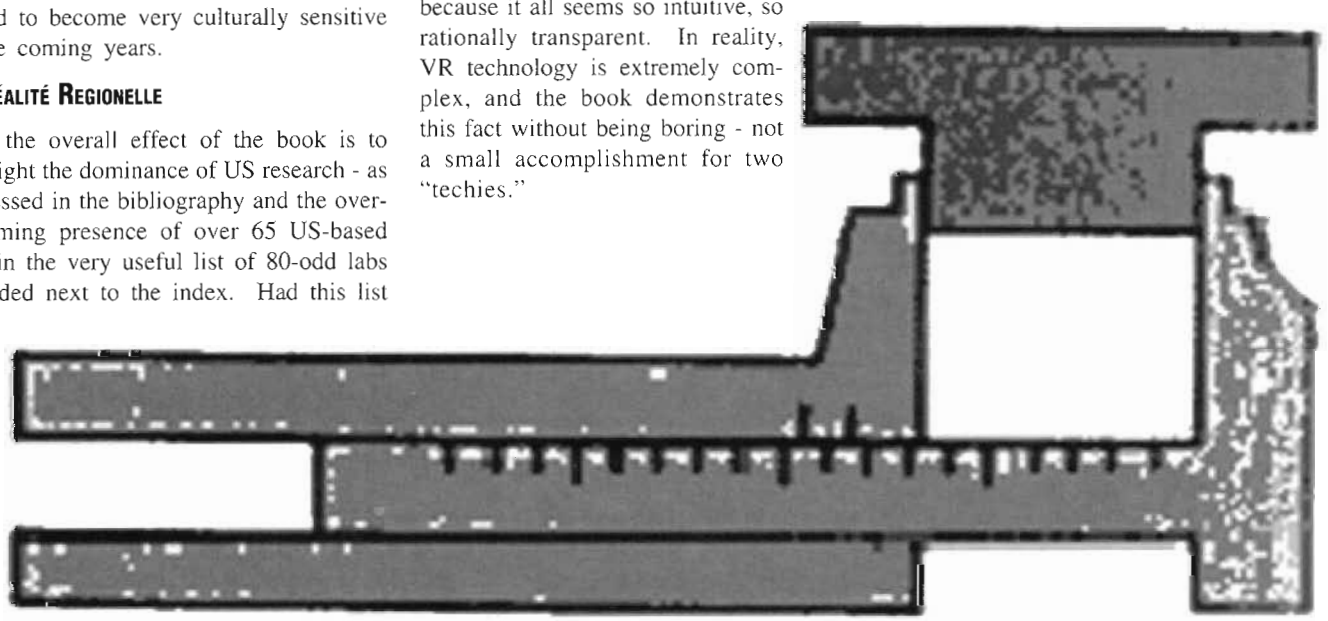
A Touchy Subject

Even casual readers who don't give a hoot about VR will benefit from the chapter on touch and force feedback. Burdea's own work is focused on touch, and this is reflected in the depth and the wealth of details throughout the book; it definitely has a "feel" of its own.

As a culture, we do not know a whole lot about the sense and process of touch; we have tied it almost exclusively to the realm of sexual activity, and been terrified of it since the Renaissance. But VR is one of the first technologies that has brought tactility to the fore without shame, with a sincere and open interest.

Despite Burdea's obvious tactile understanding, even the chapter on touch bears remnants of the Puritanical tradition characteristic of Anglo-Saxon research. There is hardly a mention of proprioception; the user's side of the technological equation.

continued on page 35



Lawnmower Lounge Lizard

by Nate Pagel

The word phlogiston was used by 17th century scientists to describe a hypothetical substance released as flame in combustion and thought to be a volatile ingredient of all combustible materials. Brian Park uses the word flogiston to describe his chair. You may remember seeing this particular chair suspended from the ceiling of the doctor's basement in *The Lawnmower Man*. When I met Brian for the first time, he was just finishing his gyro plate and a Corona at Ted's Greek Corner on Congress during a meeting of The Robot Group. Offering me some of his fries, he was warm, bright-faced and relaxed at the outset. He exibited a youthful exuberance when we began to discuss the flogiston chair and cyberspace. An exuberance not expected from a 44 year old engineer from, in his own words, "a little, uptight country called Scotland." Brian Park's conception of the flogiston chair involves energy flow more than it does sitting down. In fact, he made the first chair in 1981 to assist with mind/body relaxation. "I was very much into yoga at the time," admits Park. The idea to use information from NASA and an invitation to visit the Johnson Space Center (JSC) came from a longtime guardian angel to Park, John Jackson, a researcher at the JSC in Houston. NASA had completed a wealth of human factors studies for the design of spaces and equipment to suit astronauts in outer space.

The Corpse Pose

The chair is designed (with relaxation in mind) to support the body in a modified version of the neutral posture - the body's natural state of relaxation without gravity as determined by NASA. "The [flogiston] posture came out of a mixture of eastern teachings and western science." Brian used drawings, videos and other research from NASA archives in conjuction with his own knowledge of Savasana, the corpse pose - a yoga posture of relaxation, to arrive at the flogiston posture. He then built a chair which would support that posture in earth's gravity. "It's probably the first new yoga posture (asana) in 5,000 years," Park only half-jokes. Admittedly, though, the twopiece design of the first chair, made on a ranch in Louisiana, "wasn't really the best way to do it."

Brian didn't realize the full potential of the chair until several years later. It wasn't until 1990, when Brian met Eric Gullichsen, a pioneer in virtual reality (VR) hacking, that he recognized the possibilities of the flogiston chair outside the realm of simple relaxation. Park collaborated with Gullichsen on an installation in May 1990 at the 1st International Conference on Cyberspace here in Austin and in October 1990 at Cyberthon, a hugely successful convention/party and one of the first of its kind. Cyberthon was organized by the Point Foundation (owners of the Whole Earth Review) at Colossal Studios and was replete with the ubiquitous Tim Leary and other techno-luminaries. The installation consisted of the fourth version (with a one piece hull) of the flogiston chair and a balsa wood box containing equipment to provide a crude stereoscopic display of a virtual office when placed over the face of a participant.

It was John Jackson who recommended Park to the team designing the galley for NASA's space station. Park knew nothing of refrigeration when he was hired by Oceaneering Space Systems, contracted by NASA to create the galley. At the end of his 2 year stint, he had designed an innovative refrigerator based on a synergy of superinsulation and thermoelectric cooling. The efficiency and environmental safeness of this system may make it widely applicable to consumer markets - when the cost of the insulating panels drops.

Park's notion of concurrent spinoff can be most easily perceived with the design of the refrigerator. "If you're gonna develop a new technology you better have a practical application, otherwise you're totally wasting your time." Park finally acquired an utility patent for the flogiston chair in 1992 after a four year struggle. He can now without fear explore the concurrent spinoff possibilities of flogiston.

At the recommendation of Bowen Loftin, a lecturer and champion of virtual environment training at the Advanced Training Technologies program at NASA, Brian applied for a SBIR (small business innovation research) grant in order to develop the flogiston chair more fully. The SBIR program is quite an innovative program itself - our federal government is providing funds for cutting-edge business ideas! The application was successful. The funds awarded in phase one of the grant are being applied to the research and development of a "motion base" as well as to the manufacture of the stand-alone chair.

In order to provide a more realistic VR experience, the body's movements should "simulate generic movement in cyberspace." To this end a "motion base" is currently being developed for the chair using new technology for pistons developed at Denne Development Ltd. in England. Brian is excited about the piston, called a pem-ram (for pnuematic electromagnetic ram), which is simple, silent, and efficient.

In the motion base's simplest manifestation, three pem-rams are affixed to the base of the flogiston chair. These pistons will provide motion in three directions, which should be effective enough to provide a realistic sense of movement in cyberspace. While the prototype's development cost is well out of the range of most individuals, Park hopes to eventually be able to offer a turnkey flogiston chair and motion base for as little as $5,000.

According to Park, once the motion base is ready NASA will use the complete product "to train astronauts in virtual environments for e.v.a. (extra vehicular activity) missions." In a virtual or immersive computer environment, when trainees push on a virtual object the flogiston chair and their bodies will move in the oppostite direction in realspace. This should provide a more realistic experience as well as allow participants to be immersed for longer periods of time. Virtual environment explorers experience a kind of motion sickness when immersed for long periods of time - this occurs anytime when visual perception (haptic cues) are not synchronized to actual motion (proprioceptive cues).

The Trinity of Brian

Brian Park's vision of "threespace" is implicit to understanding the potential importance of the flogiston chair. In his press release Park had this to say, "When external forces on the body are reduced, the body finds its own internal equilibrium and balance, a minimal stress posture. By creating a balance in realspace, it helps to find balance in mindspace, and hence improves the cyberspace connect. A still point in threespace."

Threespace for Park is not simple three-dimensional space as we all know it; it is a system comprised of three historical spaces: realspace, mindspace and cyberspace. Realspace is our everyday physical reality. Human history is essentially a catalogue of our interactions with and within and our attempt to master the concepts of realspace. Mindspace has only been developed in the last 5,000 years or so. Philosophy, psychology, certain aspects of religion, and meditation are examples of interactions with and attempts to formulate mindspace.

Within the constraints of technology, cyberspace is a completely malleable digital realspace. Cyberspace began about 100 years ago with the invention of the telephone - our phone conversations take place in cyberspace. It has recently exploded in meaning and possibilities with the advent of immersive and interactive computer graphics or VR.

Park likens current perceptions and the future of cyberspace to his preconceptions of America and the subsequent reality of moving here. "When I got here I found it to be much grander, much more liberating than the U.S. media hype I had heard in Scotland." Similarly cyberspace is bound to be much greater and grander than we think.

