Math That Lies: Communicating Why Some Quantitative Arguments Are Misleading or Bogus — Math 380A and Honors 220E

Calderwood Seminar in Public Writing

Instructor: Neal Koblitz, Professor of Mathematics, koblitz@uw.edu

Class meets in HRC 135 on Thursdays 8:30–11:20

"There are three kinds of lies: lies, damned lies, and statistics."

–Often attributed (falsely) to 19th century British Prime Minister Benjamin Disraeli

"Las matemáticas no mienten, pero los mentirosos usan las matemáticas."
(Math doesn't lie, but liars use math.)

–Uldarico Malaspina, Professor of Mathematics at the Pontificia Universidad Católica del Perú

When encountering arguments using numbers or equations, even well-educated people are often paralyzed — like deer in the headlights — and lose their capacity for critical thinking. For decades, some public writers have been trying to change this — Darrell Huff, John Allen Paulos, Stephen Jay Gould, and more recently Cathy O'Neil, Adam Kucharski, and (here at UW) Carl Bergstrom. The purpose of this course is to help you develop the skills needed to join their ranks and write clearly and perceptively about quantitative arguments.

Calderwood Seminars are part of a system of courses designed to promote excellence in public writing by undergraduates. It started at Wellesley in 2013, and has gradually spread to over a dozen other universities, including UW starting in 2019. The course requires commitment, curiosity, and a critical mindset.

LEARNING GOALS

- To increase your skill and confidence as writers.
- To learn how to collaborate effectively as editors and workshop participants.
- To learn how to process, analyze, and criticize mathematical arguments related to socially important controversies.
- To learn how to communicate in clear, crisp, lively, and error-free prose about the challenges and pitfalls in interpreting quantitative information.

The key to improving your writing during this course will be to participate fully and thoughtfully in the writer-editor relationship and in the workshopping on Thursdays. In that way you will develop your skill at giving and taking constructive feedback.

Please note: This is an intensive 5-credit course. Every week you need to (1) do all the assigned reading (whether you're a writer or editor), and do it carefully; (2) proofread your written work and revise it carefully in response to feedback, if you're a writer; and (3) give the writer extensive helpful corrections and suggestions, if you're an editor. During the

first few weeks of the quarter I will check (1) by giving quizzes on the assigned reading and monitor (3) by viewing Zoom recordings of the editor-writer meetings and by noting what shape the written work is in when we workshop it in class. In the event that you do not do a conscientious job as editor in your first Zoom meeting with a writer, I will ask you to continue making Zoom recordings of your editing sessions so I can check for rapid improvement in that crucial aspect of the seminar. Of course, (2) will also affect the grade directly, because the final version of the written work will be a major component of the grade.

There is no university-level math prerequisite for this course, although you need to be open to thinking about arguments based in part on grade-school-level math and statistics. This seminar is very different from other math courses. In fact, the work might be more challenging for math majors than for non-science majors because of the focus on critical thinking about the readings, followed by writing clearly and logically for a general readership. According to University guidelines, in addition to the weekly 3-hour class the course should require an average of around 12 hours per week. But please be prepared to set aside more time than that, especially during the first few weeks of the quarter.

Please arrive promptly to class by 8:30 on Thursdays, so we can start on time.

READINGS

The course material consists of various articles and book chapters that I'll upload to Canvas and four books. The books are:

- *Math on Trial: How Numbers Get Used and Abused in the Courtroom* by Leila Schneps and Coralie Colmez, a mother-and-daughter team of mathematicians (currently available on Amazon for $\approx$ \$20).
- *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* by mathematician Cathy O'Neil (paperback is currently available on Amazon for $\approx$ \$11).
- *The Mismeasure of Man* by paleontologist and science popularizer Stephen Jay Gould (expanded 2nd edition, currently available on Amazon for $\approx$ \$17).
- *A Writer's Reference* by Diana Hacker and Nancy Sommers (it's okay to get a used spiral-bound 7th or 8th edition, which should be much cheaper than the latest edition; I have two extra copies I can lend for the quarter if you can't find a copy at an acceptable price).

If you want to use kindle or library copies, that's okay. But you'll need to have each of the first three books for a few weeks in order to read it, then either edit another student's review or write your review and then the final version after the workshopping in class.

PREPARATION FOR FIRST CLASS ON SEPT 26

Please carefully read the following three short pieces, all of which are posted in the "Files" section of the course's Canvas page, and be ready to take a quiz on them and discuss them in class: (1) "Mathematics As Propaganda" (10 pages), (2) a chapter from *How To Lie with Statistics* (pp. 76-88), and (3) an op-ed by Robert Schiller, who gives quantitative

arguments to support his claim that, on average, real estate is a bad long-term investment. In addition, please read pages 3-8 of the writing exercises posted on Canvas and see if you can explain and fix the writing problems in the exercises. Please pick out a few of them that you have trouble with (either you don't see what's wrong or don't see how to fix it) and which it would be useful to discuss in class. The posted writing exercises are 14 pages long, but I'm asking you only to read pp. 3-8.

