CS/PST 4752
Philosophical Issues in Computation

Spring 2013
T/TH 3:05-4:25
101 CCB

Professor Nancy Nersessian

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DESCRIPTION

This course will provide an introduction to metaphysical and epistemological issues in the foundations, methods, and implications of computation. Issues to be discussed include: minds, brains, and machines; representation and language; symbolic vs. non-symbolic computation; logic, judgment, and human reason; and A-life and modern computational approaches to biology.

REQUIREMENTS

There will be a significant amount of reading (80-100 pages per week). We expect all the reading to be completed before the Tuesday meeting so that all students participate in the discussions. Students will be required to make one joint presentation that spans 2 meetings, participate in discussion, and write weekly one paragraph problem formulations and two essays. Problem formulations are due on Tuesday of the week of the readings (there are 11, so you may skip one).

Grades will be determined as follows:

Presentations: 30%
Problem formulations: 20%
Essays: 50%

Due dates for assignments are **firm** deadlines. There is no room in the schedule to fall behind in either reading or writing assignments. Institute regulations do not allow the grade of incomplete to be given except in cases of extreme emergency. Students are expected to adhere to the Student Honor Code, a copy of which can be found on-line at:
http://www.deanofstudents.gatech.edu/codeofconduct

Problem Formulations: Learning to formulate problems is an important skill and necessary for critical thinking in every area. Although some people can do this easily, for most it's a skill that develops over time and writing is a necessary component. Each week you will formulate a 1-2 paragraph (250-300 (max) words, typed, double-spaced, 12-point font) problem statement with respect to the reading for that week. These are due on the Tuesday meeting every week except for the week you make a presentation. They will not be accepted after the class meeting at which they are due. They are to be handed in, not sent to me via email. They will be graded as follows: good formulation: 2, inadequate formulation: 1, not handed in: 0. Problem formulations are due on Tuesdays, by which time all the material for the week should have been read. Please bring a copy to class on Thursday since part of the discussion on Thursdays will include sharing and discussing problem statements. A document on "writing problem formulations' and problem formulation examples are on T-square in the "problem formulations" folder. **Please read before coming to class on 1/10.**

Essays: Take one of the problems you have formulated up to that point in class and discuss it. Essays may be handed in any time, but not later than the specified deadline. The first essay is due **2/21**. The second essay is due **4/25** - this essay should be based on material covered since the first essay. The text of the papers should be between 1000 and 1500 words in length, typed, double-spaced, 12 point font, page numbers, stapled, and word count included with your name. Please do not exceed the word limit by more than 100 words. Provide citations for all quotations and sources used (not included in word count). Do not use extensive quotations

Essay Evaluation includes:
- Problem posed and articulate
- Sound argumentation
- Evidence, either cited or from experience or both
- Progress made towards resolving problem

Presentations: These will be made by groups of students weekly. Please do not simply summarize the readings. Presentations should have two parts: 1. Discuss what you take to be the main problems of the author(s) and their proposed solutions (you may do this with a powerpoint presentation if you wish) and 2. Provide a set of problems formulated by your group for discussion. You should provide a written handout to guide the discussion (with your names on it) to me and the class (42 copies). Please email the presentation to Andrew Champion after your presentation. All presentations will be available in a folder on the class website. A document 'preparing presentations" and presentation examples are available on T-square in the "presentations" folder. **Please read before coming to class on 1/10.**

All students are expected to participate in discussion and not be surfing, emailing, checking

out facebook, texting etc., during class, which is distracting and impolite to those leading the discussion. Please only use your computer if you are taking notes related to the discussion. All students in the class should bring a hard copy of the reading to class to refer to during discussion.

Engaged Reading:

SQ3R is a useful technique for extracting the maximum amount of benefit from your reading time. It helps you to organize the structure of a subject in your mind. It also helps you to set study goals and to separate important information from irrelevant data.

SQ3R is a five-stage active reading technique. The stages are:

1. Survey
2. Question
3. Read
4. Recall
5. Review

The acronym SQ3R stands for the five sequential techniques you should use to read a book (or article):

* Survey:
Survey the document: scan the contents, introduction, chapter introductions and chapter summaries to pick up a shallow overview of the text.

* Question:
Make a note of any questions on the subject that come to mind, or particularly interest you following your survey. Perhaps scan the document again to see if any stand out. These questions can be considered almost as study goals - trying to understand the answers can help you to structure the information in your own mind. (NB: Problems are what underlie the questions you are asking - the often provide the motivation/basis for asking a question)

* Read:
Now read the document. Read through useful sections in detail, taking care to understand all the points that are relevant. In the case of some texts this reading may be very slow. This will particularly be the case if there is a lot of dense and complicated information. While you are reading, it can help to take notes in Concept Map format.

* Recall:
Once you have read appropriate sections of the document, run through it in your mind several times. Isolate the core facts or the essential processes behind the subject, and then see how other information fits around them.

* Review:

Once you have run through the exercise of recalling the information, you can move on to the stage of reviewing it. This review can be by rereading the document, by expanding your notes, or by discussing the material with colleagues. A particularly effective method of reviewing information is to have to teach it to someone else!

