

Fall 2024

## Arch 463/464: Media Architectures Immersive Design Tools

Andrezej Zarzycki

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NJ School of Architecture  
The Hillier College of Architecture and Design  
New Jersey Institute of Technology



Option Design Studio I and II

## Media Architectures: Immersive Design Tools

ARCH-463/464-001 | FALL 2024

CRITIC: Andrzej Zarzycki Weston 673 andrzej.zarzycki@njit.edu  
OFFICE HOURS: Wednesday 2:30-4:30 PM or by an appointment  
MEETING TIMES: Mondays and Thursdays 12:00-5:20 PM  
SPACE: Campbel Gallery Loft

*For Deleuze, both the actual and the virtual are fully real—the former has concrete existence, while the latter does not, but it is no less real for that fact. The importance of this distinction can readily be seen by giving thought to the state of being of an idea: it may only exist in our heads, or on paper, but its effects are fully real and may also be fully actual too. Initially treated as an esoteric distinction of interest only to specialists in the field of ontology, since the advent of computer games, and more especially the Internet, this distinction has become very important because it allows that what is seen or experienced on screen is still real, even if it isn't actual.*

Oxford Reference: Actual and Virtual<sup>1</sup>

*In the essay "The Actual and the Virtual," Gilles Deleuze discusses his concept of actual and virtual. He points to Leibniz's view that force is virtual until it is actualized in space and that space is virtual until it is filled with real matter.*

### COURSE DESCRIPTION

This Options Studio engages emerging digital media practices and technologies as an expanded field of architecture. It looks at photogrammetry, augmented reality (AR), and virtual reality (VR) as new frameworks for design thinking, conceptualization, and virtual habitation/immersion. This discussion is grounded in centuries-long philosophical discourse on what constitutes reality vis a vis concepts of virtuality, potentiality, and actuality. From Plato's cave metaphor and Leibniz's view of virtuality to Johan Huizinga's Magic Circle concept (Homo Ludens) and Gilles Deleuze's "The Actual and the Virtual" the evolution of the understanding of reality, both external and internal, directly informs

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<sup>1</sup> <https://www.oxfordreference.com/display/10.1093/oi/authority.20110803095349177>

current thinking associated with extended reality (XR). These technological and media perspectives are further grounded in architectural phenomenology's emphasis on human experience, intention, historical reflections, and poetic considerations. Christian Norberg-Schulz's concept of Genus Loci revives the authenticity of architectural experience and space, and provides an important conceptual framework for XR worlds.

This design studio course points to creative opportunities associated with these emerging technologies framed through existing philosophical frameworks and demonstrates effective pipelines for a wide range of design applications. It discusses the role gamification plays in enabling in-depth interactions within the built environment and new forms of habitation (being in space). While grounding its discussion in virtually built environments, the studio provides opportunities for broad interdisciplinary topics and creative collaborations from the media and interactivity to interiors and exhibition design.

Students will research the use of XR and imaging technologies across various creative disciplines with associated conceptual frameworks and will develop their own group projects that integrate these technologies into design/media and digital heritage practices. Specifically, students will develop mobile-based AR and/or VR projects (fully functioning environments) utilizing a Unity3D game engine that builds on one of the themes provided by the instructor that will include digital heritage, historic preservation, building user interface (smart building interactions), and data visualization. The structure of the studio—its open framework—will allow students with various technical backgrounds and proficiency levels to interact effectively and contribute to team projects. With the successful completion of the course, students will gain the hands-on ability to author within mobile extended reality (XR) and to conceptualize and design mobile experiences using the Unity3D game engine.

### **STUDIO TOPICS**

Students will investigate following topics based on partnership with cultural organizations and initiatives:

1. Virtual collection/experience for the Newark Museum of Art
2. Virtual experience of the Göttweigerhof Chapel (Göttweigerhofkapelle) in Krems, Austria (Kunstmeile Krems)
3. Virtual collection/experience of architectural and industrial details, Newark, NJ (DANA initiative)

### **LEARNING OBJECTIVES/OUTCOMES**

- To formulate a conceptual and artistic/design position on topics of digital media, extended reality (XR), virtual architecture, and digital heritage.
- To define the scope of work, production schedules, and required software tools to achieve design visualization goals.
- To understand the pipeline of the digital design production and demonstrate the ability to effectively use it.
- To develop a sophisticated and complex project that integrates multiple digital media, such as modeling, rendering, video editing, interactivity, and graphic design.

