



Sex Drugs and Tessellation

THE TRUTH ABOUT VIRTUAL REALITY

as revealed in the pages of CyberEdge Journal

▶ Ben Delaney

▶ Introduction by Thomas A. Furness III, Ph.D.
Founding Director of the Human Interface Technology Lab

Forward

Virtual Reality has hit the headlines again. Since the purchase of Oculus in March 2014 by Facebook, people around the world are looking at head-mounted displays and wondering what they can do with them. As Mark Zuckerberg said in his post announcing the purchase, “The incredible thing about the technology is that you feel like you’re actually present in another place with other people. People who try it say it’s different from anything they’ve ever experienced in their lives.”

Had those people had been around in the 1990’s, they could have experienced it then.

People often ask how I got into virtual reality and how *CyberEdge Journal* got started. It all started in October 1990 when Scott, a colleague at *PC World*, asked me if I’d ever heard of virtual reality. He said that there was an demonstration of it happening that night in San Francisco, at the Palace of Legion of Honor. We talked a little bit about what virtual reality was. Neither of us knew very much, but it sounded like an interesting event. Later we found ourselves taking our seats in a jam-packed auditorium and waiting to see what this virtual reality stuff was all about.

Pretty much on time, Timothy Leary, the guru of LSD and other drugs, came on the stage. Tim had moved on to technology, and he thought VR was the next mind-blowing opportunity. While his talk was disjointed and rambling, his charisma held the crowd enthralled. Soon Tim petered out, and a thin, scraggly, hippie-looking dude with blonde hair and beard and his much more put together female companion took the stage.

There wasn’t much to see other than a big projection screen and a table on which they had placed a portable computer – a Dolch 386, one of the most powerful luggables of the time. It turned out that this was Eric Gullichsen and Patrice Gelband, who had recently founded the Sense8, one of the first commercial VR developers. They proceeded to show a demonstration of virtual reality, which for most in the audience was the first time we had ever seen this technology. It was mind blowing.

While the quality of what we saw was crude, even by the standards of the day, at one point I turned to my wife and said to her, “This is going to be big. I’m going to be involved with it.” I didn’t know how, I didn’t know what it was going to look like, but I was determined that VR was the next big

Forward

thing, and I was going to be part of it.

I thought I'd get a job as a marketing director for virtual reality company. After all, I did have a technical background, having been a programmer and systems analyst in the early 70s. I had done a lot of high tech marketing, including for medical devices and computer software. I had even done process software development while I was in Dahlgren Engraving, before I became the marketing director there.

I started looking around at what virtual-reality companies existed. There were only two that I could find, Sense8, in Sausalito, and VPL, in Redwood City.

I gave George Zachary, the Director of Marketing at VPL, a call and we talked a bit about the state-of-the-art of virtual-reality, the state of the commercial aspects of virtual-reality, and whether or not there was a job for me and VPL. There was not.

So I called Tom Coull, CEO of Sense8, and he agreed to have lunch with me. We had a good chat. I liked Tom and we got along well, but Tom didn't see a place for me in his company. The Virtual Reality companies at that time were just too small. They didn't have room for another position, nor the money to pay someone. I was getting pretty depressed. As we were getting up to leave Tom casually remarked, "You know what we do need? We need a newsletter. Nobody knows what's going on in this business." I mulled that over on the way home from lunch.

As a marketing consultant I had done newsletters for many clients. I had done newsletters for myself. I'd written, I'd done layout, I knew how to do circulation, and because I was still working at *PC World* magazine, I knew a bit about the publishing business, from watching how it happened at a big computer magazine. I thought to myself, "I can do a newsletter." The big question though, was whether or not there was any demand. If I wrote it would they come?

