



PSY471F Developmental Cognitive Neuroscience

Fall 2024

Mondays 1:00 – 3:00 pm, Robarts Library (RL) 14190

Contact Information

Professor Amy Finn

email: amy.finn@utoronto.ca

Office Hours: by request

Description

This course will ask how changes in the developing brain can influence our understanding of how infants, children, and adults learn and think. To answer this question, we will first go over the process of human brain development. We will then cover specific topics including the development of sensory and motor systems and the development of multiple aspects of learning and memory. In all cases, we will ask whether neural measures inform our understanding of how cognitive processes change with age. PSY 270 and PSY202 are prerequisites; completion of PSY 210 and PSY 493 is also recommend.

Goals and Learning objectives

Each week we will read review papers and original articles in the pursuit of answering a specific question about the influence of brain development on cognition. We will see that while these original articles are directed at answering specific questions, they often do not. Instead, complexities often lead to many new questions. Our goal is to have fun diving into these “worm holes” and complexities, to dig deep, get specific, and learn to appraise the benefits and limitations of the research that we read. **Our primary objective is to develop skills that will help to assess the scope and quality of research in general, not just in the area of developmental cognitive neuroscience.** Other objectives include developing critical thinking skills, presentation skills, the ability to write concise and clear statements, and the ability to benefit from and provide constructive feedback. We will strive to create an atmosphere of mutual respect—creating a place where we can all share ideas and ask questions.

Requirements

Students will be asked to actively participate in discussions, give in-class presentations, write weekly response papers, and write a research proposal that is also presented during one of the three final class periods.

Marking Scheme

<i>% of Grade</i>	<i>Assignment/Task</i>
20	<i>Participation</i>
20	<i>Presentation</i>

20	<i>Weekly Response Papers</i>
30	<i>Research proposal</i>
10	<i>Research presentation</i>

Participation (20%)

This small seminar is a great opportunity to engage with your peers! You will get the most out of it if you come to class and come prepared. Every week your participation in the class will be scored. Your score will be based on the (1) quality (relevance, insight added), (2) quantity (not too much, not too little), and (3) conciseness (making good use of everybody’s time) of your contributions. Listening carefully to your classmates’ contributions is essential. Questions that spark a class discussion or that help us clarify understanding can be significant contributions, too. In making this assessment, I am answering the question **“how different would the class have been if that student would not have been present?”** Your score will be 0 (absent, silent, non-relevant, distracted and on their phone/doing other work during class), 1 (ok), 2 (good), or 3 (outstanding) points, for a maximum of 20 points (getting a 2 each day will therefore result in full credit: 100% for the participation component of your grade). Math is based on 10 class periods as the first day does not count. 😊

If in class participation is difficult, opportunities to participate in online forums will be made available, but coming to class (when healthy!) will still be needed to get full participation marks. If class must be missed due to health, you are welcome to comment on the online discussion board to receive participation marks for the day, making sure to go beyond what you note in your weekly response paper for that day.

Your online comments will also be scored similarly to in class comments: 0 (non-relevant and just restating the reading), 1 (ok; you asked or answered a question and it makes sense), 2 (good; you asked or answered a question and it was thoughtful), or 3 (outstanding; you asked or answered a question and it was so thoughtful it even made me think in a new way) points.

Presentation (20%)

Each class member is responsible for giving one presentation (approximately 30 minutes) prepared in PowerPoint or Keynote on one of the topics described below in the schedule. The presentation should attempt to answer the primary question for the course topic that is highlighted in the readings (for example, *“Is face perception innate?”*). **To this end, the presenter should describe their assigned article in the reading list, and indicate how this article helps to answer the overarching question.** The beginning of most presentations will be somewhat “lecture-like” going over the findings in each study, *but they should progress to set up the main topics and critical issues that will be discussed by the group as a whole.* **A PowerPoint or Keynote file containing your presentation should be uploaded to Quercus at least 1 hour before class starts the day of your presentation.**

Your grade will be based on the clarity of your presentation (slides + spoken) and your ability to summarize the research you discuss for the purpose of distilling what we have learned after hearing about this research. *If you miss your presentation due to illness or injury, this proportion of your grade will be added to research proposal grade.*

Weekly Response Papers (20%)

