INSTRUCTOR
Dr. Nicholas Ray (nmray@uwaterloo.ca)
Office: Hagey Hall, 322
Hours: Mondays, 9:00-10:30a (or by appointment)

COURSE DESCRIPTION
Intelligence is the capacity to learn, understand, reason, act, and manage other mental functions. This course will be a historical and thematic study of how those working in the sciences of mind (psychology, neuroscience, anthropology, artificial intelligence development, computer science, philosophy of mind/cognition, linguistics, and mathematics) have thought about intelligence. The study will be a comparative one, with a focus on the kinds of minds that exist, their nature, how these minds are physically realized and situated in an environment, and how we might work to design better (or at least different!) kinds of minds.

One focus will be human intelligence, especially in the contexts of linguistic communication, problem solving, decision-making, emotionality and creativity. But we will also examine minds that – due to no fault of their own – are more closed off than the typical human mind. This includes a study of animals and of artificial intelligence. We will talk about intelligence in animals as diverse as jellyfish, octopuses, fish, birds, dogs, dolphins, and non-human primates (monkeys, gorillas, and especially bonobo chimps). When it comes to machines, we will focus on the development of computer intelligence in IBM’s Watson, self-driving cars, Siri, game-playing agents like Rosie, Google translate, and others. Along the way, we will keep this non-exhaustive list of questions in mind to guide us:

• What is intelligence? How is it studied? Can we make intelligent machines?
• Is the mind a computer? If so, what kind of computer? What is the nature of computation?
• What differences and similarities are there between cognition in humans and non-human animals?
• How important is language to thinking and intelligence? Do some animals have language, or just a sophisticated form of communication?
• What is the role of emotion in intelligence? Is emotion essential to being intelligent?
• What are the ethical implications of encountering other kinds of minds? Do animals and AI have moral status? Should they have legal status? Should we be protected from AI?
• Can animals or AI be moral?
• How might we be biased to think of intelligence as a particularly human possession?
• What is the nature of creativity and creative genius?
INTENDED LEARNING OUTCOMES

The hope is that everyone learns about how the mind works, how intelligence might be characterised, and how it might be found in various kinds of minds. However, we also hope to achieve some learning outcomes not specifically tied to course content, including critical reading and writing skills, the development of peer evaluation skills, and debate and discussion skills. By the end of this class, students should be able to

1. **Apply** the theoretical ideas we encounter to concrete examples of intelligence.
2. **Learn and utilise** the key ideas and specific terminology of the different disciplines that study the mind.
3. **Offer** a theoretically informed definition of intelligence, and **defend** it against likely criticisms
4. **Critically assess** the reasons that sceptics and enthusiasts provide for their beliefs as regards non-human intelligence.
5. **Seek connections** between the descriptive study of the intelligent mind and more normative questions regarding the development and treatment of other intelligences, including animal rights and machine rights.
6. **Hone your writing and research skills.**
7. **Hone your peer evaluation skills.**

WHAT YOU MUST DO TO SUCCEED

1. **Attend classes**, and **do the readings**. Nick will be posting lecture material when it is possible to post it, but many of our meetings will not have a traditional lecture component. Because much of the course will be focussed on discussion, as a class or in smaller groups, much of your grade, and how you will perform on the writing assignments, relies on regular attendance and participation.
2. **Be critical but fair** when dealing with ideas that are coming from a different perspective from your own. There are different disciplinary ways of talking about the mind, and we have to meet each other half way.
3. Be willing to **clarify** your views using course concepts and terminology, especially in light of peer criticism.
4. **Engage in criticism and debate**. Treat your interlocutor with respect, and apply the principle of charity. Also, expect the same from your interlocutor. We want to be humble in the process of knowledge-production. We are all fallible, and we are all part of a community of inquirers that can help limit the deleterious effects of bias and unclear thinking.