So I spent the next few weeks gathering up a mailing list. Remember, this was pre-Internet, and so I was searching on USENET groups, the WELL (where there was an active cyberspace discussion group). I was grabbing cards at trade shows and asking people that I met if they knew

Forward

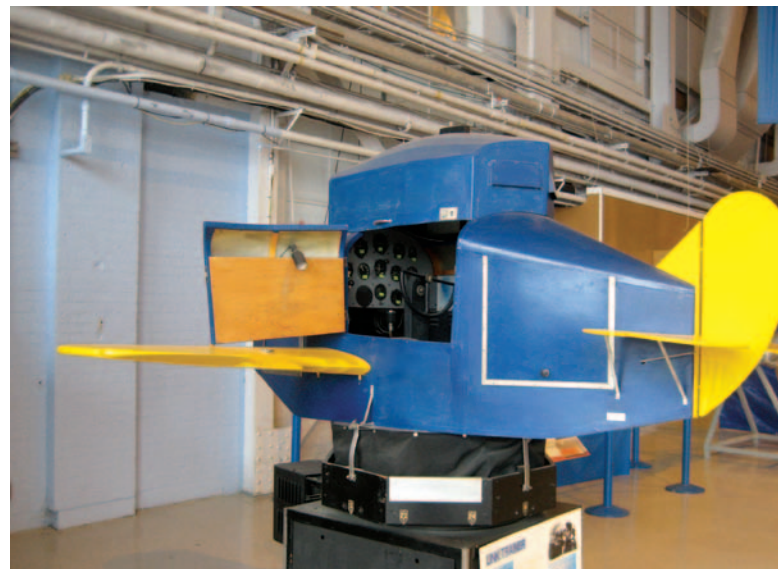
anybody else involved in the virtual reality business. Pretty soon I developed a list of about 200 names and (postal) addresses. I sent these people a survey, asking if they saw a need for newsletter, how often it should come out, what it should include, and what they would pay for it. I hoped I get enough results to be able to make an informed decision on whether or not to publish.

Much to my amazement, I got a near-75% response on the survey! There was a huge demand for a newsletter. People wanted to hear about news, the new products, the people, and events. People offered to pay and they wanted it as frequently as possible. With this survey in hand, a ton of enthusiasm, and some financial backing, I put together the issue number one of CyberEdge Journal — eight stunning, two-color pages that hit the mail in January 1991.

I'll never forget the night I was preparing the first issue for mailing, sitting at a card table in the living room in front of a television. On TV, CNN featured the bombing of Baghdad. It was the first Iraqi war — trying to get Iraq to withdraw from Kuwait — and America was pounding the stuffing out of Baghdad. It seemed like an auspicious moment to be launching a new venture. Now, 23 years later, I still remember that night, and I still remember the many adventures, great people, tremendous ideas, and the amazing inventions that I got to see and experience, thanks to Tom Coull's suggestion that the virtual reality business needed a communications channel.

Link Trainer at the Western Canada Aviation Museum. The Link Trainer saved thousands of lives in WWII. This one is equipped for instrument flying.

Uploaded to Wikipedia by William "Bill" Zuk. Released into the public domain (by the author).



Forward

In the pages that follow you're going to see some of the best articles from CyberEdge Journal (CEJ), from the very first issue, the January/February 1991 issue, through the last issue, number 35, January/February 1997. During those six years we published hundreds of pages of commentary, reporting and pictures, chronicling the exciting times, the daring adventures, the wacky ideas, and the great people who made virtual-reality real in the early and mid-90s.

This was one of the biggest adventures of my life. Not only did I get to see technology that seemed to have come right out of a science fiction movie, but I met some of the smartest and most interesting people in the world. I was welcomed in laboratories and universities and institutions around the world, where people generously shared their inventions, their ideas, their opinions, their beer, and their hospitality. I'm still friends with many of these people 20-plus years later, and I value that friendship hugely.

What I hope this book provides

My hope is that this book will help today's Virtual Reality developers skip some of the steps that would slow them down, and avoid the mistakes others have already made. There isn't much history taught in computer science courses. I hope *Sex, Drugs, and Tessellation* will provide some small piece of the foundation upon which great new Virtual Reality developments will be built.

This book celebrates the great things that were done in the 90's, which now seems like ancient history. I hope it will help those working today to understand what came before them. Most of today's exciting work in virtual-reality is based on the foundation of work done by the people whose stories you are about to read. Their work in turn was based on the work of others who preceded them. After all, simulation got its practical launch during World War II with the first flight simulator, the Link Trainer, developed to reduce the number of the fatalities during the War, when there just was not enough time to train pilots. The Link Trainer was a mechanical device that looked like a small airplane cockpit with stubby wings. It looked like a toy, no question. But this "toy" trained hundreds, if not thousands, of pilots to fly before they ever stepped into a real airplane. These early

flight simulators were the roots from which all virtual-reality has grown.