### **STUDENT CRITERIA (SC): Student Learning Objectives and Outcomes**

The National Architectural Accrediting Board accredits NJIT's architecture program. The NAAB has Shared Values of the Discipline and the Profession that must be covered by any architectural curriculum to attain their approval. This course satisfies the following shared values:

SC.4 Technical Knowledge—How the program ensures that students understand the established and emerging systems, technologies, and assemblies of building construction,

and the methods and criteria architects use to assess those technologies against the design, economics, and performance objectives of projects.

### **LEARNING AND TEACHING CULTURE POLICY**

In addition to the overarching values and ethics of the university, the New Jersey School of Architecture (NJSoA) is dedicated to optimism, diversity and solidarity, professional conduct, constructive evaluation and instruction, collaborative community, health and wellbeing, time management and school-life-work balance, respectful stewardship and space management, and well-rounded enrichment. The pedagogy of architecture and design is as complex as it is rewarding, and as dynamically evolving as the people who learn and teach it. This understanding resides at the core of the NJIT Learning and Teaching Culture Policy: <https://design.njit.edu/learning-and-teaching-culture-policy>

### **STUDIO RESEARCH CONTEXT**

The studio will focus on the development of new knowledge through synthetic **literature review** and **experimentation: prototyping and testing**. Students will review literature and media precedents by identifying existing technology and media narrative case studies. Based on these studies, students will identify the 'need', define the **research question**, and propose a **methodology** to address the 'need'. The main semester project will be dedicated to developing design and technology solutions to the 'need'.

Students will choose from several research focus areas provided by the instructor (e.g. The Newark Museum of Art) and will be expected to develop **fully-functional XR prototypes** that can be used to validate new forms of virtual habitation. This will provide students with a unique opportunity to bridge architectural design with media and information technologies.

Students are expected to document their semester work, both analytically and synthetically, and produce a poster or short paper publication for submission in the outside venue.

### **PROCESS + STUDIO MECHANICS**

This course is conducted in person, however, there will be ample opportunities to interact online/virtually even when being in the same classroom. For this purpose, we will be using the following video conference credentials: <https://njit-edu.zoom.us/j/9942383369?pwd=OWszZC9namszMkU3VTEyd1p1OG8zdz09&omn=98865887381> Some of the sessions, particularly all tutorials and Q&As, will be recorded and shared with the entire class.

### **ASSIGNMENTS**

Studio topics include interactive storytelling, narrative design, immersive experiences within (un)built environment, and digital heritage. Studio topics include interactive storytelling, narrative design, immersive experiences within (un)built environment, and digital heritage. Students will learn how to evaluate, design, and implement engaging interactive experiences by examining fundamentals of interaction design, such as UX (user experience) and UI (user interface).

The semester work will comprise of five assignments: (1) fundamentals of photogrammetry, (2) augmented reality (AR) environments, (3) virtual reality (VR) environments, (4) term project proposal, and (5) the term project. For the term project students will develop fully-functional prototype of AR or VR experience with a strong narrative component.

An ability to express an idea, present it in an engaging manner, and deliver the final product is essential for professional success. The produced work should have a broader social, cultural, or

intellectual reach and engage with current urgent issues. Students will be evaluated on the quality and sophistication of their designs as well as on their ability to take advantage of human and computational resources.

**(1) CONCEPTS + PRECEDENTS (9/5-9/9)**

As part of this assignment students will investigate philosophical positions on physical versus virtual reality ranging from the notion of Plato's Cave to Johan Huizinga's Magic Circle (Homo Ludens) and Marshall McLuhan's take on communication theory (medium is the message). They will also examine experience- and phenomenology-based ideas and their relevance to architecture and design. Each student will be assigned a concept, or a notion associated with a particular philosopher's work and propose design-based reading of these ideas. The output will include a PowerPoint presentation and a short (1000-word) written summary (an abstract) of main philosophical positions and contrapositions.