LEARN (COURSE WEBSITE)

LEARN is the main mode of communication for this course after lecture and e-mail. Nick will be posting lecture materials, announcements, any possible changes to the reading schedule, the readings themselves, and grades via LEARN. Students will also be submitting their written work to LEARN dropboxes, the feedback for which will also be published through LEARN. Because LEARN is so important, students are strongly encouraged to regularly access the site.
ASSESSMENTS AND DUE DATES

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Due Date</th>
<th>Page Length</th>
<th>Value</th>
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<tbody>
<tr>
<td>Participation</td>
<td>Ongoing</td>
<td>NA</td>
<td>15%</td>
</tr>
<tr>
<td>Reading Reflections</td>
<td>First 3 by Oct. 19;</td>
<td>2 short paragraphs</td>
<td>3% x 5 = 15%</td>
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<tr>
<td></td>
<td>Remaining 2 by Dec. 3</td>
<td></td>
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</tr>
<tr>
<td>Media Analysis</td>
<td>October 26</td>
<td>4 pages</td>
<td>15%</td>
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<tr>
<td>Project Proposal I:</td>
<td>Nov. 12, 14, and 16</td>
<td>NA</td>
<td>5%</td>
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<tr>
<td>3-Slide Presentation</td>
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<tr>
<td>Project Proposal II:</td>
<td>Nov. 18</td>
<td>1-2 pages</td>
<td>10%</td>
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<tr>
<td>Formal Proposal</td>
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<tr>
<td>Term Project</td>
<td>Dec. 12</td>
<td>8-10 pages</td>
<td>40%</td>
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All late submissions will be penalized 10% of the assignment value per day, including weekends, holidays, and part days.

ASSESSMENT DESCRIPTIONS

Participation: There will be lots of class discussion. We will have relatively unstructured discussion while talking about material on Mondays and Wednesdays, and then usually more structured discussion on Fridays (which you can think of as a kind of tutorial). Students are expected to be at every meeting, and are expected to engage in class discussion regularly. You needn’t say something every lecture, but your contributions should be frequent and of a very high calibre – always respectful and focussed on moving class discussion forward! There will also be some group exercises and discussions throughout term, so students will have opportunities to contribute in smaller groups if they feel uncomfortable speaking in front of the whole class.

Reading Reflections: These reflections will be comprised of two short paragraphs. They can be based on assigned readings, or material (popular or scholarly) related to the content of the assigned readings. The reflections should do 2 things: (1) identify the piece, situating the reader with a brief overview of the content of the piece on which you are reflecting, and (2) offer a critical comment or two, showing your reader you have given the issue some thought, exemplifying course themes.

Media Analysis: You will go out and find a popular media piece (from a newspaper, periodical, scientific magazine, respected blog, etc.) regarding non-human intelligence (animal or artificial). You will see some examples of these popular sources earlier on in the term as readings. You will then analyze the piece using relevant, scholarly course content—usually a specific course reading that addresses the issue. How are human and non-human intelligence addressed? Is the piece sceptical about non-human intelligence? How might the piece be improved given the scholarly work we have discussed in the first half of the course?
Proposal Round 1: you will develop a 3-slide presentation that you can perform in 3 minutes. A lottery will be held to decide the order of presentations. The presentation should (1) identify the problem or question to be addressed, (2) indicate what course material (and any external material) will be useful to the discussion, and (3) state your tentative thesis regarding the research you have done. Peer discussion will follow.

Proposal Round 2: This will be your formal plan of attack for the Term Project. Nick expects to see a working introduction that presents an interesting problem related to course material. You will also provide a skeletal outline for how you think the project will proceed, and an annotated bibliography including all relevant course material and at least two external sources.

Term Project: This is a major essay that you will have been developing since approximately the mid-point of the term. You will utilise lessons learned on the Reflections, Media Analysis, and the Proposal processes to craft a paper that explores one of several questions to be provided to you well in advance of the due date. If students prefer to explore a question of their own devising, or pursue a project that is not a traditional essay, then they should talk to Nick about their interests in advance.

ELECTRONIC DEVICE POLICY
You may use a laptop or a tablet functioning as a note-taking device. Please put phones away. If you are found to be using your device for non-course related activities, you may be asked to leave. If you don’t have any accessibility concerns, it is also best to move to the sides or the back of the room so your screen is not a distraction to other students.

