SIGGRAPH 97
24TH INTERNATIONAL CONFERENCE
ON COMPUTER GRAPHICS
AND INTERACTIVE TECHNIQUES

COURSE NOTES

15

Applied Virtual Reality

ORGANIZER

Carolina Cruz-Neira
Iowa Center for Emerging Manufacturing
Iowa State University

LECTURERS

Carolina Cruz-Neira
Iowa Center for Emerging Manufacturing
Iowa State University

Rudolph Darken
Naval Postgraduate School

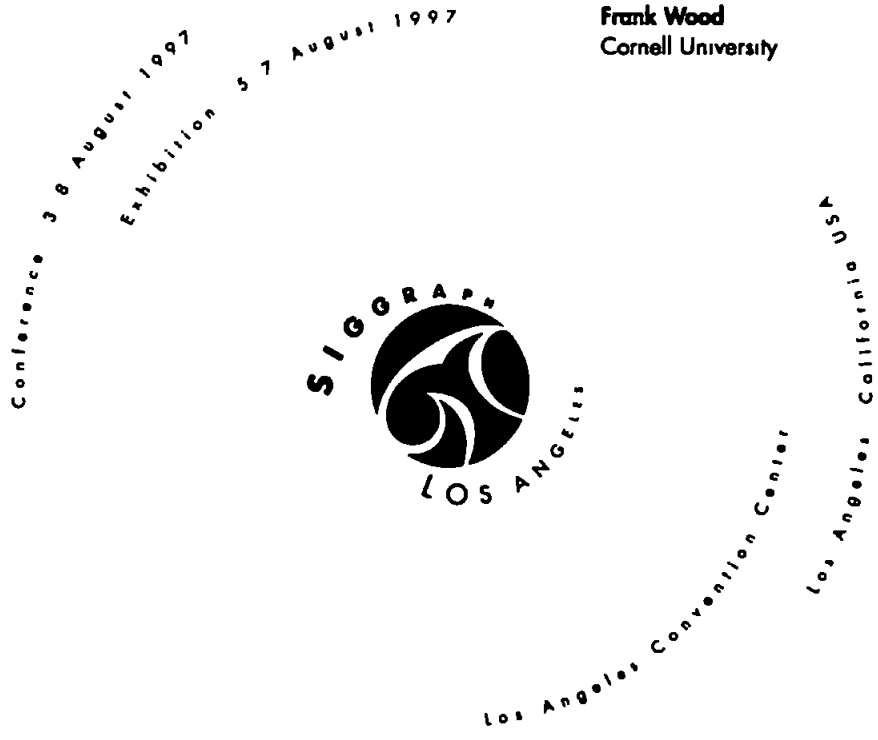
Mary Lynne Dittmar
Advanced Computing Group

Richard Gillilan
Cornell University

Oliver Ruedel
Fraunhofer Institute for Industrial Engineering

Judy Vance
Iowa State University

Frank Wood
Cornell University



Applied Virtual reality

Organizer
CAROLINA CRUZ-NEIRA
Iowa State University

Lectures
RUDY DARKEN
Naval Postgraduate School

MARY LYNNE DITTMAR
Boeing Defense and Space Group

RICHARD GILLILAN
Cornell Theory Center

OLIVER RIEDEL
Fraunhofer Institute for Industrial Engineering

FRANK WOOD
Cornell Theory Center

JUDY VANCE
Iowa State University

COURSE 15 NOTES

SIGGRAPH 1997

24th International Conference on Computer Graphics and Interactive Techniques

Los Angeles Convention Center
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Course Summary

This course addresses the field of virtual reality from the end-user's perspective The course it is focused on "what we can do" with VR technology, not "how to develop" the technology The course provides attendees with criteria to identify whether or not VR technology could be a tool in their working environment The course will cover several working VR applications in academia and industry along with discussions of their design processes

The course objective is to provide an understanding of the unique features of virtual reality and how these features can be identified and used in developing useful applications This tutorial will answer the question -why do we need VR? What does VR have to offer that I can't already develop using existing three-dimensional interactive computer graphics techniques? This course examines the features of VR technology and relates these features to specific applications The course concentrates on the applicability of VR technology not on the development of hardware/ software to control the various devices required in a virtual environment

