

ARCHY 208 Introduction to Archaeological Data Science

Ben Marwick

Course overview

This course is an introduction to basic methods of archaeology and data science. We will learn some of the key data science tools used in day-to-day archaeological and cultural heritage work, which are also becoming increasingly valued and popular in a wide variety of other research areas and professions. We will use these data science tools to tackle fascinating archaeological questions with contemporary relevance, for example: What is the purpose of Palaeolithic cave art? When were the Egyptian pyramids built (and were aliens involved)? Where did the stones in Stonehenge come from? Why did the Mayan civilization collapse? Why are there giant stone heads on Easter Island? How does archaeological evidence change what we know about the Nazi Death Camps? Woven throughout our exploration of these questions is an examination of the ethics and social impacts of archaeology and data science. This class will give students hands-on experience with tools and methods to prepare them for 400-level ARCHY courses, as well as quantitative work in many other fields. This class has no prerequisites. This is an introductory, novice-friendly class for students with no prior experience with computers, programming, statistics and archaeology. Students with prior experience in programming and statistics should consider ARCHY 495/496.

Learning goals and objectives

Goals: Upon completion of this course the student will be able to:

- Understand basic command line and programming language concepts
- Understand basic data structures and data manipulations
- Explain how archaeologists collect some commonly used types of data, including artefact counts and measurements, radiocarbon ages, environmental and ecological data, and spatial data
- Explain how to choose an appropriate visualization for different types of archaeological data
- Explain the basic concepts of reproducible statistical inference and implement basic simulation-based inference methods
- Explain how archaeologists use data science to answer questions and get insights about past human behaviour

Objectives: The specific knowledge and skills that students will learn include:

- Basic file and folder manipulation on the command line
- How to manage, summarise, analyse and visualise archaeological data analysis pipelines with the R programming language and R Markdown notebooks.
- How to identify and decide how to use the different kinds of data commonly used by archaeologists
- How to use basic statistical methods to reproducibly summarize data and identify relationships in archaeological data

Credits & Undergraduate General Education Requirement

5cr, NW (The Natural World, Areas of Knowledge requirement) and QSR (Quantitative, Symbolic, or Formal Reasoning)

Weekly Course Schedule & Curricular content

Each week students will attend two lectures (~2 h each) and one lab section (~1 h). In each week:

- the **first lecture** will **introduce the archaeological concept and skills**, and
- the **second lecture** will **introduce the data science concepts and reproducible research skills** using data related to the archaeological concept.
- In the **lab**, students will **practice applying these concepts and skills to investigate an archaeological question**.

Readings will be distributed week by week on Canvas. Our primary software tool will be a managed cloud instance of the RStudio IDE, rstudio.cloud, which is freely available to us and requires no installation. You can use it on *any* computer with an internet connection (such as library and lab computers).

Week	Data science lecture topic	Archaeology lecture topic	Lab activity
1	Basics of the command line	Archaeology in general, and archaeology of human origins	Working with files and folders on the command line
2	Basics of R, RStudio, & R Markdown	What is the purpose of Palaeolithic cave art?	Investigation of Palaeolithic cave art data
3	Basics of data structures in R	Archaeology of transitions from foragers to farmers	Working with data structures in R
4	Basics of data manipulation in R	Where did the stones in Stonehenge come from?	Investigation of Stonehenge stones data
5	Basics of data manipulation in R	Archaeology of social complexity	Manipulating data in R with the tidyverse packages
6	Basics of data visualisation in R	When were the Egyptian pyramids built (and were aliens involved)?	Investigation of Egyptian pyramid radiocarbon ages
7	Basics of data visualisation in R	Archaeology of humans and climate events	Practicing data visualisations with R with the ggplot and plotly packages
8	Basic statistical methods for description in R	Why did the Mayan civilisation collapse?	Investigation paleoclimate data for the Mayan collapse
9	Basic statistical methods for inference in R	Archaeology of recent historical events	Practising basic statistical inference using simulation with R and the infer package
10	Basic statistical methods for relationships in R	How does archaeological evidence change what we know about the Nazi Death Camps?	Investigation of archaeological data from Nazi Death Camps

Assessment

Participation 10%

Participation is you asking questions, responding to questions we ask, and offering comments in a respectful, timely, relevant, and professional manner during the lecture and labs.

