

3D User Interfaces for Games and Virtual Reality

Lecture #1: Introduction

Spring 2010

Joseph J. LaViola Jr.

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CAP6121 -- 3D User Interfaces for Games and Virtual Reality

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Instructor

Professor – **Joseph J. LaViola Jr.**

Email – jjl@eecs.ucf.edu

Office Hours – Tues. 4:00pm – 5:30pm

Wed. 5:45pm – 6:45pm

Office is Harris 321

Website will have all required info

www.eecs.ucf.edu/courses/cap6121/spr10

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Class Goals

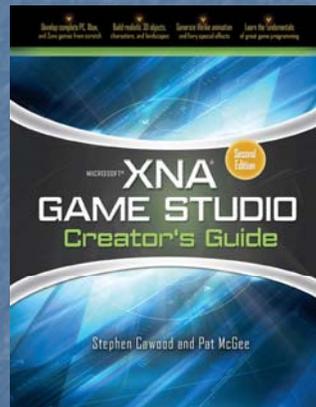
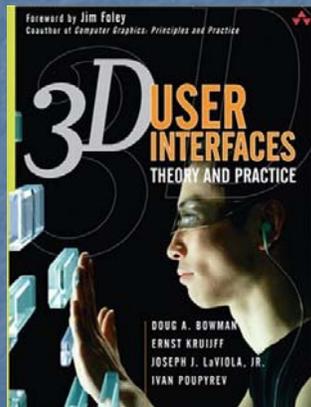
- Provide in-depth introduction to spatial 3D user interfaces
- Focus on 3D games
- Speaking and presentation skills
- Start of master's projects and PhD dissertations
- Possible publications
 - Virtual Reality 2011
 - 3D User Interfaces 2011
 - Foundations of Digital Games 2011
 - SIGGRAPH Sandbox 2011

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Required Books



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Grading

Assignment 1 (group)	15%
Assignment 2 (group)	15%
Chapter Paper (individual)	15%
Paper presentation (individual)	5%
Final Project (group)	50%

Final Projects

- 2-3 person teams
- Must have research component
 - related to games
 - innovative 3D UI
- Everyone must write and get approved a project proposal
- Final Project write up required
- DEMO DAY!!!! – May 3, 2010

Class Structure (see syllabus for details)

- Lectures
 - Fundamentals of 3D user interfaces
 - hardware
 - common interaction tasks
 - user evaluation
- Student paper presentation
 - 20 minute presentation
- Final project update sessions
- Work done in ISUE Lab – Harris 208 (laptops also)
 - key access required

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Course Topics

- XNA Development
- 3D Hardware
 - perception
 - input and output devices
- Common 3D Interaction Tasks
 - travel (e.g., navigation and wayfinding)
 - selection and manipulation
 - system control
- 3D UI Design
- 3D UI Evaluation
- 3D UI and Augmented/Mixed Reality

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Collaboration and Late Policy

- Collaboration encouraged
 - do your own work on assignments
 - cheating = BAD!!!
- All assignments must be handed in on time
 - Assignments – by 11:59pm on due date

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Tools – Hardware



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Tools – More Hardware



Natural Point
Track IR



Wii Balance Board



Novint Falcon



3rd Space Gaming Vest



IZ3D Monitor

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Tools – Software

- Visual Studio 2008, C#
- Microsoft XNA 3.0
 - basis of development environment
 - audio support, vector/matrix tools
 - physics engine (external component)
 - Bullet (3D)
 - our version: modified to handle 3D DLP stereo
- Custom built XNA components
 - Scenegraph
 - Wii controller API
 - head tracking (TrackIR from Natural Point)
 - content loader
- Google SketchUp Pro
 - nice model database

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What are 3D UIs?

- 3D interaction: Human-computer interaction in which the user's tasks are carried out in a 3D spatial context
 - 3D input devices
 - 2D input devices with direct mappings to 3D
- 3D user interface (3D UI): A UI that involves 3D interaction
- 3D interaction technique: A method (hardware and software) allowing a user to accomplish a task in a 3D UI

Why 3D Interfaces?