**(2) PHOTOGRAMMETRY (9/9 - 9/16)**

For this assignment, students will use photogrammetric technologies to photograph an object and/or a space, make it into a textured 3D model, and to bring it into the VR environment (3DMax and Unity3D). Specifically, they will use Autodesk ReCap 360 Pro, Meshroom, or a smart phone app, such as KIRI Engine to develop three textured midsize 3D models one of an object, one or a large planar façade element, and one of a space. Then import these 3D models to Autodesk Max/Blender/Maya and Unity3D.

Suggested LinkedIn Learning tutorials:

*Unity 2023 Essential Training*

<https://www.linkedin.com/learning/unity-2023-essential-training/visualize-a-house-project-with-unity-2023>

Photogrammetric modeling tools:

KIRI engine (iPhone/Android app) <https://www.kiriengine.app/> <https://www.kiriengine.app/web-version/>

Reality Capture / Reality Engine

Autodesk Recap 360 Pro (free student license) : <http://students.autodesk.com>

Meshroom (freeware) <https://alicevision.org/#meshroom>

AT Creator, app store (free)

Final presentation deliverables for the 3D scanned (photogrammetric) object/environment:

- a) Two-three photos of the object that you are scanning
- b) Several screenshots/renderings of the scanned objects. Should include wireframe, shaded views, and rendered views.
- c) A screenshot of your software interface if relevant. In some cases, software shows the camera positions, etc.
- d) Have your 3D models ready to demonstrate in photogrammetry software and in 3D modeling software for live demonstration. Additionally, please do a screen recording (video) of your model demonstrations and submit it to the shared google drive folder.
- e) If you did a couple of attempts/trials show them and tell us how you learned from them
- f) Show the diagram of your pipeline. For example, camera > ReCap Pro > Blender > Unity3D
- g) Develop three resolutions of the photogrammetric model (1) original size e.g. 150,000 faces, (2) medium size (30-50,000 faces), and (3) low resolution model suitable for gaming. When

showing these models have a screen capture/rendering of the textured model and mesh showing triangulation (faces).

h) Documentation: videos of on-screen interactions with assets and of any editing.

### (3) AUGMENTED REALITY FUNDAMENTALS (9/16-9/21)

Students will develop an augmented reality environment using Vuforia for Unity3D, use multiple image tags/marker types, implement simple user interface (UI), and compile AR app for Android platform.

Unity AR Fundamentals

<https://app.pluralsight.com/library/courses/unity-ar-fundamentals/table-of-contents>

The focus of this assignment is the development of a creative and production pipeline by utilizing assets from assignment 1. This assignment will allow students to develop a simple augmented reality (AR) environment utilizing image markers, photogrammetric models, audio and video assets, and the screen-based user interface (UI). To optimize learning experience students are encouraged to:

- a) watch relevant video tutorials on AR technologies for game engines.
- b) install Unity3D engine with Vuforia development kit.
- c) replicate steps shown in the video tutorial (setup, basic image marker environment, simple UI); before proceeding to the creative assignment.

The final submission for this assignment will be a student-designed AR environment representing similar complexity and functionalities as in the class presentations and tutorials. Specifically, each project will:

- a) deploy two-to-three 2D image markers (also a box and cylindrical markers);
- b) associate each marker with a 3D photogrammetric asset and two other mix-media assets, such as video and audio files.
- c) develop multi-button (at least two) user interface with text and graphic overlays.
- d) present all assets as a unified concept and experience. This means that the project will have a clear statement of purpose, common aesthetics, and shared theme with interconnected components (links to other assets)
- e) Final deliverable will include:
  - i. PowerPoint presentation including conceptual statement, process, and the final product.
  - ii. All AR project files (Unity3D, videos, audio, photogrammetric models). Select the seen and export as the package.
  - iii. Video recorded interactions (videos of computer/phone/table screen and users interacting with markers)

When conceptualizing this assignment, consider virtual museum, exhibition, gallery show, or e-commerce media-rich environments. For extra credit, challenge, and/or experimentation, students may deploy a 3D-object marker.

