CAP 6121: 3D User Interfaces for Games and Virtual Reality  
Spring 2020; MW 4:30pm-5:45pm ENG1 - 0383

Instructor: Dr. Joseph J. LaViola Jr.
Website:  www.eecs.ucf.edu/courses/cap6121/spr2020/  
Office Hours: M: 6:00pm-7:00pm  
T: 4:00pm-6:00pm  
Office: ENGRIII – 321, phone: x2285  
jjl@cs.ucf.edu

READINGS:

*Papers:* student/professor selected research papers

**Catalog Description:** 3D user interaction, spatial user interfaces, selection and manipulation, 3D navigation, system control, evaluation methodologies, augmented and mixed reality, input and output hardware

**Course Objectives:** 3D User Interfaces for Games and Virtual Reality is a course designed to give students a rigorous introduction to the design, implementation, and evaluation of the fundamental techniques in spatial 3D interaction.

**Student Requirements:**
1. Star Wars Game -- Students will create a lightsaber game where they control the saber with and use the force using the HTC Vive.
2. Fruit Ninja -- Students will create a Fruit Ninja game where they will travel through a maze and fend off attacking fruit using the HTC Vive.
3. Survey paper -- Students will write a paper on a 3D UI topic of their choice, focusing on summarizing and aggregating work done in the last decade.
4. Paper Presentations -- Students will have to present at least one paper on a topic in 3DUIs.
5. Final Project -- Students will do a final project of their choice that explores a particular concept in 3D user interfaces, augmented reality, or virtual reality. They must first write a short proposal and get it approved by the professor.

**Tentative Grading Scheme:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Assignment 1</td>
<td>15%</td>
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<tr>
<td>Assignment 2</td>
<td>15%</td>
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<tr>
<td>Survey Paper</td>
<td>15%</td>
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<td>Paper presentations</td>
<td>5%</td>
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<tr>
<td>Final Project</td>
<td>50%</td>
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The instructor reserves the right to use plus/minus grading in this course.
## Syllabus

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Readings</th>
<th>Assignments</th>
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</thead>
</table>
| 1    | Introduction to 3D User Interfaces  
-- What are 3DUIs?  
-- Application areas  
-- 3DUI history  
-- Games and 3DUIs | LaViola – Chapters 1,2  
LaViola (2008)  
Bowman et al. (2006,2008) |              |
| 2    | Intro to Unity 3D  
HTC Vive, Nintendo Wii Remotes, the Microsoft Kinect, PlayStation Move | Creighton  
LaViola and Marks (2010) | Assignment 1 – Star Wars out |
| 3    | Human Factors and HCI Basics | LaViola – Chapters 3,4 |              |
| 4    | 3DUI Output Hardware  
-- Visual displays  
-- Auditory displays  
-- Haptic displays | LaViola – Chapter 5 |              |
| 5    | 3DUI Input Hardware  
-- Desktop input devices  
-- Gaming devices  
-- Tracking devices  
-- Direct human input (e.g., brain, speech, bioelectric)  
-- Building custom input devices | LaViola – Chapter 6 | Assignment 1 due  
Assignment 2 – Fruit Ninja out |
| 5    | Selection and Manipulation  
-- 3D manipulation tasks  
-- Interaction techniques for 3D manipulation  
-- Design guidelines | LaViola – Chapter 7 |              |
| 6    | Travel Techniques  
-- 3D travel tasks  
-- Travel techniques  
-- Design guidelines  
Wayfinding  
-- Theoretical foundations  
-- User-centered wayfinding support  
-- Environment-centered wayfinding support | LaViola – Chapters 8 |              |
| 7    | System Control  
-- Graphical menus  
-- Voice commands  
-- Gestural commands | LaViola – Chapter 9 | Assignment 2 due |
<table>
<thead>
<tr>
<th></th>
<th>Designing and Developing 3DUIs</th>
<th>Evaluation of 3DUIs</th>
<th>Future of 3D UIs</th>
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<tbody>
<tr>
<td>8</td>
<td>-- Designing for humans</td>
<td>-- Tools for Evaluation</td>
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<td></td>
<td>-- Inventing 3D user</td>
<td>-- Evaluation metrics</td>
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<td></td>
<td>interfaces</td>
<td>-- 3D UI evaluation</td>
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<td>-- Borrowing from the real</td>
<td>characteristics</td>
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<td>world</td>
<td>-- Testbed evaluation</td>
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<td>9</td>
<td>-- Magical techniques</td>
<td>LaViola – Chapter 10</td>
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<td>10</td>
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<td>LaViola – Chapter 11</td>
<td>Final Project proposal due</td>
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<td>11-16</td>
<td>In the last 4-6 weeks of the semester one class will be for updates from students on their final projects. The second class will be for students to present papers. Each student must do at least one 15 to 20 minute presentation of a paper of their choice.</td>
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