General Education 1066: Rationality
Spring 2024, Tues & Thurs 1:30-2:45; Sever 113
Harvard University

Description: The nature, psychology, and applications of rationality.

Rationality is, or ought to be, the basis of everything we think and do. Yet in an era with unprecedented scientific sophistication, we are buffeted by fake news, quack cures, conspiracy theories, and "post-truth" rhetoric. How should we reason about reason? Rationality has long been a foundational topic in the academy, including philosophy, psychology, AI, economics, mathematics, and government. Recently, discoveries on how people reason have earned three Nobel Prizes, and many applied fields are being revolutionized by rational, evidence-based, and effective approaches.

Part I: The nature of rationality. Tools of reason, including logic, critical thinking, probability, Bayesian inference, rational choice, statistical decision theory, game theory, and causal inference.

Part II: The cognitive science of rationality, including classic research by psychologists and behavioral economists. Is *Homo sapiens* a "rational animal"? Could our irrational heuristics and biases be evolutionary adaptations to a natural information environment? Could beliefs that are factually irrational be socially rational in a drive for individual status or tribal solidarity?

Part III: Rationality in the world. How can our opinions, policies, and practices be made more rational? Can rational analyses offer more effective means of improving the world? Examples will include climate, sports, government, medicine, food, economics, politics, and philanthropy. These topics will be explored with guest lecturers who are both scholars and practitioners in the relevant endeavors.

Instructor:
Steven Pinker
Johnstone Family Professor
Department of Psychology
William James Hall 970
x5-0831
pinker@wjh.harvard.edu

Office Hours:
Thurs, 5-6pm and by appointment. Professor Pinker is happy to meet with any student for any reason. Please send him an email if you would like to set up an appointment or have a question. All emails will be answered within 24 hours.

Lectures:
Tuesday & Thursday 1:30–2:45, Sever 113

Course Web Site:
https://canvas.harvard.edu/courses/129459
This site will contain the class handouts, copies of the lecture slides, assignments, information about sections and exams, and links to relevant sites.

Head Teaching Fellow:
Greg Volynsky, gvolynsky@jd24.law.harvard.edu

Sections:
One 1-hour discussion section. Sections will begin meeting the first week of the semester.

Readings:
1. Pinker, S. 2021. *Rationality: What it is, why it seems scarce, why it matters.* Available at The Coop; used copies are also widely available from online booksellers.
2. Warburton, N. 2007. *Thinking from A to Z.* Available at The Coop.
3. Journal articles, book chapters, Web articles, and online exercises, linked in this syllabus or available on the Canvas site.

Library Systems Consultant:
Librarians from the Harvard College Library System are familiar with the course requirements and will introduce you to the library resources that will help you with assignments. The course liaisons are Kathleen Sheehan ksheehan@fas.harvard.edu and Michael Leach mrleach@fas.harvard.edu.

Requirements and Grading:

Five weekly short (<1 page) assignments, due in section, @ 4 points:	20%
Section participation:	10%
Midterm exam, in-class, March 19:	15%
Capstone project:	
Proposal and justification, due April 11:	10%.
Final project, due May 2:	20%.
Final exam, May 10, 9AM:	25%

Notes on grading:
- The grades of students will be adjusted to equalize the grading policies across TFs; that is, no student will be penalized for having a tougher grader.
- According to program guidelines, Gen Ed courses should be "as rigorous as any other in the college, with commensurate expectations for student workload, class time, and grading." The distribution of grades will be similar to those of other major courses.
- Students whose grades fall close to the dividing line between two letter grades will be given the higher grade if, in the opinion of the TF, they have performed well in sections and assignments.

Accessibility:
Any student needing academic adjustments or accommodations should present a letter from the Accessible Education Office (AEO) and **speak with the Head TF by February 9th**. All discussions will remain confidential.

Stress and Wellness:
Students often experience stress, anxiety, hopelessness, life events, and other disruptions. If you or a friend are struggling, we encourage you to seek support from course staff or on-campus resources.

A. If you are struggling with this course, or just want to chat, I encourage you to visit me during office hours or contact me by email at pinker@wjh.harvard.edu.

B. For general information about mental health in the academic setting, visit the Academic Resource Center (ARC).

C. If you are struggling in multiple classes, unsure whether you are making the most of your time at Harvard, or unsure what academic resources are available at Harvard, you can meet with your academic advisor, proctor**,** or resident dean.

D. Call CAMHS or the 24/7 CAMHS Cares Line at (617) 495-2042 or visit CAMHS (4th floor of Smith Campus Center at 1350 Massachusetts Ave, Cambridge, MA 02138) between 8:30am to 5:30pm to ask questions or make an appointment.

E. For help with getting professional resources, please visit Find Help Now | Counseling and Mental Health Service. For information about other CAMHS resources, see Our Services | Counseling and Mental Health Service. For Peer Counseling, click on the link.

