

Practical 3D User Interface Design: Siggraph '96

Course Notes 31

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Abstract

This full-day course covers principles and techniques for creating 3D user interfaces (3D UIs) for modeling, animation, information visualization, multimedia, video games, and other emerging interactive systems with an emphasis on real-world 3D UI problems and practical solutions. Speakers from both leading edge companies and the research community will address their design principles and design processes, the choices they made, and the results of their final implementations. Special attention will be given to: working with low end platforms, supporting the WWW, mixing 3D and 2D workspaces, and scalability. The course will include spirited roundtable discussions, live demonstrations, and case-study presentations.



Practical 3D User Interface Design

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NOTE: If you are viewing this document online, you can access the listed course materials by clicking on a link. Any region highlighted with a red outline box is a link. Links at the tops of pages generally take you to this section.

More information on the online version can be found in the “Notes for CDROM version.”

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Introduction

Abstract

This full-day course covers principles and techniques for creating 3D user interfaces (3D UIs) for modeling, animation, information visualization, multimedia, video games, and other emerging interactive systems with an emphasis on real-world 3D UI problems and practical solutions. Speakers from both leading edge companies and the research community will address their design principles and design processes, the choices they made, and the results of their final implementations. Special attention will be given to: working with low end platforms, supporting the WWW, mixing 3D and 2D workspaces, and scalability. The course will include spirited roundtable discussions, live demonstrations, and case-study presentations.

Motivation

The emergence of inexpensive 3D accelerators, powerful game consoles, and 3D on the WWW is driving forward market desire for 3D content and applications. To this point in time, creation of 3D content has relied on bulky 2D interfaces. 3D UI design is becoming increasingly important as traditional 2D interface techniques become less and less adequate to tasks presented in complex 3D interactive applications. But 3D UI design is in its infancy and, unlike 2D UI design, has no collection of design guidelines, examples, publications, courses, and programs of study. This course, a continuation of *Practical 3D UI Design* from last year, will elucidate many of the issues in 3D UI design and present tangible techniques for creating one's own 3D UIs. Using a 3D interface can enhance the effectiveness of 3D interactive applications by

- appealing to a wider audience including children and non-technical users
- providing richer interaction paradigms
- eliminating switching between 2D and 3D metaphors
- reducing the cognitive distance between the user and the application
- enhancing the display of information, allowing more information to be displayed to the user in a more understandable format
- supporting inherently 3D tasks

Course Objectives

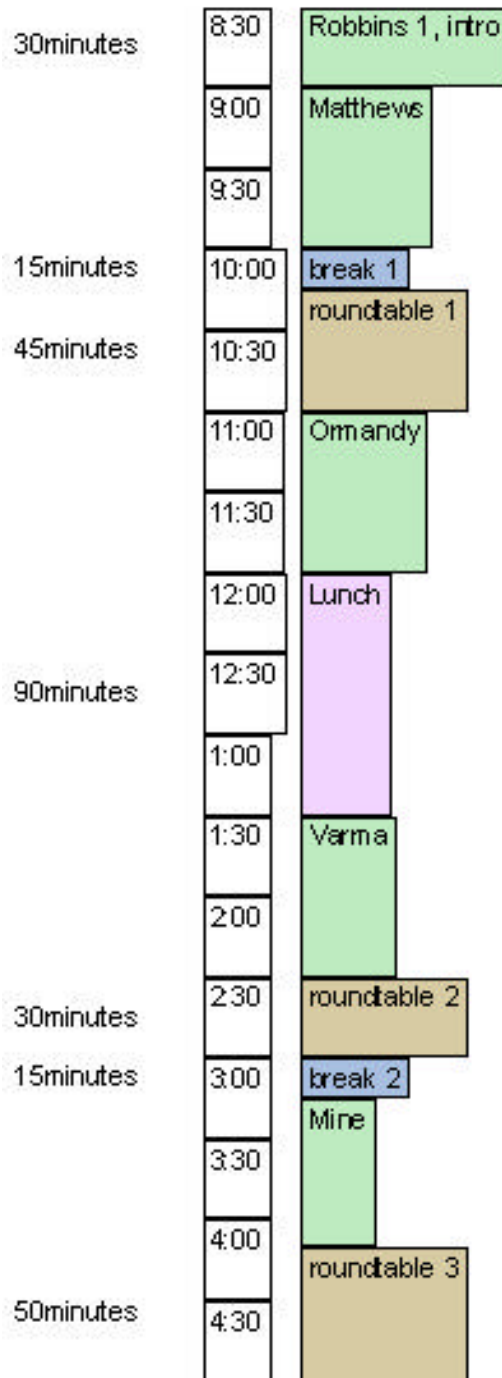
The goal of this course is to present effective design processes and principles for three-dimensional user interface (3D UI) design. Attendees will learn techniques for designing user interfaces that directly link user actions with application objects for tasks such as picking, viewing control, object manipulation, scene construction, animation specification, and data linking. This course will help attendees identify and evaluate interaction tasks used in interactive applications. The material presented will give

