OTTERBEIN UNIVERSITY
INTEGRATIVE STUDIES PROGRAM

INST 4200
Machine Intelligence
Spring 2017

Class	MWF 12:15 - 1:25 p.m. in Roush 429
Course Web	http://faculty.otterbein.edu/dstucki/INST4200/
Instructor	David J. Stucki (DStucki@otterbein.edu)
Office	Towers 133
Office Hours	MF 1:30-3:00; W 9:30-10:45; or by appointment [after spring break: MF 11-12, W 3-4, or by appt.]
Phone	823-1722
Home Phone	878-8002 (After **9 a.m.** and before **midnight**, please)

Description The notion of machine intelligence, and also questions concerning its implications, have circulated both in popular culture and academic venues ever since Arthur C. Clarke and Stanley Kubrick introduced us to the HAL-9000 computer in "2001: A Space Odyssey". From the Terminator to "smart" phones, from C3P0 to the Google search-engine, both the nature and boundaries of intelligence have come into question. We will survey the last 50 years of approaches to machine intelligence, examine the conceptual and technological foundations of these approaches, and consider the cultural trends in understanding the relationship between man and machine. This course will allow students to explore the philosophical and ethical questions that arise in the context of machine intelligence, and in the process develop a better understanding of the current capabilities and limitations of technology, as well as a sense of their ethical role in engaging technology. [4 semester hours credit]

This course is part of the Minds: Natural and Artificial Dyad, and so, taken together with either PHIL 3200 or PSYC 3710 (Mind Seminar), this course fulfills an INST dyad requirement.

Texts *The Most Human Human: What Artificial Intelligence Tells Us About Being Alive*, Brian Christian, Anchor Books, 2011. (*Required*)

Thinking as Computation, Hector J. Levesque, MIT Press, 2012. (*Required*)

Other readings will also be assigned.

Read the text materials carefully before class so you are prepared to ask questions and to actively participate in discussions. Of course, you should read the material again very carefully later and relate your reading to the reflections/discussion from class.

Dyad Overview *Minds: Natural and Artificial* (PHIL 3200, PSYC 3710, INST 4200)
This dyad is organized around various way of understanding and thinking about the nature of mind and intelligence. In the last quarter of the 20th century cognitive science emerged as an interdisciplinary field that provided multiple tools, methods and perspectives for exploring fundamental questions regarding intelligence, mind, and agency. In particular, philosophy, psychology, computer science, linguistics, and neuroscience played the most significant roles. In the pilot offering of this dyad we will focus on philosophical and technological approaches, although we would welcome future offerings to include a wider array of courses from

additional disciplines. This theme of the nature of mind and intelligence will also be explored within historical, cultural, and ethical frameworks.

I.S. Objectives

1. To inspire intellectual curiosity about the world as it is and a deeper understanding of the global condition.
2. To assist students in cultivating intercultural knowledge and competencies.
3. To promote active and critical reflection on the human self in its full range of contexts.
4. To challenge students to critically examine their ethical responsibilities and choices in both local and global contexts.
5. To encourage purposeful public engagement and social responsibility.

(http://www.otterbein.edu/Files/pdf/is/IS Mission statement and goals.pdf)

Course Objectives

Students who are successful in this course will:

- be able to articulate the historically significant arguments for and against machine intelligence.
- be able to recognize the challenges facing modern software initiatives aimed at intelligent computing.
- compose computer programs that mimic various aspects of human intelligence.
- write clear, well-structured, well-organized essays on the themes of machine intelligence which draw on relevant sources.
- evaluate the social, ethical, cultural, and practical implications of machine intelligence.

Dyad Objectives

See Appendix A.

Cultural Events

Since this is a dyad class, it is part of the Integrative Studies curriculum, and, as such, you are to attend at least two IS-approved cultural events and turn in a 1-2 page response to those events.

*Please note, it is your responsibility to attend **two** programs and to turn in your response papers.* While hopefully you will enjoy going to these events, beware: IF YOU DON'T COMPLETE THIS CORE REQUIREMENT, YOU CAN'T PASS THE COURSE.

