Are Humans Rational?

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1 General Orientation

1.1 Driving Thesis

The Aristotelian dictum that we are *rational animals* is under severe attack these days. In fact, the previous sentence may be to seriously understate the situation: the dictum is perhaps outright rejected by many, if not most. From psychologists of reasoning and decision-making to behavioral economists to the “new atheists” (all groups whose message we will consider in this class), the onslaught is firmly underway, and fierce. Yet this course revolves around a defense of the proposition that Aristotle, modernized along Leibnizian, Piagetian, and Bringsjordian ×2 lines, is right. This proposition, put a bit more precisely, is:

\[ \mathcal{R} \quad \text{Humans, at least neurobiologically normal ones, are fundamentally rational, where rationality is constituted by certain logico-mathematically based reasoning and decision-making in response to real-world stimuli, including stimuli given in the form of focused tests; but mere animals are *not* fundamentally rational, since, contra Darwin, their minds are provably, fundamentally, qualitatively inferior to the human mind. As to whether computing machines/robots are fundamentally rational, the answer is also “No.” For starters, if } x \text{ can’t read, write, and create, } x \text{ can’t be rational; neither computing machines/robots nor non-human animals can read nor write nor create; ergo, they aren’t fundamentally rational for this reason alone. But the news for non-human animals and computing machines/robots gets much worse, for they have not the slightest chance when they are measured against } \mathcal{H}. \]

And here’s \( \mathcal{H} \) set out provisionally:

\[ \mathcal{H} \quad \text{Humans have the ability to gain knowledge by reasoning (e.g., deductively) quantificationally and recursively over abstract concepts, including abstract concepts of a highly expressive, including infinitary, nature, expressed in arbitrarily complex natural language.} \]

1.2 Rapid Example

For a rapid example\(^1\) of some of the stimuli to which \( \mathcal{R} \) refers:

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**Amtrak-to-Princeton J-L Problem**

Suppose that the following two statements are true:

1. Everyone likes anyone who likes someone.
2. Abigail likes Bruno.

Does it follow deductively that everyone likes Bruno? Prove that your answer is right!

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1.3 Notice: ‘Fundamentally’

Notice that the adverb ‘fundamentally’ is used repeatedly in \( \mathcal{R} \). This means, among other things, that humans are potentially rational. What humans need in order to reason and make decisions in the relevant ways, we (i.e., S & A) further claim, is sustained study of the relevant logic and mathematics, and an ability to use what one has studied in order to reason and decide correctly in response to the aforementioned stimuli. In the course of our defense, we’re going to supply at least some of the relevant logic and mathematics to you. Hence, as you receive and judge our case, we believe that you will move some distance from being merely fundamentally rational to being presently rational. We also believe it’s fair to say that the primary purpose of an undergraduate education is to markedly increase the level of reasoning and decision-making power that constitutes being presently rational.

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\(^1\)Provided long ago on Amtrak to Selmer by Professor Yingrui Yang, who relayed it from Professor Johnson-Laird.
1.4 A Disclaimer!

Please note that guest lecturers other than A Bringsjord should not be assumed to have affirmed anything like the claims $\mathcal{R}$ and $\mathcal{H}$ issued above. This thus applies specifically to TAs Rini Palamittam and Ankur Peshin, and RAIR-Lab researchers Kevin O’Neill, Atriya Sen, and Rikhiya Ghosh (see §1.6). As to what these thinkers hold in connection with $\mathcal{R}$ and $\mathcal{H}$, that is an open question. You are free to inquire.

1.5 Context: A Research University

You have wisely decided to attend a technical research university, with a faculty-led mission to create new knowledge and technology in collaboration with students. RPI is the oldest such place in the English-speaking world; it may know a thing or two about this mission. The mission drives those who teach you in this class. The last thing we want to do is simply convey to you how others answer the driving question that gives this class its name.\footnote{Calls by various people in the U.S. to suppress/minimize the research role of faculty is self-refuting, at least within the setting of a research university, because since all fields advance by way of cutting-edge research and innovation taking place at such institutions, and since these advances and the fruit produced by them must be taught, any suppression/minimization of the research role of faculty at research universities is by definition to compromise teaching itself. In short, the only antidote to teaching old and stale material is to infuse teaching with the creation of new material, preferably by the teacher in question, in collaboration with his/her students.}

As should be obvious by now, we think we have correct answers to the driving question, and are working hard to explain them, specify them formally, and disseminate them. We’ll tell you objectively what other thinkers say, but we’re going to tell you that, at least for the most part, they’re wrong. You can judge whether our arguments are sound or not. And you should start to develop your own individual answer, which may well be different than ours. You should seek to defend your answer, and will indeed be asked to do so in this class. For purposes of evaluating your performance, it matters not a whit what your positions are; what matters is your understanding of the technical material presented, and the quality of your reasoning given in defense of your positions on the topics covered.