OVERVIEW OF CLASSES AND ASSIGNMENTS

Week 1 class (Sept 26): I will introduce the topic of misuses of mathematics, go over the schedule for the different stages of editing and writing, give some general guidelines, and describe writing assignment 1A, based on the article "The Formula That Killed Wall Street" from *Wired* magazine, which we'll start workshopping on Oct 3. The background for that article will include a brief explanation of what CDS (credit default swap) and CDO (collateralized debt obligation) mean. We'll then discuss the three articles you read in preparation for this class, so please jot down any questions you have on those readings. After the quiz on those readings, we'll devote the remaining time to in-class editing of the examples on pp. 1–8 of the posted writing exercises.

After the first week the class will be divided into Group A and Group B. Each week one group will be writers and the other will be editors, and this will alternate. In the past I've had to make adjustments during the first few weeks because of drops, sickness, and other reasons. In addition, with the longer 600-word written assignments we'll have time to workshop only four of them, so not all will get workshopped. In those cases each one that's not workshopped either will have two peer editors or else will have me as editor.

Weeks 2 – 3 (class on Oct 3 and Oct 10) For assignment 1A Group A students write a brief article of about 300 words summarizing (in plain English) the main points of the article "The Formula That Killed Wall Street." After editing, editor-writer Zoom meetings, workshopping, and revisions, the final versions will be due on Oct 17. Please record the Zoom meetings and email me (koblitz@uw.edu) with the link to the recording so that I can see what types of comments and suggestions come from those meetings. Please have these meetings early enough so that the writer can revise and send the revision to me no later than Tuesday Oct 1. In cases when a writer does not get much help from a Zoom meeting, I'll postpone the workshopping until Oct 10 and ask the editor and writer to meet again on Zoom (recording the meeting and sending me the link again). Final versions of Assignment 1A are due on Oct 17. In addition, during Weeks 2 and 3 you should read most of the assigned pages of *Math on Trial* (you may skip Chapter 4) so that you'll have a chance to ask any questions about it during class on Oct 10 before writing your review or editing a classmate's review. In general, it's a good idea to start reading each of the three books at least two weeks before the workshopping of the book reviews.

On Oct 3 we'll also have a visit for about an hour from math professor Stefan Steinerberger, who will speak about his personal experiences when dealing with fallacious quantitative arguments in economics and getting into heated exchanges in journals.

On Oct 10 we'll discuss guidelines for Assignment 1B, in which group B writes a roughly 600-word book review of *Math on Trial* (common text) and group A edits.

Week 4 (class on Oct 17): Workshopping the Group B book reviews (the final version is due on Oct 24) and discussion of guidelines for Assignment 2A. In that assignment each student in Group A writes a 600-word article as might appear in the science section of a newspaper, in which three articles on the UW IHME model of the Covid-19 pandemic (common text) are discussed. Two of the articles you will read (by Sharon Begley of statnews.com and by Kelsey Piper of Future Perfect) are highly critical and the other one (by IHME director Christopher Murray) defends the IHME approach. This is also a good time to start reading *Weapons of Math Destruction*. You are not required to read the whole book, but please read Chapters 1, 2, 3, 5, and 8 carefully.

Week 5 (class on Oct 24): Workshopping the Group A science articles on the IHME Covid-19 model (the final version is due on Oct 31) and discussion of guidelines for Assignment 2B, in which each Group B student writes a 600-word blog post reviewing the book *Weapons of Math Destruction* (common text) and group A edits. This is a good time to start reading the third book, *The Mismeasure of Man*.

Concerning the book *The Mismeasure of Man*: You are not required to read the whole book, which is over 400 pages. Please read Chapters 5–7, taking notes and jotting down comments and questions. Your book review must devote some space to explaining — briefly, but in a way that your readers will understand — Gould's central mathematical point concerning the "factor analysis" fallacy that he calls "reification."

Although there are more recent books on the topic of racist pseudoscience (for example, *Superior: The Return of Race Science* by Angela Saini, and *Race, Racism, and Science* by John P. Jackson, Jr. and Nadine M. Weidman), none of them explains the ways that mathematics is misused. For a relatively quick overview of the general topic, you might want to read the Wikipedia article "Race and Intelligence."

Week 6 (class on Oct 31): Workshopping the Group B book reviews (the final version is due on Nov 7) and discussion of guidelines for Assignment 3A, in which Group A students write roughly 600-word book reviews of *The Mismeasure of Man* (common text) and Group B edits.