E-MAIL ETIQUETTE
Professors don’t like checking unnecessary or improperly formatted e-mails. Nobody does. So what can students do to avoid sending them?

1. Make sure your question isn’t easily answered by the syllabus or assignment handouts! These are detailed documents, so read them thoroughly.
2. All e-mails should include your name and “Intelligence” OR “Phil 356” in the subject heading. This will ensure they don’t get lost. Leave 48 hours for reply.
3. Think before sending any longer e-mails dealing with substantial content. Save your questions for class discussion (where you get participation grades), or stop by during office hours for an extended chat.

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**TURNITIN**
Text matching software (Turnitin®) will be used to screen assignments in this course. This is being done to verify that use of all material and sources in assignments is documented, but also to help you learn how to properly cite the work of others, how not to use too much quoted material in your papers, and how to strike that right balance between careful exegetical work and novel contributions in your writing. Students will be given an option if they do not want to have their assignment screened by Turnitin®. In the first week of the term, details will be provided about arrangements and alternatives for the use of Turnitin® in this course.

**COURSE MATERIALS**
Primary texts will be made available as PDFs or as links to online content on LEARN. There are some very good textbooks, should you want to go back and fill in some gaps in your background knowledge. These are not in any way required. I recommend the four books listed below, but there are many other great sources. The first three were written about 20 years ago, which will give you the background knowledge you might desire for more contemporary debates (which will be our focus for the bulk of this class). The Thagard resource is of very recent vintage.

4. Thagard, Paul. *Brain-Mind: from Neurons to Consciousness and Creativity*, draft 4. (Available as an internet resource on the author’s home-page. If you have troubles finding it, just let me know.)

**TENTATIVE SCHEDULE**
The following is our plan for the term, but things might change. Students are expected to show up to class regularly so that they can know where we are in course discussions. Based on student interest, we might spend longer on some issues than others, so there is never a guarantee that we will be talking about these exact issues on these exact dates.

**Sept. 7: Welcome and Introduction**
**Mapping intelligence using interdisciplinary tools**
1. Thagard, “Chapter 1: What Are Minds?” from *Brain-Mind*
2. Dennett, “What Kinds of Minds Are There?”

**Sept. 10, 12, and 14: The Psychology of Intelligence**
**What is intelligence, and how do we measure it?**
1. APA Report on Intelligence
2. Gardner et al., “Theory of Multiple Intelligences”
Sept. 17, 19, and 21: Foundational Issues
What are our concepts of MIND and INTELLIGENCE; where did they come from?
1. Aristotle, “Part III” of De Anima (On The Soul)
2. Descartes, “Part 5” of Discourse on Method

Sept. 24, 26, and 28: AI and the Turing Test, Part I
The bar for non-human intelligence is human intelligence
1. Turing, “Computing Machinery and Intelligence”
2. Graham and Dowe, “Turing Test, Section 5: Alternative Tests” (SEP)

Oct. 1, 3, and 5: AI and the Turing Test, Part II
Are minds really just programs?
1. Searle, “Minds, Brains, and Programs”
2. Paul and Patricia Churchland, “Could a Machine Think?”

Oct. 8 and 10: Thanksgiving and Study Break

Oct. 12 (following a Monday schedule): AI and the Turing Test, Part III
1. Epstein, “The Empty Brain”

Oct. 15, 17, and 19: The Frame Problem in AI
What are the logical problems of programming AI to act?
1. McCarthy and Hayes, “Some Philosophical Problems from the Standpoint of Artificial Intelligence”

Why create other kinds of minds? There are already plenty…
1. Ristau, “Cognitive Ethology”
2. Davidson, “Rational Animals”
3. de Waal and Ferrari, “Towards a Bottom-Up Perspective on Animal and Human Cognition”
4. Optional: de Waal, “Darwin’s Last Laugh”

Oct. 29, 31, and Nov. 2: Animals and Language
Do animals have the capacity for language and complex thought?
2. Hauser, Chomsky, and Fitch, “The Faculty of Language”
3. VIDEO: Mark Pagel TED Talk, “How Language Transformed Humanity”
4. VIDEO (Time Permitting): Project Nim
Nov. 5, 7, and 9: Animal Intelligence and Animal Morality
What is special about human morality vs. primate morality?

