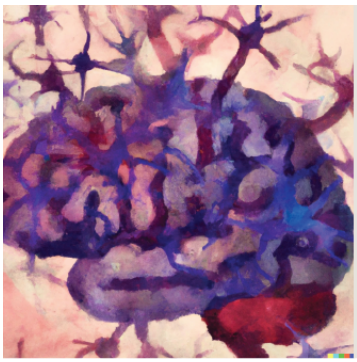

PSYC57: The Cognitive Neuroscience of Decision Making

Winter 2025

Instructor: Cendri Hutcherson
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Email: c.hutcherson@utoronto.ca
Office hours: W 5-6pm on Zoom

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Office hours: by appointment

Course Description and Goals

How did you decide to take this course? Why is it so hard to resist ice cream and chips? How do you steer true to your moral compass? Decision-making involves identifying and evaluating options in order to enact an appropriate response. It lies at the heart of most human behaviors, yet is in many ways still poorly understood. Over the last few decades, a unique synthesis of observations from neuroscience, psychology, and economics has revolutionized our understanding of both simple and complex choice and generated remarkable insights. This class covers some the major neural and computational models of decision-making that have emerged from this work, and will explore implications of these models for when and why people choose wisely (or don't!).

This course has several objectives for your development:

1. Familiarize you with key concepts and theories from economics, psychology and neuroscience regarding how people value choice options.
2. Familiarize you with key concepts and theories about reward learning (i.e., how we learn that some choice options are good and some are bad).
3. Learn how these key concepts can help us to understand human decision-making, from low-level perceptual decisions all the way up to altruism, morality, addiction, and self-control.
4. Familiarize you with some of the basic numerical and mathematical approaches to computational models of decision making.
5. Help you to develop basic skills in programming with R.

Readings

There is no textbook for this course. Readings will consist of empirical articles, journal reviews, and book chapters. All readings can be accessed from the Quercus website.

Grading

Midterm (Feb. 27)	35%
Final Exam (Date TBD)	45%
Homework assignments (5)	15% (3% per homework)
Participation	5%

Description of grade components:

1. Midterm exam: The midterm will consist of multiple choice questions covering the lectures and readings from Topics 1-6, and will take place in class on February 27.

2. Final exam: Like the midterm, the final will consist of multiple choice questions. However, unlike the midterm, the final exam will be partially cumulative. 30% of the exam will cover lecture material (but not readings) from Topics 1-6. 70% of the exam will cover lecture material *and* readings for Topics 7-11. The date is set by the UTSC registrar, will take place sometime from Apr. 9-30, and will be announced as soon as it is set.

3. Homework assignments: This course aims to introduce you to some of the major neural, mathematical and computational models in decision neuroscience, as well as to help you develop basic facility in the use of statistical software and computer programming. In the service of these twin goals, you will be asked to complete five homework assignments during the semester. Some of these assignments will involve performing simple statistical analyses and writing computer programs to implement key aspects of computational models.

   Don't panic if you don't feel particularly math- or computer-savvy!!

   Homework assignments will walk you step-by-step through an exploration of class concepts and computational models, building from simpler concepts and tasks to more complex ones. In addition, the TAs and I are here to help you if and when you need guidance to complete the homework. Students who have questions can make an appointment with the TAs and can receive one-on-one help with key programming and neuroscience concepts, as well as trouble-shooting code. Assignments will be posted on Quercus at least two weeks before they are due, and will typically require you to submit both written responses as well as, in some cases, snippets of statistical or computer-programming code that you have written. In addition, each homework will be followed by a 10-minute one-on-one meeting with the TA (scheduled in the two weeks

following submission) to discuss what you learned, what problems you ran into, and to engage in dialogue about the homework.

Late submissions. Late submissions of homework assignments will receive a 5% penalty for every 24-hour period beyond the deadline, up to 7 days following the due date. Following this date, a flat penalty of 40% will be applied, unless appropriate documentation of an emergency situation is received (see the departmental policy on missed term work for further details). After this time, students may still complete the homework, but will be capped at a maximum grade of 60% on that assignment. So for instance, imagine that without the penalty, you would have received a 90% on the homework but you turn it in 10 days late. You will now receive a 60%. If, without the penalty, you would have received a 55%, and turn it in 10 days late, you will still receive a 55%. This grading scheme is designed to encourage you to do the homework and learn its contents, even if you must complete it at a delay.