Each week, all participants will submit a **1-page response paper**, based on the assigned reading. This response will be organized into 2 sections ***and must be uploaded to Quercus at least 1 hour before class starts each day we have class.***

Part 1 will be an executive summary for the assigned reading. This needs to be BRIEF (not more than a

paragraph and should convey the take-home message of the article. After reading the paper, what do you know that you did not before? What do the data mean? When writing this, imagine that you are sharing a short elevator ride with a professor who asked you to describe the study. Imagine that your audience has some familiarity with the field in general, but not this subject in particular. *Providing a concise, accurate, and efficient summary of the work demonstrates that you understand the material. It also shows that you are able to convey a complicated idea succinctly.*

***AI might be helpful for this aspect of the summary.** If you choose to use this (see policy below), (1) make sure to indicate this on the assignment, and (2) make sure to edit this so that AI is telling the truth. You may find it easier to do this on your own immediately after reading the paper.

Part 2 will be a short paragraph summarizing your thoughts on whether and how the readings make progress toward answering the topical question for that week. Provide clear support for each of your positions, stating *why*. In cases where there is a yes/no answer and you choose no (the articles do not make progress toward the question) state how future data/experiments could. This is your opportunity to be both critical and creative. *While it can be easy (and important) to highlight a study's limitations, it is also helpful to identify its strengths and contributions and think of improvements for future work.*

***AI will not be helpful for this aspect of the summary since this pertains to your personal reactions and integrating your reading with the specific experiences you have had in this class, in your other course and research experiences and personal lived experience. I'm really interested in your thoughts here.**

Your response papers will be evaluated for clarity & concision (part 1) and for thoughtfulness (part 2). You will get up to two points for your work each week. I will not be able to provide extensive individual feedback on each response each week, but I will anonymously present examples of great responses from the previous week and indicate, specifically, what makes these exceptional. You will be permitted to skip responses for 2 classes (a total of 6 responses is required), regardless of whether you are present. Many students may choose to skip the assignment on days that they are presenting. **Late responses will not be accepted, but 2 can be missed.**

Research Proposal (30%)

Your task is to identify a specific issue in this field of developmental cognitive neuroscience that remains unresolved or requires further investigation (they all do 😊). This topic may be based on an issue from class discussion, but this is not required. However, because this is a course in developmental cognitive neuroscience, it should relate **to the brain and development**. *The most important part of this assignment is your ability to identify a specific and important experimental question and to design experiments that address this question.* This is designed to give you the opportunity to think creatively and critically about the issues we have discussed.

This proposal can be structured as a grant proposal—not longer than **4 pages, double-spaced in 12-point font with 1 inch margins not including references**. The paper should include the following sections:

Title and Abstract: This is the most frequently read section of any research article, so it is worth making it good! It should be 200 – 250 words and convey the research question/background, methods, anticipated results *and their significance*. This section is usually written last.

Introduction: The introduction should describe the problem and cite relevant studies from the literature that inform your hypothesis (these should go beyond what has been covered in class). Clearly state your hypothesis and your predictions at the end of this section.

Methods: Describe the experimental methods you will use to test your hypothesis. These should be sufficiently detailed to address the question at hand. For instance, if you are investigating the development of nonverbal memory processing in the frontal lobe with functional MRI, it is not sufficient to say “subjects will be tested on a nonverbal memory task.” Your paper should include a discussion of why your particular choice of experimental methodology is best for testing the hypothesis you present.

Expected Results and Significance: Finally, you should discuss the possible results of your experiment, and what bearing these results would have on your hypothesis. Consider that an outcome different from the one you predicted could occur, and describe possible reasons for this outcome and what this might mean for your hypothesis. Importantly, be sure to address the broader significance of your potential findings. Imagine that you are trying to convince a granting agency that they should fund this research. Why is the research important? Will it change existing theories? Might it have some clinical application? The use of figures is encouraged.

