World in Your Hand
POLSCI 427S
Fall 2021

Prof. David A. Siegel	Office: 293 Gross Hall
M, W, 3:30-4:45 pm, Physics 205/Online (Zoom)	E-mail: david.siegel@duke.edu
Office Hours: T, Th 1:45-2:45 pm (Zoom) and by appt. Zoom/in-person	Course Website: Sakai

Course Overview

Political science addresses a wealth of questions, involving everything from the determinants of the onset or resolution of conflict to the dynamics of parties and elections to the functioning of legislatures and courts and bureaucracies. Many of these questions deal with complex systems, in which it is difficult to know how a change in any one factor might affect another. Computer simulation, an increasingly popular tool in the social sciences, can help manage this complexity and so help us derive insight into such questions. This class is your chance to explore the use of this tool yourself, and hold the (simulated) world in your hand. Specifically, in this course we will explore computer simulations of political phenomena, first theoretically, then via group projects tackling discrete practical questions in the field, and finally via individual research projects.

The course will be split into three parts. The first part of the course will be devoted to providing the background and tools needed to create simple computational models of human and organizational behavior. There will be two components to this. One, we will discuss examples of computational modeling in the literature. Two, the course will provide a brief introduction to programming in Python, accompanied by discussion of best practices in computational modeling. Both components will be hands-on, in the sense that we will, as a class, work through examples, modifying them in order to get a sense of the consequences of making certain assumptions on actors' behavior and certain coding decisions. No prior experience in coding is necessary or expected; we will start at the beginning and focus on techniques most useful for modeling political behavior, rather than attempting a more encompassing introduction to computer programming. Two brief problem sets will serve as both practice and assessment.

The second and third parts of the class will focus on taking the background and tools from the first part and using them to answer real research questions in political science. In the second part we will do this in a group setting. The class will be presented with a list of concrete research questions that are amenable to a computational approach. Students will rank their preferences over questions and then be placed in groups of 3-5 people, each tasked with addressing a single question. Each group will then formulate a simple computational model intended to answer its specific research question. Class time will be broken up into individual meetings with each group to go over progress and work through issues. Students should come to these meetings prepared to discuss their progress, proposed next steps, and any roadblocks to progress. There will also be office hours for further feedback and group work. This part of the class will culminate in each group's writing of a scientific paper.

The intent of the group projects is to experience how a research project moves from idea through to fruition, and how computational approaches can provide insight into real-world questions of interest. Students will come to understand how one formulates answerable research questions, situates them in the literature, constructs formal assumptions on behavior, codes models instantiating these assumptions, analyzes models, interprets results, and writes a scientific paper. Assessment during this part of the class will be based both on contributions to the group project, which can take many forms, and the quality of the group paper.

The third part of the class will ask students to do individually, with instructor aid, what we just did in groups. To be more specific, each student will formulate a research question, situate it in the literature, construct a series of formal assumptions on behavior, code a model instantiating these assumptions, analyze the model, interpret its results, and write a scientific paper. Class time will be devoted to individual meetings with each student to go over progress and help resolve issues that may arise. As before, there will also be office hours available. Assessment will be based on both efforts toward the individual project and the quality of the final work.

Beyond being necessary for academic work, the skills the course will impart will be useful for a wide variety of post-graduation endeavors. Python is widely used in data science applications, for instance. The course also provides students the opportunity to explore what it's like to search for their own answers to questions that interest them.

Course Requirements

1. **Assignments (30%):** There will be two assignments covering computational modeling and computer programming during the first part of the course, each worth 15% of the final grade. Students will have one week to complete each. Students are welcome to work together on these, but each person's work must be written up (on a computer, not by hand) independently, and all work must represent an understanding of all parts of the assignment. Students will submit each assignment to the course's Sakai website on its due date; no late assignments will be accepted. Solutions will be made available on Sakai at this time. After this point students will have a week to figure out, with the help of the solutions, where they might have gone wrong, and why. Each student will then provide detailed comments (also by computer, in the form of comments on a text document or pdf) that identify any incorrect points and explain and justify how each question should have been done. Students will not assign themselves any grades, however. Students will turn in these commented, revised assignments to Sakai. Students' grades on the assignments will be based on both their original performance and their

self-assessment. Do not put assignments off to the last minute! The earlier you start, the more help you can expect.

2. **Group Project Work (40%):** During the second part of the course, there will be work on the group project, as discussed previously. Because research often involves starts and stops, assessment of students' work for this part will be based both on effort and on outcome. Attempting to the best of one's ability to perform one's tasks each week, even if this is not always met with success, will garner full scores for effort. Each group will be collectively responsible for the outcome of its project, which will take the form of a journal article that would typically be classified as a research note (approx. 20 pages or 4000 words, not including appendices). More information about the format will be provided during the semester. Group research notes are due to Sakai at the date in the schedule below.

3. **Individual Project (30%):** During the third part of the course, students will devise, perform the work for, and formally write up a piece of original research. Aid from the instructor will be frequent and extensive; however, each student is expected to individually complete an original piece of research. The format is similar to that of the group project, though with more leeway: a journal research note of 2000-4000 words, or 10-20 double-spaced pages, not including any appendices. We will talk at length during the class about the specific requirements for this paper, and will see how to complete each piece of the paper during the group projects. These research notes are due to Sakai one week after the last class ends. No extensions will be given.

