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The Perils of Prediction
GESM-161g (4 units) Spring 2018
Tue and Thu 11-12:20, LVL 3V

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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. Paradoxes of probabilistic reasoning. 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 science 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.

Course Notes
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. My lecture notes will be scanned in and made available on Blackboard, along with all assignments and other course content.

Technological Proficiency and Hardware/Software Required
We may make simple use of Mathematica, available through a USC site license. 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.

Grading Breakdown

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.

Required Readings
Most readings are either excerpted in a **course reader** (available from the USC Bookstore) or provided in electronic form, but some will be purchased separately.

These will be read in their entirety:
Instructor's Lecture Notes and Handouts
Love is a Fallacy, Max Shulman
An Illustrated Book of Bad Arguments, Ali Almossawi
How to Lie With Statistics, Darrell Huff
Foundation, Isaac Asimov
Paris in the 20th Century, Jules Verne
The New Atlantis, Francis Bacon

These will be excerpted (typically 1-3 chapters):
Symbolic Logic, Lewis Carroll
Probability: the Logic of Science, E.T. Jaynes
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
The Wealth of Nations, Adam Smith
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.

Course Schedule: A Weekly Breakdown

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

Statement on Academic Conduct and Support Systems

Academic Conduct:
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems:
Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.
Provides overall safety to USC community. dps.usc.edu