The flogiston chair can be used to "to diminish realspace signals comming in so that we can focus more on cyberspace. We want to accentuate cyberspace, diminish attention to realspace while balancing the mindspace - that's where the chair comes in." Why diminish realspace? Park gives this answer: "Why is flying such an essential part of dreaming? Because we don't need our body [in mindspace] ... I think it's the same in cyberspace"

"Cyberspace is bound to be much greater and grander than we think."

Park adds that the problem with cyberspace is that it is constrained by and because of technology. If we can leap that, by any means, then maybe we can begin to discover the true possibilities of this relatively new space. He agrees that, once we can break the shackles that a technology of representation weaker than our perception places upon our experience of cyberspace, proprioceptive and tactile cues will be unnecessary, the motion platform will be unneccessary, our bodies will be unnecessary.

The Prophecy of Brian

Park had this to say about the future usefulness of cyberspace: "We want to get to the point where we can create true volumes in cyberspace that people can go into and find things that are not created, per se, as part of the program. Then [cyberspace] will be a valuable tool for us in terms of the exploration of mindspace." Congruent to this is the prophecy that, once cyberspace is developed to a point in which it is at least as "real" to our perceptions as realspace is, a person in cyberspace long enough should be able to jump around in the space-time continuum as we perceive it in realspace.

Sit-in at SIGGRAPH

In The Edge section of SIGGRAPH this July in Orlando, Park hopes to be able to install a "one-man flogistabarium." A flogistabarium for Park more typically involves several of his flogiston chairs with motion platforms all sharing the same physical or cyber-space. A common virtual environment would be explored by all of the participants usually with an experienced guide.

At SIGGRAPH the installation should include one flogiston chair and the first motion base as well as an HMD from either Virtual I/O or Kaiser Electro-Optics. Sound will be provided either via headphones with an audio card provided by VSI Co. or by an external speaker system from Kintec. The virtual world viewed by the participant will be generated on a Silicon Graphics Reality Engine2 with software provided by Hughes Training of Arlington Texas. Navigation through the virtual space will be accomplished using Logitech 6dof controllers. Content will be created by a host of talented virtual world and computer artists' depictions of their own mindspace - both aural and visual. The list of possible collaborators includes VRASPian Steve Speer (who is also providing animations for uniVRsum, the VRASP entry to the Edge), Thomas Dolby, Fiorella Terenzi and the folks at NASA. The entire system will incorporate infrasound for subliminal effects.

If you want a flogiston chair (without the motion base) you can get one for around $1,000. Contact Brian Park at his e-mail address: 71324,3663@compuserve.com.

VRASP Thanks

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Best of All Possible Worlds Contest

The results are in!

The judging for the Best of All Possible Worlds Contest was completed in May. Michael Frenchman, Ed Lahood, Ken Pimentel, Bernie Roehl and Bill Meredith unanimously agreed the entrants did an amazing job and gave kudos to VRASP for giving worldbuilders the recognition they deserve.

Superscape VRT entry ties with VR Studio entry for First Place!

Based on criteria including technical level of skill, creativity and interactivity, our judges deemed two very different applications winners. Congratulations to Tim Gifford of Connecticut and Harold Reid of Michigan. Tim's *Space Yacht Ariel* entry showed off the visually vibrant and sophisticated architectural tools of Superscape's VRT software. Harold Reid's *Expedition to Mars* entry in VR Studio showed that with a bit of creativity and not a lot of money, you can design a highly interactive world worth revisiting. The very close runners up included an exciting REND386 entry, *World Trade Center*, by Chris Kwasnicki and a WorldToolKit entry, *Trellis*, submitted by Eben Gay and Paul Matthews. Harold also had another entry, *Reid's World*, that placed. All of these worlds will be on display in the VRASP project, uniVRsum, premiering at The Edge at SIGGRAPH '94 in Orlando, Florida.

WorldToolKit for Windows and VREAM chosen as Grand Prizes!

The delighted winners chose their prizes from products donated by the following generous companies: Domark, Logitech, Sense8, Simsalabim Systems and VREAM. Their gracious support made the contest possible. Indeed, awarding these products to the entrants will encourage them to continue their VR efforts and foster software and hardware experimentation the worldbuilder might not otherwise be able to afford.

The Best of All Possible Worlds Contest was a winner itself, in providing an exciting opportunity for both professional and hobbyist programmers to explore virtual world design in their chosen toolkit and have their efforts be reviewed and critiqued by some of the most experienced virtual world designers in the industry. In addition to extraordinary efforts by the judges to view these worlds, we experienced particularly wonderful support the industry including Bob Lowe of Superscape Limited and to Phar Lap Software, Inc.

Whether you are a student exploring VR for a homework assignment or a professional creating a virtual reality marketing or training tool, show your creativity off and be recognized in our next Best of All Possible Worlds Contest coming in the winter of 1994.

CELL-ebrations

We are pleased to announce a new feature spotlighting the activities of VRASP neocells.

OhioVRASP is co-coordinated by Ethan Dicks erd@kumiss.infinet.com and Michael Liebold at CIS 73321.514 The Cell will cover the area of Columbus and Dayton and eventhough meeting dates have been chosen, please contact Ethan or Michael for up-to-the-minute information.

Meeting Dates and Cities:

July 31st	Columbus
August 28th	Dayton
September 25th	Columbus
October 30th	Dayton
November 27th	Columbus

All will be afternoon meetings; starting around 2:00pm and ending around 7:00pm. One primary focus for the first year of OhioVRASP is getting exhibits ready for Marcon 30 (in May of 1995). Marcon is a local science-fiction convention that has chosen a 3D/Virtual Reality theme for next year; they have set aside an extensive exhibit area for hands-on VR exhibits. A number of early OhioVRASPians, including Terry Griner:
hasen@kumiss.infinet.com and
Eric Zimmerman:
ezimmerm@cgrg.ohio-state.edu have already started designing projects.

Front Range Virtual Reality Group covers southern Wyoming, down through Denver, into Colorado Springs. We have been meeting since the beginning of 1994 (every one-two months), and currently have about 15 regulars. The VRASP members here have been discussing becoming a VRASP cell, but we do not currently have the required number of VRASP members. We are continuing to inform the group of VRASP and its goals, and hope we can take up this effort again in the future.

This year, we've had Dr. Richard Blade as a speaker of current and up-and-coming VR technologies, Steve Elliott of the Vspace VR Centers talk about the state of VR in the entertainment industry, Tom Meinerz of Special Family Recreation Centers talk about VR and people with disabilities, and Paul Russel of InnerQuest demonstrate a unique physically and mentally immersive game called the Makoto, to which they are investigating applying VR technologies.

So we are in the beginning stages of forming a VR community here along the Rockies. Hopefully, with more meetings and maybe some other events, we will develop a vibrant, active group (and some day, even aspire to a VRASPizza Party!!)

Contact Rick Duffy at (303) 978-0997, or rduffy@nyx.cs.du.edu

VRASP Austin had their first meeting at the Communications Department of theUniversity of Texas in Austin on June 9. Over 70 VR enthusiasts attended the entertaining and educational event, including local VRASPians Brian Park, Donald Conklin, and Jason Asbahr.

Sandy Stone, director of then Interactive Multimedia Lab at UT, talked about the progression of virtual reality and interface design. Joe Martin of Cybersim Systems, Inc.of Houston then provided an overview of commercial applications and a hands-on demo with HMD, dataglove and joystick. Organizer and VRASPian Nate Pagel lectured briefly on the limitations and freedoms of VR.

Soon a gopher site will be established through the Advanced Communications Technology Lab at UT for VR and VRASP related enquiries and an electronic newsletter will be posted. A student section for the group is also being considered.

A local VRASP voicemail system is set up listing the latest activities.Voicemail (512) 370-4624 or email natep@io.com

MetroVRASP NJ/NY, the original Cell of the organization, has been having regular monthly meetings or parties since December 1992. Our last Chat in May was hosted by Michael Getlan at his Milford Amusement Center. It coincided with the birthday of the founder and president of VRASP, Karin August, and featured champagne in addition to Q-Zar.

On July 13, a video phone teleconference will link the LAVRSIG group run byDave Blackburn with VRASP. This will be a first for east coast members to discuss VR face to face with enthusiasts on the west coast. We hope some of the LA members of VRASP will make a special effort to be on the other end of the line in the Electronic Cafe, Santa Monica.

Mainly the continued focus of the Cell has been preparing for our exhibition at The Edge in SIGGRAPH. uniVRsum evolved from a VRASP Chat on 1/25/94 and since then members have worked extensively with VREAM, REND386, 3D Studio, VR Studio and created C code to create a clearing house of VR information, ideas, and worlds. Our real goal in uniVRsum is interoperability between VR files and products. Bill Burton, Project Manager, will be working with VRASPians Bernie Roehl, Tony Asch, Ed Lahood and a few others on creating a standardized file format, an element crucial to the success of uniVRsum and, we believe, to the VR industry as a whole.

And of course, we're expecting our first international intern, Joerg Kloss, to arrive on July 17. VRASP has been very successful in offering internship opportunities locally and will meet the challenge of accommodating qualified students from anywhere in the world. We are planning to develop a national "shadow intern program" so interns coming from abroad can sample a diversity of VR opportunities in the states with other VRASP members who own or work for VR firms.

Stay tuned for next issue's updates on PotomacVRASP in Washington DC and a new Cell forming out in San Jose, California.

