General Information

Where/When  Class meets Mon/Wed/Fri, tbd.
Discussions (50min / week) meet in ZHS 130.

Instructors

Professor:       Julien Emile-Geay ZHS 275 julienege@usc.edu
Teaching Assistants: tbd tbd tbd@usc.edu

Office Hours  MWF 10-11 in ZHS 275, or by appointment.

Course Description

Synopsis  No sooner have we entered the Information Age that we find ourselves shrouded in misinformation. “Alternative facts”, “post-truth” and “fake news” have replaced the age-old propaganda. With most of us increasingly seeking information from disjoint opinion bubbles, how is an informed person to make a rational judgment on hot-button issues such as climate change, evolution, gun violence, vaccine safety, genetically modified organisms, or nuclear risk? What separates truth from denial? Fact from fiction? Rational risk assessment from alarmism?

This class (GE-F Quantitative Reasoning) will introduce you to evidence-based methods to form reliable judgments on any topic where quantitative measurements exist. The class will first focus on man-made climate change as a parable for any complex topic where expert consensus and societal perceptions differ. Along the way, you will learn the basics of statistics and data science and how to apply them to almost any problem. In so doing, you will learn a bit about physics, psychology, biology, and yes, maths. Finally, a series of case studies will apply the quantitative reasoning skills to a number of contemporary controversies, partially guided by class student interest.

Course Catalog blurb  Quantitative reasoning tools to form reliable judgements from quantitative evidence, discerning truth from lies, science from pseudoscience. Application to contemporary scientific and social issues.

Learning Objectives  Students will learn to soundly reason from quantitative evidence. They will learn to: empirically analyze data; understand the logical structure of evidence-based arguments; deconstruct common logical fallacies that use the data incompletely or improperly (“lying with data”). Students will apply skills such as inductive, deductive, and mathematical reasoning to solve problems. Students will learn how to apply probabilistic reasoning to discriminate between competing hypotheses based on factual evidence. Students will learn how to critically evaluate quantitative claims in visual and written forms. Students will demonstrate proficiency in the visual display of quantitative information and associated plotting and editing software.
Requirements
This course requires the ability to adjust your beliefs when exposed to data that contradicts prior opinions. A personal computer with Python 3 installed\(^1\) is helpful, but not required.

Grade
The class is worth 4 units, which means that it requires substantial work. Attendance to discussion sections is mandatory (register separately, please).

Table 1: Numeric to letter grade conversion (cutoffs)

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<th>Numeric Cutoff</th>
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Rules
There are a few many rules, and they’re all important. First, you should read the syllabus (if you’ve gotten this far, you’re on the right track). Second, please check BlackBoard. Third, please ask questions when you don’t understand things; chances are you’re not alone. Fourth, don’t miss class or lab. Fifth, please do not email the instructor with questions whose answer is in the syllabus. Sixth, under no circumstance should you ever even think of haggling for your grade. Seven, read the syllabus once more (just in case). If you still have questions, we’ll be more than glad to answer them.

Reading
Main book

Relevant Books
- Weart, S., *The Discovery of Global Warming*, URL.
- Emanuel, K., *What we know about climate change*, URL.
- Edwards, P.N., *A vast machine*, URL.

\(^1\)https://www.continuum.io/downloads
Course Schedule

I Settled Science that Unsettles People
   Week 1 — 01/07/19— Introduction
      Lectures Class roadmap; Facts, myths, theories, measurements, and experts.
      Discussion Merchants of Doubt
      Assignment: 5 quantitative claims you wish to investigate. (see this for inspiration)
   Week 2 — 01/14/19— Vaccines
      Lectures (Monday: MLK day). Scientific consensus on vaccine efficacy; popular denial.
      Assignment: Why are vaccination rates declining?
      Discussion Analyzing anti-vaxxer arguments
   Week 3 — 01/21/19— Evolution
      Lectures The case for evolution; Creationism; the roots of denial.
      Assignment: Creationist Education
      Discussion Analyzing creationist arguments
   Week 4 — 01/28/19— Life and death
      Lectures Dietary risk: sugar vs fat; Crime statistics; Tobacco mortality
      Assignment: The Disinformation Playbook
      Discussion The Tobacco Strategy
   Week 5 — 02/04/19— Climate Change
      Lectures Anthropogenic global warming. Consensus vs denial. Midterm 1
      Assignment Weart, The Carbon dioxide greenhouse effect
      Discussion Analyzing Climate Denial

II Evidence-Based Reasoning
   Week 6 — 02/11/19— Principles of Data Science I
      Lectures Probabilities. Exploratory Data Analysis. Distributions. Data Visualization
      Assignment G&S, chapter 1–5
      Discussion Data analysis with Python. Quincux game.
Week 7 — 02/18/19 — Principles of Data Science II
Assignment G&S, chapters 9–11
Discussion Fitting trends to data

Week 8 — 02/25/19 — Statistical Booby Traps
Assignment G&S, chapter 6–8
Discussion Storks deliver babies ($p = 0.008$)