Policies:

Late papers: Weekly response papers that are late will get a grade of zero. Other late assignments will be subject to a late penalty of ten percentage points (about a letter grade) per day. A little arithmetic will show that getting a zero for a response paper, or losing points for an assignment, will have a good chance of lowering your letter grade for the course as a whole.

The late penalty will be waived only in cases of sickness, inescapable conflicts, or other emergencies, and only with a letter from your Resident Dean.

***Academic integrity*:** This course adheres to the university's standards regarding academic integrity. Suspected cheating, plagiarism, or the illegitimate use of generative AI will be referred to the Honor Council of Harvard College, as is required by the university. Students are responsible for knowing what constitutes plagiarism; please refer to the *Harvard Guide to Using Sources* for a detailed description of the different types of plagiarism. This includes all forms of representing work as your own that you did not write or create. Submission of computer-generated text without attribution is also prohibited by the terms of service of the generative AI platforms, such as ChatGPT ("You may not … represent that output from the Services was human-generated when it is not").

***Collaboration*:** You are permitted (indeed, encouraged) to discuss the content of your assignment with other students, and to make suggestions about sources. You are also permitted to show a draft of your work to other students for general feedback about coherence and style (e.g., "This claim doesn't seem to follow logically," or "This paragraph is hard to understand"). You are also encouraged to solicit feedback on writing style, unclear

wording, and errors in spelling, punctuation, and grammar. However, this feedback should consist of the reader pointing out problems to you and offering guidance on how to fix them, including editing one or two paragraphs as an example. But it may *not* consist of another person (including a fellow student, friend, parent, significant other, teaching assistant, tutor, or counselor) reworking or editing your draft by adding, deleting, or rewriting sentences, or by fixing errors in spelling, punctuation, or grammar. Finally, you are *not* permitted to share or divide up the work of finding, reading, and summarizing sources. And you are *not* permitted to collaborate on the planning, researching, or writing of papers with similar content.

Midterm: An absence from the in-class midterm exam will ordinarily be excused only if you are ill on the day of the exam *and* present a signed form from Harvard University Health Services to your House Dean or the Assistant Dean of Freshman, who then provides a letter of excuse to the Head TF. In either case, the Head TF will ensure that you are not penalized for your absence.

Except in highly unusual circumstances, we do not administer make-up exams for other reasons, such as students traveling on the date of the exam. Please check the schedule for your extracurricular activity and ensure that you will be able to take the midterm exam on **March 19.**

Goals of the Course:

Rationality falls within the **Ethics and Civics** category of the General Education requirement.

Here is how Harvard College explains its General Education requirement:

> Focusing on urgent problems and enduring questions, Gen Ed courses are unusually explicit in connecting the subjects students study to the people they will become and the world beyond the classroom. Transcending disciplinary divisions, these courses demonstrate the value of embedding what students will learn in their concentrations within the broader context of the liberal arts.

This course is designed to satisfy all these goals.

Rationality is the quintessential **enduring question**, having been a central topic in philosophy since the ancient Greeks. Today research on rationality takes place at some of the most exciting frontiers of knowledge, including behavioral economics, the psychology of judgment and decision-making, and Artificial Intelligence.

Rationality is an **urgent problem,** as we grapple with an apparent surge of irrational beliefs in popular culture, individual choices, and politics—paradoxically, at the same time that many fields are striving to become *more* rational, including policy (Nudge), crime (Compstat), development aid (Randomistas), sports (Moneyball), reporting (Politifact), polling (538.com), health (Quality-Adjusted Life Years), psychotherapy (Feedback-Informed Treatment), forecasting (prediction markets & tournaments), and philanthropy (Effective Altruism).

I hope to connect rationality to the **people you will become and the world beyond the classroom.** The course will introduce you to tools for rational thinking that have been honed for millennia (including logic, statistics, and game theory), while alerting you to the fallacies, biases, and cognitive illusions that we are all prey to. I hope these will help you to become more rational in your own thinking and choices, and more effective at solving problems in your professional life and at your efforts to improve the world.

This course **transcends disciplinary divisions** with a vengeance. You will be exposed to ideas from philosophy, psychology, computer science, statistics, mathematics, and economics, and how they are being applied to medicine, government, history, journalism, climate science, crime, and philanthropy.

Parts of the Course:

***Lectures*:** You must attend all the lectures; as a rule, recordings of the lectures will not be available. Anything explained in a lecture may be on the weekly assignments or midterm and final exam. We try to back up lecture material with the readings and online resources, but cannot guarantee complete coverage.