Falling In Glove Again

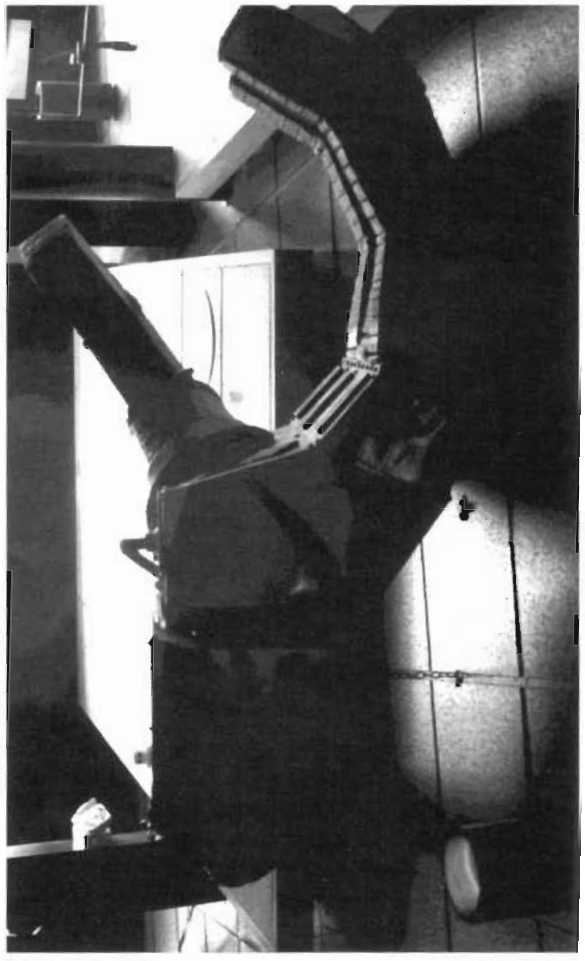
by Daniel Lipsky

On Tuesday, April 26, 1994, a demonstration on Virtual Reality and Force Feedback was presented by Professor Greg Burdea and staff. Professor Burdea, who is in charge of the human interface lab at Rutgers, is presently working on a second generation force feedback glove with several grad students.

The first generation force feedback glove was designed to be lightweight and low cost. Unlike the first generation glove design, the second will have a four-finger system of feeling, increased sensitivity in the pistons, and a better interface. This glove, unlike the ARM or EXOS glove designs, weighs less than a pound. Professor Burdea decided on a glove over a tracker ball because he didn't want to limit a user to a desktop. The glove will also be designed so that it won't be limited to working only on expensive computers. This glove uses pistons that are attached to the tips of three fingers and thumb. When the user grabs a virtual object, the pistons "harden up" to create a virtual feeling of the object by the computer.

The use of stereoscopic vision also plays a major part in the second generation design. After careful research and tests involving over 80 subjects, Professor Burdea and students have found out that the learning process with stereoscopic vision as opposed to monoscopic vision was substantially faster. This along with the other features when combined with the second generation design will shorten the learning curve of users enough to inspire new options with future glove designs.

The role of graduate students working with the force feedback glove ranges from applications involving simulating knee surgery for medical students to baggage scanners at airports. Mike Dinsmore, one of Burdea's grad students, is presently working on the interaction between the glove and a three dimensional knee model. This model is composed of realistic bones and ligaments. He is concentrating on producing a different feel for different parts of the knee. The feel is mainly composed of several different algorithms for collision detection. There are concerns however, one of which is the problem with working in real time. An early idea his predecessor thought up was to create spheres of influence which help simplify the calculations involved in the different parts of the knee and muscles. After completion of the project, he hopes to create a virtual knee surgery simulator for medical students. After perfecting the hand's feel of the force feedback glove with the model, he is going to be working up to using other equipment on the knee such as a cutting and probing tools and how they would affect the model.



BattleMech mitt courtesy of VirtualWorld Entertainment

Another one of Burdea's grad students, Sonal Deshpande, is working on medical imaging (MRI, X-RAYS). This application would also be used for training tools for surgeons, and help in computer assisted surgery. First, she is working on extracting surfaces of DNA to get a polygon model out of the data. Eric Harper, the last of the student presenters, talked about baggage scanning applications with the force feedback glove. Basically, he hopes to use VR to lift objects in luggage and feel them for bomb detection. His biggest constraint is working with real time.

As you can see from this demonstration provided by Professor Burdea and staff, the applications of virtual reality force feedback gloves are endless. VR is an important future for technology, but unfortunately Rutgers isn't directly giving a budget to Professor Burdea's research, therefore the development of these applications is going slowly. Perhaps the newly forming VRASP Chapter at Rutgers will focus the administration's attention on the importance of his work.

Some other ideas for VR applications would be allowing disabled people to play virtual sports due to increased sensitivity with the force feedback glove. Indeed prominent VRASPians are working towards this end. You could even conceivably be able to have a famous sports pro, pianist, or surgeon, teach you how to play different sports, instruments, or teach you how to perform different types of surgery just by interacting with your computer. The possibilities are indeed endless.

Fraunhofer Frolic

by Joerg H. Kloss

As a continuation of the first German forum for VR in 1993, the "Virtual Reality '94" in Stuttgart again offered the latest information about the trends in national and international VR projects. On February 9th and 10th, the Fraunhofer Institutes gave participants the opportunity to present especially German research projects, and to get their first experiences with the still "mythical" technology known as VR. In this way the visitors received the (not inexpensive) opportunity to try out some VR products and to listen to many talks.

The Fraunhofers are the biggest German research institutes and clearly dominate VR in Germany. They are both independent research institutes, as well as developers for the industry in a variety of fields. Besides the Fraunhofer Institute in Darmstadt - the first to run a demonstration center for VR in Germany - there is a stronghold of VR in Stuttgart. The IPA (Institute of Production Technique and Automation) and the IAO (Institute of Industrial Science and Organisation) in Stuttgart are the initiators of the virtual reality conferences and are planning to continue these events annually.

Upon entering the Fraunhofer's walls and receiving a big folder of information materials, the visitor rushed towards the VR demonstration materials fixed up in front of the conference room. Most of it came from the local demonstration center of the Fraunhofer Institute. The presence of SGIs VGX, VGXT, Reality Engine, SkyWriter, VPL's DataGlove and EyePhone, Virtex' Cyberglove, Virtual Research's Flight Helmet, StereoGraphic's CrystalEyes, Polhelmus' 3Space and FASTRAK and a lot of other high-end VR products allowed participants to try out some of the projects presented shortly after the actual Fraunhofer research activities.

Additionally, the new Austrian company "Reality Two", a division of "Funware GMBH" and official retailer of Sense8 WorldToolKit, presented a virtual environment which is planned to become the first Austrian television show of that kind.

H.J. Bullinger, the leader of the IAO, inaugurated the session with the "Strategic Dimensions of VR".

In spite of the growing interest, there is still a hesitance in the German industry to accept the new technology.

The reasons are the totally insufficient ergonomic quality of the current hardware (especially the weight and low resolution of the HMDs), the unfavorable proportion between costs and usability, and the missing standards which could save the investments. It has been difficult to obtain the neccessary hardware in Europe because it has to be imported from the USA, but it is expected Japan will come out with reasonable hardware soon. Therefore the main emphasis in Germany will be on the development of software especially in the field of professional industrial applications. In addition to the research in the fields of all kinds of design, architecture and medicine, the institutes are particularly focusing on rapid prototyping techniques.

Tools of the Trade Show

Within the framework of a strategic alliance between the British firm Division Ltd. - represented by P. du Pont, Marketing Director - and Stuttgart's Fraunhofer Institute, a new software package called CIA-Tool (Cooperative-Interactive Application Tool) has been developed. A part of the software will be made commercially available with an upcoming release of the product dVISE.

The CIA-Tool was motivated by the idea to support the planning specialist in presenting and altering his/her design to the future user. To reduce the duration of each step in the iterative planning spiral (thus the rising costs) the iterative planning process should be carried out interactively with the user. With an example of interior design, the audience was presented a well performed, live session where the planner furnished a house. On an ONYX RE2, the planner using a Flying Joystick chose elements out of several icon toolboxes viewed in the HMD. The user has access to graphical databases which, for example, contain the products of a furniture company. After choosing a piece of furniture and putting it into the virtual house, the user could change the position, size, colour and texture corresponding to the special palette of the company.

Another Fraunhofer project was the development of the robot simulation system VR4RobotS. With a performance of 15888 polygons, 174 moving objects and 6 fps, the client (Boehringer Mannheim GmbH, a leading diagnostic manufacturer) received an exactly timed and profitable virtual prototype of their future bottling robot.

What's up Doc?

Fraunhofer Institute researches for new

solutions through the application of VR in medicine as well. By further development of current surgical tools, operations could be safer than today. The combination of the filming of a more controllable and moveable endoscope with a freely inspectable three-dimensional representation of the scanned patient (by computer tomography or magnetic resonance imaging) allows safer working in these highly sensitive areas of human bodies. In the presentation of a prototype there was also a further safety feature added. While marking dangerous areas in the virtual body, an implemented algorithm would prevent the surgeon from inadvertent injury to the patient.

Another remarkable institution for VR in Germany is the Art&Com in Berlin. Two representatives informed the audience about their latest impressive projects. On the occasion of the architecture competition in Berlin for designing the new German capital, Art&Com realized one of the suggestions in VR. While controlling the fly-through by moving a small input device across a miniaturized plan, the audience enjoyed the future Berlin displayed with textures and changing 'levels-of-details' on an oversized stereoscopic screen.

The other project was sponsored by Mercedes Benz and called the "virtual soap-box". While sitting in a local imitation of the interior of a Mercedes, the designer could touch everything in the real 'soap-box' while seeing a virtual representation of a Mercedes through his HMD. The style of all the components in the interior could be changed now in whatever colour or texture desired. Because of the aesthetic criteria the interior designer must incorporate, the need for high resolution virtual representation is very high. The current frame-rate differs between 2 and 10 fps and one of the central matters of concern is to reduce the amount of polygons in the best possible way. Another problem appears in the context of that aesthetic application of VR: an enlargement of few centimetres of the interior of a car ends up to be enormous in a real car, but is hardly perceptible in VR!