Turning in Response Papers

You are required to turn in your responses in a timely manner. These papers are due at the next class meeting after the event you attended (for example, if you go to a performance on a Monday night, your paper would be due in class on Wednesday). If you attend an event the night before a class meeting, however, you may turn in your paper an extra class later (for example, you go to a lecture on Tuesday night, you may turn in the paper the next day if you choose or wait until Friday). Response papers turned in later than what is described above will not be accepted. No papers will be accepted after the last day of class, so be sure to plan ahead for an event occurring during week fifteen.

ePortfolio

As part of the Integrative Studies curriculum, you will be asked to submit certain assignments to your ePortfolio. Your portfolio will continue to be a resource that you develop and add materials to until you graduate from Otterbein. An ePortfolio is a great way for you to showcase your work in a variety of contexts, and can eventually provide components of your resume. More information about which documents to upload will be provided separately.

Please keep copies of everything you turn in during the semester so that you will have them available to upload at the appropriate time.

Work Load	"Students are expected to spend three hours per week (including class hours) in study for each semester hour of credit attempted." (Otterbein University Bulletin) Since INST 4200 is 4 Semester Hours, 168 hours of study/time is expected: 56 hours in class (4 hours per week), and ***112 hours beyond class hours*** (8 hours per week), for reading, reflection, study, discussion, and writing, as well as engagement in INST activities.

Participation We learn in a social context. Therefore, we need each other. This need is the reason we have classroom meetings. ***Attendance is required.*** If you miss class you are expected to find out what happened in class from me, or from a classmate. You are also required to present a written note to me explaining your absence. You should make a positive contribution to this class by offering your opinion, sharing your learning and research, and by listening to what others have to say. I expect you to come and see me several times if I can help you in any way. Don't rely solely on e-mail; talk to me in person; we're part of a small college campus community of learners.

Each time you are absent without *advance* permission, you will lose 1% of your grade up to a maximum of 3% (taken from the participation category). Each student is expected to participate in the class discussions throughout the semester. To this end, all assigned readings for each day should be completed before the class period in which they are discussed.

Academic Honesty Policy All members of the Otterbein College community of learners are expected to follow the rules and customs of proper academic conduct. Proper conduct includes avoiding academic misconduct as defined in the Campus Life Handbook. Students are encouraged to study together and to work together on assignments and projects, consult other books and sources, and ask for hints, suggestions, and help. Participants in these discussions usually enjoy the benefit of deeper and greater learning. However, all work submitted for evaluation that is based on discussions with others must be your own work; created with your own hands and fingers while thinking it through. You also must give due credit to all relevant sources of help and information. Documentation is critical.

Any work submitted for evaluation that includes work done by another, copying of another's work, or the result of following another's step-by-step keystrokes and mouse clicks, is a case of academic misconduct. When academic misconduct is found in any assignment or examination you submit, you will receive a zero grade for that assignment or exam. The misconduct will also be reported to the Office of the Academic Dean. If a previous academic misconduct offense is on your record, you will receive a grade of F for this course and a referral to the judicial system.

(See page 33, http://www.otterbein.edu/public/CampusLife/HealthAndSafety/StudentConduct.aspx.)

Disability Statement Otterbein University is committed to ensuring that students with disabilities have access to an education. In order to receive appropriate accommodations in my class, you must first be registered with the Office for Disability Services (823-1618 or kmanley@otterbein.edu). Please meet with me as soon as possible to discuss your needs and accommodation requests. If necessary, we can work cooperatively with the Disability Services Coordinator to determine optimal accommodations in this course.

Course Schedule

This course will be organized around three major lines of inquiry:
- Q1: How much of what historically been regarded as intelligent thought can be automated?
- Q2: How can machine intelligence be recognized or measured?
- Q3: What are the possible implications of machine intelligence?

Hector Levesque's text *Thinking as Computation* will be our main resource for Q1; Brian Christian's book *The Most Human Human* will be our main resource for the Q2; and we will use a variety of articles and other resources for Q3.

As much as possible we will rotate these inquiries focusing on Q1 on Wednesdays, Q2 on Fridays, and Q3 on Mondays.

The following schedule is tentative and subject to change. Please make sure to be in class or check your email regularly for updates and changes to the schedule.

