A310

Introduction to Digital Archaeology and Virtual Reality

Fall Semester 2017
CB-1
Tuesdays/Thursdays

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Hours Available: Immediately after class or by appointment
Introduction to Digital Archaeology and Virtual Reality

Course Description
The archaeological methodology has been changing at a revolutionary pace throughout the last decade. Today old ways of recording and interpreting archaeological data are being replaced by cutting-edge digital methods and virtual reality is becoming a key component of archaeological projects. This course will explore the digital age of archaeology and cultural heritage management. The main aim of the course is for the student to have a comprehensive understanding of the new possibilities offered by the most recent tools and methods, as well as to acquire a practical skill set, which will be useful for both archaeological fieldwork and cultural heritage management projects.

Upon the successful completion of the course requirements by the end of the semester, the students will gain theoretical knowledge on and develop a deep familiarity with:

- archaeological databases and data management;
- tablet-based digital excavation recording systems, such as iDig;
- nondestructive methods of archaeological exploration and remote-sensing such as LIDAR, Ground Penetrating Radar, and Thermal Imaging;
- airborne imaging and its uses in archaeology;
- international digital archaeology case studies, such as Çatalhöyük, Kaymakç, and Keros;
- the use of Geographical Information Systems (GIS) in archaeological research and interpretation of spatial data;
- online and digital publication of archaeological projects.

Students will also gain practical experience in 3D modeling and photogrammetry, which is fast becoming the norm on many fieldwork projects. They will also have hands-on practice of spatial recording using a total station. Upon the successful completion of the course requirements, they will be able to:

- create 3D models of excavation trenches or buildings;
- create 3D models of archaeological artifacts (statues, weapons, etc.);
- digitally record architecture using geo-rectified photos;
- set-up and use a total station for spatial recording;
- create orthomaps and DEMs (digital elevation models), using drone photographs.

This course requires no previous archaeological fieldwork experience; however, since it is designed as a higher level archaeology class, a previous knowledge on archaeology/ancient world is expected.

Course Resources and Activities
Given the ever-changing nature of the subject matter, rather than a particular textbook, we will be using chapters and articles from recent and up-to-date publications. The readings, lecture slides, and workflows/technical tutorials for the computer-based projects will be regularly posted on Moodle.

For the computer-based projects, free and/or open-source software solutions will be used. The students may choose to use CYA computer lab or their own computers. For some of the virtual reality assignments, the students are expected to take their own photographs. They can use their own cameras (any digital camera would work) or a camera provided by CYA.

Most of the classes will take place in the classroom unless stated otherwise.
Course Requirements

a) **Midterm and Final exams:** The exams are designed to assess your theoretical knowledge on the state of the art in digital archaeology. There are no make-ups without an authoritative excuse and written documentation such as a note from the V.P for Academic Affairs or a physician.

b) **Small object 3D modeling:** Using the tutorial provided, you will create a 3D model of a small object, such as a stone artifact or a piece of jewelry. As archaeological objects in museums cannot be photographed from all angles, you will need to choose a modern object.

c) **Large object 3D modeling:** Using the tutorial provided, you will create a 3D model of a large object, such as a statue. You can choose to model a statue from one of the many archaeological museums in Athens; or, alternatively, you may choose to use a modern statue or even the body of a friend of yours.

d) **3D modeling of a trench:** Today many projects photogrammetrically record their trenches, and their numbers are rapidly increasing every year. Detailed Virtual recording of stratification proves to be an invaluable tool to understand archaeological processes. In this project, using the photo-set provided, you will create a model of an excavation trench.

e) **2D digital recording of architectural features:** The days of architectural illustrators using their plumb bobs and rulers have long gone. In this assignment, you will learn how to use geo-rectified photographs for 2D recording of architectural features.

f) **DEM and Orthomap:** The increasing quality of digital airborne imaging and the decreasing prices of drones revolutionized archaeological practice. In this assignment, you will create digital elevation models (a fancy term, which simply means 3D representation of a terrain’s surface) and mosaic orthomaps (aerial maps, corrected according to ground control points), using the photo-set provided. Potentially, you may be able to take your own aerial drone photographs, depending on new drone-flying regulations in Greece and the class size.

g) **Class participation:** The frequency and quality of the questions raised and contributions to in-class discussions and practice will determine your class participation grade.

