

The Perils of Prediction

GESM-161g (4 units) Fall 2023

Tue and Thu 11-12:20, VPD 107

Instructor: Todd A. Brun

Office: EEB 502

Office Hours: Mon 12-1:30, Thu 2-3:30, in person and by Zoom

**Contact Info: tbrun@usc.edu (email)
(213) 740-3503 (Office)**

Course Motto: “It’s tough to make predictions, especially about the future.”—Yogi Berra

Course Description

Throughout history, many attempts have been made to forecast the future, by leaders, prophets, fortune-tellers, sages, businessmen, scientists, charlatans and storytellers. The results, taken all in all, have not been impressive. In spite of our best efforts, the future remains fundamentally unpredictable.

In this seminar, we will study quantitative tools for dealing with uncertainty—logic, probability, statistics, and mathematical modeling—and some of the phenomena that make prediction difficult, such as chaos and complexity. We will also look at some specific areas in which people would like to make predictions: weather, economics and politics, technology and social change. This course is aimed at students in the arts and humanities who are not afraid of numbers.

Learning Objectives

Students in this course will gain proficiency in the following areas:

- **Critical Thinking:** Logic and probability. Using Bayesian probabilities to represent uncertainty. The connection between probabilities and statistics. Chaos and complexity, and their effects on predictability.
- **Logical Integrity:** Logical versus plausible reasoning, and common logical fallacies. Deceptive statistics. Tetlock’s model of predictive style; foxes versus hedgehogs.
- **Formal Reasoning:** Constructing mathematical models of the world. Making deductions from a formal model and comparing them to reality.
- **Applications:** Predicting weather versus predicting climate. Attempts to make economic and political predictions, and their limitations. The unpredictability of scientific and technological advances.

These subjects will be illustrated by readings from a wide variety of sources, both popular and technical, with an emphasis on subjects important to society.

Recommended Preparation: A good knowledge of simple algebra and basic numeracy. Knowledge of calculus is helpful, but not required. Some previous exposure to probabilities and statistics is also useful.

Class Notes

My class notes will be made available on Blackboard in digital form, along with all assignments and other course content.

Required Readings

Most readings are either excerpted in the **course reader** (available from the USC Bookstore) or provided in electronic form, but a few will be purchased separately. A list of all readings is provided below.

Technological Proficiency and Hardware/Software Required

We will make simple use of Mathematica demonstrations in class. Some problems will use calculators or a spreadsheet. Course content will be distributed through the online Blackboard system.

Description and Assessment of Assignments

The eight problem sets will be on the main quantitative topics of the course: logic and probability, statistics, chaos and complexity, and mathematical models. The two papers will be on topics of the students' choice related to prediction in human society, such as predicting political or economic events, or social or technological change, and will draw on the readings. The exams will be a mix of quantitative and essay-type questions. There will also be a grade for participation, based on engaging in class discussions with other students and the instructor. Lack of attendance will count against the participation grade.

Grading Breakdown

This class will be graded based on the following: participation in class discussions; eight problem sets; two papers; a midterm exam, and a final exam.

Assignment	Percentage of grade
Class participation	10%
Problem sets	20%
Papers	20%
Midterm Exam	20%
Final Exam	30%
TOTAL	100%

Additional Policies

Students are encouraged to discuss assignments with each other, but all assignments must be done and submitted individually. Late work will not be accepted unless permission is obtained in advance and will require a strong justification. Exams cannot be made up except in case of a medical emergency. Assignments, papers and exams will be graded and returned as quickly as possible (generally within a week).

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings	Due Dates
Week 1	Unpredictability. Logic and probabilities; reasoning with uncertainty.	<i>Love is a Fallacy; Symbolic Logic; Bad Arguments.</i>	
Week 2	Probability: dice vs. horse races. Subjective probability and the Bayes rule.	<i>Chance and Chaos; Probability.</i>	HW 1 due
Week 3	Predicting the unpredictable. Unexpected events. Coincidences.	<i>The Signal and the Noise; The Black Swan.</i>	HW 2 due
Week 4	Probability and Statistics. Polling and uncertainty.	<i>How to Lie With Statistics; Handout on Statistics.</i>	
Week 5	Expert prediction. Foxes and hedgehogs.	<i>The Black Swan; Expert Political Judgment; The Signal and the Noise.</i>	Paper 1 due
Week 6	Statistical significance. Why do so many studies turn out to be wrong?	<i>Probability; Handout on Statistics.</i>	HW 3 due
Week 7	Chaos theory. Dynamical systems. The logistic map.	<i>Chaos; Complexity: A Guided Tour.</i>	HW 4 due
Week 8	Midterm Exam. Fall Recess.		
Week 9	Predicting weather vs. predicting climate.	<i>Chaos; Climate: A Very Short Introduction.</i>	
Week 10	Complexity. Systems with many moving parts.	<i>Complexity: A Very Short Introduction.</i>	HW 5 due
Week 11	Building mathematical models.	<i>Complexity: A Very Short Introduction.</i>	HW 6 due
Week 12	Predicting new technology.	<i>New Atlantis; Wonderful Future; Paris in the 20th Century; Anticipations; 2081.</i>	HW 7 due
Week 13	Modeling the economy.	<i>The Signal and the Noise.</i>	HW 8 due
Week 14	Predicting political and economic events. Thanksgiving.	<i>The Black Swan; Expert Political Judgment; Foundation.</i>	
Week 15	Predicting social change.	<i>2081; Foundation; Paris in the 20th Century.</i>	Paper 2 due
Exam Period	Final Exam. For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at www.usc.edu/soc .		

List of Readings

These will be read in their entirety:

Instructor's Class Notes and Handouts

Love is a Fallacy, Max Shulman

An Illustrated Book of Bad Arguments, Ali Almosawi

The New Atlantis, Francis Bacon

Enoch Soames, Max Beerbohm

Foundation, Isaac Asimov

Paris in the 20th Century, Jules Verne

These will be excerpted (typically 1-3 chapters):

Symbolic Logic, Lewis Carroll

Probability: The Logic of Science, E.T. Jaynes

How to Lie With Statistics, Darrell Huff

The Signal and the Noise, Nate Silver

Chaos, James Gleick

Chance and Chaos, David Ruelle

Climate: A Very Short Introduction, Mark Maslin

2081, Gerard K. O'Neill

Expert Political Judgment: How Good Is It? How Can We know?, Philip Tetlock

The Wonderful Future That Never Was, Gregory Benford

The Black Swan, Nassim Nicholas Taleb

Anticipations, H.G. Wells

Complexity: A Guided Tour, Melanie Mitchell

Complexity: A Very Short Introduction, John H. Holland

There may be other short readings or excerpts, pictures, or videos, at the instructor's discretion.

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see [the student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. [The Office of Student Accessibility Services](#) (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

[Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

[988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a

week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.