Adapted from: http://www.mindtools.com/pages/article/newISS_02.htm
Further useful suggestions for managing your student career can be found on the mindtools website.

REQUIRED BOOKS

Books are located in the **Engineer's Bookstore**. Articles are on course t-square site.

Andy Clark: *Natural Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence*, Oxford University Press

John Haugeland, ed.: *Mind Design II: Philosophy, Psychology, and Artificial Intelligence*, MIT Press

SCHEDULE

Please read in the order in which the chapters are listed.

WEEK 1: 1/8 -1/10 overview

Please read and bring printed copies of the document on problem formulations, exemplars of problem formulations, and of presentations before class on 1/10

WEEK 2: 1/15 -1/17 Teuscher (on website); Haugeland (1997): Chapter 2, Turing; Dennett (2004) (on website),

WEEK 3: 1/22 - 1/24 Haugeland: Chapter 3. Dennett, and Chapter 7. Searle

WEEK 4: 1/29 - 1/31 Haugeland: Chapter 4. Newell & Simon, and Chapter 6. Dreyfus

WEEK 5: 2/5 - 2/7 Haugeland: Chapter 8. Rumelhart, Chapter 9. Smolensky, and Chapter 12. Fodor & Pylyshyn

WEEK 6: 2/12 - 2/14 Haugeland: Chapter 15. Brooks and Chapter 16. Van Gelder

WEEK 7: 2/19 - WRITING DAY - NO CLASS MEETING - TA appointments available;
2/21 - FIRST ESSAY DUE - discussion of essays

WEEK 8: 2/26 – 2/28 Clark (2003): Introduction, Chapters 1-4

WEEK 9: 3/5 - 3/7 Clark: Chapters 5-8

WEEK 10: 3/12 - 3/14 Voit (2013): Chapter 1, Rosenberg (2001), and Powell and Dupré (2009) (all on course website)

WEEK 11: 3/19 SPRING BREAK

WEEK 12: 3/26 - 3/28 Brenner and Sismour (2005), O'Malley et al. (2007), and Knuutilla and Loettgers (2012) (all on course website)

WEEK 13: 4/2 - 4/4 Szalay and Gray (2006), Anderson (2007), Weinberg (2010), Golub (2010) and Callebaut (2012) (all on course website)

WEEK 14: 4/9 - 4/11 Ray (1994), Dennett (1996): chapter 7, and Boden (1996) (all on course website)

WEEK 15: 4/16 - 4/18 Dennett chapters 8-9 (On course website)

WEEK 16: 4/23 - WRITING DAY - NO CLASS MEETING - TA appointments available;
4/25 - SECOND ESSAY DUE - general discussion

References

Anderson, C. (2007). The End of Theory: The Data Deluge Makes the Scientific Method Obsolete. WIRED http://www.wired.com/science/discoveries/magazine/16-07/pb_theory

Boden, M. (1996). Autonomy and artificiality, in *The Philosophy of Artificial Life,* Oxford University Press: Chapter 2

Brenner S.A. , Sismour, A. Michael, (2005). Synthetic Biology. *Nature Reviews* 6, 533-543

Callebaut, W., (2012) Scientific perspectivism: A philosopher of science's response to the challenge of big data biology. *Studies in History and Philosophy of Biological and Biomedical Sciences* 43, 68-80.

Clark, A. (2003). *Natural Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence*, Oxford University Press

Dennett, D. (1996). *Darwin's dangerous idea: Evolution and the meanings of life*. Simon and Schuster.

Golub, T.(2010). Countpoint: Data first. *Nature* 464, 679

Haugeland, J. (1997) *Mind Design II: Philosophy, Psychology, and Artificial Intelligence*, MIT Press.

Humphreys, P. (2009). The philosophical novelty of computer simulation methods, *Synthese*, 169:615–626

Knuutilla, T. , Loettgers, A. (2012) Basic science through engineering? Synthetic modeling and the idea of biology-inspired engineering.

O'Malley, M., Powell, A., Davies, J.F., Calvert, J. (2007). Knowledge-making distinctions in synthetic biology. BioEssays 30, 57-65.

Powell, A., Dupré, J. (2009). From molecules to systems: the importance of looking both ways. *Studies in History and Philosophy of Biological and Biomedical Sciences* 40, 54-64

Ray, T.S. (1994). An Evolutionary Approach to Synthetic Biology: Zen and the Art of Creating Life. *Artificial Life* 1: 179-209

Rosenberg, A. (2001). *Philosophy of Molecular Biology*. Encyclopedia of Life Sciences (Wiley & Sons) www.els.net

Teuscher, C. (ed) (2004) *Alan Turing: Life and Legacy of a Great Thinker* (Springer: NY)

Szalay, A., Gray, J. (2006). Science in an Exponential World. *Nature* 440, 413-414.

Voit, E. (2013). *A First Course in Systems Biology* (Garland Science: NY)

Weinberg, R. (2010). Point: Hypothesis First. *Nature* 464, 678