The path to today's Virtual Reality runs from the Link simulator, to Ivan Sutherland's work with 3D interactive graphics at the University of Utah, through Andries van Dam's work on 3D graphics at Brown University, on to Mort Heilig's Sensorama, through Tom Furness's breakthroughs in interface design at the Wright-Patterson Air Force lab in Dayton Ohio, and then the HIT Lab in Seattle, by way of Myron Kreuger's Video Place interactive systems, and many other labs around the world. Many other inventions and inventors, content creators and even philosophers created the foundation upon which today's virtual reality is based. Facebook's purchase of Oculus, developers of the Oculus Rift head-mounted display (HMD), would never have happened if it were not for the pioneers and those who built upon their work. In the pages that follow you'll read some of their stories, you'll see some of the early inventions, listen in on the philosophical discussions that took place in conference halls and late at night in hotel bars, and get a sense of how the virtual reality of today came to be.

The story is not over, of course. Today's virtual reality systems have better graphics, faster responses, and most of all, a much lower cost than any systems of the 1990's. However, the challenges of virtual worlds are not merely developing better hardware, better programs, and better displays. Many of the old philosophical questions remain: What is the meaning of a virtual reality application? What does it mean to enter cyberspace? If a theft or an assault occurs in a synthetic environment, what impact does that have on the real world? How long does it take to get from one place to another in a virtual world? What is "virtual reality?" These are all questions that were first asked in the 1990's. Most of them have not been answered yet.

Many technical challenges have not yet been solved, either. You cannot yet smell a flower in a virtual world. You cannot taste anything that you might eat in a virtual environment. Haptic and force feedback are still elusive sensations. You cannot feel the weight of the object you pick up, nor its texture. Simulator sickness still plagues many users.

Forward

The senses are not easily satisfied with the simulation technologies of today. For years science fiction writers have been suggesting that we would jack-in to virtual worlds, directly connecting our nervous systems with the computers controlling the simulations. Even on Star Trek, the Borg, half machine, half human, creatures, required an intimate physical connection between computers and their biology in order to have the full synthetic experience that mankind has sought almost from the beginning of technology.

We are still a couple of decades away from the ability to jack into a computer, to interface our nervous system directly with a machine. But I am sure that this will happen. We've already have very crude interfaces between the mind and the computer. We have synthetic retinas, we have artificial hearing, and we can stimulate the sensory neurons in a way that replicates traditional sensory input. While we have not yet productized artificial sensory input, there is no question in my mind that we will, and that it probably won't be long before we see it. Many of us alive today will live to see, and perhaps experience, a live, real-time direct connection between an electromechanical device and our nervous systems. Until that time comes we'll have to make do with the crude virtual-reality, synthetic environments, tactile feedback devices, 3-D audio, and other accoutrements of virtual-reality systems of the 21st-century.

I hope you enjoy this book. The title comes from some of the most common issues of the 1990's Virtual Reality developers: cybersex, simulation of "trips," and how to best build 3D models for real-time presentation. You will find all of these issues discussed in these articles.

It's been a blast for me putting this book together. I have to thank all the hundreds of people who helped me while I was publishing CyberEdge Journal, when I was working on my virtual-reality market studies, and most recently as I put this book together. Without their contributions at so many levels, virtual reality wouldn't exist, you wouldn't be reading this book, and I would have had a really different job during the 90's. It was a great time and I hope this book gives you a sense of how exciting it was to be there.

About the book

This book is arranged chronologically. Reading it straight through will give you a sense of the development of VR as a science and industry through the mid-1990's. The articles included here are printed with only some light editing for grammatical corrections and length. Many pictures are included here that were not in CEJ due to space limitations. Interspersed with the original articles from CEJ you will find contemporary recollections of some of the pioneers who helped make VR real. The book concludes with some additional material, including a round-up of the best-known VR personalities contributed by my long-time associate and friend, Kenny Meyer.