1.6 Graduate Teaching Assistants; Further Help

The TAs for this course are: Rini Palamittam; email address: palamr@rpi.edu; and Ankur Peshin; email address: peshia@rpi.edu. Rini will hold office hours on Thurs 145–345 at TBA, and by appointment. Ankur will hold his office hours on Fri 230–430 at TBA, and by appointment. Additional assistance will be provided by RAIR-Lab researchers Kevin O’Neill (re. The Lottery Paradox), Atriya Sen (re. both The Lottery Paradox & The Paradoxes of Time Travel), and Rikhiya Ghosh (re. NLP & computational linguistics). Please note again §1.4.

2 Prerequisites

There are no formal prerequisites. However, this course covers parts of such things as formal deductive logic, formal probabilistic logic, game theory, etc. This implies that — for want of a better phrase — students are expected to have a degree of “mathematical maturity.” At RPI, this expectation is quite reasonable.\footnote{To be a bit more specific, the logico-mathematics alluded to in claim $\mathcal{R}$ can be partitioned into three general areas: analysis and continuous mathematics (A1); deductive formalisms, systems, and techniques (A2); and inductive/statistical/probabilistic formalisms, systems, and techniques (A3). Because of the nature of RPI’s requirements for a BS, A1 is generally already covered in other classes (e.g. calculus). The emphasis in the present class is on (introductory elements of) areas A2 and A3. Please be aware that some available coverage of the formal material associated with systematic coverage of rationality is (irrationally) restricted to only formalisms commonly associated with micro-economics. An example is the book \textit{Rational Choice} (2010) by Itzhak Gilboa — a nice book, certainly, and one I will refer to later, but a very narrow one in the context of our class here at RPI.}
3 Texts/Readings

In-class lecture, discussion, and debate deliver the crucial content; indeed, the primary content to be learned is obtained in class. (Assuming that things go according to plan, all lectures will be recorded, and will be available for review to all students.) Attendance is required and will be taken, and note-taking is key. Sometimes slides will be distributed by posting on the course web page. Most readings will be electronic, and either distributed by email, or can be obtained by url. As a first example, students should read (Baker 2013) asap, since it (we claim) represents a stark example of an implicit denial of $\mathcal{R}$ and $\mathcal{H}$. As to books, it’s required that students purchase and read Kahneman’s (2013) Thinking, Fast and Slow.

There is also a recommended book, available online, from which S Bringsjord will sometimes draw. For anyone serious about the study of rationality at the human level, the book in question is an absolute must read. The book in question is Robert Nozick’s (1993) The Nature of Rationality. It’s available as a pdf online at here. Of course, in this day and age, there’s a lot more available online that’s relevant to the present course, and as we proceed, links will be provided. In the schedule which follows, some links to readings are provided.
4 Schedule

4.1 Setting the Stage

- **Aug 31**: General Orientation, Logistics, Mechanics. The syllabus is reviewed in detail. It’s made clear to students that there is a very definite position (viz., $R$ and $H$) advocated in the class, and that content from the formal sciences will be presented at a fast pace. Students who, upon learning about the nature of Are Humans Rational?, find that it’s not their cup of tea, are encouraged to make a change in their schedule before next class.

- **Sep 4**: No Class (Labor Day)

- **Sep 7**: Main Claims $R$ and $H$ Presented and Initial Discussion Stage I, via Overarching Picture. Humans, despite recent claims to the contrary, are rational: more specifically, $R$, which is the main claim. Rationality consists in cognition that conforms to relevant logic & mathematics, in the face of tests. Piaget was fundamentally correct that humans are fundamentally logical. The methods and anti-$R$ claims of “disparaging” psychology of reasoning and decision-making are irrational and should be rejected. Corollary: Claims, such as N Baker’s, that algebra should be optional, with all of mathematics, if heeded, would doom people to a pre-rational phase — which obviously would be a very bad thing. It would also doom them to disemployment by machines.

4.2 The Attack from Failures of Deductive Reasoning

- **Sep 11**: Now we move to Stage II in the presentation of the overarching picture, and defense and discussion thereof. Review and Expansion of “Main Claims Presented.” Then: The Original, Classic Shots at Piaget (from Wason, Johnson-Laird, etc.). This includes the Wason Selection Task and the THOG Problem, e.g.

- **Sep 12**: Recent Shots @ Piaget (& @ Aristotle too). The shots are warded off.

