14
Applied Virtual Reality

Organizer
Carolina Cruz-Neira
Iowa State University

Lecturers
Allen Bierbaum
Carolina Cruz-Neira
Christopher Just
Judy Vance
Iowa State University

Rudolph Darken
Naval Postgraduate School

Mary Lynne Dittmar
Boeing Information, Space, and Defense Systems

Richard Gillilan
Cornell University

Oliver Riedel
Fraunhofer Institute for Industrial Engineering

course notes

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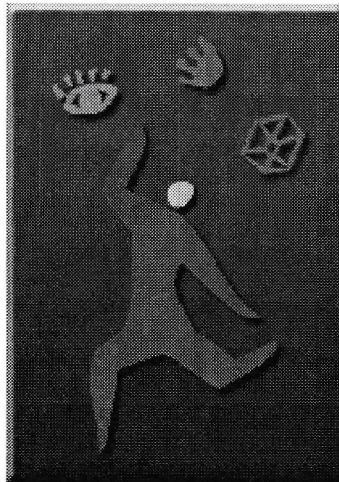*Boeing Information, Space & Defense*

RICHARD GILLILAN
Cornell Theory Center

CHRISTOPHER JUST
Iowa State University

OLIVER RIEDEL
Fraunhofer Institute for Industrial Engineering

JUDY VANCE
Iowa State University

COURSE 14 NOTES

SIGGRAPH 1998

25th International Conference on Computer
Graphics and Interactive Techniques

Orange County Convention Center
Orlando, Florida, USA
July 19th-24th, 1998

Course Summary

This course addresses the field of virtual reality (VR) from the end-user's perspective. It provides attendees with criteria to identify whether or not VR technology could be a tool in their working environment. This course will present various rationale justifying the need for virtual reality (VR) and outline what VR can offer beyond traditional computer solutions. This tutorial will answer the question: what does VR have to offer that is not available using existing three-dimensional interactive computer graphics.? This course examines the features of VR technology and relates these features to specific applications. The course concentrates on identifying how VR can be applied to help solve today's science and engineering challenges and does not focus on exploring the various VR hardware and software products available on the market.

Course Schedule

Speaker Biographies

Mr. Allen Bierbaum is presently working towards his M.S. in Computer Engineering at Iowa State University. He is a Research Assistant at the Iowa Center for Emerging Manufacturing Technology (ICEMT), where he is part of the team working on VR Juggler, a new development system for virtual reality (VR) applications.

Mr. Bierbaum's research interests are centered in the field of VR, with emphasis on software engineering and distributed computing. Additionally, he is also performing work on high-performance computing, artificial life, and computer graphics. He has been at ICEMT for over 4 years working on a variety of projects in these areas.

Mr. Bierbaum received a B.S. in Computer Science from Iowa State University with honors in May of 1997. His senior research project involved the development of a parallel real-time radiosity algorithm to be used in VR applications, which was demonstrated at the Silicon Graphics Inc. booth at the conference Supercomputing '96. Mr. Bierbaum did an internship in the Advanced Graphics Division at Silicon Graphics Inc. where he worked with the Iris Performer team. Before entering Iowa State University, Mr. Bierbaum worked for 3 years developing database and multimedia applications for a medical software company.

Dr. Carolina Cruz-Neira is a Litton Assistant Professor in the Department of Electrical and Computer Engineering and the Associate Director of the Iowa Center for Emerging Manufacturing Technology, both at Iowa State University.

Dr. Cruz's main research area is on the integration of virtual reality interfaces, high-speed networks and high-performance computing engines for the real-time visualization of and interaction with scientific and engineering applications. Her work focuses on the development of software tools to support virtual reality application development, such as efficient multi-processing methods, distributed programming environments, immersive interfaces, and hardware-independent application development environments. She is currently performing collaborative research with scientists and engineers in places such as the Cornell Theory Center, John Deere Corporation, Rockwell International Corporation, and Shell Oil.

Dr. Cruz obtained a Ph.D. from the Electronic Visualization Laboratory (EVL) at the University of Illinois at Chicago in May of 1995. Her Ph.D. 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, Argonne National Laboratory, Engineering Animation Inc., Allied Domeq, and MechDyne Corp. She received her Master's degree at EVL and a Cum Laude bachelors in Systems Engineering at the Universidad Metropolitana in Caracas, 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.