Readings

All readings for the class are listed in the tentative schedule below in the order in which they will be used, and in the order in which they should be read. Any book chapters or articles not available through Duke's library or on the Internet will be posted to Sakai. Required readings are to be done before class in all cases. Students, particularly those lacking specific methodological training, should focus on the substantive contributions of the readings; we will discuss all methods in class. Readings were chosen to be a very small sample of important research and to illustrate points I desire to make in class. Note that the reading load for this class is intended to be light: we'll be learning by doing, primarily, and most of students' time outside of class will be allocated to active research and writing.

Attendance

Though no separate grade is assigned to class attendance, attendance during class sessions/group and individual meetings is mandatory. While absences will of course be accommodated as per Duke University policy, the student missing class is responsible for getting in contact with the instructor as soon as possible after the class meeting in order to: (i) discover what was missed; and (ii) provide an update on individual or group work progress. Any individual meeting missed in the third part of the class will be rescheduled.

A Note on Writing

As the goal of each of the group and the individual projects is the production of a piece of original research that satisfies journal standards, it is important that all students be familiar with standard requirements for source citation and use. The university offers several resources to aid students with this, which may be found at these links: https://library.duke.edu/research/citing, https://library.duke.edu/research/plagiarism, and https://twp.duke.edu/twp-writing-studio/resources-students/sources.

The Academic Resource Center

The Academic Resource Center (ARC) offers free services to all students during their undergraduate careers at Duke. Services include Learning Consultations, Peer Tutoring, Learning Communities, ADHD/LD Coaching, Outreach Workshops, GRE/MCAT Prep, Study Connect, and more. Because learning is a process unique to every individual, we work with each student to discover and develop their own academic strategy for success at Duke. Contact the ARC to schedule an appointment. Undergraduates in any year, studying any discipline can benefit!

CONTACT INFO:

arc.duke.edu

theARC@duke.edu

919-684-5917

211 Academic Advising Center Building, East Campus – behind Marketplace.

Class Schedule with Readings

M Aug 23: Introduction to Computational Modeling 1

Schelling segregation model on-line simulations (from Schelling 1971): http://nifty.stanford.edu/2014/mccown-schelling-model-segregation/

Axelrod, R and WD Hamilton. 1981. "The evolution of cooperation." *Science* 211 (4489): 1390-1396. DOI: 10.1126/science.7466396

De Marchi, Scott and Scott E. Page. 2014. "Agent-based models." *Annual Review of Political Science* 17:1–20.

W Aug 25: Introduction to Computational Modeling 2

Golder M, SN Golder, and DA Siegel. 2012. “Modeling the institutional foundation of parliamentary government formation.” *Journal of Politics*. 74(2): 427-445.

Kollman, Ken, John H. Miller, and Scott E. Page. 1992. “Adaptive parties in spatial elections.” *American Political Science Review* 86(4): 929–937.

Weidmann N and Idean Salehyan. 2013. “Violence and ethnic segregation: a computational model applied to Baghdad.” *International Studies Quarterly* 57: 52–64.

M Aug 30: Introduction to Python

Class Notes (Sakai)

W Sep 1: Basic Programming in Python

Assignment #1 handed out.

M Sep 6: Coding Computational Models 1

Class Notes (Sakai)

W Sep 8: Coding Computational Models 2

Assignment #1 due.

M Sep 13: Methods for Analyzing Computational Models 1

Siegel, David A. 2018. “Analyzing Computational Models.” *American Journal of Political Science* 62 (3): 745-759.

W Sep 15: Methods for Analyzing Computational Models 2

Assignment #1 revision due. Assignment #2 handed out.

M Sep 20: Extended Example of a Computational Model Derivation 1

Siegel, David A. 2009. “Social Networks and Collective Action.” *American Journal of Political Science* 53 (1): 122-138 with appendix at http://people.duke.edu/~das76/Research/Siegel_network_model_AJPS_appendix_final.pdf.

Siegel, David A. 2011. “When Does Repression Work?: Collective Action and Social Networks.” *Journal of Politics* 73 (4): 993-1010 with appendix at http://people.duke.edu/~das76/Research/Siegel_Repression_JOP_2011_Appendix.pdf.

Siegel, David A. 2013. “Social Networks and the Mass Media.” *American Political Science Review* 107 (4): 786-805 with appendix at http://people.duke.edu/~das76/Research/Siegel_APSR2013_appendix.pdf.

W Sep 22: Extended Example of a Computational Model Derivation 2

Assignment #2 due.

M Sep 27: Group Project Begins--Full Class Meeting to Choose Projects

W Sep 29--
M Oct 25: Group Meetings (see Sakai)
Assignment #2 revision due Wed Sep 29.

W Oct 27: Group Project End—Full Class Meeting to Discuss Results

M Oct 25--
M Nov 29: Individual Project Begins; Individual Project Meetings (See Sakai)

W Dec 1: Individual Project Ends—Full Class Meeting to Discuss Results

W Dec 8: Individual Projects Due by noon to Sakai