### (4) MEDIATED ENVIRONMENTS: PRECEDENTS (9/19-9/29)

The *Precedent* assignment will focus on the research of immersive and interactive technologies as they relate to architecture, urban environments, and digital heritage. The goal of the assignment is to help students in defining the area of interest for the term project and prepare base research with the

literature review to facilitate the execution of the term project. As such, students should investigate both conceptual and technical frameworks behind precedents.

(Part I) The research should involve three-to-four case studies of similar designs that can be easily compared. It should have comparable technological and narrative complexity.

(Part II) In the second part of the research assignment you will choose 2-3 academic papers that discuss XR experiences analogous to those in Part I above. Students will write a short report on each of these papers identifying key elements of each research: (1) context or the 'need', (2) research questions, (3) methodology, (4) findings / results, (5) limitations, and (6) the impact / contribution.

### **(5) TERM PROJECT PROPOSAL (9/19-9/30)**

Students will propose data-rich interactive experience scenarios that consider spatial navigation, knowledge sharing and authorship within the virtualized world. Documentations will include (1) storyline, (2) interactive/game tree, (3) examples of assets, (4) screen interfaces, and (5) other materials to convey the design intent.

Specifically, define the scope and theme of your term project with the following content items:

- (a) project title
- (b) project description (this should include the general description and also description how users/players would interact with your AR/VR environment)
- (c) names of the team members
- (d) project audience
- (e) list of assets that you will be developing for the project (2D graphics, 3D models, audio, video, etc)
- (f) example of assets to be used in the AR/VR environment
- (g) sketch of the user interface (UI) showing all interactive components
- (h) 'game tree' showing possible interactions (similar to website tree), if applicable.

Imagine the following scenario that mirrors or extends your Photogrammetry and AR-based assignments:

*You have arrived to a virtual museum, store, or science fair, or simply visiting an unknown location. You see a number of interesting spots (locations) that you would like to visit. How do they manifest themselves? Are they stand alone or part of the larger scene? How are you introduced to this virtual world? Is there a text or audio/video that explains the game play/mechanics? You can teleport to various locations. What do you encounter in each location? What assets do you interact with? How do these assets manifest themselves? How do you keep track of those you already interacted with (destroy)?*

*After completion of the entire tour what do you want players / virtual users to take away from this experience?*

Develop custom user interaction (UI) approach and assets, in addition to in-scene environmental components. Projects will be evaluated on the level of technical sophistication (custom interactions) and/or the quality of the user experience (UX) (evocative narrative and 3D visuals). While addressing both, student projects can lean heavily on one of these aspects.

### **(6) TERM PROJECT—AR/VR ENVIRONMENT (9/30-12/5)**

Students will execute the term project based on the proposal (assignment 3) by developing spatial narratives and a user interface (UI) to enhance user experience (UX) of virtual/augmented spaces will be a primary focus of this assignment.

As part of the final presentation students will present:

- a) A written **project statement** that will include:
  - i. a brief description (goals, learning lessons)
  - ii. an audience
  - iii. a broader value/impact to the culture/society (why does it matter)
- b) Project **demonstration** (while students may opt to show their work real-time, everyone needs to have video+audio recording of their interactions/play (user experience)). This is important for the documentation/submission and as a backup during the final presentation.
- c) A clear **authorship statement**, with visuals, of author/student contribution and acknowledgment of work done by others and work done by a student for previous assignments/classes. This could be illustrated by showing examples of assets created by the author and others.
  - i. Show assets developed by the author
  - ii. Show assets developed by others.
  - iii. Show assets developed by others and significantly adopted/changed by the author.
- d) **Interactive/game tree**. A graphic diagram of the story/gameplay clearly showing current level of development in the context broader aspirational ideas.
- e) **User interface (UI)** and the role it plays. Students will reflect on why this particular approach is important. Individual high-resolution demonstration screen shots should be used to discuss UI.
- f) Creative and development process:
  - i. **Virtual environments and objects** showing details and texture work. If texture unwrapped, show it. If used procedural modeling, particle systems, show both outcomes and process.
  - ii. **Virtual interactions** showing types, complexity, and interconnection of various components.
  - iii. Show diagram of 3D soundscape in VR/game.
- g) The overall project should include:
  - i. at least three virtual locations (events) each with three content interactions per location/event. Interaction needs to include at least one audio/video content.
  - ii. comprehensive strategy for and implementation of the 3D soundscape.