- **Sep 14**: Additional Recent — & More Elaborate — Shots. These shots too are rendered impotent.

4.3 The Attack from Failures of Probabilistic Reasoning

- **Sep 18**: Probabilistic Logic/Entailment. Kolmogorovian axioms sets “declarativized.” Normative correctness characterized with help from the basic Venn-Diagram approach, in so-called ‘probability logic.’ Also presentation, in miniature, of uncertainty calculus to be used later in conjunction with Lottery Paradox and St Petersburg Paradox. Does the Monty Hall Problem show that humans are irrational? And in the next two classes, we deflate, in his sequence, Nobelist (economics) Kahneman’s four main attacks on rationality:

  - **Sep 21**: Linda, Heuristics, & Logic. Reading from Kahneman must be studied beforehand. We present a new theory of “narratological” reasoning that explains why so many humans fail to correctly solve Linda-style probability problems. This is (ironically) connected to Humans are Underrated.

  - **Sep 25**: Overconfidence in “Professional” Investors; the Efficient Market Hypothesis. Reading from Kahneman must be studied beforehand. Bad Choices, Framing Effects, Prospect Theory. The case of Jim Simons is considered.

  - **Sep 28**: Test #1: Basic Machinery of Rationality (from areas A2 & A3; see footnote 3.)

4.4 Rational Response to the Threat of “Demonic” AI/Robots


- **Oct 5**: The Singularity. The claim that machines with superhuman intelligence will before long suddenly arrive is debunked. Evaluation of the original argument for The Singularity by Good. CRA and irrational fearlessness. AlphaGo, SchmalfaGo. How hard are these games — compared to other things humans do? • Bi-Pay Auction and Setup for Simon

- **Oct 9**: No class: Columbus Day — but the next day, Tues, is Mon schedule; hence:

  - **Oct 10**: Guest lecture by Rini on the prematurely terminated history of the quest for the “deep Alification” of companies, and prospects for reviving Herbert Simon’s dream of doing so.

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4See also for the argument Chaps. 15 & 16 in (Nozick 1989).
• Oct 12: The MiniMaxularity, & Human Disemployment. Fears about The Singularity are irrational, but if we calmly focus on what we know is coming from AI, there’s reason to be concerned — despite what sanguine economists tell us. What should we then do? The distinctive (Descartes was right!) human power for: general problem-solving, robust language, creativity. Background reading is: (Bringsjord & Bringsjord forthcoming). There will also be coverage of Arrow’s Impossibility Theorem, democracy, and rational moves to be made at the government level in light of the MiniMaxularity.

• Oct 16: Making Morally X Machines (and Robots). We here consider a proposal for a rational, measured response to the concern on the part of the likes of Musk, Hawking, and Bostrom that autonomous machines pose an “existential” threat. The response is to engineer machines and robots that are ethically correct! This class provides an overview of the “Making Morally Competent Robots” MURI project at RPI, sponsored by the Office of Naval Research.

• Oct 19: Test #2: short essay questions, some of which call for issuing and defending a non-trivial claim.

4.5 The Paradoxes

• Oct 23: Why study paradoxes? (In a word, because they focus the mind in the direction of careful, rigorous, rational thought.) We begin with The Liar & Russell’s Bogus Barber. But then we shift to the The Knowability Paradox, and see whether a robot can navigate its turbulent waters.

• Oct 26: Newcomb’s Problem (original and Stalnaker’s cancer variation).

• Oct 30: The Lottery Paradox — or how a lottery almost led to a divorce for Selmer. This paradox is solved with RAIR-Lab technology! One solution provided by RPI-undergrad Kevin O’Neill — with some inspiration & help from the late John Pollock; a different solution, albeit in the same spirit, provided by Selmer Bringsjord. Can the St. Petersburg Paradox be solved as well? Yes!

• Nov 2: The Paradoxes of Time Travel (grandfather paradox and looping painter). A key component of the discussion is Gödel’s gift to Einstein: a proof that time travel (backwards) is possible.

4.6 Darwin’s Dumb Ideas

• Nov 6: Descent into Error & Veneration of the Dog. Wallace’s argument. Why Darwin would’ve flunked Logic 101 in light of his reasoning about human vs. non-human reasoning in his Descent of Man (Darwin 1997). Note: This isn’t Origin! That’s different, and a masterpiece.

• Nov 9: The great divide between human vs. non-human reasoning and problem-solving. This class includes an analysis, formalization, and discussion of the Penn et al. (2008) BBS paper “Darwin’s Mistake,” available at here. We also consider whether fish are so smart that maybe we should adjust our behavior toward them. The book What a Fish Knows (Balcombe 2016) is evaluated.

