

Cognitive Neuroscience of Decision Making

PSYC57H3

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Course Description

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!).

Readings

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

Grading

Midterm Exam (Feb. 27)	30%
Final Exam (Date TBD)	30%
Homework assignments (4)	32% (8% per homework)
Class participation	8%

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 Feb. 27.
2. Final exam: Like the midterm, the final will consist of multiple choice questions covering lecture material and readings for Topics 7-11. The date is set by the UTSC registrar, will take place sometime from April 8-25, 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 four homework assignments during the semester. Some of these assignments will involve performing simple statistical analysis on, 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 the brain and of the 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 troubleshooting code. Assignments (which are due by Tuesdays at midnight) will be posted on Quercus 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.

Late submissions. Late submissions will receive a 10% penalty for every 24-hour period beyond the deadline, unless appropriate documentation of an emergency situation is received (see the departmental policy on missed term work for further details). Answer keys for homework will be released one week following the deadline. Once answer keys are released, no late submissions will be accepted.

4. Class participation: Although this is a lecture-style class, a major goal of the class is to engage you in substantive interaction with me, the TAs, and other students in the class. This interaction will form the basis of your participation grade. Participation can take a number of forms, and will be graded on a simple point system with 8 total points possible.

Each documented instance of participation will contribute to your total grade, and include the following:

- Asking or responding to questions in class - 1 pt/class (not per question)
- Responding to TopHat questions - .5 pts/class
- Attending office hour sessions - 1 pt/session
- Discussion board- 1 pt/substantive post (can be a question, comment, or response to another student's post)

Missed Term Work due to Medical Illness or Other Emergency:

All students citing a documented reason for missed term work must submit their request for accommodations **within three (3) business days** of the deadline for the missed work.

Students must submit **BOTH** of the following:

- (1.) A completed **Request for Missed Term Work Accommodations form** (<http://uoft.me/PSY-MTW>), and
- (2.) **Appropriate documentation** to verify your illness or emergency, as described below.

Appropriate documentation:

For missed **TERM TESTS** due to **ILLNESS**:

- Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with an **original** copy of the official UTSC Verification of Illness Form (uoft.me/UTSC-Verification-Of-Illness-Form) or an **original** copy of the record of visitation to a hospital emergency room. Forms are to be completed in full, clearly indicating the start date, anticipated end date, and severity of illness. The physician's registration number and business stamp are required.
- Note: If an end date of "ongoing" is specified, the medical note will be assumed to cover a period of two weeks. If no end date / an "unknown" end date is specified, the note will be assumed to cover a period of three business days (starting from illness start date.)

For missed **TERM TESTS** due to **ACCESSABILITY REASONS**:

- Meet with your **AccessAbility consultant** and have them email Keely (keely.hicks@utoronto.ca) detailing the accommodations required.

For missed **ASSIGNMENTS** due to **ILLNESS**:

- Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with a **hardcopy** of the Self-Declaration of Student Illness Form (uoft.me/PSY-self-declare-form).

For missed **ASSIGNMENTS** due to **ACCESSABILITY REASONS**:

- If your desired accommodation is **within the scope** of your Accommodation Letter (ex. your letter includes "extensions of up to 7 days" and you need 3 days), submit the Request for Missed Term Work Accommodations form

(<http://uoft.me/PSY-MTW>) and attach a copy of your letter. **Specify how many days extension you are requesting** on the request form.

- If your desired accommodation is **outside the scope** of your Accommodation Letter (ex. your letter includes “extensions of up to 7 days” but you need more time than that) you will need to meet with your **AccessAbility consultant** and have them email Keely (keely.hicks@utoronto.ca) detailing the accommodations required.

For missed term tests or assignments in **OTHER CIRCUMSTANCES**:

Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with:

- In the case of a **death of a family member or friend**, please provide a copy of a death certificate.
- For U of T varsity-level or professional **athletic commitments**, an email from your coach or varsity administrator should be sent directly to Keely Hicks (keely.hicks@utoronto.ca) **well in advance** of the missed work, detailing the dates and nature of the commitment.
- For **religious accommodations**, please email (keely.hicks@utoronto.ca) **well in advance** of the missed work.
- For circumstances **outside of these guidelines**, please email Keely (keely.hicks@utoronto.ca) on or before the date of the test / assignment deadline to describe your circumstances and ask what documentation would be appropriate

Documents covering the following situations are NOT acceptable: medical prescriptions, personal travel, weddings/personal/work commitments.

Procedure:

Submit your (1.) [request form](#) and (2.) [medical/self-declaration](#)/other documents in person **WITHIN 3 BUSINESS DAYS** of the missed term test or assignment.

Submit to: Keely Hicks, Room SW420B, Monday – Friday, 9 AM – 4 PM. (Slide forms under door if out of office.)

After submitting your documentation, within approximately one to five business days, you will receive a response from your instructor detailing the accommodations to be made (if any).

You are responsible for checking your official U of T email and Quercus course announcements daily, as accommodations may be time-critical.

You should continue to work on your assignments to the best of your ability, as extension accommodations may be as short as one business day, depending on the nature of the illness/emergency.

If an accommodation has been granted but you are unable to meet the conditions of the accommodation (ex. you need a longer extension, or you missed a make-up test), you will need to repeat the missed term work procedure and submit additional forms to request further accommodation. Note that in the case of a missed make-up test, an opportunity to write a second make-up test may not be provided.