The work will be judged on:

- I. compelling story telling (visually or narratively) and presentation (emersion + user experience (UX))
- II. quality/sophistication of the 3D environments (modeling, texturing, and lighting)
- III. quality/sophistication of user interaction and their user friendliness.

The final (archival) submission will require upload to Kepler via Canvas of presentations, videos, and screenshots and full back up of the gaming projects including Unity/Unreal projects.

## COURSE SCHEDULE

Each student is expected to attend all class meetings, to verbally participate in class discussions, as well as to develop additional work and ideas beyond the minimum requirement.

The semester is arranged as follows:

WEEK 1	<b>Introduction + Precedents</b>
9/5	Introduction to semester work and studio expectations



Past work presentation  
Precedent Studies Explorations (I)  
Introduction to digital media and photogrammetry  
Photogrammetry session (KIRI app install + account setup, hands-on session)  
Studio computer set up, Unity3D software installation  
Assignment 1 distributed

WEEK 2

9/9

Concepts + Precedent  
Assignment 1 Review + Submission  
Individual discussions regarding selected topics  
Photogrammetry Lecture: Concepts + Applications  
Photogrammetry hands-on session  
Photogrammetry pipeline: Autodesk Maya + Unity 3D  
Assignment 2 distributed  
Mixer Lab Demos (starting at 11:30AM GITC 3800 (3808))  
Mixer Lab: User Studies Discussion, Evaluation Participation

9/12

Photogrammetry Working Session (I)

WEEK 3

9/16

Assignment 2 Review + Submission  
Augmented Reality Fundamental  
AR and Unity working session | hands-on exercises  
Individual discussions regarding selected articles  
Assignment 3 distributed

9/19

Research and Precedent Study (II) Submission Due  
Term Project Team Forming (groups of 2)  
Initial Project Ideas Discussion  
Assignment 4 and 5 distributed

9/21

Assignment 3 due (Submission)

WEEK 4

9/23

Mediated Environments: Precedents  
Precedent Studies

9/26

Precedent Documentation

9/28

Precedent Documentation Due (on Google Drive)

WEEK 5

9/30 @ 12PM

Term Project Starts  
Term Project Proposals due (Presentation + Submission)

10/3

Term Project: Concepts + Pipelines (Desk Critiques)

WEEK 6

10/7

Term Project: Narratives + Assets Development  
Desk Critiques

10/10

Conceptual Review

WEEK 7

10/14

Term Project: User Interactions  
Desk Critiques

10/17

Desk Critiques

WEEK 8	Term Project: Prototyping
10/21	Desk Critiques
10/24	<u>Design Development + Prototyping Review</u> <u>Joint Review with IT 382</u> (It will require an early start of the class)
WEEK 9	Desk Critiques
10/28	Desk Critiques
10/31	<b><u>MIDTERM REVIEW</u></b> (15% grade, outside crits)
WEEK 10	User Experience (UX) + User Interface (UI)
11/4	Desk Critiques
11/7	Desk Critiques (tentatively: Lecture by Prof. Margarita Vinnikov)
WEEK 11	User Interface (UI) + User Experience (UX)
11/11	Desk Critiques Last Day to Withdraw from Classes
11/14	<u>Progress Review: UI + UX</u> (guest review)
WEEK12	Final Design: Prototypes II
11/18	Desk Critiques
11/21	Desk Critiques Mixer Lab: User Experience Testing
WEEK13	Final Design: Prototypes II ( <b>Thanksgiving Week—Schedule Changed!</b> )
11/25	Desk Critiques
11/26	<u>Pre-Final Review</u> (in-class)
WEEK 14	Final Design: Presentation
12/2	Desk Critiques
12/5	Desk Critiques
WEEK 15	Documentation
12/9	<u>FINAL REVIEW</u> Final Documentation due, (Kepler Upload + Google Drive)