1. VIDEO: Frans de Waal TED Talk, “Moral Behaviour in Animals”
2. Finlay and Workman, “Human Exceptionalism”
4. Henriques, “On Human Exceptionalism” (a response to Bekoff)

Nov. 12, 14, and 16: 3-Slide Presentations

Nov. 19, 21, and 23: The Ethics of AI and Transhumanism
Should we be worried about AI? Might AI morality be an improvement?

1. Bostrom and Yudkowsky, “The Ethics of Artificial Intelligence”
2. Peters, “Machines, Animals, and Aliens: Horizons of Incommunicability”
4. Optional: Ellison, “I Have No Mouth, and I Must Scream”

Nov. 26, 28, and 30: Creativity and Intelligence
What does it mean to be a creative genius? I don’t know… I’m just a regular genius

1. Boden, excerpts from The Creative Mind
2. Thagard, Chapter 11, “Creativity” from Mind-Brain

Dec. 3: Emotion and Intelligence
Does being intelligent require us to feel?

1. Interview with Antonio Damasio by Jason Pontin, MIT Technology Review
2. Scheutz, “Artificial Emotions and Machine Consciousness”

Cross-Listed Course
Please note that a cross-listed course will count in all respective averages no matter under which rubric it has been taken. For example, a PHIL/PSCI cross-list will count in a Philosophy major average, even if the course was taken under the Political Science rubric.

Academic Integrity and Discipline

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility. See the Office of Academic Integrity webpage for more information.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for his/her actions. Check the Office of Academic Integrity for more information. A student who is unsure whether an action constitutes an offence, or who needs help in learning how
to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline. For typical penalties check Guidelines for the Assessment of Penalties.

**Grievances and Appeals**

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department’s administrative assistant who will provide further assistance.

**Appeals:** A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 - Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 - Student Appeals.

**Accommodation for Students with Disabilities**

**Note for students with disabilities:** The AccessAbility Services office, located on the first floor of the Needles Hall extension (1401), collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AS office at the beginning of each academic term.

**Mental Health Support**

All of us need a support system. The faculty and staff in Arts encourage students to seek out mental health supports if they are needed.

**On Campus**

- Counselling Services: counselling.services@uwaterloo.ca / 519-888-4567 ext 32655
- MATES: one-to-one peer support program offered by Federation of Students (FEDS) and Counselling Services
- Health Services Emergency service: located across the creek from Student Life Centre

**Off Campus, 24/7**

- Good2Talk: Free confidential help line for post-secondary students. Phone: 1-866-925-5454
- Grand River Hospital: Emergency care for mental health crisis. Phone: 519-749-433 ext. 6880
- Here 24/7: Mental Health and Crisis Service Team. Phone: 1-844-437-3247
- OK2BME: set of support services for lesbian, gay, bisexual, transgender or questioning teens in Waterloo. Phone: 519-884-0000 extension 213
Full details can be found online at the Faculty of ARTS website
Download UWaterloo and regional mental health resources (PDF)
Download the WatSafe app to your phone to quickly access mental health support information

Territorial Acknowledgement
We acknowledge that we are living and working on the traditional territory of the Attawandaron (also known as Neutral), Anishinaabe and Haudenosaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes 10 kilometres on each side of the Grand River.

Academic freedom at the University of Waterloo
Policy 33, Ethical Behaviour states, as one of its general principles (Section 1), “The University supports academic freedom for all members of the University community. Academic freedom carries with it the duty to use that freedom in a manner consistent with the scholarly obligation to base teaching and research on an honest and ethical quest for knowledge. In the context of this policy, ‘academic freedom’ refers to academic activities, including teaching and scholarship, as is articulated in the principles set out in the Memorandum of Agreement between the FAUW and the University of Waterloo, 1998 (Article 6). The academic environment which fosters free debate may from time to time include the presentation or discussion of unpopular opinions or controversial material. Such material shall be dealt with as openly, respectfully and sensitively as possible.” This definition is repeated in Policies 70 and 71, and in the Memorandum of Agreement, Section 6.