- 3D applications should be useful
 - immersion
 - natural skills
 - immediacy of visualization
- But, applications in common use have low complexity of interaction
- More complex applications have serious usability problems
- Technology alone is not the solution!

What makes 3D interaction difficult?

- Spatial input
- Lack of constraints
- Lack of standards
- Lack of tools
- Lack of precision
- Fatigue
- Layout more complex
- Perception

Interaction Goals

- Performance
 - efficiency
 - accuracy
 - productivity
- Usability
 - ease of use
 - ease of learning
 - user comfort
- Usefulness
 - interaction helps meet system goals
 - interface relatively transparent so users can focus on tasks

Universal 3D Interaction Tasks

- Navigation
 - travel: motor component
 - wayfinding: cognitive component
- Selection/Picking
- Manipulation
 - specification of object position & orientation
 - specification of scale, shape, other attributes
- System Control
 - changing the system state or interaction mode
 - may be composed of other tasks
- Symbolic Input

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3D UI Design Philosophies

- Artistic approach: Base design decisions on
 - intuition about users, tasks, and environments
 - heuristics, metaphors, common Sense
 - aesthetics
 - adaptation/inversion of existing interfaces
- Scientific approach: Base design decisions on
 - formal characterization of users, tasks, and environments
 - quantitative evaluation results
 - performance requirements
 - examples: taxonomies, formal experimentation

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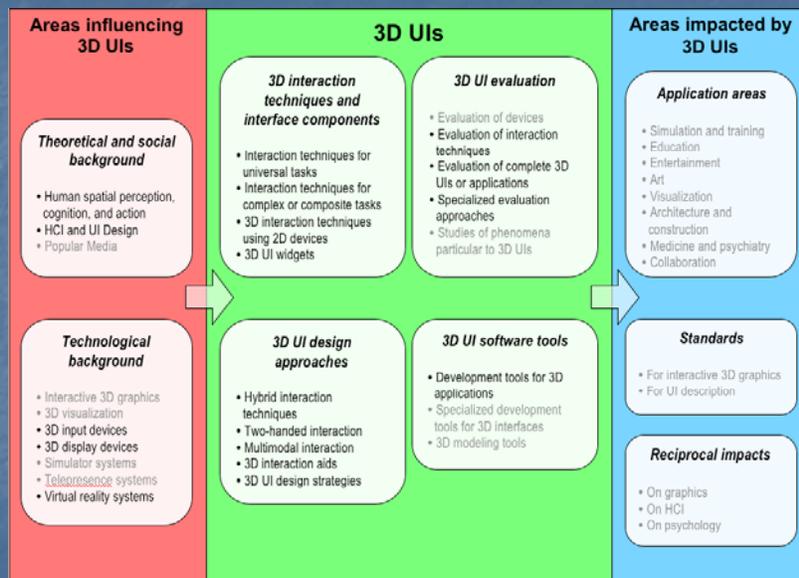
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Applications

- Architecture / CAD
- Education
- Manufacturing
- Medicine
- Simulation / Training
- Entertainment – *Games!!!*
- Design / Prototyping
- Information / Scientific Visualization
- Collaboration / Communication

3D UI RoadMap



Next Class

- Games and 3DUIs
- Readings
 - Bowman – Chapters 1 and 2
 - Bowman, D., Chen, J., Wingrave, C., Lucas, J., Ray, A., Polys, N., Li, Q., Haciahmetoglu, Y., Kim, J., Kim, S., Boehringer, R., and Ni, T. "New Directions in 3D User Interfaces", *International Journal of Virtual Reality*, vol. 5, no. 2, 2006, pp. 3-14.
 - LaViola, J. "Bringing VR and Spatial 3D Interaction to the Masses through Video Games", *IEEE Computer Graphics and Applications*, 28(5):10-15, September/October 2008.
 - Doug A. Bowman, Sabine Coquillart, Bernd Froehlich, Michitaka Hirose, Yoshifumi Kitamura, Kiyoshi Kiyokawa, Wolfgang Stuerzlinger, "3D User Interfaces: New Directions and Perspectives," *IEEE Computer Graphics and Applications*, vol. 28, no. 6, pp. 20-36, Nov/Dec, 2008