We post the Powerpoint lecture slides on the course website, and encourage you to print them out and take notes on them with a pen or pencil, or import them into a tablet-based note-taking program like Notability or Evernote. They are intended to spare you from having to write down every diagram and term mentioned in the lecture; they are not a substitute for attending the lecture and taking notes. Actively taking notes, rather than passively listening, is an important means of learning, understanding, and remembering.

Readings: The readings complement and reinforce the content of the lectures, but neither is a substitute for the other. Unofficial College and Gen Ed guidelines call for 100–200 pages of reading a week. We have kept the assignments well within that range. They include Professor Pinker's bestseller *Rationality,* which is explicitly keyed to the topics in the first two sections of the course, and classic and recent academic articles on each topic. MIT Press's open-access *Handbook of Rationality,* with systematic reviews of many of the topics covered in the course, is an excellent backup.

For students whose curiosity (or confusion) about the subject matter outruns the assigned readings, we have also suggested a variety of online resources, including articles, book excerpts, and Web sites. They are also a good starting point for your capstone project.

While we encourage you to explore related Youtube videos and TED talks, they cannot substitute for the deeper intellectual engagement that comes from reading well-crafted text.

***Discussion sections*:** Also required. The purpose of the section is *active learning* of the content from the preceding week's lecture and readings. Sections give you the opportunity to probe and clarify your understanding of concepts and terms introduced in the lectures and readings**,** to ask questions, and to argue the issues. Sections may include review of problems in the assignments, new problems and exercises, and debate and discussion of the content (some of the course topics are controversial, and you may have opinions on them). Ten percent of your grade will come from section participation. In addition, your Teaching Fellow will get to know you in the sections, will be your main contact with the subject, and will influence your final grade and other decisions.

Weekly assignments. These brief (< 1-page) assignments will be released every Thursday, and may include simple problems, instructions to seek examples of irrationality from the news and everyday life, questions about the readings, and invitations to reflect and respond to the course contents.

Midterm exam. The in-class midterm on March 19 will cover the major "tools of reason," together with research on the psychology of judgment and decision which investigates the degree to which people use them. It will consist of a mixture of multiple-choice and short-answer (1-pgh) questions.

Final Exam: A cumulative exam on May 10, which will cover the tools of reason from the first chunk of the course, the heuristics, biases, illusions, and explanations from the second, and major ideas from each of the applied domains in the third. Like the midterm, it comprises a mixture of multiple-choice and short-answer questions.

Capstone Project. Here's where you put it all together and make the course relevant to your intellectual, political, and professional passions. We will ask you to select a national or global problem, assess its impact on well-being, and argue why it is important to address. You will present these analyses in a first submission, due around two weeks before the end of classes. For the final version, submitted at the end of Reading Period, you will explore the problem in depth using the tools of rationality and sources of irrationality covered in the course: why the problem remains unsolved (explaining, if relevant, how cognitive biases and other forms of irrationality may have exacerbated the problem or hindered solutions), how to mitigate or solve it most effectively. These may be taken from the topics covered in the third segment of the course—climate, medicine, war, forecasting, government policy, public health, journalism—or one of your own choosing.

Each assignment will be explained in a more detailed handout and by your TF.

How to Get the Most from Gen Ed 1066:

It would be hypocritical for us to advocate rationality in every walk of life except how best to learn in this very course! Here are some tips on how to get the most from this course, based on our experience with the practices of successful students in the past, and on research in cognitive psychology on attention, memory, and learning.

1. Show up for the lectures. This should be obvious, but many Harvard students treat lectures as optional, hoping to make up what they've missed from handouts, readings, and notes taken by other students. The lectures are not optional.
2. Give the lectures your undivided attention. We do not recommend having a laptop open during the lectures. As the Muppets in the movie trailers point out, it's distracting to the other people in the room, which is why we ask students who feel they must use a laptop to sit in the back four rows. (If you're using a tablet to take notes with a program like Notability, you may sit anywhere.) If you do have a laptop open, turn off your Web browser and email program, and don't turn them on again until the lecture is over. This also may sound obvious, but many people believe in a myth called "multitasking." Research in cognitive psychology shows that the brain is incapable of processing two streams of verbal material simultaneously.
3. Take notes on paper with a pen or pencil, or with a stylus on a note-taking program, rather than by typing into a computer file. Several studies have shown that people remember material better this way, probably because they can more easily use spatial and visual resources of a 2-D page to organize the material, rather than relying only on strings of text. These resources include arrows, circling, underlining, text size, comments on diagrams, and so on. A major reason we provide PDFs of the lecture Powerpoints is so that you can annotate them yourselves; they are not a set of crib notes or a supplementary textbook.
4. For similar reasons, you should take your own notes; the notes of another student will reflect that student's assumptions, background knowledge, habits and styles, and idiosyncratic associations, which can differ dramatically from your own.
5. As you read and study, actively organize the material in your mind; don't try to pound it in through repetition. Make a set of notes; don't use a highlighter. Organize the material hierarchically into a list of ideas, with each major idea expanded into a list of subsidiary ideas. Close the book and see if you can recall the material, as if trying to explain it to someone else. Actually try to explain it to someone else.
6. Distribute your learning over time. Don't cram or binge-read in an all-nighter or a marathon session. When you do, everything will tend to run together in your mind.
7. Aim at a deep understanding of the ideas, not a superficial familiarity with the words and phrases. (The multiple-choice questions in particular try to distinguish these two levels of acquaintance with the material.) Can you paraphrase the material using different words from those in the text, lecture, or reading? As you're reading, do you find yourself muttering, "I *think* I understand this"? If you do, it means you don't understand it.
8. Ask and discuss. If you think you don't understand something, it's not a failing; it's an opportunity to learn it. Ask your fellow students. Ask your TF in section, or during office hours. Ask your professor, after the lecture, during his office hours, or in an email. Follow through with the optional readings, or with readings from the Web or library.
9. Read the assignments carefully. We mean what we say in them, and we grade according to how well the students carry out the terms of the assignments.