Course Schedule

10 minutes	**Welcome and Course Overview** Carolina Cruz-Neira	1-1
20 minutes	**Introduction to Virtual Reality** Carolina Cruz-Neira	2-1
1 hour	**Reusability and User Interface Issues in Virtual Reality** Frank Wood	3-1
15 minutes	*Break*	
1 hour	**Design Issues in Virtual Environments** Judy Vance	4-1
1 hour	**Navigation in Virtual Environments** Rudy Darken	5-1
90 minutes	*Lunch Break*	
1 hour	**Psychological and Physiological Effects of Immersive Environments** Mary Lynne Dittmar	6-1
30 minutes	**Making Virtual Reality Useful** Carolina Cruz-Neira	7-1
15 minutes	*Break*	
1 hour	**Scientific Applications of Virtual Reality** Richard Gillilan	8-1
1 hour	**Using Virtual Reality in Engineering Applications** Oliver Riedel	9-1
15 minutes	**Wrap Up and Panel Discussion** All Speakers	10-1

Speaker Biographies

Dr. Carolina Cruz-Neira is a Litton Assistant Professor in the Department of Electrical and Computer Engineering and an Associate Scientist at the Iowa Center for Emerging Manufacturing Technology, both at Iowa State University Dr Cruz obtained a Ph D from the Electronic Visual ization Laboratory (EVL) at the University of Illinois at Chicago in May of 1995 Her PhD research involved the design and implementation of the CAVE virtual reality system and the development of paradigms to integrate high performance computing and communications with the CAVE for applications in computational science and engineering She has consulted for IBM Wall Street, the Chicago Board of Trade, the National Center for Supercomputing Applications and Argonne National Laboratory She received her Master's degree at EVL and a bachelors in Systems Engineering at the Universidad Metropolitana in Caracas, Venezuela

Dr, Cruz's main research area is on the integration of virtual reality interfaces, high-speed net works and high-performance computing engines for the real-time steering of distributed simula tions in science and engineering She is currently performing collaborative research with scientists and engineers at the Cornell Theory Center, Argonne National Laboratories, John Deere Corporation, and Rockwell International Corporation

Dr Cruz grew up in Alicante, Spain, were she started studying classical ballet dancing at the Music Conservatory of Alicante at the age of 5 She moved to Venezuela in 1981 to pursue her undergraduate degree and to continue her dance education as well Before discovering virtual reality, she was part of several dance companies and performed in theaters in Spain and Venezuela

Dr. Rudy Darken is an Assistant Professor of Computer Science at the Naval Postgraduate School in Monterey, California He joined the department in July of 1996, having been at the Naval Research Laboratory in Washington, D C since 1991 as director and co-founder of the Tactical Electronic Warfare Division's Virtual Environment Laboratory

Dr Darken's research has been primarily focused on human factors in virtual environments with emphasis on navigation and wayfinding in large-scale virtual worlds His background includes experience in interface design, collaborative computing, computer augmented training systems, team training systems, real-time visual simulation, computer graphics, and computer animation Recent research initiatives include spatial audio in aircraft training and operations and wireless mobile computing, or more to the point, virtual environment technology applied to real world tasks

He is a member of the editorial board of PRESENCE Journal He received his B S in Computer Science Engineering from the University of Illinois at Chicago in 1990 and his M S and D Sc. degrees in Computer Science from The George Washington University in 1993 and 1995, respectively

Dr. Mary Lynne Dittmar is currently the technical lead of the Visualization Laboratory and the Usability Laboratory of the Advanced Computing Group, Boeing Defense and Space Group, Huntsville, Alabama She took her Ph D from the University of Cincinnati in 1989, with an emphasis in human perception and performance (Human Factors and Experimental Psychology) She was a Lecturer at the University of Cincinnati from 1984 to 1989, and a faculty member at The University of Alabama in Huntsville from 1989 to 1995, before leaving to start her own company, RAD Company (Research, Analysis & Design) of Huntsville, Alabama Prior to joining Boeing in March of 1996, she served as a human factors consultant on a number of research projects, ranging from sustained operations and human performance to virtual reality applications at NASA Marshall Space Flight Center

She is a member of the Human Factors and Ergonomics Society, the American Psychological Society, the American Association for the Advancement of Science, and Sigma Xi (National Honor Society in Science) as well as several other professional and civic organizations