Day	Date	Topics	Reading
1	1/9	Introduction	None
2	1/11	Thinking and Computation	Levesque, Chapter 1 (pp. 1-21)
3	1/13	The Turing Test	Christian Chapters 0 & 1 (pp. 1-15)
	1/16	**NO CLASS**: Martin Luther King, Jr.	
4	1/18	A Procedure for Thinking	Levesque, Chapter 2 (pp. 23-39)
5	1/20	Getting to Know You	Christian Chapter 2 (pp. 16-37)
6	1/23	The Thinking Machine (video)	TBA
7	1/25	The Prolog Language	Levesque, Chapter 3 (pp. 41-52)
8	1/27	Where Am I?	Christian Chapter 3 (pp. 38-52)
9	1/30	Digital Experts	TBA
10	2/1	Prolog Back-Chaining	Levesque, Chapter 3 (pp. 52-61)
11	2/3	Embodiment	Christian Chapter 3 (pp. 52-73)
12	2/6	Digital Brains	TBA
13	2/8	Writing Prolog Programs (Recursion & Induction)	Levesque, Chapter 4 (pp. 63-72)
14	2/10	What Does it Mean to be Human?	Christian Chapter 4 (pp. 74-98)
15	2/13	Hollywood, Part I	*Metropolis, The Forbidden Planet, & 2001: A Space Odyssey*
16	2/15	Infinity & Efficiency in Prolog	Levesque, Chapter 4 (pp. 72-81)
17	2/17	The Game of Kings	Christian Chapter 5 (pp. 99-131)
18	2/20	What Computers Can't Do	TBA
19	2/22	Satisfying Constraints: Sudoku	Levesque, Chapter 5 (pp. 85-96)
20	2/24	Purpose & Intention	Christian Chapter 6 (pp. 132-149)
		SPRING BREAK 2/27 – 3/3	

21	3/6	Google	TBA
22	3/8	Satisfying Constraints: Cryparithmetic & Logic	Levesque, Chapter 5 (pp. 96-103, 107-112, 114-115)
23	3/10	**NO CLASS**	
24	3/13	Robots	TBA
25	3/15	Lists in Prolog	Levesque, Chapter 7 (pp. 137-150)
26	3/17	The Limits of Computation	Christian Chapter 7 (pp. 150-173)
27	3/20	Hollywood, Part II	*Blade Runner*, *War Games*, *The Matrix*, & *A.I. Artificial Intelligence*
28	3/22	Natural Language	Levesque, Chapter 8 (pp. 153-158)
29	3/24	Lies, Misdirection, & Fluency	Christian Chapter 8 (pp. 174-195)
30	3/27	Consciousness	TBA
31	3/29	Interpreting Language	Levesque, Chapter 8 (pp. 158-176)
	3/31	Is Anyone at Home?	Christian Chapter 9 (pp. 196-218)
32	4/3	Digital Statisticians	TBA
33	4/5	Planning	Levesque, Chapter 9 (pp. 179-191)
34	4/7	Information & Communication	Christian Chapter 10 (pp. 219-235)
35	4/10	Military Intelligence	TBA
36	4/12	Playing Games	Levesque, Chapter 10 (pp. 209-222)
37	4/14	**NO CLASS**: Good Friday Compression & Entropy	Christian Chapter 10 (pp. 235-259)
38	4/17	Smart Technology	TBA
39	4/19	Bigger Games	Levesque, Chapter 10 (pp. 226-234)
40	4/21	Being Human	Christian Chapters 11 & 12 (pp. 260-271)
41	4/24	Hollywood, Part III	*Her*, *Transcendence*, *The Machine*, *Chappie*, & *Ex Machina*
		Final Exam: Wednesday, April 26, 11:00 - 1:00	

The previous schedule is tentative and subject to change. Please make sure to be in class or check your email regularly for updates and changes to the schedule.

Assignments

Participation (10%)
We learn best in a social context. Class participation and discussion is a significant aspect of this course. Therefore, we need each other. ***Attendance is required.*** You are expected to have read the assignments and be prepared to contribute thoughtfully to these discussions.

Please leave distractions (cells phone, mobile devices, laptops, playing cards, etc.) turned off and put away unless they are being used to actively participate in a class activity.

INST (4%)
Each of the two INST event papers (see above) will contribute 2% to your total grade.

Movies (15%)
Three times this semester a Monday class will be devoted to activities and discussion of Hollywood's take on machine intelligence. To prepare for each of these class periods you will view 2-3 films outside of class time. Details will be provided soon, including opportunities to view some of the movies as a group.

Homework (15%)
A variety of small programming assignments (in Prolog) will be made that give you the opportunity to work with the ideas introduced in class and the readings.

AI Paper (20%)
You will write a term research paper on a topic or theme related to the course material. A paper proposal must be submitted (week 6) for approval and either an early draft or detailed outline of the paper will be due in week 11. More detailed requirements will be provided in a separate document.

Exams (36%)
There will be one take-home midterm exam (week 9) and an in-class final exam (week 16). They will cover lecture material, readings, and questions regarding homework. If you can document that you have three final exams scheduled for the same day I will attempt to arrange for an alternate time only if given at least a week's notice.

