

# Spring 2023 PSYCH 420

Britt Anderson

*<2023-03-21 Tue>*

## **1 Course number and title**

PSYCH420 Introduction to Computational Neuroscience Methods

## **2 Term and year of offering**

Spring 2023

## **3 Class days, times, building, and room number**

M 14:30-17:20 HH 1106

## **4 Class instructor's name, office, contact information, office hours**

Britt Anderson, PAS 4032, x 43056, Office hours by arrangement

## **5 Teaching assistant's name, office, contact information, office hours (if applicable)**

No teaching assistant.

## **6 Course description**

An introduction to the basic elements of computational modeling with an emphasis on psychology students.

## 7 Course objectives

1. You will understand the scope of subjects and tools that comprise computational neuroscience and computational cognitive modeling.
2. You will program a few different versions of a spiking neuron. This will introduce us to how differential equations may be used in computational modeling. We will also look at how some of the tools developed for studying differential equations can be brought to bear on neural models.
3. You will program a few simple examples of a few different types of neural networks. We will use these to introduce us to some of the ways that linear algebra is used in computational modeling, and how some of the tools of analyzing linear systems can be brought to bear on neural and cognitive models.
4. We will also consider what it means for something to be computational, and ask ourselves if the brain or the mind is rightly considered as such? We will enrich our discussion by having you program a simple Turing machine.
5. You will compare the symbolic and computational approaches to brain and mind modeling by implementing a simple logic in code.

## 8 Required text and/or readings

This is no required text for this course. Some of the material was covered in a book I wrote many years ago, and which is available online through the library.

Additional material will be provided as links to online material.

Most of the code and presentation material to be shared in class will be found in the course github repository: Comp-Neuro-420. Make sure you track the "racket-book" branch.

## 9 A general overview of the topics to be covered

See Course objectives.

## 10 The evaluation structure for the course including course requirements, deadlines, weight of requirements toward the final course grade

Category	Contribution
Participation	12%.
Final Project	20%.
Homeworks	68%
Extra-credit (research participation)	3%

NB. I have found since we returned to in-person learning, that many students have fallen out of the habit of going to class. A lot of informal learning occurs in class, and this is missed when attendance is missed. In addition, having you in class gives me a chance to see if something is giving people trouble or not. I can then adapt or adjust. If I don't find out about this until an assignment is due, or even the end of term, I don't have a chance to make sure changes are implemented to assist you learning. Thus, I will take role at the **start** of every class. If you are there, you get 1%. If you are not, you don't. This includes coming later. You must be there at the start to get this participation point. We all have good reasons for missing things, and there may be times when you feel it is better to skip. That is fine. You can make your own decisions, but this will create a little bit of moral hazard when you consider the choice. I will adjust for documented illnesses, but not for things like leaving early for a vacation or double booking yourself with an interview at the same time as class. You also do not have to stay. If you want to come just long enough to get marked present and then leave. Okay. I will not take the 1% away. My hope is that most of you most of the time will decide to stay for at least a while if you have gone to all the work of showing up in the first place. To emphasize, the only reason I am doing this is because based on the last two terms, and comparing that to earlier terms teaching the same material, I believe it will help more of you learn more.

## 11 Acceptable rules for group work (See Group Assignment Checklist)

Group work is the norm in post-graduate life (both academic and professional). Group work will be graded as a group. All group members will get the same grade for their group project. More details on the nature of the group project will be shared during the term.

## **12 Indication of how late submission of assignments and missed assignments will be treated**

Late assignments will be graded and will lose 5% for each week they are late.

## **13 Indication of where students are to submit assignments and pick up marked assignments**

Assignments will be submitted in dropboxes on Learn. Submissions and Announcements are the main uses we will make of learn. All other material will be shared in class or via the github repository.

## **14 Intellectual Property**

Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain

materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

## 15 Chosen/Preferred First Name

Do you want professors and interviewers to call you by a different first name? Take a minute now to verify or tell us your chosen/preferred first name by logging into WatIAM.

Why? Starting in winter 2020, your chosen/preferred first name listed in WatIAM will be used broadly across campus (e.g., LEARN, Quest, WaterlooWorks, WatCard, etc). Note: Your legal first name will always be used on certain official documents. For more details, visit Updating Personal Information.

Important notes

If you included a preferred name on your OUAC application, it will be used as your chosen/preferred name unless you make a change now. If you don't provide a chosen/preferred name, your legal first name will continue to be used.

## 16 Mental Health Support

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

### 16.1 On Campus

Due to COVID-19 and campus closures, services are available only online or by phone.