Schedule of Lectures and Readings (all unliked articles are available on the Canvas site)

Part I: The Nature of Rationality; Tools of Reason

Tuesday, Jan. 23: Course introduction. Phenomena of rationality and irrationality. Deductive, inductive, practical, and moral reason. Normative and descriptive models. Course content, goals, and expectations. Preview of the guest lecturers.
-*Rationality,* chapter 1, "How Rational an Animal?"

Thursday, Jan. 25: Rationality itself. Why follow reason? Why adhere to objectivity, truth, the existence of a real world? Nonrational versus irrational thoughts. Can morality be grounded in reason? Should we ever be irrational? Possible examples: Discounting the future; Paradoxical tactics; Rational ignorance; Taboo.
-*Rationality,* chapter 2, "Logic and critical thinking"
-Sotala, K. 2010. What cost for irrationality? *Less Wrong,*
-Warburton, N. 2007. *Thinking from A to Z*, "Absurd Consequences" through Gobbledygook."
-Nagel, T. 1997. *The Last Word,* chaps. 1, "Introduction" and 2, "Thought from the Outside."

Other resources:
-Pinker, S. & Goldstein, R. N. 2012. The long reach of reason: An animated Socratic dialogue. TED talk. Professor Pinker and his wife, the philosopher and novelist Rebecca Newberger Goldstein, are turned into cartoons who debate the role of reason in moral progress.

Tuesday, Jan. 30: Logic and logical thinking. Formal logic. Valid and sound arguments. Do humans think logically? Is rationality the same as logic? What is intuition? Wittgenstein, family resemblance categories, fuzzy logic.
-*Rationality,* chapter 3, "Logic and Critical Thinking."
-Warburton, N. 2007. *Thinking from A to Z,* "Humptydumptying" through "Zigzagging." Pay special attention to these entries: Affirming the antecedent; Affirming the consequent; Antecedent; Argument; Assumption; Conclusion; Conditional statements; Consequent; Consistency; Contradiction; Contraries; Deduction; Denying the antecedent; Denying the Consequent; Enthymeme; Family resemblance; Formal fallacy; Iff; *Modus ponens*; *Modus tollens*; Necessary and sufficient conditions; *Non sequitur;* Paradox; Premises; Some/All confusion; Sound argument; Supposition; Validity.

Other resources:
-Priest, G. 2017. *Logic: A very short introduction.* The basics up to the cutting edge in 152 pages. Oxford University Press's "Very Short Introduction" series is an excellent way to learn about almost any subject.
-A collection of tools and mini-courses may be found on the site *Clearer Thinking,*
- *LessWrong.com* is a forum for the "Rationality community," an informal network of bloggers who call attention to biases and fallacies and try to reason more rigorously (sometimes to extreme lengths).
-The *Stanford Encyclopedia of Philosophy* has explanations of just about every concept and topic in philosophy, together with philosophically relevant topics in psychology, economics, and

other fields, written by real philosophers. For this course and for academic work in general, it's more suitable than *Wikipedia.*

Thursday, Feb. 1: Natural and Artificial Intelligence. Will AI make reasoning obsolete? Symbolic computation, constraint satisfaction, neural networks, Deep Learning. How generative AI models like ChatGPT and DALL-E work, and their strengths and weaknesses.
-Pinker, S. 2007. *How the Mind Works.* Chap. 2, "Thinking Machines."
-Olah, C. 2014. Deep Learning, NLP, and Representations.