Homework 25%

There are five homework assignments that are linked to each lab investigation activity. You will document your data analysis in a research compendium using R Markdown,

and do additional scholarly research to give background context and explore the archaeological implications of your results.

Quizzes 25%

We will have quizzes every lecture using Poll Everywhere on the content of the previous week's lectures.

Midterm Exam 20%

Final Exam 20%

The exams will be a hand-written papers that will include questions about archaeology and about data analysis and visualisation.

Overall course grading system

Please keep an eye on your grades in the Canvas gradebook. We do make mistakes grading and are happy to correct them, but in order to make the process work smoothly we require requests for re-grading to be made in a courteous message from you. So if you feel that your work was incorrectly or unfairly graded, please write a detailed statement with the relevant details (including URLs to the assignment instructions so we know exactly which one you are referring to), and send it to us along with your original work. We'll all take a look, and as a caveat, please note that (1) we also have the option of re-examining your entire work for the course and (2) the outcome might be a lower grade rather than a higher one for the assignment you're concerned about, or any other that we look at. For more details on how we grade:

http://www.washington.edu/students/genclat/front/Grading_Sys.html and
<http://depts.washington.edu/grading/practices/guidelines.htm>

The following grading scale will be used:

Percent = Grade

95 = 4.0 88 = 3.3 81 = 2.6 74 = 1.9 67 = 1.2

94 = 3.9 87 = 3.2 80 = 2.5 73 = 1.8 66 = 1.1

93 = 3.8 86 = 3.1 79 = 2.4 72 = 1.7 65 = 1.0

92 = 3.7 85 = 3.0 78 = 2.3 71 = 1.6 64 = 0.9

91 = 3.6 84 = 2.9 77 = 2.2 70 = 1.5 63 = 0.8

90 = 3.5 83 = 2.8 76 = 2.1 69 = 1.4 60-62 = 0.7

89 = 3.4 82 = 2.7 75 = 2.0 68 = 1.3 <60 = 0.0

Each student receives three free "**late days**", each of which allows you to submit an assignment up to 24 hours late without penalty. You will need to **notify me by stating on your submitted work** (not by email) that you are using a late day. Once you have used up all late days, assignments will have 10% deducted from the grade per day (including weekends). Assignments will not be accepted more than seven days after the due date (which means you'll get a zero score for that assignment). If you have circumstances that you suspect will influence your assignment scheduling then let us know in writing in advance. I review late requests and circumstances on a case by case basis and make decisions accordingly.

Course policies

Academic misconduct

This short [statement](#) by the Committee on Academic Conduct in the College of Arts and Sciences will help you avoid unintentional misconduct and clarify the consequences of cheating. The university's policy on plagiarism and academic misconduct is a part of the Student Conduct Code, which cites the definition of academic misconduct in the [WAC 478-121](#) (WAC is an abbreviation for the Washington Administrative Code, the set of state regulations for the university. The entire chapter of the WAC on the student conduct code is [here](#)) According to this section of the WAC, academic misconduct includes:

"Cheating"—such as “unauthorized assistance in taking quizzes”, “Falsification” “which is the intentional use or submission of falsified data, records, or other information including, but not limited to, records of internship or practicum experiences or attendance at any required event(s), or scholarly research”; and “Plagiarism” which includes “[t]he use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgment.”

The UW Libraries have a useful guide for students at <http://www.lib.washington.edu/teaching/plagiarism>

Accommodations

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. The website for the [DRO](#) provides other resources for students and faculty for making accommodations.

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (<https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/>). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (<https://registrar.washington.edu/students/religious-accommodations-request/>).

Inclusivity

Among the core values of the university are inclusivity and diversity, regardless of race, gender, income, ability, beliefs, and other ways that people distinguish themselves and others. If any assignments and activities are not accessible to you, please contact me so we can make arrangements to include you by making an alternative assignment available.

Learning often involves the exchange of ideas. To include everyone in the learning process, we expect you will demonstrate respect, politeness, reasonableness, and willingness to listen to others at all times – even when passions run high. Behaviors must support learning, understanding, and scholarship.

Preventing violence is a shared responsibility in which everyone at the UW plays apart. If you experience harassment during your studies, please report it to the [SafeCampus](#) website (anonymous reports are possible). SafeCampus provides information on counseling and safety resources, University policies, and violence reporting requirements help us maintain a safe personal, work and learning environment. I strongly discourage you from being on campus after dark, but if you are, please use the [Husky NightWalk](#) service to ensure you move around safely.