Power Tools

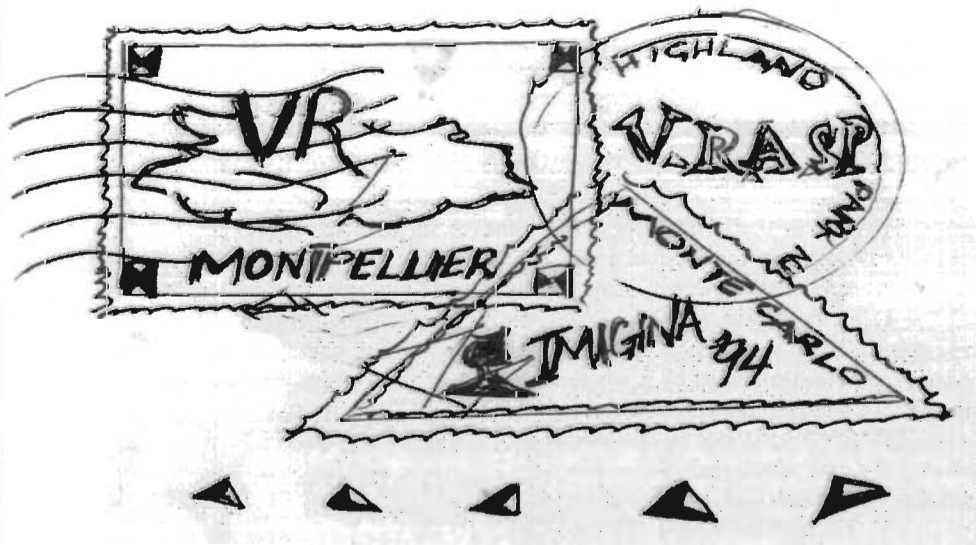
One of the most interesting projects was the "Responsive Workbench" approach from W. Krueger and B. Froehlich of the German National Research Center for Computer Science. Based on the early ideas of Myron Krueger's non-immersive interactive multimedia environments, the computer acts as an intelligent server in the background providing support to the specific problem solving process in the daily working situation of different computer users. This approach is founded on the assumption that most of the users want to focus on their tasks rather than on operating the computer. Therefore the Responsive Workbench concept has been developed as an alternative model to the multimedia and VR systems of the past decade. Virtual objects and control tools are located on a real "workbench". The objects, displayed as a computer-generated stereo-images, are projected onto the surface of the workbench. This setting corresponds to the actual work situation for example in an architect's office, at surgery environments, on the workbench for 3D atlases, etc. A guide uses the virtual working environment while several observers can also watch events through shutter glasses. Depending on the application, various input and output modules can be integrated, such as motion, gesture and language recognition systems.

After hearing about this 'fiction' the audience was surprised to see a demonstration of the prototype. On an ONYX RE2 workstation (realtime rendering by IRIS Performer) with shutter glasses and datagloves with mounted Polhemus, and incorporating an excellent time critical and low latency visual feedback and a neural network (recognizing natural language commands like "zoom in", "rotate" or "transparency"), the visitors viewed some impressive example applications. In a medical training situation the skin of a model of a patient became transparent and the resulting visible bones were picked with the dataglove for examination.

The German company Siemens AG presented their spectactular and very natural, non-immersive input device for realtime control of virtual environments. Hand position, orientation and finger gestures are obtained using a video camera and image processing techniques. Therefore, no datagloves are necessary anymore. Siemens is also working on a video control for head moving as a welcome alternative to the wearing of some kinds of trackers.

Finally, the last remarkable lecture of the VR94 was held by Josh Mogal from Silicon Graphics Computer Systems. Talking about the company's ideology he emphasized that VR is still only technology rather than a developed market. It is crucial to make the demands on VR in relation to the currently available technology. Only realistic promises could prevent the disappointment of potential interested persons. Also the development of low-cost mass products (i.e. HMDs) holds many dangers. Health defects after longtime-use of such bad quality products could set back the process of acceptance of VR in the society by some years.

Joerg a 24 year old computer linguistics major, has received a scholarship to spend 4 months with VRASP learning about VR. He'll arrive mid July and I'm inviting companies to take part in an educational 'Shadow Program' allowing Joerg to intern for them, help out with whatever tasks necessary but also have an opportunity to learn about varied disciplines in VR. Please contact me as soon as possible. Karin



IMAGINA '94 - MONTE CARLO

Once again, Monaco played host to one of Europe's most exciting media events, Imagina '94, part of the Monte Carlo International Television Festival. Lasting three days in February, Imagina's 35 sessions covered a broad range of topics from interactive television to virtual actors.

There were several hot talks at the show, from the latest developments in the VR industry to interactive TV, but the hottest was "How could Jurassic Park win the best of show awards!" Many people debated the usual "What is virtual reality anyway?"

Mr. Yuzo Naritoma, director general of SEGA, outlined their ambitious plans on a variety of fronts. We've all seen Virtual Racer, and their new AS-1 pods, and they have aggressive plans for developing a series of VR game centers around the world. The most exciting developments will be on our home front. Mr. Naritomi suggested that "Saturn," their new home systems, will be available next year. They're also developing a system code named "the Edge 16" which will make multiplayer video game play possible over regular phone lines. "The Edge 16" is being developed with AT&T.

3DO had little to report on new developments. New games are still being developed, but they were not being developed as fast as everyone had hoped.

Michael Dulion of Iwerks had one of the best overall presentations I've seen at a conference. It was focused on the industry more than Iwerks-specific works, and that was refreshing. He talked about their new Virtual Adventures - the Loch Ness Expedition. There seems to be some talk whether or not Iwerks is virtual reality; since their experiences are well liked by the participants, I'm not sure it matters.

Rachel Carpenter spoke about large audience events, which seems to be an area where much more development work will be done in the future. Look out for her special SIGGRAPH presentation in Orlando this year.

A session was devoted to virtual communities; the premise being that until we can reach a larger audience, the technology may not reach its critical mass as quickly. Dr. Mike Moshell, from the Institute of Simulation and Training in Orlando, addressed this issue in his discussion on Networked Simulation and Education. He believes in VR technology for educational purposes, and is one of its most vocal supporters.

Also from IST, Jackie Morie discussed "Virtopia," and the development of an artistic shared environment. She points out that emotional involvment in VR experiences is sorely missing in most experiences, and Jackie is changing that. Fortunately, Jackie is co-chairing The Edge at SIGGRAPH this year and stressing content over technology.

ZKM Germany developed an "Extended Viewing Environment," consisting of an inflatable dome, with one person piloting the experience for a larger audience. This seems to be a very popular way to develop multiple-user systems for theme parks, trade shows and other public arenas.

Lennart Fahlen, from the Swedish Institute of Computer Sciences, discussed his work in shared virtual environments. Participants can create their own likeness within the virtual world, for VR teleconferencing, while sharing information with other participants.

Carl Loeffler, from Carnegie Mellon, also discussed shared virtual environments. Once the phone line from Pittsburgh was working, he spoke of the Carnegie Mellon's plan to create a virtual city or "Virtual Polis." It involves the creation of a full "city" in a virtual environment. If you've read "Snow Crash," it sure sounds a lot like the Metaverse. They're also working with George Romero on a new horror movie--talk about bringing VR to the masses!

The use of virtual actors is on the rise. Steve Glenn was there, representing SimGraphics, and demonstrating his Vector suit. Other companies from around the world have also developed similar technologies, namely Medialab of Paris.

In all, Imagina '94 was a well produced event, with a high quality of exhibitors. And, of course, it was in Monaco, which was spectacular!

David

Interface To Real and Virtual Worlds - Montpellier

An Air France jet delivered me from the North Pole (i.e. New Jersey) this February pampering even our Economy class with champagne. For three years now the French have promoted VR in Montpellier. This university town, 10 miles from the Mediterranean Sea, prides itself with being the oldest medical school in Europe (circa the 13th century). Its "well connected" mayor decided to invest heavily in high-tech. As a consequence, the whole city is wired in fiber optics, and is surrounded by a whole group of small and medium research firms including IBM, SUN, and several National Research Labs. An ideal place for a VR conference. And it was sunny and warm!

This year I gave a tutorial in "VR Engineering," a topic that might still be lacking in our otherwise prolific literature and which was hoped would attract a large audience in part, because I had recently published, "La Realite Virtuelle," in Paris together with my colleague and friend Philippe Coiffet.

Having attended the earlier Montpellier conferences, I noticed a disappointing trend. Two years ago, there were quite a number of American researchers, as well as other investigators from Europe. The whole conference was festive; Ben Delaney delivered the keynote in 1992, while Myron Krueger had the honor in 1993. In 1994, however, the number of speakers as well as the quality of work presented was declining. One obvious reason was the 'state' of the French economy, where the State is the main sponsor of high-tech research. According to my cousin, a system programmer for DEC in Paris, the economy here is in 'chute libre' or free fall.