There are three important deadlines for your proposal:

1. **Submit your idea (1 point of the total 30) as a research abstract** with **1)** a figure depicting the task or design and **2)** a figure depicting anticipated results. You will spend time in class giving each other feedback on your ideas. I will also provide formal feedback. ***This is due on October 7th. Late responses will not be accepted*** and the portion of your overall grade (1 point) will be added to the final proposal.
2. **Submit a first draft of your proposal and providing feedback to peers (1 point of the total 30)**. This draft of your proposal is due ***on November 4th***. After submitting your proposal you will have one week to provide feedback to 3 peers via Quercus on their drafts by ***November 11th***. Writing is an inherently social and iterative processes that is greatly improved by both giving and receiving such feedback! ***Late drafts will not be accepted*** and you will also not be able to provide or receive feedback to/from peers. If this deadlines is missed, the portion of your overall grade (1 point) will be added to the final proposal.
3. **Submit a final draft of your proposal (28 points of the total 30)**. Finals drafts of proposals are due ***on November 18th***. Papers will be evaluated for containing all of the features listed above. The ability of the design to test the outlined question and potential contribution of the study to extant literature will be assessed. Detailed feedback will be provided. ***Late papers will be deducted 5 points per day they are late if not explanation nor correspondence about the lateness is provided.***

Research Presentation (10%)

The “data blitz” talk is a staple of many scientific conferences and is an opportunity to express your ideas convincingly and succinctly. In the last three classes, each student will briefly present their proposal to the class. I anticipate that each student will have approximately 10 minutes to pitch their idea (with 5 minutes for discussion). When preparing this presentation, imagine that you are presenting it to a grant panel: you need to convince them that your research question is theoretically motivated, your methods are sound, and that the results will make an important contribution to the field.

Your grade for this section will be based on the clarity of your presentation (slides + spoken) and your ability to succinctly communicate your research question and proposed design. *Missed “data blitz” talks will be accommodated if there is remaining class time; this is however unlikely, so the portion of your overall grade (10%) will be added to your Research Proposal (making the Research Proposal constitute 40% of your overall grade in the course).*

Course Webpage/Quercus

The website associated with this course is accessible via <http://q.utoronto.ca>

Writing Help

Book an appointment online with the Writing Centres on St. George Campus:

<http://www.writing.utoronto.ca/writing-centres/arts-and-science>

English is not your first language? Take a look at these resources:

<http://www.writing.utoronto.ca/faqs/english-as-second-language>

<http://www.artsci.utoronto.ca/current/advising/ell>

Academic Integrity

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your own honest efforts.

Plagiarism—representing someone else's work as your own or submitting work that you have previously submitted for marks in another class or program is a serious offence that can result in sanctions. Speak to me or your TA for advice on anything that you find unclear. To learn more about how to cite and use source material appropriately and for other writing support, see the U of T writing support website at <http://www.writing.utoronto.ca>.

The University of Toronto's Code of Behaviour on Academic Matters (<https://www.vicereprovoststudents.utoronto.ca/policy-guideline/code-of-behaviour-on-academic-matters/>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offenses.

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

University's Plagiarism Detection Tool

Normally, students will be required to submit their course writing to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their work to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation website (<https://uoft.me/pdt-faq>).

On the use of Generative Artificial Intelligence (Gen AI) Tools

Students may use generative artificial intelligence tools (e.g., ChatGPT) for assignments in this course. If you choose to use generative artificial intelligence tools to assist you in the assignments in this course (including posting on the discussion board and providing peer feedback), this use must be documented in an appendix for each assignment and noted in the posting/feedback. The documentation should include **what tool(s) were used, how they were used (e.g., include your prompts), and how the results from the AI were incorporated into the submitted work**. These tools can be most helpful in improving your writing and clear expression of your ideas (rather than trying to generate complete content which is unlikely to meet the standards of the assignments).

Absences and missed-term work policy

If you become ill or have an extenuating circumstance that affects your ability to attend class or complete and assignment, send me an email within one week of the missed class or term-work. I will ask you for documentation which can take any of the following forms:

- Absence declaration via [ACORN](#) (see below for important information on eligibility)
- [U of T Verification of Illness or Injury Form \(VOI\)](#)
- College Registrar's letter

- Letter of Academic Accommodation from Accessibility Services

Please see <http://www.illnessverification.utoronto.ca>. For information on Absence Declaration Tool for A&S students, please see <https://www.artsci.utoronto.ca/absence>. If you get a concussion, break your hand, or suffer some other acute injury, you should register with Accessibility Services as soon as possible.