Week 9 — 03/04/19 — On the shoulders of giants
Lectures Scientific reasoning; Good Science, Bad Science, and Ugly Science; Scientific Legitimacy
Assignment How do you know a paper is legit?; Fake Scientists
Discussion Expert identification game

SPRING RECESS: March 10 – 17

Week 10 — 03/18/19 — Logical Reasoning
Lectures How to fool others: informal fallacies. How to fool yourself: motivated reasoning, confirmation bias, cultural cognition; Friday: Midterm 2.
Assignment Robot Fallacies
Discussion Harstorf & Cantril, They Saw a game

III SPOTLIGHT: ANTHROPOGENIC CLIMATE CHANGE
We finish this class with a survey of climate science, one of the topics where the gap between scientific consensus is the largest. We explore the reasons for this gap in detail.

Week 11 — 03/25/19 — Observing Climate
Lectures The Climate System. Instrumental (in-situ and remote) observations. Data systems.
Assignment A vast Machine, Chap 1
Discussion Reasoning with the temperature record

Week 12 — 04/01/19 — Climate Physics
Lectures Energy conservation; Greenhouse effect; Carbon Cycle;
Discussion Planetary energy balance
Week 13 — 04/08/19 — Climate models

Lectures
1D climate models. General circulation models. Forcings, Feedbacks & Climate Sensitivity.

Assignment
A. Hoffman, *Climate Science as Culture War*.

Discussion
Climate Tribalism

Week 14 — 04/15/19 — A greenhouse world

Lectures
Attribution. Climate Projections & Impacts. Climate Options.

Assignment
The Collapse of Western Civilization: A View from the Future.

Discussion
Reasoning with general circulation models

Week 15 — 04/22/19 — Agnotology

Lectures
Merchants of Doubt; Climate change in the media. Can we be rational about climate change?

Assignments
UCS Deception Dossier

Discussion
Deconstructing climate myths

second week of May — Final Exam —

IV TECHNOLOGY

Blackboard
BlackBoard is our primary medium of communication outside the classroom. It is where I post class notes, announcements, and assignments. Is where you access that content, participate in discussions, and check your grades. **It is your responsibility to ensure that you receive BlackBoard announcements.** Make sure you enable email notifications, and importantly, make sure your inbox is not full; every year I get emails bounced from students too neglectful to clean up their inbox. If you have a doubt about when an assignment is due, go check it on BlackBoard. Also note that BlackBoard messages are richer than the email notifications they generate. Frequently, the announcements I’ll send will have links to content archived on BlackBoard – those links will not appear in the emails. If the email digest you read does not make sense, please check it on BlackBoard; it might have the answer you need over there. If it still doesn’t, please email me.

Email etiquette
Email is a relatively new advent in the world of education. It allows an unparalleled level of access to professors, which has both pros and cons. In some cases you will spot a mistake of mine in an assignment or a grade, and pointing it out will save everyone a lot of time. In many cases, however, emails unnecessary clog my inbox. Here are some rules to use email wisely:

– Check BlackBoard before you type. Chances are the answer you seek is already there.
– Direct all lab-related queries to your TA.
– Write exactly as if you were speaking to me in person. Not more, not less formally.

Emails that break any one of these rules will not receive an answer. If you can spare the time, please come to office hours or see me after class. I’d much rather talk to a human than a computer, and I have yet to bite a student. Other email etiquette tips may be found [here](#).
Laptops & Tablets
Laptops and tablets look way cool, but they have proven far less effective than good old pen&paper at information retention. Moreover, their use in the classroom can be disruptive to you and people around you if you use them for activities unrelated to the class. Please exercise best judgment and be considerate of others around you.

V Student Affairs
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 Section 11, Behavior Violating University Standards. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct.

 Discrimination
Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity or to the Department of Public Safety. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men provides 24/7 confidential support, and the sexual assault resource center webpage describes reporting options and other resources.

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.
https://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.
http://www.suicidepreventionlifeline.org

Relationship & 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.
https://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: http://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. https://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. https://studentaffairs.usc.edu/bias-assessment-response-support/

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

Diversity at USC Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students.
https://diversity.usc.edu/
GradeBuddy

The following is a reminder from Academic Policies memo 11/25:
Any student selling or distributing notes taken in a classroom is in violation of the University's Academic Integrity policy and is subject to university sanctions. This policy is clearly stated in Section 11.12 of the student handbook, SCampus, which identifies the following as violations of community standards:

- Acquisition of term papers or other assignments from any source and the subsequent presentation of those materials as the student’s own work, or providing term papers or assignments that another student submits as his/her own work.

- Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes, but is not limited to, providing materials for distribution by services publishing class notes. This restriction on unauthorized use also applies to all information which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the Internet or via any other media. (See Section C.1 Class Notes Policy.)

- Recording a university class without the express permission of the instructor and announcement to the class. Recording can inhibit future free discussion and thus infringe on the academic freedom of other students as well as the instructor.