Dr. Richard Gillilan received his Ph D in Theoretical Chemistry from the University of Pennsylvania in 1988 studying nonlinear dynamical phenomena in surface diffusion He continued his work at Cornell University as a postdoctoral associate in the Chemistry department In 1990, Dr Gillilan moved to the University of California, San Diego as a Postgraduate Research Chemist in the laboratory of Kent Wilson While working on solution-phase reaction dynamics, reaction-path calculation strategies and quantum control theory, he developed an interest in scientific visualization and animation production

Dr Gillilan has been a Research Scientist and Visualization Specialist at the Cornell Theory Center since 1992 He specializes in animation production and virtual reality in chemistry, molecular biology and biophysics

Mr. Oliver H. Riedel was born in Osnabrueck, Germany in 1965 After finishing senoir high school and the military service requerirments, he started studies in technical cybernetics at the University of Stuttgart in Germany Because of his specific interests, he obtained a degree in biomedicine and digital machine processing Before joining the Institute for Human Factors and Technology Managment (IAT), at the University of Stuttgart, he was a staff memeber of the biomedical division at Hewlett-Packard At the end of 1991 he received the assignment to build a virtual reality research laboratory at the Fraunhofer Institute for Industrial Engineering (IAO) - one of the world's largest industrial research organizations In 1995 he became the head of the Competence Center Virtual Reality at IAO The lab now plays an important roll in pushing the industrial and commercial capabilities of VR

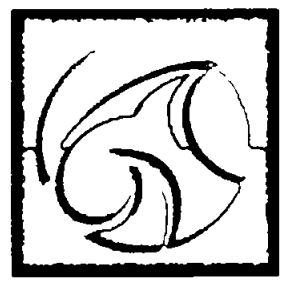
He is the author of many publications in the field of industrial applications of VR and human factors of immersive displays Since 1994, Mr Riedel has been a member of the German Research Society in the category of special research area "rapid prototyping of innovative products"

Dr. Judy Vance is an Assistant Professor of Mechanical Engineering at Iowa State University After receiving her B S in Mechanical Engineering from Iowa State University, she worked as a manu facturing engineering at the John Deere Des Moines Works She later returned to Iowa State and received her M S and Ph D in Mechanical Engineering

Professor Vance's research interests are in the area of virtual environment applications for engineering design She recently received the prestigious National Science Foundation CAREER award which is based on her research and teaching record She also has two other National Science Foundation grants supporting this research Specific project areas include mesh decimation, virtual training, and virtual conceptual design She has performed research for the Ford Motor Company and is currently working on developing a virtual environment for engineering design for John Deere

Mr. Frank Wood recently received his BS in Computer Science from Cornell University Mr Wood was employed by Fujitsu and the University of Illinois at Chicago before coming to the Cornell Theory Center He is currently working with industrial partners to develop real-time virtual simulation environments and continues to research distributed collaborative interfaces for immersive environments

WELCOME
TO
APPLIED VIRTUAL REALITY



Welcome!

At SIGGRAPH 93, we offered the first "Applied Virtual Reality" course, which was a big success with over 700 attendees Since then, I have received numerous e-mails and comments from people that attended or had heard about the course asking me to do an updated version for another SIGGRAPH conference Most VR courses offered at SIGGRAPH are targeted towards virtual reality systems development, not on how industry and research can use this technology to their advantage These comments have motivated me to prepare this course for SIGGRAPH 97, bringing together an impressive team of speakers from different disciplines to share their ideas and practical experiences in the fascinating and quickly growing world of applied virtual reality

Our objective is to provide an understanding of the unique features of virtual reality and how these features can be identified and utilized in developing useful applications This course will address questions such as why do we need VR? What does VR have to offer that I can't already develop using existing three-dimensional interactive computer graphics techniques? The answers will be provided by examining the features of VR technology and relating these features to specific applications

The speakers enthusiam and support of the course is evident in the materials provided in these notes as well as in the presentations We believe that this course will be very beneficial to those already working on VR, as well as those beginning to be exposed to it and starting to think how VR can be integrated in their workplace We hope you find this course enjoyable, interesting and professionally beneficial

Carolina Cruz-Neira
Course Organizer