Resources and Accommodations

Accessibility Needs

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, you should register with Accessibility Services (AS) at the beginning of the academic year by visiting <http://www.studentlife.utoronto.ca/as/new-registration>. Without registration, you will not be able to verify your situation with your instructors, and instructors will not be advised about your accommodation needs. AS will assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. Remember that the process of accommodation is private: AS will not share details of your needs or condition with any instructor, and your instructors will not reveal that you are registered with AS.

Religious Accommodations

As a student at the University of Toronto, you are part of a diverse community that welcomes and includes students and faculty from a wide range of cultural and religious traditions. For my part, I will make every reasonable effort to avoid scheduling tests, examinations, or other compulsory activities on religious holy days not captured by statutory holidays. Further to University Policy, if you anticipate being absent from class or missing a major course activity (such as a test or in-class assignment) due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two to three weeks), so that we can work together to make alternate arrangements.

Other Resources

Student Life Programs and Services (<http://www.studentlife.utoronto.ca/>)

Academic Success Services (<https://studentlife.utoronto.ca/department/academic-success/>)

Counselling and Psychological Services (<https://studentlife.utoronto.ca/department/health-wellness/>)

Health and well-being

As a student, you may experience challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation, financial concerns, family worries and so forth. These factors may affect your academic performance and/or reduce your ability to participate fully in daily activities. Everyone feels stressed now and then – it is a normal part of university life. Some days are better than others, and there is no wrong time to reach out. There are resources for every situation and every level of stress. There are many helpful resources available through your College Registrar (<https://studentlife.utoronto.ca/>) or through Student Life (<https://studentlife.utoronto.ca/task/support-when-you-feel-distressed/>). An important part of the University experience is learning how and when to ask for help. Please take the time to inform yourself of available resources.

Wellness Statement*

As your professor, I value your health and well-being. In order to succeed in my class, in University, and beyond, you must work hard AND balance the work with rest... and attention to your mental and physical health. Yes, I plan to challenge you... By the end of this class, I hope you will feel proud of your growth and learning much like the marathoner feels accomplished by their triumphs across the finish line.

However, this work cannot be at the expense of your well-being. **Working until exhaustion is NOT a badge of honour; it shows you are out of balance.**

In addition to the many resources and supports available to you at UofT , you might find this [self-care packet](#) (with a self-assessment, advice, and worksheets) helpful in reaching your self-care goals. **excerpted from Dr. Molly Metz of the UofT **Schedule, Topic, Questions, Reading and Sign up***

Date	Topic, Question, Reading & Sign up
Sept. 9	<p>Introduction</p> <p>overview, presentation topics, writing and presentation tips, brief methods, welcome!</p>
Sept. 16	<p>Structural brain development</p> <p><u>Question:</u> <i>How might structural changes in the brain influence brain function and cognition?</i></p> <ol style="list-style-type: none"> 1. Ducharme, S., Albaugh, M. D., Nguyen, T.-V., Hudziak, J. J., Mateos-Pérez, J. M., Labbe, A., et al. (2016). Trajectories of cortical thickness maturation in normal brain development — The importance of quality control procedures. <i>NeuroImage</i>, 125, 267-279. 2. Natu, V. S., Gomez, J., Barnett, M., Jeska, B., Kirilina, E., Jaeger, C., et al. (2019). Apparent thinning of human visual cortex during childhood is associated with myelination. <i>Proceedings of the National Academy of Sciences</i>, 116(41), 20750-20759. <p><i>optional additional background reading to contextualize brain development</i></p> <p>Stiles, J., & Jernigan, T. L. (2010). The basics of brain development. <i>Neuropsychology review</i>, 20(4), 327-348.</p> <p>Presenters</p> <hr/>
Sept. 23	<p>Plasticity</p> <p><u>Question:</u> <i>What is brain plasticity? How does experience shape brain function?</i></p> <ol style="list-style-type: none"> 1. Reh, R. K., Dias, B. G., Nelson, C. A., Kaufer, D., Werker, J. F., Kolb, B., et al. (2020). Critical period regulation across multiple timescales. <i>Proceedings of the National Academy of Sciences</i>, 201820836. 2. Huber, E., Webster, J. M., Brewer, A. A., MacLeod, D. I. A., Wandell, B. A., Boynton, G. M., et al. (2015). A Lack of Experience-Dependent Plasticity After More Than a Decade of Recovered Sight. <i>Psychological Science</i>, 26(4), 393-401. <p>Presenters</p> <hr/>
Sept. 30	<p>Experience and Vision</p> <p><u>Question:</u> <i>What is the role of experience in shaping our ability to see?</i></p> <ol style="list-style-type: none"> 1. Jamal, Y. A., & Dilks, D. D. (2020). Rapid topographic reorganization in adult human primary visual cortex (V1) during noninvasive and reversible deprivation. <i>Proceedings of the National Academy of Sciences</i>, 117(20), 11059-11067. 2. Kamps, F. S., Hendrix, C. L., Brennan, P. A., & Dilks, D. D. (2020). Connectivity at the origins of domain specificity in the cortical face and place networks. <i>Proceedings of the National Academy of Sciences</i>, 117(11), 6163.