Grading and Evaluation

Your grade for this course will be based on the following distribution:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm Exam</td>
<td>15%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td>Small object 3D modeling</td>
<td>12%</td>
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<tr>
<td>Large object 3D modeling</td>
<td>12%</td>
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<tr>
<td>3D modeling of a trench</td>
<td>12%</td>
</tr>
<tr>
<td>2D architectural recording</td>
<td>12%</td>
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<tr>
<td>DEM and orthomap</td>
<td>12%</td>
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<tr>
<td>Class participation</td>
<td>5%</td>
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Use of Laptops and Tablets
In-class or on-site use of laptops and other devices is permitted if that facilitates course-related activities such as note-taking, looking up references, etc. Laptop or other device privileges will be suspended if there are not used for class-related work.

Attendance Policy
Only one unexcused absence will be allowed. Further unexcused absences will lower your final grade. Please contact the Executive Director of Student Affairs in the case of an absence due to illness.

Accommodations for Students with Disabilities
If you are a registered (with your home institution) student with a disability and you are entitled to learning accommodation, please inform the V.P for Academic Affairs and make sure that your school forwards the necessary documentation.

Class Schedule

1. Introduction to Digital Archaeology
   The history of digital archaeology and introduction to course

2. Introduction to Archaeological Methodology
   Fundamental concepts
   Stratigraphy and fieldwork methodology

3. Photogrammetry I
   Introduction to photogrammetry
   3D recording and archaeology

4. Photogrammetry II
   Stratigraphical recording
   Artifact recording
   Workflow for stratigraphical photogrammetry
   Assignment schedule for trench modeling

5. Remote Sensing in Archaeology
   LIDAR
   Ground Penetrating Radar
   New Kid on the Block: Thermal Imaging
   Case studies

6. Spatial archaeology I
   GIS and spatial recording in archaeology
   Spatial recording tools: theodolite, GPS, DGPS, Total Station

7. Spatial Archaeology II
   Spatial analysis in archaeology
   Use of statistics software in spatial analyses
   GIS software solutions: an overview
8. **Spatial Archaeology III**
   - Survey methodology in the digital age
   - *Workflow for large object photogrammetry*
   - *Assignment schedule for large object modeling*

9. **Digital documentation of archaeological fieldwork I**
   - Archaeological Fordism: The paper form revolution
   - History of archaeological databases
   - Archaeological databases: what to record?

10. **Digital documentation of archaeological fieldwork II**
    - Real-time tablet-based digital documentation.
    - Case Studies: Çatalhöyük and Kaymakçı

11. **Digital documentation of archaeological fieldwork III**
    - Case Studies: Keros and iDig

12. **Cultural Heritage Management and Digital Age I**
    - Can a virtual museum save Palmyra?
    - Museum collection management
    - *New Media: museums & archaeological sites*
    - 3D reconstruction

13. **Midterm**

14. **Cultural Heritage Management and Digital Age II**
    - The Internet, Social Media, and the presentation of archaeological projects
    - Open Access to archaeological data (or the lack thereof)

15. **Archaeological Illustration and the Digital Age I**
    - History of archaeological illustration
    - Small object (pottery, stone tool, etc.) illustrations and digitization

16. **Archaeological Illustration and the Digital Age II**
    - Architectural recording methods
    - Geo-rectified photos and architectural illustration

17. **Field work**
    - Total Station spatial recording practice

18. **Field work**
    - Total Station spatial recording practice
    - Recording architecture

19. **Archaeological Illustration and the Digital Age III**
    - *Workflow for 2D digital recording of architectural features*
    - Architectural drawing practice session
    - *Assignment schedule for architectural recording*
20. The use of drones in archaeology I
   - History of aerial photography and archaeology
   - Types of drones
   - Case studies

21. The use of drones in archaeology II
   - Drones and macro-scale 3D modeling
   - Topographic Maps
   - Orthophotos and Digital Elevation Models
   - Workflow for DEMs and Orthomaps
   - Assignment schedule for DEMs and Orthomaps

22. Computational approaches to archaeological sciences
   - Geoarchaeology, Archaeobotany
   - Archaeozoology, Archaeoanthropology

23. Theorizing Digital Archaeology I
   - Critical approaches
   - Efficiency vs. Slow Archaeology Debate

24. Theorizing Digital Archaeology II
   - The future of archaeology

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