TECH 1711 - Mixed Reality Studio

Section Name: TECH.1711 08/21/2017 - 12/08/2017
Monday & Wednesday 9:30AM - 12:00pm
Classroom: M209
Instructor: Ivaylo Getov - ivaylo.getov@woodbury.edu

This class will explore various platforms for the design and creation of AR and VR applications. Emphasizing hands-on experimentation, this experiential studio is meant to be a collaboration between both programmers and designers to research and develop new paradigms for user experience and new pipelines for the creation of 3D content. Using the Unity game engine and various hardware equipment, such as the Microsoft Hololens, HTC Vive, and mobile devices, students will work individually and in teams to practically apply novel design principles, culminating in a semester project demonstrating a critical approach to designing for these emerging forms of media.

This Monday-Wednesday class will be substituted for a Saturday 5-hours class up to three times during the semester. Dates TBD.

Former students looking for materials from TECH 3706 & ARCH 6760 - AR/VR in Architectural Environments or TECH 421 - Future of Digital Media (Fall 2017) can check out the fall2017 branch of this repo.

Class Format

Mixed Reality is a rapidly evolving field, both professionally and pedagogically. Encompassing VR, AR, and any number of trendy buzzwords such as "experiential" and immersive, it stretches across disciplines and can be informed by a variety of expertise. I want to create an environment where you can experiment with new techniques and practices, which are themselves in constant flux as the technology changes and finds its audience.

The class will be structured as a hands-on lab - lectures will serve to introduce or explore concepts that are then put to the test.

The first session each week (Monday) will tend to be more theoretical, while the second (Wednesday) will dive deeper into execution, coding, and implementation.

We will be on our feet. We will move fast and break things so that we learn how to fix them. We may venture outside and get our hands dirty. You will be asked to split into groups - others may be relying on you to complete a portion of a larger project and it will be your responsibility to deliver.

This course itself is relatively new - the schedule below is tentative and will *very likely* change over the first couple weeks. Please check this git repository each week to find the most up to date schedule and topics.

Reading and Course Notes

This course will not have an assigned textbook. Rather, students are required to read or watch additional material as assigned each session. We will be leaning heavily on participation and discussion in this course, and these readings will help get a better intuition and deeper understanding into relevant topics.

All presentation materials, notes, and referenced texts will be made available via this git repository as soon as possible after each session.

Requirements and Grading

Your final grade will be made up from:

- Participation, attendance, in-class projects/exercises: 60%
- Midterm project: 15%
- Final project: 25%

Schedule (*Tentative*)

Session 01 - 01/17/18 (Wednesday)

- Introductions, course overview, housekeeping
- Intro to AR/VR/MR design principles
    - A brief history
    - Defining some terms
    - designing the real world
- Choosing our tools for efficient prototyping
    - What is *abstraction*?

    - Why use gaming engines?
- Intro to Unity

Session 02 - 01/22/18 (Monday) && Session 03 - 01/24/18 (Wednesday)

- Intro to Unity
- *Ivaylo out of town*
- *One day guest speaker, one day no class - schedule TBD*
    - Note: Class time will be accounted for with a Saturday class later this semester.

Session 04 - 01/29/18 (Monday)

- What is *"Creative Coding"*?
    - Coding as writing
    - Coding as prototyping
- Design principles continued
    - designing the real world (continued).
    - User interaction and expectations

Session 05 - 01/31/18 (Wednesday)

- Into to Unity Continued
- Introducing `C#`
    - `C# VS JavaScript`
- Basic Programming Concepts Review
    - variables and functions
    - operations and assignment
    - "returning" a value

Session 06 - 02/05/18 (Monday)

- Design principles continued
    - VR Health and Safety concerns
    - Thinking about different scales
    - What is *"room-scale"*?
- Designing for "Experience"
    - UX and UI

    - Diegetic vs Non-Diegetic

Session 07 - 02/07/18 (Wednesday)

- `Programming++`
    - classes and objects
    - public vs private
    - Debugging/Testing
- Pseudocode and planning
- Unity colliders and triggers

Session 08 - 02/12/18 (Monday)

- Design principles continued
    - User interaction and expectations continued
    - HTC Vive hand controllers: form + function
- VR in Unity
    - Using the SteamVR plug-in

Session 09 - 02/14/18 (Wednesday)

- C# recap - Create a C# "cheat sheet"
- Unity recap
    - Summarize concepts and workflow

No Class - 02/19/18 (Monday)