Originally, CyberEdge Journal included contact information for almost every organization and person mentioned in the articles. I debated including that info in this book, but decided against it, as most of it is decades obsolete.

Ads that are reprinted here suffer from a similar problem – very few of the companies are still in business. However, I think it is both fun and informative to see these old ads, and so have reprinted them without alteration.

All unattributed articles were written by me. Articles written by others or by more than one person include the original byline. Likewise, most of the photos in the book were taken by me, but many are publicity photos provided by the product developers and old pictures that are in the public domain.

The cover photo is from NASA, which used it in promoting their VR experiments of the late 80's and early 90's. It quickly became an icon of the era.

Ben Delaney
October, 2014

Contents

Acknowledgements	V
Introduction	VII
Forward	XI
1991: Takeoff	27
What is VR?	33
VR in San Francisco	35
Big Kids Play With VR.....	45
Brenda Laurel Recalls	55
W Industries	61
Senate VR Hearing	63
Jon Peddie Recalls	69
The Holodeck.....	73
Feedback	77
Tomorrow's Realities	79
VR in the UK	83
Bob Stone Recalls	87
SF VR II	93
Bill Chernoff Recalls	101
Zippy in VR!	107
VR on \$5 a Day	109
1992: Thank you, Mort!	117
Product of the Year	119

Contents

Nicole Stenger Recalls	125
Online VR Resources	127
CyberSpace: 1st Steps	131
Life on the Edge.....	135
Informatique '92	141
Legend Quest	147
Lawnmower Man.....	151
Rheingold Recalls.....	155
VR: The Miracle Cure?	157
Force Feedback Glove.....	165
The Horvitz Test.....	167
SIGGRAPH '92	169
Wheelchair in VR	175
Metaphor Mixer	177
The Fall of VPL	179
Bill Chapin Recalls.....	185
Art in Cyberspace	189
Mike Macedonia Recalls.....	193
1993: Best of VR	195
Military VR	201
NASA's Crystal Ball.....	203
Jim Kramer Recalls.....	209
VR in DC.....	213
VR and Disabilities.....	219

Contents

Informatique '93	225
NASA's Training Vision.....	231
Sex in VR	239
Caterpillar VR Tests	243
New HMD Tech.....	245
Virtual Worlds Center.....	249
Toni Schneider Recalls	253
Assistive Technology	255
The \$1200 VR system.....	259
SIGGRAPH '93	263
Mirror World Review.....	269
Issues with HMDs	273
Other HMD Issues	279
Art, Mind & Tech	285
1994: Howdy Hubble!	291
VR and Epilepsy	295
Virtual Therapy	297
Solving Real Problems.....	301
Cyberhead — VR Art.....	305
Handling Nuclear Waste	311
Virtual Brewery	315
VR Tests Best	319

Contents

1995: VR Pioneers	327
Autistic Children	333
The New CyberEdge.....	337
NTT's CyberCampus	339
Jon Waldern Recalls.....	343
1996: Fear of Flying.....	347
Simulator Sickness	351
Sutherland Speaks.....	357
Gorillas in the Bits.....	363
Walk Anywhere	367
Truck DriVR.....	373
1997: In the Boiler.....	377
Jack Scully Recalls	381
The End	383
Saying Goodbye	385
Lest We Forget	389
Every CJ Winner.....	397
Index	402

Illustrations

Ivan Sutherland’s mechanically-tracked, head-coupled display.....	VIII
Link Trainer at the Western Canada Aviation Museum.	XIII
The “No VR Hype “button	26
This was our original and only mission statement.	27
CEJ #1. Oh, to be so young... ..	30
Eric Gullichsen and Pat Gelband, founders of Sense8.....	35
The original HIT Lab logo, 1991.....	45
Brenda Laurel on a panel at Informatique ‘91, Montpellier, France.....	58
W Industries’ sit-down Virtuality system offered multi-player gaming. ...	61
Simulation through the ages, by Barbara Thomason.....	67
Enterprise class starships may hold two or more Holodecks.....	74
Tom Furness looks on as Fred Brooks describes the features of UNC’s exhibit.	80
An early Superscape demo.	84
The ProVision system from Division.	85
Professor Bob Stone looks on during an experiment at ARRC.....	87
Bill Chernoff ran this ad for many issues	102
Even Zippy got caught up in the VR excitement.	107
Randy Pausch wowed the CHI ‘91 crowd with VR for \$5 a day.....	113
Mort Heilig developed Sensorama in 1961	118
The first VR Product of the Year Award was a beauty	120
Virtuality’s stand-up system provided multi-player VR gaming in 1991.	121