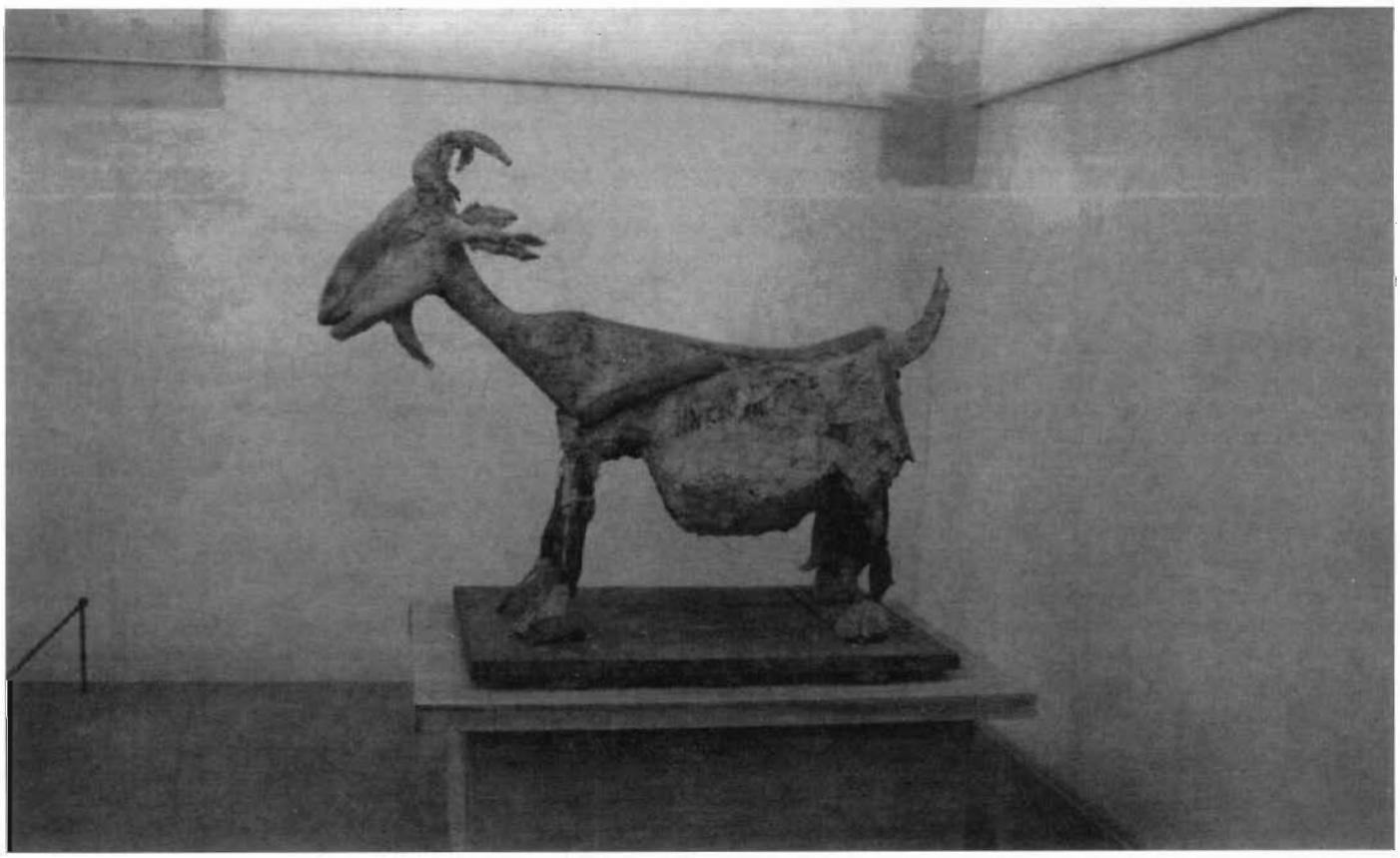
Making up for this reduction in government research was an obvious increase in French start-up firms developing VR applications; these were represented in force on the exhibit floor. They were, in my opinion, the interesting part of the conference, where enthusiasm and energy were plainly visible.

A bientot,

Greg

VIA AIR MAIL

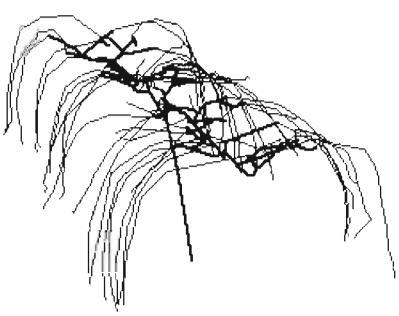
Karin August
VRASP
P.O. Box 4139
Highland Park, NJ 08904



A CLOCKWORK KIWIFRUIT

by John Curtis

Picture this: the sweet smell of an orchard in the early morning, sun filtering down through dew laden leaves, scattering dynamic flecks of light over a Macintosh PowerBook hooked up to a Polhemus FasTrak. With nervous anticipation you turn on the unit and cross your fingers, waiting for the dreaded Built In Test (BIT) error to signal that the FasTrak is dead and has to be returned to the country of its origin. But not this morning - the system kicks in; it is hungry for new data.



Today's data will consist of several hundred more 3-D coordinates to digitize the structure of a kiwifruit vine in the field. Each bend in every cane is recorded, along with the wood type and diameter, where it joins onto the rest of the plant, and the location of each fruit. This is not exactly the sort of application FasTrak was designed for, and you're stretching its limits a little - considering its useful range is 1 metre and the average kiwifruit vine covers about 12 sq metres of ground area. Nonetheless, the FasTrak turns out to do a pretty good job - and it's a *whole* lot faster than using a theodolite...

A Kiwi Defined

Firstly, let's clear up some terminology. This article is mainly concerned with what the international community know as "kiwis." Here in New Zealand, to save confusion they are called "kiwifruit." A "kiwi" (aka Apteryx) is a small flightless native bird about the size of a chicken. A "kiwifruit," on the other hand, is a small brown furry fruit with bright green flesh. The difference is remarkably easy to spot.

The Science

Analysis of tree growth, and the influence of canopy architecture on fruit quality is a major area of research at The Horticultural and Food Research Institute of New Zealand (Hort Research). By building up databases of tree structures on computers, we model plant and fruit growth and study light interception and source/sink relationships between leaves and fruit. Hort Research started mapping trees in 1991, using a road surveying theodolite to locate each point. We have mapped apples, persimmon and kiwifruit using this method. With about 1,200 points to describe the structure and 1,000 fruit to locate, it took two people about 3 weeks to map an entire kiwifruit vine. The physical and chemical characteristics of each fruit were measured, and this information was linked to the original location of the fruit. The tree was reconstructed using 3-D computer graphics, showing at a glance complex trends in fruit quality across the canopy.

FasTracking the Tree

Last year we embraced new technology to speed up the process of treemapping. We now use a Polhemus FasTrak in a single transmitter/single receiver configuration to log data directly into purposebuilt software running on a Macintosh laptop. The advantages of this system over the theodolite are many. For example, it now takes only a day or two to map what used to take weeks with the theodolite. Also, we use interactive software that draws the tree on screen as it is being mapped - this certainly beats storing data blindly into the theodolite and processing it sometimes weeks later, only to find that the axes weren't defined properly and your data is meaningless.

Establishing World Coordinates

Our system requires two operators. One person points to parts of the tree with a stylus connected to the tracker while the other enters point codes and clicks the record button on the computer. To start mapping a tree, a world coordinate system first has to be established. This is done by recording three points on a triangular board using the tracker. The board points north, and has to lie perfectly flat. The base of the trunk is designated as being the origin. Given these four points, a matrix is computed which maps the tracker's local coordinates to a world coordinate system.

Strategic points along the trunk and main branches of the tree are next labelled with mapping pins, and the stylus operator points to each one in turn. The Mac operator enters a code for the point and clicks the record button; this adds the point to the database and places its graphic image in the correct position. The Macintosh draws the tree and lets you watch the virtual movements of your colleague under the vine in the form of a black dot moving eerily around the screen display. With a simple click of a button the point is recorded, and another branch is added to the picture. At full speed, it is possible to map 20 consecutive points down a branch in about 30 seconds.

Relocating

The Polhemus FasTrak produces accurate readings out to a radius of 3 feet from the transmitter. Readings can be taken from up to 5 feet away, but with reduced

repeatability. For particularly large trees, the transmitter must be relocated several times in order to cover the entire area. Relocating the transmitter and restoring world coordinates is done by remapping three previously recorded points from a new position; a matrix is computed from this data which establishes the new location and orientation of the transmitter and restores world coordinates. Accuracy is very important for this procedure to work successfully. A measure of error is displayed when remapping the three points, and in an ideal "magnetically friendly" environment, relocation is accurate to within millimetres.

We develop plant growth models so growers can practice crop techniques over a simulated season in their virtual orchard without risking their valuable crops.

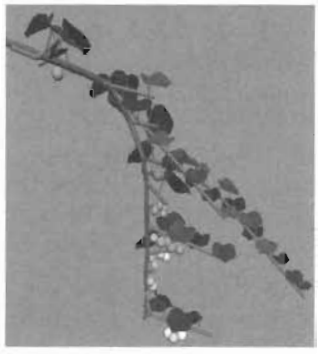
But In Practice...

This ideal environment rarely exists. Because we use a magnetic tracker, it is very sensitive to any metallic objects in the vicinity.

Kiwifruit are trained along steel guide wires, and although the thin wires don't affect the tracker too badly, it is often enough to throw a relocation slightly out of alignment. Using a long stylus (40cm) introduces even greater error because this tends to amplify any errors in the angle data generated by the FasTrak. The software therefore employs several techniques for reducing errors, and it constantly checks range and stability.

Because it was there...

So why map trees? Well, when you see a tree reconstructed on the screen, all the hidden qualities of the fruit are revealed. These displays often demonstrate surprising patterns which we hadn't known to be present. Case in point: the way the canopy is trained is a deciding factor for sunlight



interception, which is the determinant of many physiological processes that govern size, shape and flavour. A flat trained "pergola" kiwifruit vine behaves differently to an 'n' shaped "T-Bar" structure. By analysing light interception properties and measuring the variation in fruit quality, we can start predicting how a particularly shaped canopy will behave. We then use this data to develop *plant growth models* so growers can practise crop techniques over a simulated season in their virtual orchard without risking their valuable crops. Obviously this takes a lot of testing and as such is still in development, but significant findings have already begun to arise.