attendees a rich repertoire of new 3D interaction techniques for their applications. Attendees will be exposed to the creative solutions arrived at by the speakers, solutions tested daily in the commercial market.

Course Highlights

This course emphasizes the application of 3D UI design principles and the development of successful design processes. We will focus on real-world 3D UI problems and practical solutions. The presenters for this course are developing the cutting edge of practical 3D UI design for both desktop systems and emerging technologies. They will discuss design decisions made in implementing their own applications and how these decisions contribute to the larger issue of 3D UI design. Attendees will be presented with definitions, examples, methods, and guidelines for designing their own robust 3D UIs that make use of affordances, cues, and status indications. This discussion will be informed by implementation issues such as hardware platforms and 3D APIs, and will explore how to ensure the effectiveness of a 3D UI design.

Schedule



Syllabus

Motivation: Why 3D UIs?

Daniel C. Robbins, 3D UI Designer - Microsoft Corp.

8:30am - 9:00am **30 minutes**

- limitations of 2D UIs
- benefits of 3D UIs (reducing cognitive distance, easy migration to VR, more natural than 2D UIs for inherently 3D tasks, shallow learning curve)
- example cutting-edge 3D UIs

Implementation: Keeping Simple Tasks Simple via 3D UIs

Kevin Matthews, President, Artifice, Inc.

9:00am - 10:00am **60 minutes**

- supporting the 3D design and modeling process with “natural and transparent interaction”
- picking appropriate freedoms and appropriate constraints (what is a “good tool?”)
- establishing spatial relationships between objects and between tool and object (non-stereographic depth cueing, etc.)
- correlating 2 1/2D and 3D operational modes by seamlessly using feature-based modeling concepts
- correlating object-manipulation methods with view-manipulation methods (and their potential interdependence)
- working without hardware acceleration of 3D graphics (tricks of minimalism)

Break 1

10:am - 10:15am *15 minutes*

Roundtable 1: How to Arrive at Creative Solutions

Dan Robbins

10:15am - 11:00am *45 minutes*

- finding, using, and dispensing with real-world metaphors
 - determining a base set of functionality
 - stretching a 3D UI design to its limit and then stretching it more
 - taking advantage of rapid-prototyping
 - using 3D designs to inform 2D implementations
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Integration: Integrating Diverse Tasks via 3D UIs

Roman Ormandy, President, Caligari Inc.

11:00am - 12:00pm *75 minutes*

- presenting a consistent 3D UI for modeling, texturing, and animation
 - accommodating users of different levels
 - integrating modeling, texturing, and animation into one modeless application
 - blurring the difference between application objects and 3D UI elements
 - extending 3D interfaces beyond modeling and animation
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Lunch

12:00pm - 1:30pm *90 minutes*

Ease of Use: Learning from Children

Narendra Varma, Program Manager - 3D Movie Maker, Microsoft Corporation

1:30pm - 2:30pm *60 minutes*

- supporting children in the authoring domain
- choosing the right degrees of freedom
- taking advantage of sound to support 3D

- relying on spatially-based events rather than time-based events
- working with the constraints of low-end real-time 3D graphics rendering