4. Class participation: A major goal of the class is to engage you in substantive interaction with me, the TAs, and other students in the class, because this is one of the primary ways to help you develop critical thinking capacity, and the ability to apply the knowledge you obtain beyond the specific circumstances in which it is presented. Participation can take one of four forms: participating during class discussion time, participating substantively on the Discussion Board (accessed via Quercus), attending office hours on Zoom, and attending get-to-know-you meetings (see more details on this below). Participation will be graded on a point system, with 10 total points possible.

   Documented instances of participation are worth the following:
   Participating in class - 1 pt/class
   Attending office hours on Zoom – 1 pt/session
   Posting in course discussion boards - 1 pt/substantive comment
   Participating in Meet-the-Professor session – 2 pts (max of once)

Lectures

Lecture content will consist of a mix of short, pre-recorded videos (typically not more than 20-30 minutes for relevant topics) designed to introduce major concepts and ideas, as well as in-person lectures on Thursdays from 3-5PM, designed to present content while giving students the opportunity to ask questions about the material and to engage more actively in class lectures. In weeks with short, pre-recorded introductory videos, you are responsible for making sure you watch videos prior to class time. Videos and in-person lectures will present major research areas, theories and experiments from the field of decision neuroscience. Introductory videos will be posted at the beginning of each week to give you plenty of time to watch them prior to class.

Please note: there will be no lecture content posted for reading week or the week of the midterm exam.

Meet-and-greets

Because I am committed to getting to know you, starting in Week 2, I will be hosting weekly "Meet and Greet" sessions. These will be small, one-hour gatherings of no more than 10 students, with no agenda other than for me to get a chance to know you, for you to get to know some of your classmates, and for us to discuss anything that interests us about the class or beyond. Sessions will be held from 12-1PM on Thursdays, and student will sign up in advance, using the link provided on Quercus. I will hold 8 in-person meetings, with 2 online meetings scheduled on alternate days to accommodate student schedules. An incentive to come to one of the in-person sessions is that I will provide free beverages (e.g., coffee or tea) for all in-person attendees! While these sessions are not mandatory, you are strongly encouraged to sign up for one, and will receive 2 automatic participation points if you attend one. Note: due to space constraints, students can sign up for only *one* Meet-and-Greet session, and will not receive participation points beyond the maximum of 2 for this activity.

Psychology Department Missed Term Work Policy, Winter 2025:

For missed term work (assignments and term tests) due to illness, emergency, or other mitigating circumstances, please follow the procedure outlined below.

Procedure:

1. Complete the Request for Missed Term Work Accommodations Form ("MTW Form").

2. Email **BOTH** your MTW Form and Supporting Documentation to c.hutcherson@utoronto.ca according to the instructions specified below.

Supporting Documentation Requirements and Deadlines:

Reason for Missed Work	Documentation required for a *first absence* in the term	Documentation required for *subsequent absences* in the term	Deadline for submitting MTW form and supporting documentation
Illness or Injury	ACORN Absence Declaration	UofT Verification of Illness Form	within 2 business days of the missed work

<table>
<tr><td>Bereavement</td><td>ACORN Absence Declaration</td><td>A death certificate or funeral announcement</td><td><u>within 2 business days</u> of the missed work</td></tr>
<tr><td>University-sponsored athletic or artistic obligation at the varsity/provincial/national level</td><td>ACORN Absence Declaration</td><td>A note from a university staff member (advisor, coach, residence staff, etc.) who can substantiate the obligation, sent directly to the course email</td><td><u>10 business days IN ADVANCE</u> of the missed deadline</td></tr>
<tr><td>Disability-related reasons for students registered with AccessAbility Services</td><td colspan="2">For missed TERM TESTS,
- Contact your AccessAbility consultant and have them write to the course email detailing the accommodations needed.
For missed ASSIGNMENTS,
- If your desired accommodation is within the scope of your Accommodation Letter (e.g. your letter includes “extensions of up to 7 days” and you need 3 days), send your Accommodation Letter to the course email and specify how many days extension you are requesting.
- If your desired accommodation is outside the scope of your Accommodation Letter (e.g. your letter includes “extensions of up to 7 days” but you need more time than that), contact your AccessAbility consultant and have them write to the course email detailing the accommodations needed.</td><td><u>PREFERABLY IN ADVANCE of the missed work, or as soon as possible</u></td></tr>
<tr><td>Academic Conflict (e.g. two midterms at the same time)</td><td colspan="2">Screenshot from Quercus demonstrating the conflict.</td><td rowspan="2"><u>10 business days IN ADVANCE</u> of the missed work</td></tr>
<tr><td>Religious Conflict</td><td colspan="2">None required</td></tr>
</table>