Perhaps some day in the not-too-distant-future, systems of this sort will be applied to all horticultural industries, dramatically increasing crop yields worldwide and saving farmers and biologists untold hours of labor. When that day arrives, you'll know where to find us - out standing in our field.

The project described is lead by Dr Garth Smith of Hort Research, Ruakura Research Centre, Hamilton, New Zealand. Software development for the project is done by John Curtis, with matrix math by Bob Jordan (also of Hort Research).

The field software is MAC-based, and was written in Symantec's Think Cv6.0. Data files are transferred to a Silicon Graphics IRIS Indigo for rendering and further analysis using IRIS Inventor and C++.

continued from page 23

It is quite revealing that, while no researcher ever experiences any qualm about speculating on what you see or hear, they somehow find ways to ignore how you feel - even as they pretend to describe touch. While Burdea and Coiffet are correct in suggesting that technical differentiations must be made between *tactile* and *force-feedback* effects, it is even more important, for human satisfaction, to distinguish between the *surface* and the *depth* perceptions of touch. This is something that a trained musician like Claude Cadoz would not miss. Cadoz prefers to talk about "le canal gestuel" (the "gesture channel"), than about "le toucher," because, as he observes, with touch there is a constant back and forth (aller et retour) sensation that reaches deep into the individual's body. Were this only an aesthetic comment, one might overlook it. However, because Cadoz has translated his observations into a highly refined force-feedback technology, even trained engineers might have to give it some thought.

Where For Art Thou?

Perhaps artists really *do* have something to say to engineers in a technology that not only reunites all previous technologies, but all previous representations - especially those directly related to our senses.

And herein lies the biggest problem with this book - a problem which is endemic to the engineering mentality of the whole computer-human interface research community. Burdea and Coiffet spend 10 pages on the arts of VR, and 340 on engineering problems. This might be expected in a book called Les Technologies de la Réalité Virtuelle, but the engineering hegemony is explicit: *VR is a bunch of machines, folks, and you'd better learn all about how they work.* The fact that artists can be trusted to make VR relevant in more than strictly commercial or industrial applications is blithely ignored - even by those who claim to perceive the whole of the still modestly-sized VR ecology. Engineers may work with machines, but VR is made for people.

In sad fact, the user is almost forgotten in La Réalité Virtuelle. Another well-known book which goes by the same title (Howard Rheingold's Virtual Reality, Simon and Schuster, New York 1991), presented a very exacting account of the historical circumstances attending the development of VR, and also found some room to ask about VR's impact on human nature. The same historical account makes it apparent that artists have played a greater role than even the military establishment in pushing VR technology forward.

I am referring to artists like Myron Kreuger, of course (whose rather limp preface to the book seems to provide the necessary alibi), but also to Claude Cadoz, David Rokeby, Jeffrey Shaw, Tamas Walicsky, Roc and Narcis Parhs, Agueda Simo, Christian Moller, Toshio Iwai, Francesco Antinucci, Seisuke Oki, and many, many others who should by all rights stand beside the rather restrictive American all-stars palmares. The next book that claims to tell us "all about VR" should perhaps pay more attention to the top-level engineering going on in the world of VR arts today. Little substantial progress will be made in VR technology as long as the inspiration and contributions of artists are not recognized and thoroughly understood by professional engineers.

In the end analysis La Réalité Virtuelle is not really about Virtual Reality as a whole, but only about the *technologies* of Virtual Reality. The understanding of one does not necessarily demand understanding the other, but if taken in this more specific light, this book stands as the most comprehensive and technically informed work on how to make VR.

INTERFACE

I'm looking for computer artists with experience in low resolution [(320x200), (320x240) 256color] for background graphics for computer games. I need conventional artists who can deliver ".pcx" or ".gif" files. Scanned original art is great as long as you have software to comply with special requests such as "only use the first 128 colors of the pallette."

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The Meckler Month of May

by Bernie Roehl

The recent Meckler conference, in San Jose, was far and away the most exciting and inspiring VR conference. Hundreds of people attended the seminars, and estimates of exhibit hall attendees ranged as high as 6000. The vendors were there in force displaying their latest and greatest hardware and software.

There was a definite sense that VR is actually happening, that people are out there using it for practical applications and even making money at it. There's an increased "credibility" within the VR community; people are filled with enthusiasm by the fact that the field we're all involved with is rapidly bearing fruit.

Doug and John overdressed for their virtual showers

Where's the beef?

All the major players in the VR industry were there, along with some exciting new start-ups. Whereas last year's exhibit hall filled a large hotel ballroom, this year's required a larger separate pavilion across the plaza. The trade floor also revealed a significant change from previous conferences, namely the emphasis on applications. We're starting to see some of the answers to the question "where are the apps?"

Clearly, the entertainment industry will be the major market for VR systems for years to come. Medical and architectural applications are already significant, in importance if not in sales volume. Trailing these is the education and training market, as well as scientific and financial visualization applications.

The major VR software houses showed fairly standard fare, but there were some new versions and some useful enhancements.

Sense8 showed off their WorldToolKit running on both 486s and SGIs; the portability of applications is certainly one of their selling points. An interesting development related to WTK is ironically not from Sense8 itself, but is the Genesis World Builder, an interactive VR construction environment for creating WTK worlds. The product, while still in a very early stage of development, is sound and will no doubt help Sense8 find new markets.

Formerly known as Dimension, the folks at Superscape have renamed their company to match the name of their product. The latest version of their software is still fast, flexible, powerful and too expensive. If I had an unlimited amount of money to spend on a VR system, Superscape is the one I would get; their development environment is well thought-out, and it's possible to build applications with it very quickly. Unfortunately, they've still priced their product well out of the reach of a large part of the market, even with educational discounts.

VREAM showed the latest version of their software, called VRCreator. Unlike their earlier version, VRCreator runs under Windows: it uses the Windows interface, and runs amazingly fast (which is quite an achievement under Windows). They've also dropped their price substantially; their first price drop was apparently so successful at increasing their sales that they decided to do it again. VRCreator will retail for $495, making it one of the least expensive complete VR packages available. They've also announced a special "distribution license"; instead of having to license individual copies of the runtime library, you can pay a one-time $295 price that lets you do unlimited distribution of the runtime with your application.

Autodesk lint

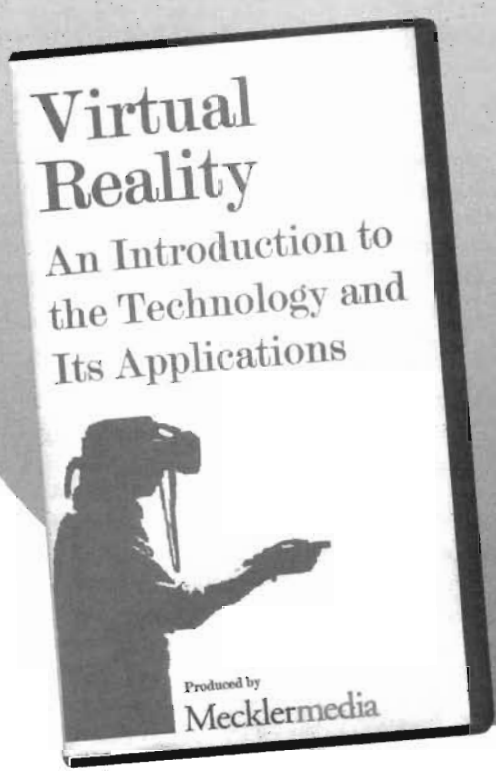
While Autodesk continues to market their Cyberspace Developers Kit, interest in the product seems to have waned. Almost no one I spoke to was using it; those who were using authoring systems had settled on Superscape or VREAM, and those developing applications in C tend to favor WorldToolKit over CDK. Whether it's the learning curve imposed by C++, or relative lack of performance of CDK in it present form, remains unclear. However, Autodesk has deep pockets and a lot of marketing clout; I doubt if they'll give up without a fight.

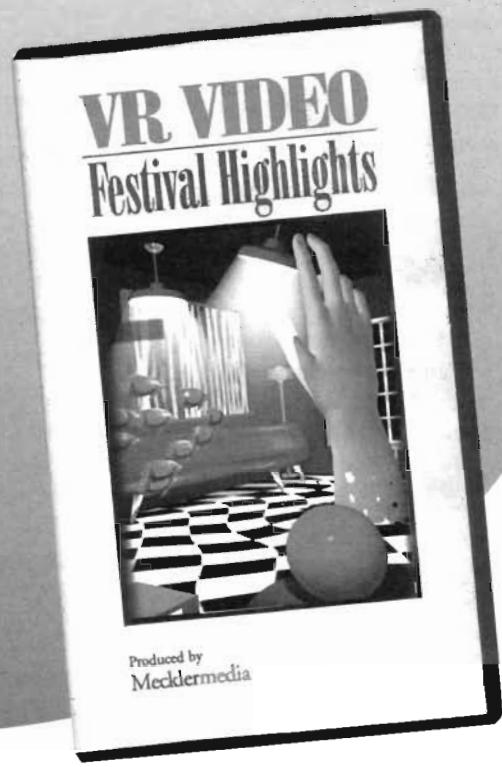
While Virtus isn't really in the same market as the other VR systems, their product does provide some of the same features. You can construct a simple virtual world, and walk through it in real time. Easy to use and intuitive, it's an inexpensive introduction to world-building. Their latest product is a set of libraries of virtual objects; home remodelling, archaeology and office design are among the markets they're targeting.

New bloke in town

Virtek International, another UK-based company, showed their PC 3D-Ware. This library is available in two forms: a high-end professional version that sells for $1499, and a much less-expensive "entry level" product. The library can be called

What is Virtual Reality?