Completion of this form does NOT guarantee that accommodations will be made. The course instructor reserves the right to decide what accommodations (if any) will be made. Failure to adhere to any aspect of this policy may result in a denial of your request for accommodation.

Missed Accommodations

If an accommodation is granted but a continued illness/emergency prevents you from meeting the requirements of your accommodation, you must repeat the missed term work procedure to request additional accommodations.

(E.g.) If you miss a make-up midterm, you would need to submit another Request for Missed Term Work Accommodations form. If your original medical note / documentation included the date of the make-up midterm, then only the Request form is required. If the date of the make-up midterm fell outside of the dates indicated on your original medical note/other documentation, then a new medical note/other appropriate documentation must also be submitted.

Importance of Three Business Day window:

If you are unable to submit your documents in-person within the three business day window, **you must email Keely (keely.hicks@utoronto.ca) within the three business day window** to explain when you will be able to bring your documents in person. Exceptions to the documentation deadline will only be made under **exceptional circumstances**. Attach scans of your documentation, and be prepared to bring your documents to Keely in-person as soon as you are well. Late documents may not be accepted.

NOTE: Assignments due at end of term

Instructors cannot accept term work any later than five business days after the last day of class. Beyond this date, you would need to file a petition with the Registrar's Office (<https://www.utscc.utoronto.ca/registrar/term-work>).

NOTE: Final Exams

This policy applies only to missed assignments and term tests. Missed final exams are handled by the Registrar's Office (<http://www.utscc.utoronto.ca/registrar/missing-examination>).

Missed Exams

Midterm. If you are approved to miss the midterm, your final exam score will be reweighted to count for 60% of your course grade. For reasons of fairness, there will be no exceptions to this policy.

Final. 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.

Lectures

Lectures take place on Thursdays from 3-5pm in IC 220, and are designed to present major research areas, theories and experiments from the field of decision neuroscience. While there will be some overlap between lectures and the readings, there will not be a 1-to-1 correspondence. Some things may be covered in lecture but will not appear in the reading and vice-versa. I therefore recommend that you make every effort to attend class each week. Attendance and participation during lectures is also a good way to achieve full points for your course participation grade.

Please note: there will be no lectures on Feb. 20 (reading week) or Feb. 27 (replaced by an in-class midterm).

Office Hours (SW565, Mondays 5-7PM)

Office hours 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 arrive for office hours, please come inside my office, even if other students are already present. That way I will know you are present, and you can hear the discussion with other students.

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 either in-person on campus, or, for your convenience, online (made possible by the wonders of modern technology like Skype and appear.in). Students should be proactive about scheduling time with TAs well in advance of the homework deadline to receive personalized mentorship.

Top Hat

I will occasionally be polling the class during lectures to add an element of interaction, as well as to provide a way for you to earn participation points. We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message.

You can visit the Top Hat Overview (<https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide>) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.

An email invitation will be sent to you by email. If you don't receive this email, please contact Professor Hutcherson ASAP in order to receive alternate instructions.

Note: our Course Join Code is 257598.

Important: You will only be able to receive participation points from TopHat participation if you register for a paid account. You can participate in polls during classtime even if you do not register for Top Hat, but your participation will only be officially recorded, and participation marks assigned to you, if you purchase a paid subscription. A full breakdown of all subscription options available can be found here:

www.tophat.com/pricing.

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their Support Team directly by way of email (support@tophat.com), the in app support button, or by calling 1-888-663-5491.

AccessAbility:

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.

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.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 homeworks (11 in all). Students who complete these weekly evaluations can earn up to a maximum of 1% 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 under the "Extra Credit" section on Quercus.

Course Schedule

DATE	TOPIC	READINGS	ASSIGNMENTS
Jan 9	Topic 1. Logistics; Introduction to Decision Making and the Brain	Ch. 1, NE Niv, 2017 Optional: Ch. 6, NE	
Jan. 16	Topic 2: The value of things: Costs and benefits, risks and rewards	Kuhnen, 2005	
Jan. 23	Topic 3: An introduction to programming and computational models	Ch. 4, NE (see reading guide for details)	
Jan. 30	Topic 4: Reward Learning I: Learning from the past	Chiu, 2008 Li, 2011	Homework 1: Basics Due: Feb. 4
Feb. 6	Topic 5: Reward learning II: Predicting the future	Wimmer, 2012; Otto, 2013	
Feb. 13	Topic 6: Taking action: turning evidence into a choice	De Martino, 2013	Homework 2: Reward learning Due: Feb. 18
Feb. 20	Reading Week	NO CLASS	
Feb. 27	Midterm Exam (In class)		
Mar. 5	Topic 7: Attention, context and expectancy effects	De Martino, 2009 Sullivan, 2019	
Mar. 12	Topic 8: Intertemporal choice and self-control	Hutcherson, 2012; Chen, 2017	Homework 3 Implementing choice Due: Mar. 17
Mar. 19	Topic 9: Social Decisions I: Altruism and Morality	Hutcherson, 2015 Sharot, 2016	
Mar. 26	Topic 10: Social Decisions II: Strategy and interaction	Yamagishi, 2016	Homework 4: Social choice, discounting Due: Mar. 31
Apr. 2	Topic 11: Pharmacology, addiction, and disorders of decision making	Genevsky, 2017	