4.7 And What AIs? Can They Talk?

• Nov 13: The Marvel That is Human Linguistic Ability. Analysis and discussion of linguistic divide between humans vs. nonhuman animals (and we refer again here to PHP’s paper), and humans vs. contemporary AIs. Chimps can’t talk, and so Chomsky was right — and listening to him could’ve saved a lot of money. With the advent of Siri, Alexa, various chatterbots, etc., is there now reason to think that machines are closing the gap with us in the area of natural-language communication? Does AI translation technology likewise show that the gap is closing?

• Nov 16: Story Generation. Can machines, as is claimed in Humans are Underrated (Colvin 2015), generate stories at the level of what humans do in this regard?

• Nov 20: The Astonishing Hardness of First Language Acquisition. This is an optional class. There will also be a sober assessment of today’s “machine learning” techniques and technology, including “Deep Learning.” Are machines really and truly learning? Or is there just a lot of hype?

4.8 The Attack on Rationality From “New” Atheism

• Nov 23: No Class (Thanksgiving Recess)

• Nov 27: Rash Russell; Hapless Harris. Breaking Dennett’s (Dennett 2007) Breaking the Spell. Focus includes Dennett’s argument from inconsistency of the union of religious claims. Is religious belief irrational?

4.9 Steeple of Rationalistic Genius: Gödel

• Nov 30: Gödel’s Completeness Theorem and the Long Island Rail Road. Excerpted from Gödel’s Great Theorems. (We will already have visited Gödel’s Time Travel Theorem, recall.)
• **Dec 4**: Return of The Liar: Gödel’s Incompleteness Theorem. Excerpted from *Gödel’s Great Theorems*. We begin by taking stock of Hilbert’s 1920 lecture, in which he set out the great problems for future mathematicians to tackle.

• **Dec 7**: The Continuum Hypothesis, and Gödel’s Greatest Theorem. Excerpted from *Gödel’s Great Theorems*.

• **Dec 11**: **Test #3**: short essay questions, *each of which calls for issuing and defending a non-trivial claim.*
5 Grading

Test #1: 15%. Test #2: 20%. Test #3 (= Final): 25%. Paper: 20%. (The logistics of the paper will be explained later. It will be done in two submissions. The first submission will receive feedback and a tentative grade. A final version will be submitted that takes account of the feedback. The paper must be a direct attack on a claim and supporting argument of S Bringsjord’s.) Class Participation: 20%. Test #1 will have few to no essays, as it will be focused on technical material. Tests #2 will have some combination of multiple-choice, short-answer, and short- and medium-sized essay questions. Test #3, which is not cumulative, will have only essay questions. In the case of essays in which you must articulate and defend a determinate, non-trivial claim, you will need to give an argument for your claim, and at least one serious objection must be rebutted. Hard-working students with the aptitude of those admitted to RPI have it within their power to receive an A in this course.

6 Some Learning Outcomes

There are three desired outcomes.

- **O1** Students will understand the covered arguments against the theses \( R \) and \( H \).
- **O2** Students will understanding the main covered Bringsjordian arguments and counter-arguments in favor of the thesis that (i) humans are fundamentally rational (\( = \) in favor of \( R \)), while (ii) non-human animals and computing machines/robots aren’t.
- **O3** Students will understand, to a significant degree, the relevant logico-mathematical terrain on which debates over the driving question take place (e.g., propositional calculus, first-order logic, basic modal logic, probability logic, game theory, decision theory, etc.). See again footnote 3.

7 Academic Honesty

Student-teacher relationships are built on mutual respect and trust. Students must be able to trust that their teachers have made responsible decisions about the structure and content of the course, and that they’re conscientiously making their best effort to help students learn. Teachers must be able to trust that students do their work conscientiously and honestly, making their best effort to learn. Acts that violate this mutual respect and trust undermine the educational process; they counteract and contradict our very reason for being at Rensselaer and will not be tolerated. Any student who engages in any form of academic dishonesty will receive an F in this course and will be reported to the Dean of Students for further disciplinary action. (The *Rensselaer Handbook* defines various forms of Academic Dishonesty and procedures for responding to them. All of these forms are violations of trust between students and teachers. Please familiarize yourself with this portion of the handbook.)
References

URL: https://harpers.org/archive/2013/09/wrong-answer


URL: http://kryten.mm.rpi.edu/SBringsjord_review_PThagard_TBTMOL.pdf

URL: http://kryten.mm.rpi.edu/SBringsjord_ABringsjord_SingularityBiz_0915151500.pdf