Have you been searching for just the right vehicle to explain Virtual Reality to friends, colleagues, and business associates? Now, from Mecklermedia, publishers of ***Virtual Reality World*** and sponsors of three annual Virtual Reality conferences around the world, comes a tape to fit your need. ***Virtual Reality: An Introduction to the Technology and Its Applications*** explains various types of VR systems including: Using presentations from the *Introduction to Virtual Reality* workshop given at the New York Virtual Reality Expo (November 29-December 2, 1993, New York Hilton Hotel) and footage from the Expo exhibit hall and from manufacturers, Louis M. Brill and Otto von Ruggins have produced a two-hour tape that is perfect for showing in corporations, schools, and at computer club meetings—or for your own enjoyment.

Speakers: Louis M. Brill, Illuminations;
Dr. Bernie Roehl, University of Waterloo, "Introduction to Technical Concepts"
Don Morris, CEO, Magic Edge, Inc., "Cab Simulator";
David Smith, CEO, Virtus Corporation, "Through the Window";
Steve Glenn, V.P., Simgraphics, "Waldo World";
Dr. Myron Krueger, Artificial Reality, "Mirror World".

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from C, Pascal or even Modula-2. It's royalty-free, which is a major selling point for people developing applications for a mass market. It currently only runs at 320x200 resolution, but it's definitely one of the fastest VR libraries on the market. I saw it in operation, and was really impressed by the raw performance of the product running on standard hardware.

While not an exhibitor, Marc de Groot announced a new product worth watching, MEME. Since the dissolution of Ono Sendai, Marc has started his own company, Immersive Systems, Inc. Meme is a development system that allows the creation of networked VR applications using TCP/IP. It's based around Forth, a threaded interpretive language that is designed for rapid prototyping and good performance.

There was more innovation on the hardware end than in software. Probably the most talked-about product at the show was the Reality Blaster, a single ISA bus card that provides a complete VR environment. The idea is that the entire world database is loaded onto the card, which then does all the transformation and rendering for every frame; this is different from a graphics accelerator, which only improves the low-level rendering. The board claims 60,000 texture-mapped polygons per second (2,000 on-screen polys at 30 frames per second), which is pretty amazing. Their price is around $2500, which is quite good considering their performance. It directly supports shutter glasses for 3D viewing, and has options for anti-aliasing and NTSC output.

Reality Simulation Systems offered LittleSquirt, a 3D graphics board for the PC, at less than $500. It claims 100,000 flat-shaded polys per second; it does Z buffering and provides NTSC and SVGA output. They say that a texture-mapping option will be available next year.

Hardieware

The folks at Division haven't really done much in the way of hardware for the PC environment — until now. They've released the Pixel Planes 6 system, a high-performance graphics engine that does five million Gouraudshaded polygons per second, and is capable of Phong shading and texturemapping. The hardware is based on the Pixel-Planes architecture that was originally conceived at the University of North Carolina at Chapel Hill some years ago.

Sourceless trackers also seem to be gaining in popularity; the latest is from Precision Navigation. It provides three degrees of freedom (i.e., 3 axes of rotation information), and sells for $599 in single quantities. The guys at the Precision Navigation booth say that in large quantities the price could drop by a factor of 50 or more, which makes the tracker very cost-effective indeed. The unit itself has a two-axis tilt sensor, and a magnetic sensor that uses the ambient magnetic field.

On Blitzen

Another sourceless tracker was the GyroChip from Systron Donner. Originally developed for military application, the GyroChip uses a micro-miniature quartz tuning fork as a kind of "gyroscope"; by measuring the coriolis forces, it provides information about the rate of rotational acceleration. From that you can derive orientation information. The main advantage is cost; it can be produced quite cheaply in large quantities.

You have to have money to burn in order to afford a setup like that, but the results are pretty impressive.

Liquid Image had the distinction of having the most HMDs on the floor, specifically the MRG2. It's still monoscopic, but the price is quite attractive; I was quoted $3500, down from almost $6000 for the MRG1. Their holographic diffuser (from Kaiser Electro-Optical) is available as an option; it does eliminate the obvious "grain" of the image without blurring it.

Virtual Research (the guys who did the original Flight Helmet) were there with their VR4. It's quite nice, and stereoscopic to boot, but somewhat pricier than the Liquid Image HMD.

The HMSI display from RPI was there; I again didn't have a chance to try it out (it was down due to hardware problems) but if it lives up to its spec sheet it should be quite a contender. It's certainly one of the smallest and lightest-weight HMDs around.

The new Cybermaxx HMD from VictorMaxx looks like it might be an excellent choice for low-end systems; they're talking less than $700 retail, and probably less than that later on. I haven't seen it in operation, but it's certainly comfortable to wear; it's also stereoscopic, and has built-in tracking (unlike most HMDs, which require a separate Polhemus, Ascension or Logitech tracker).

Here's the beef

Most of the applications that were being shown at the exhibits were aimed at the Location-Based Entertainment market; perhaps the best example was the Cutty Sark display, done by Horizon Entertainment for Hiram Walker and Sons. It's definitely a high-end system, using a Silicon Graphics Reality Engine, the n-Vision HMD (which sells for several tens of thousands of dollars) and the Fastrak from Polhemus. You have to have money to burn in order to afford a setup like that, but the results are pretty impressive.

Another application I stumbled across is from, of all things, a Swiss stage magician named Marco Tempest. According to his literature, he currently uses a wall of television monitors as part of his stage illusions; he was at the conference shopping around for VR hardware and software to integrate into his show. Clever idea.

A very impressive and imaginative use of VR came from neighboring Italy and the folks at Infobyte. Their "La Citta di Giotto" recreated the Basilica of St. Francis of Assissi and in particular the fresco murals painted by Giotto. They used VR to go one step further by speculating what was going on in the mind of the Renaissance man/artist at this time. By traveling into the murals, one entered a truly virtual world based on the ideal city Giotto portrayed in the chapel. Here one could see glimpses of the religion and culture of the period, including little gargoylesque devils.

If you've never gone to a Meckler conference, you probably should. All the real innovators are there, and just having a chance to meet and hobnob with other people in the industry is inspiring.

MEMBERSHIPS

Individual Member dues are $45 per year in the US and abroad*. For students in the US who are under 25 years of age and can provide valid student ID, Student Member dues will be $30. International Students who meet the same criteria will have a dues rate of $40 per year.

VRASP also has special business and institutional memberships.

As a VRASPian you will receive PIX-Elation and be encouraged to submit articles or graphics. You may qualify for discounted advertising rates and take advantage of the Interface page. Members are welcome to regularly attend Chats, activities and business meetings. Other benefits include a resume database, emailing list and discounts at our Workshops.

Volunteering in the Alliance is necessary to keep it going and will be rewarded by a special Contributing Member designation. This entitles you to privileges such as holding office in the organization, as well as public acknowledgment in PIX and at conferences.

To join the Virtual Reality Alliance of Students and Professionals and receive PIX-Elation, please complete the VRASPian Profile/Application and send along with the appropriate dues. Students: remember the legible and legitimate student ID!

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Profiles help us tailor the activities, articles and future plans of VRASP to the interests and backgrounds of our members. We use them to alert members to neat activities in their field of interest or geographical area, helping those who wish to actively participate in the event or network. Frequently VRASP has trade show activities where we need representation and can also arrange free passes.

We also put students and professionals who cite relevant skills and experience in touch with those who need assistance on VR-related research and projects.

Send dues and VRASP Volunteer Profile form to:

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VRASP Volunteer Profile #10

Please print clearly.

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Position or Year _____

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I would consider myself a: ☐ Leader ☐ Follower

On an activity scale of 1 — 5 with 5 being the most active, my intended involvement would be:

1 2 3 4 5

On a reliability scale of 1 — 5 with 5 being the most reliable, I would consider myself:

1 2 3 4 5

I would like to volunteer at conferences ☐ Yes ☐ No

I could donate:

☐ Services ☐ Money ☐ Equipment ☐ Other _____

I could offer the following for VRASP activities/events:

☐ Car Pool ☐ Food Provider ☐ E-Mailer ☐ Meeting Hosting

☐ Designer ☐ Crash Space ☐ Photocopier ☐ Advisor

☐ Writer ☐ Speaker/Presenter ☐ Phone Caller ☐ Equipment Loaner

☐ Artist ☐ Other _____

I have the following experience:

☐ Fund Raising ☐ Marketing ☐ Publishing

☐ Group Administering ☐ Other _____

I use a:

☐ Macintosh ☐ PC (DOS/Windows) ☐ SGI ☐ Unix

☐ Amiga ☐ Other _____

I use or know:

☐ Assembly ☐ C++ ☐ Hypercard ☐ LISP

☐ FORTRAN ☐ C ☐ Pascal ☐ COBOL

Interests:

☐ Design ☐ Applications ☐ Marketing

☐ Military ☐ Education ☐ Software

☐ Entertainment ☐ Games ☐ Hardware

☐ Programming ☐ Training ☐ Other _____

I would attend VRASP activities in my area ☐ Yes ☐ No

I would like to receive additional VR information ☐ Yes ☐ No

READ.ME

VRASP Needs YOU! More than ever before, VRASP needs member participation. Special Projects need design, programming and documentation efforts, VRASP Cells need leadership and support, **PIX-Elation** needs articles, VRASP Needs **YOU**.

↳ If you're working "in the biz" and want to become more involved with this highly specialized field, there's no better way to get practical experience and firsthand knowledge of VR designs, requirements, techniques and equipment.

↳ If you're finishing college and would like to "get into" VR when you graduate, VRASP offers you the opportunity to gain practical experience before hitting the job market. Think what a staff position in VRASP will do for your resume!