Week 7 (class on Nov 7): Workshopping the Group A book reviews (the final version is due on Nov 14) and discussion of guidelines for Assignment 3B, in which everyone in Group B writes a script of 250 words for an NPR Academic Minute about an example of the misuse of math that's chosen by the writer (common genre, possibly joint byline with about 500 words); Group A edits. Please email me your topic as soon as possible, so that I can either approve it or suggest changes. Also, Group A students receiving Honors credit should start working on Assignment 4A, which is to write a roughly 600-word report on a topic of your choice involving the misuse of mathematical/logical/statistical reasoning, **based primarily on an in-person or Zoom interview with an expert on the topic** (and using other sources — which should be listed at the end of your report — as background). Your report should consist of a brief introductory section followed by an edited version of the interview. For example, after reading one of the following books, you could interview a book author: (1) *People Count* by Susan Landau (perhaps focusing on Chapter 5); (2) *Calling Bullshit* by Carl Bergstrom and Jevin West (who are UW professors) – see especially Chapters 4, 5, 7, and 11; (3) *The Rules of Contagion* by Adam Kucharski (perhaps focusing on the author's carrying over disease epidemiology to

non-medical settings). Please email me your topic (and ideas for whom to interview) for approval before starting work on it.

Week 8 (class on Nov 14): Workshopping the Group B NPR scripts (the final version is due on Nov 21).

Week 9 (class on Nov 21): Workshopping the Group A reports/interviews (the final version is due on Dec 5).

Week 10 (class on Dec 5): Concluding discussion of the social damage caused by pseudo-mathematics. Group A's final versions of the last assignment are due on Dec 5, and Student Reflections on the Course are due (as an email attachment) by 6 pm on Friday Dec 6.

WEEKLY RHYTHM OF THE CLASS

Most weeks one half of the seminar participants (say, Group A) will write on the assigned topic. The other half (Group B) will serve as editors and commentators on these essays. In order for the seminar to function smoothly, **all participants need to adhere to the schedule** and complete their roles in a timely fashion. Each writer-editor pair will take the writing assignment through three stages of revision, using Zoom (or in-person meetings) and shared .docx files or Google Docs. If the paper is not being workshopped, then the writer and editor have a more relaxed schedule, since a revision doesn't have to be sent to me in time for in-class workshopping.

STAGE 1. Writers share a draft with their assigned editor by a mutually agreed-upon time on Sunday evening (preferred) or Monday (at the latest). The editor meets with the writer (perhaps on Zoom) to share their comments and suggestions. That meeting should occur no later than Tuesday morning. The first time please record the meeting on Zoom if possible, and share it with me (koblitz@uw.edu) and with the writer. I'll want to see how the writer-editor meetings are going, and the writer may want to have the recording to refer back to during revision. You might also record later editor-writer meetings on Zoom for the writer (but not to send to me).

STAGE 2. In preparation for workshopping, writers produce revised drafts and send them to me (koblitz@uw.edu) no later than Tuesday night so that I can share them with the whole class. All participants in the seminar must have read and thought about these revised drafts and (in the case of common text assignments) also finished reading the common text **before** class discussion on Thursday morning. Please have notes with comments on the revised draft so that you're prepared to discuss the drafts. The seminar will workshop the drafts during class.

Workshopping the assignments will take most of the Thursday class. Some time will be devoted to previewing the topic for the following week. We'll also discuss writing exercises based on sections in *A Writer's Reference* that deal with common problems that bring down the quality of public writing (wordiness, poor word choice or word usage, run-on sentences, jargon, clichés, lack of parallelism, dangling modifiers, unclear antecedents, wrong tense, awkward passive constructions, punctuation errors, and so on).

STAGE 3. Final versions of the essays are due in class the following Thursday. I will assign a grade to the final version.

Please feel free to email me with any questions that you have during the quarter. If you want to talk about something instead of emailing, we can set up a private Zoom meeting.

USE OF WIKIPEDIA

Wikipedia articles are useful for two purposes: to get an overview of a topic, and to get a start on finding suitable sources. Most Wikipedia articles have extensive footnotes and often sources for further reading.

Wikipedia is not perfect. It has been criticized for poor writing, uneven application of editorial policies, inadequate coverage of prominent women and people of color, U.S.-centric bias, and many other things. Wikipedia even has an article on "Criticisms of Wikipedia." As a general rule, articles on major topics tend to be better written and more reliable than articles on side topics. For example, the article "Scientific racism" is in pretty good shape, whereas the somewhat related article "John Hunter (surgeon)" is less so. The reason is that articles on major topics are watchlisted — that is, monitored — by many editors, who tend to spot deficiencies and fix them.

USE OF AI BOTS

Please **do not use AI bots in this course**, for two reasons. First, according to University plagiarism policy, the papers you hand in should be fundamentally your own work. Just as it would be wrong to have someone else write the draft of a paper that you will hand in, the same applies to a draft written by AI software. The second reason is that essays written by AI bots are compiled from what the algorithm finds on the Internet. They are superficial, are often full of inaccuracies or outright falsehoods, and of course never use independent thinking and analysis. Independent thinking and analysis are at the heart of this course.

Note: Special enhanced translators ("better than Google translate") are available, sometimes called "Deep L translators". They are a type of AI. ("Deep L" stands for "deep learning," which is how AIs are trained.) AI-enhanced translators must not be used for your writing assignments in this course.

Work that is plagiarized or AI-generated will receive a grade of 0.0. -

FURTHER INFORMATION

The University's policies concerning Covid-19: https://www.washington.edu/coronavirus/

The University's religious accommodations policy:
https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/