Other resources:
-Wolfram, S. 2023. What is ChatGPT doing…and why does it work? *Stephen Wolfram Writings*.. A somewhat technical (but still accessible) explanation of how Large Language Models work, by the founder of Mathematica, and author of *A New Kind of Science.*
-Karpathy, A. 2023. Intro to Large Language Models. Well-regarded video introduction. Be sure to expand the text explanation below the video.
-Choi, Y. 2023. Why AI is incredibly smart and shockingly stupid. *TED* talk. Nontechnical, entertaining, by Yejin Choi, an AI star.

Tuesday, Feb. 6: Probability and randomness. Randomness and illusions of non-randomness. A priori versus a posteriori probability. Sampling and the Laws of Large and Small Numbers. Conditional probabilities and their hazards. The gambler's fallacy. The birthday paradox. Poisson processes. The hot-hand fallacy and the hot-hand fallacy fallacy.
-*Rationality,* chapter 4, "Probability and Randomness."
-Hastie, R. & Dawes, R. 2010. *Rational choice in an uncertain world: The psychology of judgment and decision making.* "Appendix: Basic principles of probability theory," pp. 331–356.
- Krämer W. & Gigerenzer, G. How to confuse with statistics. *Statistical Science*, 20 (3), 223-230. A deeper look into conditional probability, why people find the concept difficult, and how to convey it more effectively.

Other resources:
-*Grasple* is an interactive learning site with easy modules on basic concepts in probability and statistics. If you have not taken a course on probability theory, we recommend working through the first five modules on probability: "Probability trees" through "Conceptual understanding of probability rules." You must register for a (free) account. Exercises are essential: in math, you never really understand something until you use it to solve problems.

Thurs, Feb. 8: Bayesian reasoning. Inductive reasoning and Bayes' theorem. Applications. Relevance to scientific and common-sense reasoning. Failures of Bayesian reasoning: Conservatism; Base-rate neglect; Forbidden base rates.
-*Rationality,* Chapter 5, "Beliefs and Evidence (Bayesian Reasoning)
-Gigerenzer, G. 2011. What are natural frequencies? *British Journal of Medicine, 343*, d6386.

Other resources:
-For a different intuitive explanation of Bayes' Theorem, see Yudkowsky, E. 2003. An intuitive explanation of Bayes's Theorem. *Less Wrong.*

--"Bayes rule: Guide." *Arbital.com,* Recommended path: "I want the basics, but I'm also interested in reading more…" For a deeper dive, select "I'd like to read everything."

Tues, Feb. 13: Rational Choice. Axioms of rational choice and Expected Utility Theory. Violations of Expected Utility Theory. Bounded rationality and satisficing. Risk aversion. Intransitive preferences and money pumps.

-*Rationality,* chapter 6, "Risk and Reward (Rational Choice and Expected Utility)"

-Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211*, 453-458.

- Nielsen, K. & Rehbeck, J. 2022. When choices are mistakes. *American Economic Review*, 112, 2237-2268.

Other resources:

- For another introduction to the theories of Rational Choice and Expected Utility, see Briggs, R. A., "Normative Theories of Rational Choice: Expected Utility", *The Stanford Encyclopedia of Philosophy.*

Thurs, Feb. 15: Statistical Decision Theory / Signal Detection Theory. Integrating the costs & benefits of hits, misses, false alarms, and correct rejections into statistical decisions. Sensitivity vs. Response Bias. Applications in engineering, perception, medicine, law. Null hypothesis significance testing and the difference between statistical significance and Bayesian posterior probability.

-*Rationality,* chapter 7, "Hits and False Alarms (Signal Detection and Statistical Decision Theory)"

-Swets, J. A., Dawes, R. M. & Monahan, J. 2000. Better decisions through science. *Scientific American.*

Other resources:

-If you have not taken statistics, we recommend working through the *Grasple* modules "Inferential Statistics—Foundations," "Statistical Tests," "Null-hypothesis statistical testing," "NHST Procedure," and "Statistical significance." If you have trouble understanding the references to probability distribution and density functions, they are explained in the later modules on probability.

-Gray, P. & Bjorklund, D. F. 2014. *Psychology, Seventh Edition.* "Statistical Appendix," pp. A-1–A-9; "Statistical Methods in Psychology," pp. 41–52.

-Another good explanation: Lynn, S. K, & Barrett, L. F. 2014. "Utilizing" signal detection theory. *Psychological Science. 25(9),* 1663–1673.

-For a deeper explanation of the relation between Signal Detection Theory (aka the Neyman-Pearson framework) and Null Hypothesis Significance Testing (NHST), and a scathing critique of NHST as it is practiced in the social sciences, see:
Gigerenzer, G., Krauss, S., Vitouch, O. 2004. The Null Ritual. In D. Kaplan, Ed., *The Sage Handbook of Quantitative Methodology for the Social Sciences.*

Tues, Feb. 20: Game Theory. Game Theory. The Rendezvous Game and Schelling points. Rock-paper-scissors. The Stag Hunt. Chicken. The Battle of the Sexes. The Volunteer's Dilemma. The Prisoners' Dilemma. The Tragedy of the Commons.