- Presidents Day

Session 10 - 02/21/18 (Wednesday)

- Introduce VR group project
- Introduce project organization/management
- Catch-up/recap as needed

Session 11 - 02/26/18 (Monday) && Session 12 - 02/28/18 (Wednesday)

- No Class - To be replaced by Saturday intensive - Date TBD
- Lab open for project work or catch up

- Instructor available for questions
- No Class - To be replaced by Saturday intensive - Date TBD
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Session 11A/12A - TBD

- **Saturday intensive**
- Group project intensive

Session 13 - 03/05/18 (Monday)

- Introduce midterm project
- Design Process
  - Double Diamond model
  - Minimum Viable Product

Session 14 - 03/07/18 (Wednesday)

- Midterm Project Proposals & Discussion
- Vive recap
- Catch-up as needed

No Class - 03/12/18 (Monday) and 03/14/18 (Wednesday)

- Spring Break

Session 15 - 03/19/18 (Monday)

- Midterm workshop
  - Advanced interactions in VR
  - Individual Questions

Session 16 - 03/21/18 (Wednesday)

- Individual midterm meetings
- Midterm workshop
  - Topics TBD as needed

Session 17 - 03/26/18 (Monday)

- Midterm Projects Due
  - In-class showcase and discussion

No Class - 03/28/18

- Cezar Chavez Day

Session 02A/03A - TBD

- **Saturday intensive**
- BIG UNITY RECAP
- Unity Animations
  - Keyframes and Curves

Session 18 - 04/02/18 (Monday)

- Intro to AR
  - Designing for a layer *on top* of the world instead of everything the user sees
  - Sensing the real world
- Overview of AR Devices
  - Microsoft Hololens
  - Mobile AR (Apple ARKit)

Session 19 - 04/04/18 (Wednesday)

- Introduce final project
- Recap important concepts
- Recap available tools/resources
- "Tech for Me vs Tech for You"
  - technology as design process for the artist/creator VS technology as final deliverable/medium for the user
  - Using AR/VR as tools for the "Generalist"

Session 20 - 04/09/18 (Monday)

- Final project pitches and individual meetings

Session 21 - 04/11/18 (Wednesday)

- Available resources: HoloToolkit
  - Don't re-invent the wheel
- Building to Hololens
  - Using Unity files from "mini" project
  - Using the Microsoft MixedReality Toolkit for Unity
  - Previewing to a device over the network

Session 22 - 04/16/18 (Monday)

- Final Projects Check-In
  - Setting Milestones
- Final Project Workshop
  - Raycasting
  - Hololens Spatial Mapping
  - Individual Questions

Session 23 - 04/18/18 (Wednesday)

- Final Project workshop and notes
  - Topics TBD as needed

Session 24 - 04/23/18 (Monday)

- Final Projects - Final Lab day
  - If you are doing AR, today should be the day you troubleshoot your final build.
  - Individual Questions & Cleanup

Final - 04/25/18 (Wednesday)

- Final Project presentation and discussion
- Class Topic Recap
  - Revisit "The Future of Media"
- Final Project Public Demo Day (Alt date TBD)

Coding Resources

- Hello Unity is a great place to start that would specifically help you in *this* class. He covers a good intro to Unity as well as coding in general.

- One of my favorite general learn-to-code resources is anything by Daniel Shiffman at NYU. He has a series of videos called Computer Programming for the Total Beginner, but once you've got the very very basics down (what are variables? what are functions?) I would highly recommend his video series The Nature of Code: Simulating Natural Systems with Processing.
- Harvard's intro to CS class is available via HarvardX and youtube: Harvard CS50 2012 or CS50 2017

Suggested Reading

Reference

- Form+Code in Design, Art, and Architecture - Casey Reas, Chandler McWilliams
- The Design of Everyday Things (Revised Edition) - Don Norman
- The Nature of Code: Simulating Natural Systems with Processing - Daniel Shiffman
- Generative Design: Visualize, Program, and Create with Processing - Hartmut Bohnacker, Benedikt Gross, Julia Laub
- In the Blink of an Eye - By Walter Murch
- Virtual Reality - By Steven M. LaValle
- Gödel, Escher, Bach: an Eternal Golden Braid - Douglas Hofstadter
- The Pragmatic Programmer - Andrew Hunt, David Thomas
- Code Complete, Second Edition - Steve McConnell

Fiction

- Snow Crash - Neal Stephenson
- Neuromancer - William Gibson
- Ready Player One - Ernest Cline