3D User Interfaces for Games and Virtual Reality

Lecture #1: Introduction
Spring 2013
Joseph J. LaViola Jr.

Instructor

Professor – **Joseph J. LaViola Jr.**
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Office Hours – Tues. 4:00pm – 5:30pm
                        Wed. 6:00pm – 7:00pm
Office is Harris 321

Website will have all required info
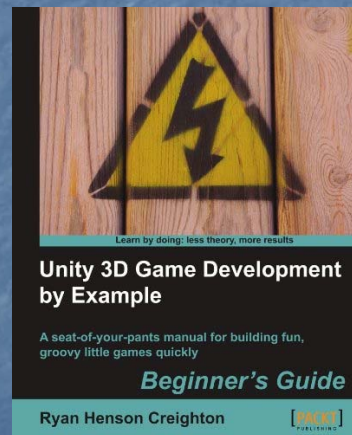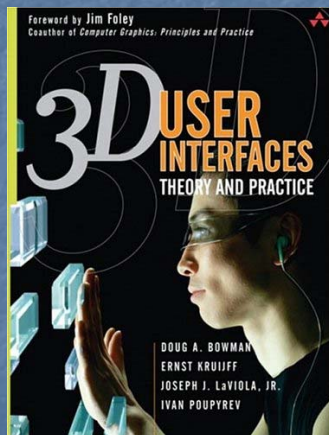www.eecs.ucf.edu/courses/cap6121/spr13

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 2014
  - 3D User Interfaces 2014
  - Foundations of Digital Games 2014
  - SIGGRAPH Asia 2013

Required Books

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Grading

Assignment 1 (group)	15%
Assignment 2 (group)	15%
Survey 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
- DEMO DAY!!!! – April 25, 2013

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)
  - code access required

Course Topics

- Unity 3D
- 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

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

Tools – Hardware

Wii Sensor Bar

PC with Intel Quad Core processor

8GB RAM

NVIDIA Quadro 5600 (others)

Samsung 50" 3D DLP HDTV

TriDef Stereo Emmitter

5.1 Speaker System

Wii controllers

TriDef Shutter Glasses

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Tools – More Hardware

NVIDIA 3D Vision Kit

Wii Balance Board

Novint Falcon

3rd Space Gaming Vest

IZ3D Monitor

Microsoft Kinect

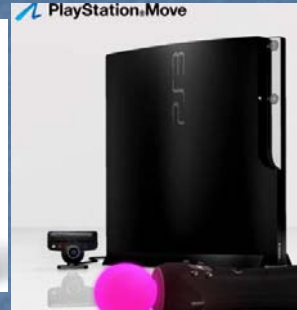# Tools – Even More Hardware

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Tools – Software

- Visual Studio 2010, C#
- Unity 3D
  - game engine
  - audio support, graphics support
  - physics engine
  - development UI
  - Scripting in C#, Javascript
  - Supports 3D stereo
- Microsoft Research Kinect SDK
- Sony Move.Me
- Razer Hydra API
- Leap Motion API
- Custom Client/Server code
- Google SketchUp Pro
  - nice model database

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

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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

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

Applications

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

3D UI RoadMap
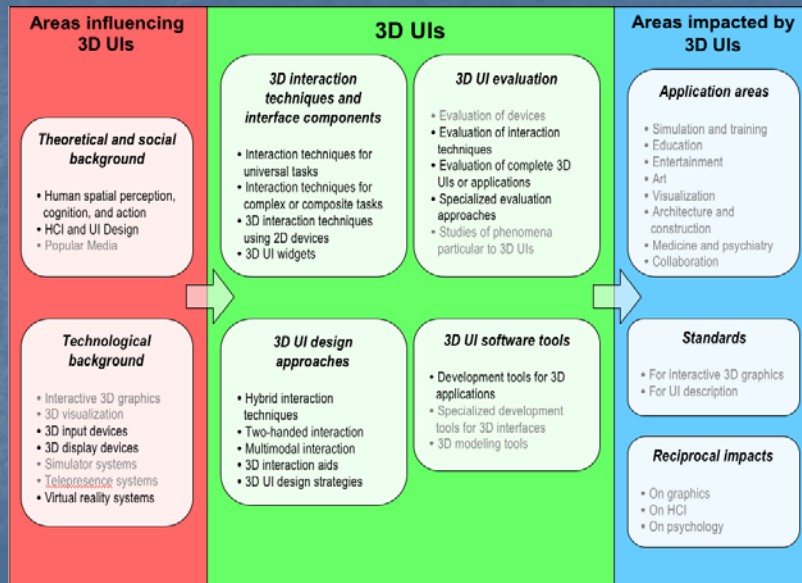
Next Class

- 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