-*Rationality,* chapter 8, "Self and Others (Game Theory)"
-Alexander, S. 2012. Introduction to Game Theory: Sequence Guide, particularly Sections 1–6,

Other resources:
-Poundstone, W. 1992. *Prisoner's dilemma: John von Neumann, game theory and the puzzle of the bomb*. A clear and entertaining presentation on game theory and its founder.
-Binmore, K. 2007. *Game theory: A very short introduction.* New York: Oxford University Press.

Thurs, Feb. 22: Correlation and causation. Nominal, ordinal, interval, & ratio scales. Contingencies, comparisons, correlations. Regression to the mean. Simple vs. multifactorial Analysis of Variance; simple vs. multiple regression. Clinical vs. statistical prediction. Main effects and interactions. Randomization, experimental and natural. Causal networks.
-*Rationality,* chapter 9, "Correlation and Causation."
--Pinker, S. 2007. *The Stuff of Thought: Language as a Window into Human Nature,* chap. 4, "Oomph: Thoughts on Causality," pp. 208–218. Available on the Canvas site.
-If you are unfamiliar with regression and correlation, take the Grasple modules "Relations (interval/ratio)" and "Regression."

Other resources:
-The confusion within statistics and science on how to understand causality has begun to change with the groundbreaking work of Artificial Intelligence researcher Judea Pearl. For an older introduction to his work, see his lecture "The Art and Science of Cause and Effect.". For a new, accessible, and comprehensive discussion, see his 2018 bestseller *The Book of Why: The New Science of Cause and Effect,* particularly the introduction, "Mind Over Data," and first chapter, "The Ladder of Causation." Available on Reserve.

Part II: The Cognitive Science of Rationality

Tues, Feb. 27: Heuristics, biases, and cognitive illusions. Representativeness. The Law of Small Numbers. The gambler's fallacy. Base-rate neglect. The conjunction fallacy. Availability. Illusions of risk and danger. Anchoring and adjustment.
-Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*, 1124-1131.
-Slovic, P. (1987). Perception of risk. *Science, 236*, 280-285.
-A poster showing "24 cognitive biases stuffing up your thinking" has been compiled by The School of Thought, and may be found on the Canvas site in large and small sizes. These and other posters and card decks on fallacies and biases may be downloaded from yourbias.is

Other resources:
-Lewis, M. 2016. *The Undoing Project: A Friendship That Changed Our Minds.* This book tells the historical and personal story of the revolution in cognitive psychology and behavioral economics fomented by Amos Tversky and Daniel Kahneman.

Thurs, Feb 29: Human rationality reconsidered. Ecological and evolutionary rationality. Alternative definitions of probability. Random sampling assumption. Assumptions of a stable world. Conversation and implicature.

-Pinker, S. 2007. *How the Mind Works,* chap. 5, "Good Ideas," section on ecological intelligence, pp. 299–306.

- Gigerenzer, G. (1991). How to make cognitive illusions disappear: Beyond "heuristics and biases." *European Review of Social Psychology, 2*, 83-115.

- Kahneman, D., & Tversky, A. (1996). On the reality of cognitive illusions: A reply to Gigerenzer's critique. *Psychological Review, 103*, 582-591.

-Gigerenzer, G. (1996). On narrow norms and vague heuristics: A reply to Kahneman and Tversky. *Psychological Review, 103*, 592-596.

Tuesday, March 5: Political and social bias. Motivated reasoning. Biased evaluation. Cultural and identity-protective cognition. Tragedy of the belief commons. Political ideology and viewpoint diversity.

-*Rationality,* chapter 10, "What's Wrong With People?"

-Duarte, J. L., Crawford, J. T., Stern, C., Haidt, J., Jussim, L., & Tetlock, P. E. (2015). Political diversity will improve social psychological science. *Behavioral and Brain Sciences, 38*.

-Williams, D. 2020. Socially adaptive belief. *Mind and Language, 36*, 333-354. Also available on Canvas.

Other resources:

-Kahan, D. M., Peters, E., Dawson, E. C., & Slovic, P. (2013). Motivated numeracy and enlightened self-government. (Note that in this paper, Kahan disagrees with the Nudge approach of Prof. Sunstein, who is giving a guest lecture on April 2.)

-Braman, D., Kahan, D. M., Slovic, P., Gastil, J., & Cohen, G. L. (2007). The Second National Risk and Culture Study: Making Sense of--and Making Progress In—The American Culture War of Fact. *GW Law Faculty Publications & Other Works, 211*.

Thursday, March 7: Debiasing. Guest lecturer: Carey Morewedge, Professor, Boston University.