Final Grades due, Saturday, December 23rd

See the academic calendar: <https://www.njit.edu/registrar/fall-2024-academic-calendar>

## EVALUATION

Completion of ALL assigned projects and presentations is required to complete this course. All assignments are due at the beginning of class. Your performance will be graded based on the successful completion of the class objectives, projects, presentation and documentation requirements. The NJIT- Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

Concepts + Precedents	5%
Photogrammetry	5%
Augmented Reality Fundamentals	5%
Mediated Environment: Precedents	5%
Progress Reviews	5%
Term Project Proposal	10%
Term Project	60%
Digital Documentation	5%
Final Kepler/Canvas Posting (due Dec 14 <sup>th</sup> ) Required	
Final Google Drive Folder (due Dec 14 <sup>th</sup> )	Required

## COURSE GRADING CRITERIA

The final grades are broken down as follows:

A	4.0	Superior	92 -- 100%
B+	3.5	Excellent	86 -- 91.99%
B	3.0	Very Good	80 – 85.99%
C+	2.5	Good	74 – 79.99%
C	2.0	Acceptable	67 – 73.99%
D	1.0	Minimum	60 – 66.99%
F	0.0	Inadequate	below 60%

## DELIVERABLES

All work needs to be submitted to the Google Drive folder provided by the instructor: *Google Drive\ARCH463+464\_F24* and by uploading works in the Assignments page of Canvas platform (<https://canvas.njit.edu/> or <https://njit.instructure.com/courses/37755> and <https://njit.instructure.com/courses/37770> ) and to Kepler. Please use PDF formats for all Canvas uploads. The Google Drive folder should have all native files/formats. This includes final products as well as individual components.

## DOCUMENTATION

Digital documentation of the entire semester's work, including process and progress imagery, will be required from each student/group. This documentation will provide the Department with a review of your study, and information contained in the digital files might be used in future electronic or printed media publications, either in whole or in part. This record will also enable interested students, faculty, and others to have access to your work in the future.

## WORK BACKUP

You are expected to keep multiple backups of all course work and to have your current project files available at all times during class time. You are encouraged to keep a cloud storage account in addition to a physical backup.

### **ACADEMIC INTEGRITY**

Academic integrity and honesty are of paramount importance. Cheating and plagiarism will not be tolerated. The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students. All students are responsible for upholding the integrity of NJIT by reporting any violation of academic integrity to the Office of the Dean of Students.

The identity of the student filing the report will remain anonymous. All students are expected to adhere to the University Code on Academic Integrity: <https://www.njit.edu/dos/academic-integrity> and to the Code of Student Conduct: <https://www.njit.edu/dos/policies/conductcode/index.php>

The HCAD library has assembled resources for a students on using images, citing, and plagiarism: <https://researchguides.njit.edu/c.php?g=671665&p=4727920>

### **ABSENCES**

Each student is expected to attend all class meetings, to verbally participate in class discussions, as well as to develop additional work and ideas beyond the minimum requirements. Everyone is expected to be punctual and prepared with each assignment. Excessive lateness will be counted as if a student is absent. After three recorded absences, your grade will be lowered by ½ grade point for each additional absence, if the absence is not approved by the Dean of Students (DOS).