Grading

Range	Grade	Range	Grade
93 - 100%	A	73 - 76.9%	C
90 - 92.9%	A-	70 - 72.9%	C-
87 - 89.9%	B+	65 - 69.9%	D+
83 - 86.9%	B	60 - 64.9%	D
80 - 82.9%	B-	0 - 59.9%	F
77 - 79.9%	C+		

Late Work
Work turned in late without prior approval from me will be penalized 10% for each day it is late.

Appendix A: Dyad Objectives

1-4: Students imagine and critically explore likely and alternative global futures.	(INST) Based largely on examples from Hollywood, but also from literature and speculative essays, students will be asked to consider the possible implications of machine intelligence and the impact that it may have on the future. Perspectives spanning a broad range of utopian (e.g., Star Trek) and dystopian (e.g., Terminator) alternatives will be explored. Through viewing film excerpts, reading, participating in class discussions, and writing essays student will be asked to demonstrate an understanding of these perspectives.
2-1: Students gain enhanced understanding of the diversity of ideas, beliefs, and practices across cultures and throughout historical eras.	(PHIL) In the Philosophy course, students will learn about historically significant views of the mind and the self, including *substance dualists* (who see the mind as an immaterial substance, distinct from the physical body), *substance monists* (who see the mind as simply the physical brain), and *property dualists* (who think that physical brain exhibits both physical and non-physical properties). Contemporary debates about the nature of the mind and its relationship to the brain are closely linked to views expressed in the last 2500 years of philosophy, so wrestling with the contemporary debates will, naturally, draw us back into the history of philosophy and students will see how historical views about the mind recur in those present debates.
3-1: Students study the self and the ways in which it is situated in human, natural, and physical worlds	(PHIL) A prominent question in the philosophy of mind is the relationship between the mind (the locus of thought, consciousness, feeling, emotion, desire, etc.) and the physical world of brains and bodies. Can a physical entity--a brain--be a thinking thing? Can a brain have beliefs, feelings, emotions, desires? The dominant view in the history of philosophy is that it cannot: mere physical entities cannot think. In the last two centuries or so, philosophers of mind have, largely, rejected the view that the mind is a non-physical entity and have worked to figure out how the physical brain and nervous system can be the locus of thought. Accordingly, a great deal of time in the Philosophy course will be spent on the question of how, if at all, the mind or the self can be a part of the natural, physical world.

3-4: Students recognize and engage with that which is other or unfamiliar to them.	(INST) Students will be introduced to Alan Turing's test for machine intelligence (The Turing Test), and asked to discuss and critically respond to the notion that linguistic discourse is the best such metric or rubric. On the one hand "smart" technologies often have a design goal of "invisibility" or "transparency to the user"; in contrast some AI designers have as their goal the public recognition and acknowledgement that their systems are intelligent. This tension will be a theme of the course. Readings, reaction essays, exams, and class discussion will enable students to engage in analysis and reflection on this theme.
4-1: Students affirm value of an enlarged ethical responsibility to other persons, the natural world, and future generations.	(PHIL) A dominant strand of thinking in environmental ethics is the idea that whether or not we have obligations toward a creature depends on facts about that creature's mental life. Whether or not a creature can feel pain, whether or not it is self-conscious, whether or not it has plans and projects for its future-- these issues are, for many, relevant to questions about our moral obligations toward that creature. Accordingly, questions about the "mental lives" of non-human animals--a topic which shall be discussed in the Philosophy of Mind course--become relevant to questions about our ethical responsibilities to those parts of the natural world. (INST) The possibility of machine intelligence in its fullest sense, a mind, raises numerous ethical questions that parallel those that will be considered in the philosophy course related to animal minds. This course will built on the foundation of that previous investigation to consider the possible roles that machines will play in the future, and our obligations to them as "other persons". Topics will include robot slavery, genocide, and machine rights.
4-2: Students explore and engage their relationship to the global public good as well as the larger goals of human and ecological flourishing	(INST) Even if artificial minds are never achieved, there are still ethical implications of "smart" technology and applications of AI. Students will be asked to take and defend positions on the deployment of a variety of

	technologies that raise ethical concerns for the people or communities that use them.
5-4: Students come to see themselves as responsible, engaged and informed persons, capable and willing to act in ways that will improve or reshape the world.	(INST) Students will complete this course with a much fuller understanding of the impact of technology on society and their lives, both positive and negative. This knowledge will enable them to make responsible choices, both personally and civically.