-Milkman, K. L., Chugh, D., & Bazerman, M. H. (2009). How can decision making be improved? *Perspectives on Psychological Science, 4(4)*, 379-383.

Please watch the following two videos developed for IARPA (the US Intelligence community research organization) by Prof. Morewedge.

-Video 1: Confirmation bias, bias blindspot, fundamental attribution error

-Video 2: Anchoring, Projection biases, Representativeness

Other resources:

-Professor Morewedge's work is explained in these articles:

Morewedge, C. K., Yoon, H., Scopelliti, I., Symborski, C. W., Korris, J. H., & Kassam, K. S. (2015). Debiasing decisions: Improved decision making with a single training intervention. *Policy Insights from the Behavioral and Brain Sciences, 2(1)*, 129-140.

Sellier, A.-L., Scopelliti, I., & Morewedge, C. K. 2019. Debiasing training improves decision making in the field. *Psychological Science, 30*, 1371-1379.

Tues, Mar. 12 & Thurs, Mar. 14: Spring break.

*****Tuesday, March 19: Midterm exam*****

Part III: Rationality in the World

Thursday, March 21: Rationality and Academic Freedom. Rationales for, components of, threats to, and possible limitations of academic freedom.

-Pinker, S. (2019) Why we are not living in a post-truth era. *Skeptic, 24,3,*.

-Sunstein, C. (2023) Free Speech on Campus? Thirty-Five Questions (And Almost As Many Answers). *SSRN*.

-Haidt, J. (2016) Why Universities Must Choose One Telos: Truth or Social Justice. *Heterodox Academy,* Oct. 22.. Please also read the commentaries on the site by Tomasi, Traldi, Casey, McBrayer, Gonzaels, & Bankston.

Other Resources:

-In response to threats to academic freedom at Harvard, in 2023 Professor Pinker and many of his colleagues founded the Council on Academic Freedom at Harvard. He and Prof. Bertha Madras explained the need for the council in an article in the *Boston Globe,*. In response to the crisis of leadership at Harvard instigated by President Claudine Gay's testimony to Congress in December, 2023, he published a follow-up in the Globe: "A Five-Point Plan to Save Harvard From Itself."

-Students interested in the legal and administrative battles over academic freedom may be interested in the Foundation for Individual Rights and Expression (FIRE). Notably, in their latest ranking of the academic freedom of 248 American colleges and universities, Harvard came in in last place, with a score of 0:

-Students who are interested in political and viewpoint diversity in universities are encouraged to check out Heterodox Academy, "a non-partisan collective of professors, administrators, and graduate students committed to enhancing the quality and impact of research—and improving education—by promoting open inquiry, viewpoint diversity, and constructive disagreement in institutions of higher learning."

Tuesday, March 26: Medicine and public health. Guest Lecturer: Talithia Williams, Associate Professor of Mathematics and Mathematics Clinic Director, Harvey Mudd College.

-Readings TBA.

☐Assigned: Capstone project.

Thursday, March 28: Gambling and bluffing: Poker as a way to enhance thinking and decision making. Guest Lecturer: Maria Konnikova '08, psychologist, author, and poker player. Game theory, subjective probability, cognitive biases, self-control, social trust and con artistry.

As preparation for the lecture and readings, you should be familiar with the game of poker. The place to start is the simplest version of the game, "Five-card draw," explained here; try it with friends, or look for an app or online site (while being aware that online gambling is

illegal in Massachusetts). The most popular version, and the one discussed in the articles, "Texas Hold-em,", is explained here, and may be played online here.
-Harford, T. 2006. The poker machine. *Financial Times.*
-Konnikova, M. 2020. The Hard Truth Of Poker—And Life: You're Never 'Due' For Good Cards. *FiveThirtyEight.*

Tuesday, April 2: Rational governance. Guest lecturer: Cass Sunstein, University Professor, Harvard University.
- Sunstein, C. R. (2011). Empirically informed regulation. *University of Chicago Law Review, 78*(4), 1349-1429.

Other resources:
-Students interested in evidence-based policy, "nudges," and other rational approaches to governance are encouraged to check out Apolitical, "The global learning platform for government,"

Thursday, April 4: Climate, and war. Guest lecturer: Joshua Goldstein, Professor Emeritus, American University, and cowriter of the 2023 Oliver Stone film, *Nuclear Now*. Data vs. stereotypes in the history of war, and in solutions to climate change. Thinking in scale versus thinking in narratives.
-Goldstein, J. 2011. *Winning the War on War: The Decline of Armed Conflict Worldwide.* New York: Dutton. Chapter 2, "The Long-Term Trend: A Trip in a Time Machine, 2011 to Preshistoric Times." On the Canvas site.
-*Nuclear Now*, streamable on Amazon Prime Video, Apple TV, and Vudu.
-Goldstein, J. & Qvist, S. 2019. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow.* Public Affairs. Chapter 7, "Safest Energy Ever," and 8, "Risks and Fears." Canvas.