↳ If you're just looking to do something different, to be in on the beginnings of a new and radical technology, or to meet some people who may soon become household names, this is the perfect chance.

↳ Don't feel isolated if you're nowhere near a center of activity; local VRASP cells are growing in number, and are in need of people for important staff positions. If you have access to the Internet, your geographic location becomes even less important with each passing day - the people who bring you this magazine, for instance, are scattered across the US (and elsewhere) - most have never met f2f (face to face). For all practical purposes, the Internet *is* the **PIX-Elation** Development Office - talk about *virtual reality!*

↳ Let us not forget that those of you who receive PIX in the mail are not merely subscribers, but VRASP MEMBERS. This is *your* organization, and you can make a difference for VRASP and for yourself. And to those of you who picked us up at a local newstand, we welcome your queries and look forward to your participation...

Be part of a new reality.

Don't just sit around...

Calendar of Events

July 24-29	SIGGRAPH 94 Orange County Convention Center Orlando, FL (312) 321-6830 See our project uniVRsum at The Edge!
July 28	VRASP General Meeting at SIGGRAPH 12:45 PM - 2:00 PM Fairview Room, Peabody Hotel Orlando, FL
Aug 4-6	Cyberspace in Music Therapy Institute for Music and Healing Immaculata College, PA (215) 647-4400 x3490
Aug 23-26	VRST '94 VR Software and Technology Singapore luiss@iss.nus.sg FAX 65 774 4998
Sept 13-15	VR User Show London Novotel FAX 44 81 995 3633
Sept 28-Oct 2	Geneva Virtual Reality Fair - Palexpo Congress Center Geneva, Switzerland FAX 41 22 786 40 80
Oct 11-13	VR Entertainment & Developers Expo Stan Goldstein, Organizer Bally's Casino Resort Las Vegas, NV (212) 717-1318
Oct 17-21	IEEE Visualization '94 Sheraton Premiere Tysons Corner, VA rdb@cs.unh.edu (papers)
Oct 25-27	AUSI-VR '94 World Congress Centre Melbourne, Australia FAX 61 08 234 1148

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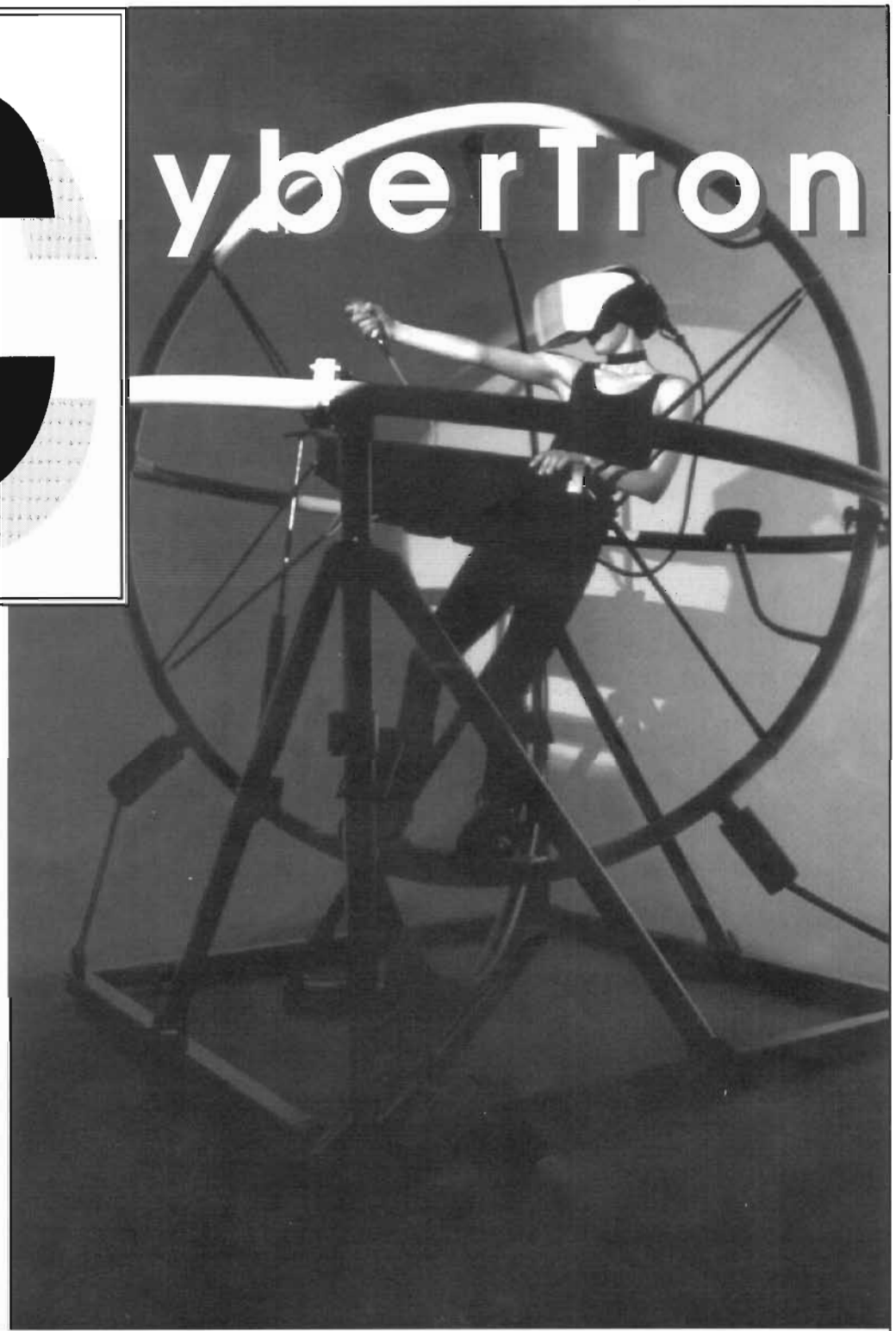

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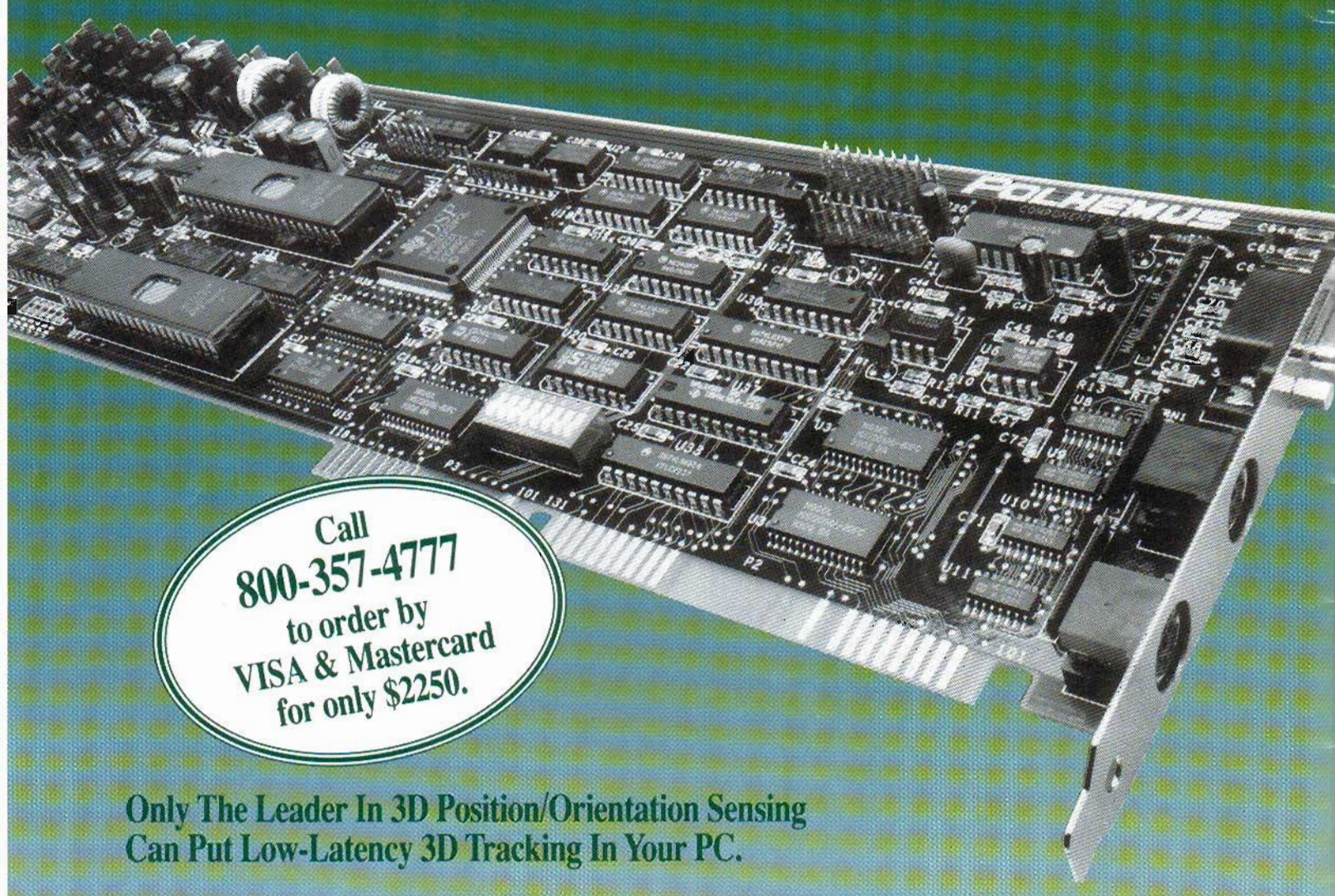

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