Counselling Services: [counselling.services@uwaterloo.ca](mailto:counselling.services@uwaterloo.ca) / 519-888-4567 ext. 32655 MATES: one-to-one peer support program offered by the Waterloo Undergraduate Student Association (WUSA) and Counselling Services

### 16.2 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: 519-749-4300 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

## **17 Territorial Acknowledgement**

Academic freedom at the University of Waterloo 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 ten kilometres on each side of the Grand River.

For more information about the purpose of territorial acknowledgements, please see the CAUT Guide to Acknowledging Traditional Territory. Academic freedom at the University of Waterloo

## **18 Policy 33, Ethical Behaviour**

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

## **19 Sona Participation and Research Experience Marks Information and Guidelines**

Experiential learning is considered an integral part of the undergraduate program in Psychology. Research participation is one example of this, article review is another. A number of undergraduate courses have been expanded

to include opportunities for Psychology students to earn grades while gaining research experience.

Since experiential learning is highly valued in the Department of Psychology, students may earn a **"bonus" grade of up to 3%** in this course through research experience. Course work will make up 100% of the final mark and a "bonus" of up to 3% may be earned and will be added to the final grade if/as needed to bring your final grade up to 100%.

The two options for earning research experience grades; participation in research through online remotely operated and In Lab studies, as well as article review; are described below. Students may complete any combination of these options to earn research experience grades. For Fall 2022, credits will be permitted to be earned with half from online, and the other half (1.5)

## **19.1 Option 1: Participation in Psychology Research**

Research participation is coordinated by the Research Experiences Group (REG). Psychology students may volunteer as research participants in remotely operated, In Lab and/or online (web-based) studies conducted by students and faculty in the Department of Psychology. Participation enables students to learn first-hand about psychology research and related concepts. Many students report that participation in research is both an educational and interesting experience. Please be assured that all Psychology studies have been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee.

### **19.1.1 How to earn extra marks for your Psychology course(s) this term by participating in studies ...**

- You will earn "credits" which will be converted to "marks" (1 credit = 1%)
- You can schedule your remotely operated (replacing in-lab) and ONLINE studies using the "Sona" website.

### **19.1.2 *Educational focus of participation in research***

To maximize the educational benefits of participating in research, students will receive feedback information following their participation in each study detailing the following elements:

- Purpose or objectives of the study

- Dependent and independent variables
- Expected results
- References for at least two related research articles
- Provisions to ensure confidentiality of data
- Contact information of the researcher should the student have further questions about the study
- Contact information for the Director of the Office of Research Ethics should the student wish to learn more about the general ethical issues surrounding research with human participants, or specific questions or concerns about the study in which s/he participated.

Participation in remotely operated (counts as the same as in-lab) studies has increment values of 0.5 participation credits (grade percentage points) for each 30-minutes of participation. Participation in ONLINE studies is worth .25 credits for each 15-minutes of participation. Researchers will record student's participation and at the end of the term the REG Coordinator will provide the course instructor with a credit report of the total credits earned by each student.

### **19.1.3 /How to participate?\***

Study scheduling, participation and grade assignment is managed using the SONA online system. All students enrolled in this course have been set up with a SONA account. You must get started early in the term.\*

For instructions on how to log in to your SONA account and for a list of important dates and deadlines please, as soon as possible, go to:

Participating/SONA information: How to log in to Sona and sign up for studies

Please do not ask the Course Instructor or REG Coordinator for information unless you have first thoroughly read the information provided on this website.

More information about the REG program in general is available at: Sona Information on the REG Participants website or you can check the Sona FAQ on the REG website homepage for additional information.



## 19.2 Option 2: Article Review as an alternative to participation in research

Students are not required to participate in research, and not all students wish to do so. As an alternative, students may opt to gain research experience by writing short reviews (1½ to 2 pages) of research articles relevant to the course. The course instructor will specify a suitable source of articles for this course (i.e., scientific journals, newspapers, magazines, other printed media). *You must contact your TA to get approval for the article you have chosen before writing the review.* Each review article counts as one percentage point. To receive credit, you must follow specific guidelines. The article review must:

- Be submitted before the last day of lectures. Late submissions will NOT be accepted under ANY circumstances.
- Be typed
- Fully identify the title, author(s), source and date of the article. A copy of the article must be attached.
- Identify the psychological concepts in the article and indicate the pages in the textbook that are applicable. Critically evaluate the application or treatment of those concepts in the article. If inappropriate or incorrect, identify the error and its implications for the validity of the article. You may find, for example, misleading headings, faulty research procedures, alternative explanations that are ignored, failures to distinguish factual findings from opinions, faulty statements of cause-effect relations, errors in reasoning, etc. Provide examples whenever possible.
- Clearly evaluate the application or treatment of those concepts in the article.
- Keep a copy of your review in the unlikely event we misplace the original.