His 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, mobile computing, collaborative computing, computer augmented training systems, team training systems, real-time visual simulation, computer graphics, and computer animation.

He is an associate editor 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 took her Ph.D. in Experimental Psychology (Cognitive/Human Factors) and Psychopathology (Applied Clinical Research) from the University of Cincinnati in 1989. She was an Assistant Professor of Psychology at the University of Alabama in Huntsville for 5 years before leaving to start RAD Company (Research, Analysis & Design) in 1994. She served as a NASA consultant in the areas of Virtual Reality and Human Computer Interaction at the Marshall Space Flight Center from 1990 to 1996. In 1996, she joined the Advanced Computing Group of the Boeing Company in Huntsville, Alabama, where she works in Training, Human Factors, and Virtual Reality and visualization. Recently, she has moved to Houston, Texas to work with Boeing's International Space Station program and NASA's Division of Spaceflight Training at the Johnson Space Center on a knowledge engineering/knowledge acquisition (capture) effort with the goal of facilitating integration of training systems. She is coordinating a similar effort at the Marshall Space Flight Center in Huntsville, Alabama.

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. Christopher Just is currently pursuing an M.S. in Computer Science at Iowa State University. He is a Research Assistant at the Iowa Center for Emerging Manufacturing Technology, where he is part of the team working on VR Juggler, a new development system for virtual reality applications.

In addition to virtual reality and 3D graphics, Mr. Just's research interests are wide-ranging, and include operating system design, formal specification systems, and performance measurement of time-critical software. As part of his degree program, he is combining several of these areas to perform a detailed performance analysis of the VR Juggler software.

Mr. Just is a long-time resident of the state of Iowa, and received a B.S. in Computer Science from Iowa State University in December of 1995. In his off time, he enjoys abusing electric guitars and collecting LPs of obscure progressive rock groups.

Dr. Oliver H. Riedel was born in 1965. After finishing senior high school and military service he started studies in technical cybernetics at the University of Stuttgart in Germany. Due to his focus he got a degree in biomedicine and digital image processing. Before he joined the Institute for Human Factors and Technology Management (IAT) at the University of Stuttgart he was staff member of the biomedical division of Hewlett Packard. End of 1991 he got the assignment to build a VR 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 the IAO and plays together with his colleagues a significant role in Germany pushing the capabilities of industrial and commercial VR.

Dr. Riedel obtained a Ph.D. from the faculty for construction and manufacturing technology at the University of Stuttgart. His Ph.D. research involved different new techniques for real-time rendering adapted to the anatomical and physiological parameters of the human eye. He is the author of many publications in the field of industrial applications of VR and human factors of immersive displays. Since 1994 Dr. Riedel has been a member of the German Research Society in the category of the special research area "rapid prototyping of innovative products".

Dr. Judy Vance is an Associate Professor of Mechanical Engineering at Iowa State University. After receiving her B.S. in Mechanical Engineering from Iowa State University, she worked as a manufacturing 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 engineering data visualization, virtual training, virtual manufacturing and virtual conceptual design. She is working on projects for the Ford Motor Company, Boeing, and Procter and Gamble. Dr. Vance also leads of team of researchers who are developing a virtual environment for engineering design for John Deere.

Welcome! Last year, at SIGGRAPH 97, we offered the second "Applied Virtual Reality" course, as an update to the first course which was offered at SIGGRAPH 93. We had not planned to organize a third course on "Applied Virtual Reality" for SIGGRAPH 98, but, due to the incredible number of e-mails and notes asking about a sequel for this year, we are presenting here an updated version for SIGGRAPH 98. We received many helpful comments and suggestions from people that attended last year's course and also from the SIGGRAPH Courses Committee that have been used to improve and expand our content for this year. We bring you a course that is focused on how virtual reality technology can be applied to a variety of scientific and engineering applications. Our objective is to provide an understanding of the issues involved in the use of virtual reality, the different features that need to be considered when creating applications, and the decision factors to consider when exploring today's today's available technology.

This course brings together speakers from different disciplines to share their ideas and practical experiences in the fascinating and quickly growing world of virtual reality. We believe that this course will be very beneficial to those already working on VR applications, as well as those beginning to be exposed to this technology and starting to think how VR can be integrated into their workplace. As last year, we hope you find this course enjoyable, interesting and professionally beneficial.

Carolina Cruz-Neira
Course Organizer