Roundtable 2: TBA

2:30pm - 3:pm 30 minutes

Break 2

3:00pm - 3:15pm 15 minutes

The Future?: Virtual Environments Empowered via 3D UIs

Mark Mine, Graduate Student in Immersive Modeling, University of North Carolina at Chapel Hill

3:15pm - 4:15pm 60 minutes

- determining the advantages and disadvantages of working in a virtual environment— what makes VR practical
- characterizing the differences between “through-the-window” and VR
- designing interaction techniques and UIs for a virtual environment
- dealing with the limitations of current virtual environment technology
- demonstrating and critiquing several VR interfaces

Roundtable 3: Unsolved Problems

all speakers

4:15pm - 5:00pm 50 minutes

Speakers will be given in advance a sample unsolved 3D UI problem. Each speaker will respond, during the course, with several possible solutions to this problem. Possible “unsolved problems” are:

- hierarchy: what kind of 3D UI can be used to create, edit, and display groups, parents, children, siblings, and other data relationships?
- 3D UIs for non-geometric qualities: what is the best way to control qualities such as color, transparency, weight, and time?
- precision: how can a user be precise when using gestural controls?
- 3D navigation: why are there still no good methods for viewing control?
- using 3D interfaces for non-traditional tasks

Speaker Biographies and Contact Information

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Dan Robbins recently joined the Multimedia Tools group at Microsoft where he is working on 3D authoring tools. For the last eight years he was a user-interface designer with the Brown University Computer Graphics Group under Andries van Dam. He has a BA in visual arts with an emphasis on industrial design from Brown University. He has also worked on 3D UI for Avid Technology and video-game design for P.O.'d from Any Channel.

Kevin Matthews, Artifice, Inc.

President

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Kevin Matthews is C. E. O. of Artifice, Inc., a start-up software company developing and publishing 3D modeling and graphics software for environment design and design development. The lead product for Artifice is the award-winning DesignWorkshop(r), a virtual building toolkit for Power Macintosh.

Professor Matthews is also on the faculty of the Department of Architecture of the University of Oregon, where he teaches design and directs the Design Integration Laboratory, developers of The Great Buildings Collection, a multimedia encyclopedia of architecture on CD-ROM, published by VanNostrand Reinhold.

He was born in Oregon, grew up in Massachusetts, and he went to college at Deep Springs College, at UC Santa Cruz, and as a graduate student at UC Berkeley, where he also taught in the Department of Architecture. He has worked in and consulted with a number of architecture firms on the west coast, and he was the original CAD systems architect for the Superconducting SuperCollider project.

Roman Ormandy, Caligari Corporation

President

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Roman's original background is in AI and Linguistics. He received in 1981 an advanced degree in CS from Komensky University in Bratislava. Later Roman worked as a researcher in the department of Computational Linguistics at Charles University in Prague. In 1982 he defected to the United States and after short stints in New York City as a worker in the shipping department of a suitcase factory (making suitcases for the APPLE II!), programmer for educational software developer, and computer graphics consultant to Edwin Schlossberg Inc. Roman Ormandy visited SIGGRAPH 85 and there became inspired to start Caligari. Roman's ultimate goal is to establish a new communication medium, networked PC (as opposed to multimedia) and make it a part of mainstream culture.

Narendra Varma, Microsoft Corporation

Program Manager - 3D Movie Maker

Microsoft Corporation

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Narendra Varma has been working at Microsoft for five years. His first project at Microsoft was a database product called Microsoft Access. For the last three-and-a-half years, Narendra has been working in the kids group at Microsoft where he was responsible for Creative Writer, Fine Artist, and 3D Movie Maker. He has a B.A. in educational technology from Brown University. Narendra recently moved to Australia where he is working on consumer software for Microsoft.

Mark Mine, University of North Carolina

Graduate Student in Immersive Modeling

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Mark Mine is a fourth year graduate student at the University of North Carolina. His dissertation research involves the exploration of virtual environment interaction techniques and the development of an immersive modeling system for architectural design. He has a BS in Aerospace Engineering from the University of Michigan and a MS in Electrical Engineering from the University of Southern California. Before coming to UNC he worked at NASA's Jet Propulsion Laboratory on the Voyager and TOPEX/Poseidon projects.