<u>Notes:</u>

- The following reasons are not considered sufficient for missed term work: social activities, recreational travel, technological issues, avoidance of assessments or deadlines, work commitments
- Missed Final Exams are handled by the Registrar's Office and should be declared on eService.
- For ACORN absence declarations, the date you declare the absence is required to fall within the seven-day declaration period (i.e.) the absence cannot be submitted proactively or retroactively.
- Instructors cannot accept term work any later than five business days after the last day of class. Beyond this date, accommodations are only possible via the Registrar's Office petition process.
- If you are unable to submit your request within the specified number of business days, you must still email Prof. Hutcherson within that window to explain the nature of the delay. Exceptions to the deadlines are made only under exceptional circumstances.
- Multiple assignments due on the same day are not considered academic conflicts. Students are expected to manage their time effectively to meet assignment deadlines.
- Back-to-back tests/quizzes are not considered academic conflicts. Only overlapping activities are conflicts.
- Students are responsible for keeping their course timetables conflict-free. Students who register in two courses with overlapping lecture/tutorial/lab schedules will not be accommodated.

Next Steps:

After submitting your documentation, you will receive a response from Prof. Hutcherson. The course instructor reserves the right to decide what accommodations will be made. Failure to adhere to any aspect of this policy may result in a denial of your request. **You are responsible for checking your official U of T email and Quercus course announcements daily**, as accommodations may be time-critical.

For missed assignments, **do not wait for Prof. Hutcherson's response to resume work on your assignment.** Extensions may be as short as one business day, depending on the nature of the illness/emergency. Complete your assignment as soon as you're able, and email it to your instructor.

If an accommodation is granted but a continued illness/emergency prevents you from meeting its requirements, you must repeat the missed term work procedure to request additional accommodations. **Please make it clear in your subject line that you are requesting a second accommodation.** Examples: If you were granted an extension for a paper but are still unable to meet the new deadline, or if you miss a make-up term test, you must submit *another* MTW form and supply documentation according to the "subsequent absences" column in the chart above. *Note: In the case of a missed make-up test, an opportunity to write a second make-up test may not necessarily be provided.

Missed Exams

Midterm. A makeup midterm exam session will be scheduled for students who have a documented and acceptable reason for missing the midterm. The time and date will be determined after the midterm exam and in consultation with affected students.

Final Exam. If you must miss the final exam, then you should contact the Registrar's Office directly, as I am not authorized to make any changes to the final exam date and time.

Quercus

The course's Quercus website is the central location where you will find all important course information, including the syllabus, reading materials and information for homework assignments, handouts, announcements, and supplementary information. Quercus is also where the course Discussion Boards can be found (important both for your participation grade and for getting your questions answered). Lecture materials will be available on the Quercus site prior to the start of class. To accommodate student discussion, lectures will sometimes deviate from the posted pre-lecture slides. In these cases, finalized lecture slides will be posted within 48 hours after class each week.

To access Quercus, log on at q.utoronto.ca using your UTORid and password. I strongly recommend regularly checking the "Announcements" sections of the course website, since you are solely responsible for making sure that you stay up to date with course requirements. To facilitate this, please make sure that your account is up to date so that your correct email address is listed. If you are registered for the course, you should see this class displayed automatically when you log in.

Office Hours (Zoom, Wednesdays 5-6PM or by appointment)

Office hours (accessed through the Quercus Zoom tab) are a great way for you to get answers to specific questions you may have, as well as a way for you to receive points for participation. They are also a good forum for hearing answers to questions that other students have and learning about things you may not have thought about. When you log on for office hours, to protect student confidentiality, you may be placed in a waiting room for a few minutes. Please be patient – I will make every attempt to keep these wait times short but in some cases this may not be possible.

TA office hours and help sessions

To assist you in completing the homework assignments, the TAs in this class will be available for one-on-one or small group (e.g. 2-3 student) help sessions. These sessions are meant to provide guidance to students, and to help them troubleshoot their homework assignments.