Illustrations

The invitation to the first CEJ Product of the Year Award party	122
Ada Lovelace	123
In Nicole Stenger’s “Angels” one can touch the heart of an angel.....	125
Nicole Stenger prepares to play with Angels in this picture from 1991	126
The VR bookshelf.	130
<i>CyberSpace: First Steps</i>	130
Ian Capon, Sherry Epley, Ben Delaney, and Jon Waldern.....	137
Superscape VR systems with networked connectivity.....	140
Ben Delaney joins Susan Wyshynski and Vincent John Vincent.....	144
Things get steamy in the Lawnmower Man’s virtual world.	151
Colonel Richard Satava, MD.....	160
Dave Warner, Ben Delaney, and Francis Hamit.....	163
The Rutgers FFB Glove	166
Jannick Roland, Henry Fuchs, Richard Satava, Walter Greenleaf, Steve Ellis	174
Metaphor Mixer.	177
Metaphor Mixer	178
Jaron Lanier, VPL co-founder, and George Zachary,	181
Eric Howlett, developer of the seminal LEEP Optics	184
Inside a BattleTech pod from Virtual Worlds Entertainment.....	189
The DataSuit from UK firm TCAS	193
Wheelchair VR helped people design accessible spaces	197
The CyberTouch glove helped one feel virtual objects.	209
The Haptic Workstation set up for a driving simulator.....	210

Illustrations

Myron Kreuger, William Chapin (seated), and James Kramer	211
The Grimes Input glove, patented in 1980.	221
Kenny Meyer, Walter Greenleaf, Francis Hamit	224
Training for the Hubble Telescope repair mission	235
Zippy © Bill Griffith	248
The Virtual Worlds Center.....	250
The pod bay.	250
VWC published this pseudo-history of the Virtual Geographic League.....	251
Toni setting up a Virtual Reality demo at a WinHEC conference.....	254
KEO's SIM EYE HMD provided high res for only us\$145,000.	265
Straylight's CyberTron may look familiar.	267
Overview of HMDs, featuring 12 commercially available systems.	272
Brenda Laurel and Howard Rheingold.....	284
Mission specialist Jeffrey Hoffman, Thomas Akers, Kenneth Bowersox, Claude Nicollier, Richard Covey and Kathryn Thornton.....	291
The astronauts did a great job on the Hubble repair mission.	293
Artist Rita Addison suffered severe brain trauma	305
Welcome to Sapporo's Virtual Brewery.....	315
Scott Fisher oversees demos of the Virtual Brewery	316
Motorola University's Virtual Assembly Line	319
One of the robot assembly stations	321
Figure 1: Average Errors per Student	325

Illustrations

Drawing by Scot Steele.....	327
CyberEdge Electric was a leader in internet presence and website design	332
Subject S quickly accepted the bulky HMD	334
The “new-look” Cyberedge Journal	338
CyberCampus is entered at the Visitors Center.....	339
Ben Delaney presents Ivan Sutherland with the first CyberEdge Journal Virtual Pioneers award.....	356
Sutherland makes an emphatic point.....	356
Ivan Sutherland’s early head-coupled display.....	362
Interacting with virtual gorillas is a lot less scary	365
The Omnidirectional treadmill at the naval Postgraduate School	367
An earlier test of the ODT	370
I had a lot to learn about driving an eighteen wheeler.	373
The Virtual Boiler enables fine tuning of burner emissions.....	378
Number 35, the last issue of CyberEdge Journal.	383
Fred Brooks always seemed to enjoy himself.	389
Char Davies, winner of the 1995 Art and Event CJ for Osmose, right.	400
The 1995 Virtual Reality Pioneer Award	401