Presenters

Oct. 7

Attention

Question: *How does brain development impact the development of attention (also what is attention?)*

1. Rohr, C. S., Vinette, S. A., Parsons, K. A. L., Cho, I. Y. K., Dimond, D., Benischek, A., et al. (2017). Functional Connectivity of the Dorsal Attention Network Predicts Selective Attention in 4–7 year-old Girls. *Cerebral Cortex*, 27(9), 4350-4360.
2. Jung, Y., Forest, T. A., Walther, D. B., & Finn, A. S. (2023). Neither Enhanced Nor Lost: The Unique Role of Attention in Children's Neural Representations. *Journal of Neuroscience*, 43(21), 3849-3859.

Research abstracts due

Presenters

Oct. 14

Thanksgiving Holiday

Oct. 21

Statistical Learning

Question: *Does statistical learning change with development?*

1. Moreau, C. N., Joanisse, M. F., Mulgrew, J., & Batterink, L. J. (2022). No statistical learning advantage in children over adults: Evidence from behaviour and neural entrainment. *Developmental Cognitive Neuroscience*, 57, 101154.
2. Ellis, C. T., Skalaban, L. J., Yates, T. S., Bejjanki, V. R., Córdova, N. I., & Turk-Browne, N. B. (2021). Evidence of hippocampal learning in human infants. *Current Biology*, 31(15), 3358-3364.e3354.

optional additional background reading to contextualize brain development

Forest, T. A., Schlichting, M. L., Duncan, K., & Finn, A. S. (2023). How statistical learning changes across development. *Nature Reviews Psychology*, 2, 205–219.

Presenters

Oct. 28

Reading week

Nov. 4

Memory

Question: *In what ways does human memory change with development?*

1. Schlichting, M. L., Guarino, K. F., Roome, H. E., & Preston, A. R. (2022). Developmental differences in memory reactivation relate to encoding and inference in the human brain. *Nature Human Behaviour*, 6(3), 415-428.

2. Brod, G., Lindenberger, U., & Shing, Y. L. (2017). Neural activation patterns during retrieval of schema-related memories: differences and commonalities between children and adults. *Developmental Science*, 20(6), e12475.

Research proposals, draft 1 due

Presenters

Nov. 11 Critical Periods in Language

Question: *How is neural plasticity related to the ability to learn and process language?*

1. Finn, A. S., Hudson Kam, C. L., Ettlinger, M., Vytlačil, J., & D'Esposito, M. (2013). Learning language with the wrong neural scaffolding: The cost of neural commitment to sounds. *Frontiers in Systems Neuroscience*, 7.
2. Smalle, E. H., Daikoku, T., Szmalec, A., Duyck, W., & Möttönen, R. (2022). Unlocking adults' implicit statistical learning by cognitive depletion. *Proceedings of the National Academy of Sciences*, 119(2), e2026011119.

Research proposals peer feedback due

Presenters

Nov. 18 Sleep

Question: *What is the role of sleep in development and child/adult learning?*

1. Li, W., Ma, L., Yang, G., & Gan, W.-B. (2017). REM sleep selectively prunes and maintains new synapses in development and learning. *Nature Neuroscience*, 20, 427.
2. Batterink, L. J., & Paller, K. A. (2017). Sleep-based memory processing facilitates grammatical generalization: Evidence from targeted memory reactivation. *Brain and language*, 167, 83-93.

Research proposals due

Presenters

Nov. 25 Data blitz #1

Dec. 2 Data blitz #2