

POLS 3320: INTRODUCTION TO MODELS IN POLITICAL SCIENCE

Spring 2022

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“You can’t really know anything if you just remember isolated facts. If the facts don’t hang together on a latticework of theory, you don’t have them in a usable form. You’ve got to have models in your head.”

–Charlie Munger (investor, vice chairman of Berkshire Hathaway)

In this class, I aim to put models in your head. Models are stylized mathematical representations of the world, and knowing a bunch of them can help you better understand politics, society, and even your own personal life. We’ll learn how to forecast elections, how epidemics spread, how economies grow, why your friends are all (statistically) cooler than you, how to distinguish correlation from causation, what drives residential segregation, how to guess the number of circus clowns in Chicago, and much, much more.

By the end of this course, you will be able to:

1. Explain the assumptions and implications of over four dozen foundational models in the social sciences
2. Apply multiple models to understand a single topic (“many-to-one thinking”)
3. Apply a single model to understand multiple topics (“one-to-many thinking”)

Prerequisites

This is a class on mathematical models, so ... there will be math. But not, like, hard math. If you can do high school algebra (e.g. solve an equation for X) then that’s all you need. Knowing some calculus will help you *appreciate* many of the models on a deeper level, but it’s not a prerequisite.

Course Structure

This course will be “flipped”, with pre-class time dedicated to reading, videos, and online quizzes so that class time can be spent on discussion and projects. Before coming to class, please complete the assigned readings and complete the quizzes on eLC. Successfully completing a quiz is my indication that you’re ready to come to class and participate in group discussions and projects. Late quizzes will receive half credit. I will make it clear on eLC when everything is due. The midterm and final exam will be online and open-book. Dates TBD.

COVID-19 Precautions

Due to the COVID-19 pandemic, I expect that there will be more than the usual share of setbacks and hardships this semester. Please don't hesitate to ask questions or reach out to me with your concerns. If you test positive for COVID-19, please isolate for five days and report the positive test through [DawgCheck](#) (woof woof), which will automatically inform me that you'll be missing class for a few days. Given the structure of the course, you can easily miss a couple of classes and catch up by reading the Table Reads. See [this page](#) for more up-to-date and detailed guidance.

Textbook

You will need one book for this course:

- Scott E. Page, *The Model Thinker: What You Need to Know to Make Data Work for You*, Basic Books, 2018.

This semester, you should order the book through [Perusall](#), an online social annotation platform. Once you've signed up for an account, enter the course code ORNSTEIN-6ZYE2 to join our group. I will assign a manageable chunk of the book before each class period, typically one or two chapters. Use Perusall to read, annotate, and ask questions prior to class, and the platform will automatically assign you a grade based on the quality of your comments and questions. By the way, thanks for reading the syllabus. If you send me an email saying "Hey professor I read your syllabus and it was awesome! Meticulously crafted and really informative. Looking forward to seeing what all this model stuff is about." and include a fun fact about yourself, I will award you an extra point on your midterm. For most of the reading assignments, I will include a short quiz on the course website to ensure that you've gotten the key points.

Grading Policy

Reading (25%), Quizzes (25%), Midterm (25%), Final Exam (25%)

Office Hours

I will hold office hours by appointment every Tuesday and Thursday. You can sign up for 15 minute slots [here](#). One of the great things about college is that all of your professors are required to set aside time each week to just talk with their students. Take advantage of it!

Software

We will occasionally play around with models using a piece of software called NetLogo. You can download it for your computer [here](#).

“Show And Tell”

If, during the course of the semester, you encounter something in the real world (in your life, a news story, etc.) that one of the models from class can help you understand, I want to hear about it! Discuss your example in class and email me a 2-3 sentence summary and I will award you two extra exam points (maximum four extra points on the midterm and four extra points on the final).

Tentative Course Outline

Moltke the Elder writes that no battle plan survives first contact with the enemy. The same is true for syllabi. The following schedule should serve as a rough outline, with each module taking about 1-3 weeks. You can find more day-to-day details on the course website.

Module 1: Thinking With Models

Pre-Class Survey, What Are Models?, The Condorcet Jury Theorem, The Diversity Prediction Theorem, Fermi Estimation, Categorization Models, Classification Trees, Random Forests

Module 2: Diffusion and Contagion

The SIR Model, Herd Immunity, Complex Contagion

Module 3: Probability and Chance

Modeling Randomness, Bayes Rule, The Normal Distribution, Central Limit Theorem, Long Tails

Module 4: Correlation and Causation

The Linear Model, DAGs, Forks, Colliders

Module 5: Growth and Decay

Exponential Functions, The Rule of 72, Increasing and Diminishing Returns, The Forgetting Curve, Economic Growth, The Solow Model, O-Rings

Module 6: Networks and Graphs

Centrality, Small Worlds, The Friendship Paradox, Robustness, Stable Matching Problems, Metcalfe's Law

Module 7: Games and Strategy

Decision Theory, Zero-Sum Games, Mixed Strategies, Sequential Games, Commitment Problems, The Prisoner's Dilemma, Cooperation, Coordination, Signaling, Collective Action Problems

Module 8: Elections and Social Choice

Aggregating Preferences, Arrow's Theorem, Spatial Models, Median Voter Theorem, Veto Players, Gerrymandering, Election Forecasting, Polling, Prediction Markets

Module 9: Institutions and Incentives

Mechanism Design, Auctions, Coalitions, Shapley Value, Principal-Agent Models, Delegation, Selectorate Theory

Module 10: Dynamics and Chaos

Random Walks, Markov Chains, Path Dependence, Chaos Theory, System Dynamics, Mass Protest, Sorting, Segregation

Module 11: Learning and Problem-Solving

Reinforcement Learning, Replicator Dynamics, Multi-Armed Bandits, Rugged Landscapes

Academic Honesty

Remember that when you joined the University of Georgia community, you agreed to abide by a code of conduct outlined in the academic honesty policy called *A Culture of Honesty*. It has some pretty specific things to say on the subject of cheating. Quite specific. I will make clear which assignments I expect to be team efforts and which I expect to be completed by individuals. Please complete the midterm, final exam, and online quizzes individually.

Mental Health and Wellness Resources

- If you or someone you know needs assistance, you are encouraged to contact Student Care and Outreach in the Division of Student Affairs at 706-542-7774 or visit <https://sco.uga.edu>. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services.
- UGA has several resources for a student seeking [mental health services](#) or [crisis support](#).
- If you need help managing stress anxiety, relationships, etc., please visit [BeWellUGA](#) for a list of FREE workshops, classes, mentoring, and health coaching led by licensed clinicians and health educators in the University Health Center.
- Additional resources can be accessed through the UGA App.