The NJIT office of the Dean of Students (DOS) maintains a way for students to explain absences that instructors can use to regulate absenteeism. By providing verifiable documentation through filing an online Student Absence Excuse Request form related to the absences within 14 days, a student can ask for accommodation and that their absences not affect their grade. Once the absence has been verified, the DOS will communicate with the instructor. Nonetheless, the DOS only verifies documentation, and it remains the instructor's discretion to provide any accommodation and the student's responsibility to follow up with the instructor. Accepted reasons for absence include bereavement, medical concerns, military activity, legal obligations, or university-sponsored events. Additional DOS information outlined here: <https://www.njit.edu/dos/student-excusals>

### **PRECEDENTS**

AR Mail from Harbin (St. Sophia Cathedral) Siggraph 2017

*AR exhibit device developed by T. Nagakura and W. Sung.*

<https://www.youtube.com/watch?v=Tnr42dE9cSo>

Baker House AR

*Takehiko Nagakura and ARC Group*

[https://www.youtube.com/watch?v=z\\_5iOSNHjFs](https://www.youtube.com/watch?v=z_5iOSNHjFs)

VR prototype: Aalto NY Pavilion

*Producer/Director: T. Nagakura (MIT ARC group)*

<https://www.youtube.com/watch?v=lpvmJKp-cBw>

See time 6:04 for sectional perspective views

AR Travel to Aalto House

<https://www.youtube.com/watch?v=O67lnQI-9Xs>

[https://www.youtube.com/watch?v=Pbc\\_J8ofvLE](https://www.youtube.com/watch?v=Pbc_J8ofvLE)

The GEAR.sg AP

<https://www.youtube.com/watch?v=mk62GRWmeEA>

Göttweigerhof Chapel

<https://www.imareal.sbg.ac.at/en/imareal-projects/monastic-estates-in-the-wachau-region/>

<https://memo.imareal.sbg.ac.at/wsarticle/memo/2018-landkammer-bilder-die-raeume-erschliessen/>

<https://www.museumkrems.at/standorte/goettweigerhofkapelle/besuch>

360 Panoramic Littman Library Tour (Proof of Concept)

<http://andrzejzarzycki.com/360/pPhotoTour.html>

## **TUTORIALS** (for skills and inspirational)

Unity: Interactivity for AEC

<https://www.linkedin.com/learning/unity-interactivity-for-aec/welcome>

Unity: Integrating GPS and Points of Interest

<https://www.linkedin.com/learning/unity-integrating-gps-and-points-of-interest/learn-how-to-use-gps-with-android-and-ios>

Unity: Architectural Visualization Interactivity

<https://www.linkedin.com/learning/unity-architectural-visualization-interactivity/unity-creating-interactive-elements-in-architectural-visualizations>

Unity and Vuforia: Trying on Watches in Augmented Reality

<https://www.linkedin.com/learning/unity-and-vuforia-trying-on-watches-in-augmented-reality/create-an-augmented-reality-watch-try-on-app>

Understanding Augmented and Virtual Reality

<https://www.linkedin.com/learning/understanding-augmented-and-virtual-reality-an-introduction/transforming-your-business-today>

Introduction to C# with Unity

<https://www.linkedin.com/learning/introduction-to-c-sharp-with-unity/introduction-to-unity>

## **READINGS**

Reading assignments will be issued throughout the semester and discussed in class. Please see Google Drive folder for relevant scientific literature.

Huizinga, J. (1949). *Homo Ludens: A Study of the Play-Element of Culture*. London: Routledge & Kegan Paul.

Russell, Catherine (2004). "[New Media and Film History: Walter Benjamin and the Awakening of Cinema](#)". *Cinema Journal*. **43** (3): 81–85. [doi:10.1353/cj.2004.0024](https://doi.org/10.1353/cj.2004.0024). [ISSN 0009-7101. JSTOR 3661111](https://www.jstor.org/stable/3661111).

McLuhan, Marshall (1964). *Understanding Media: The Extensions of Man*. [ISBN 81-14-67535-7](#).

"**The medium is the message**" is a phrase coined by the Canadian communication theorist [Marshall McLuhan](#) and the name of the first chapter<sup>[1]</sup> in his [Understanding Media: The Extensions of Man](#), published in 1964.

Consalvo, Mia. "There is no magic circle." *Games and culture* 4, no. 4 (2009): 408-417.

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