These sessions may be scheduled with the individual TA, so may take place via Zoom or other remote meeting software, as arranged by your TA. Students should be proactive about scheduling time with TAs well in advance of the homework deadline to receive personalized mentorship.

Accommodations:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services as soon as possible.

AccessAbility Services staff (located in Rm SW302, Science Wing) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Academic Integrity

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

- Using someone else's ideas or words without appropriate acknowledgement;
- Submitting your own work in more than one course without the permission of the instructor;
- Making up sources or facts;
- Obtaining or providing unauthorized assistance on any assignment.
- Using Generative AI in unpermitted ways

On tests and exams:

- Using or possessing unauthorized aids;
- Looking at someone else's answers during an exam or test;
- Misrepresenting your identity; and
- When you knew or ought to have known you were doing it.

In academic work:

- Falsifying institutional documents or grades;

- Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes; and
- When you knew or ought to have known you were doing so.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If students have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, they are expected to seek out additional information on academic integrity from their instructors or from other institutional resources.

Note: You may see advertisements for services offering grammar help, essay editing and proof-reading. Be very careful. If these services take a draft of your work and significantly change the content and/or language, you may be committing an academic offence (unauthorized assistance) under the *Code of Behaviour on Academic Matters.*

It is much better and safer to take your draft to the Writing Centre as early as you can. They will give you guidance you can trust. Students for whom English is not their first language should go to the English Language Development Centre.

If you decide to use these services in spite of this caution, you must keep a draft of your work and any notes you made before you got help and be prepared to give it to your instructor on request.

English Language Development Center

This class assumes a degree of fluency in English, for both writing and comprehension. All students are encouraged to take the Academic English Health Check at the start of the term, and to visit the English Language Development Center for support if needed. The ELDC supports all students in developing better Academic English and the critical thinking skills needed in academic communication. Make use of the personalized support in academic writing skills development and Café sessions to enhance your ability to do better in the various components of this course. Details and sign-up information: http://www.utsc.utoronto.ca/eld/

Extra Credit

I am committed to incorporating your feedback in order to make this class a challenging but fun and worthwhile experience for students. In service of this goal, I will be asking a short series of questions to evaluate the strengths and weaknesses of each week's lecture, readings, and homework assignments (10 in all). Students who complete these weekly evaluations can earn up to a maximum of .5% extra credit, which will be added to their total grade at the end of the semester. The amount of extra credit will depend on the percentage of evaluations provided, marked simply as completed or not. Feedback will be anonymized before it is given to me, and I am keenly interested in improving the class, so you should feel free to give honest evaluations. Weekly feedback questions can be found in the Modules for each week, or in the "Extra Credit" section under the Assignments tab on Quercus.

Course Schedule

DATE	TOPIC	READINGS	ASSIGNMENTS
Jan. 9	Topic 1. Logistics; Introduction to Decision Making and the Brain	Ch. 1, NE Pop: Niv, 2017 Optional: Ch. 6, NE	
Jan. 16	Topic 2: The complexity of value (Part I)	Genevsky, 2017 Pop: Futurity article	
Jan. 23	Topic 3: The complexity of value (Part II)	Hutcherson, 2012	
Jan. 30	Topic 4: Reward Learning I: Learning from the past	Li, 2011 Pop: Obermeyer, 2021	Homework 1: Brain basics Due: Jan. 27
Feb. 6	Topic 5: Reward Learning II: Predicting the future	Otto, 2013 Pop: Christensen, 2019	
Feb. 13	Topic 6: Taking action: turning evidence into a choice	Globig, 2021	Homework 2: Value Due: Feb. 10
Feb. 20	**Reading Week**	**No CLASS**	
Feb. 27	**Midterm**	IN CLASS	Homework 3: Reward learning Due Feb. 24
Mar. 6	Topic 7: Attention and context effects	Sullivan, 2019	
Mar. 13	Topic 8: Intertemporal choice and self-control	Crockett, 2013 Pop: Chen, 2017	
Mar. 20	Topic 9: Social Decisions I: Strategy and Interaction	Yamagishi, 2016	Homework 4: Choice Due: Mar. 17
Mar. 27	Topic 10: Social Decisions II: Altruism and Morality	Sharot, 2016	
Apr. 3	Topic 11: Pharmacology, addiction, and applications of decision neuroscience	TBD Pop: Samuel, 2023	Homework 5: Discounting Due: Apr. 3