Tues, April 9: Sports. Guest lecturer: Sig Mejdal, statistician, Baltimore Orioles. Quantifying the subjective; clinical vs actuarial decision-making; "Moneyball" and application to sports.
- Dawes, R. M., Faust, D., & Meehl, P. E. 1989. Clinical versus actuarial judgment. *Science*, 243, 1668-1674.
-Bonabeau, E. 2003. Don't trust your gut. *Harvard Business Review,* May. Read to the end of "Expanding the mind," and the conclusion, "Beyond intuition."
-Lewis, M. 2004. *Moneyball: The art of winning an unfair game,* chap. 4, "Field of ignorance."

Other resources:
-Sig is in town because his team, the Baltimore Orioles, are playing the Red Sox at Fenway Park on April 9, 10, and 11. For fun, go over to Fenway or stream a game on NESN!

☐ Due: Proposal, Capstone project.
Thursday, April 11: Enhancing Rationality through Norms & Institutions. Guest lecturer: Robin Hanson, Associate Professor of Economics, George Mason University, and blogger, *Overcoming Bias*. How to make people more rational. The

"Rationality Community." Rationality and the efficacy of markets and policy. Prediction markets and betting as mechanisms to incentivize collective rationality.
-Arrow, K. J., Forsythe, R., Gorham, M., Hahn, R., Hanson, R., et al. 2008. The promise of prediction markets. *Science, 320*, 877-878.
-Hanson, R. Futarchy: Vote values, but bet beliefs.

Thursday, April 16: Effective altruism and animal welfare. Guest lecturer: David Kay, formerly of Memphis Meats and Upside Foods, now Harvard Business School. Introduction to Effective Altruism, and one of its applications, animal welfare. Philanthropic, technological, and policy solutions.
-MacAskill, W. 2018. Effective altruism. In the *Norton Introduction to Ethics.* On the Canvas site.
-Singer, P. 1971. Famine, affluence, and morality. *Philosophy and Public Affairs, 1,* 229–243.
-Singer, P. 1989. All animals are equal. In T. Regan & P. Singer (eds). *Animal Rights and Human Obligations*. New York: Oxford University Press.

Other resources:
-Klein, E. 2021. We Will Look Back on This Age of Cruelty to Animals in Horror. *New York Times,* Dec. 16.

Thursday, April 18: The psychology and sociology of irrationality. Guest lecturer: Michael Shermer, Founding Publisher, *Skeptic*. Why people believe weird things: UFOs, conspiracy theories, ESP, fake news, Holocaust denial, QAnon, etc.
-Shermer, M. 2023. JFK Blown Away 60 Years Ago Today. *Skeptic,* Nov. 22.
-Shermer, M. 202. Understanding the unidentified. *Quillette,* June 3.
- Wood, M. J., Douglas, K. M., & Sutton, R. M. 2012. Dead and alive: Beliefs in contradictory conspiracy theories. *Social Psychological and Personality Science*, 3, 767-773.

Tuesday, April 23: Rational optimism. Progress and its causes. Skepticism about progress. Dimensions of progress: Life, health, sustenance, prosperity, education. The future of progress.
-*Rationality,* chapter 11, "Why Rationality Matters."
-Pinker, S. 2018. *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress*. chaps. 4 , "Progressophobia," 5, "Life," 8, "Wealth," 15, "Equal Rights," 17, "Quality of Life," 20, "The future of progress."

Other resources:
-Students interested in seeing dynamic data visualizations and explanations of global and national data relevant to progress are encouraged to visit these Web sites:
-*Our World in Data*. This is the most comprehensive and rigorous of the sites. Its explanations of the sources of data and the history and causes of the trends are extraordinarily good. This site is highly recommended as a starting point for your capstone project.
-*Human Progress*. This one is less extensive and more political, advocating rational optimism from a libertarian viewpoint. It has some data sources that are not on *Our World in Data,* together with regularly updated posts on new examples of progress, and colorful histories of pioneers of progress.

-The late Hans Rosling was a TED star for his stunning data visualizations and witty commentaries on human progress and people's misconceptions about it. Some of his talks are collected here. Rosling's visualizations were done in collaboration with his son Ola and daughter-in-law Anna Rosling Rönnlund, who continue his work. Their Web site *Gapminder* is another excellent resource, as is their recent bestseller *Factfulness.*

-*Future Crunch* by Angus Hervey is the best of several new sites devoted to counteracting the gloom and pessimism of the news by presenting positive and constructive developments in the world. In a similar vein, ex-Talking Head David Byrne has founded a site called Reasons to be Cheerful.

☐ **DUE May 2: Capstone project.**
☐ **Final Exam, May 10, 9AM.**