



PSY471F Developmental Cognitive Neuroscience

Winter 2022

Mondays 12:00 – 2:00 pm, Sidney Smith 2101 and online for January, Zoom link:
<https://utoronto.zoom.us/j/86758877199>

Contact Information

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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), 1 (ok), 2 (good), or 3 (outstanding) points. This will make up 20% of your grade overall. If in class participation is difficult, opportunities to participate in online forums will be made available, but coming to class (when healthy if class is in person) will still be needed to get participation marks. If class must be missed due to health (especially when in person), 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.

Presentation (25%)

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.

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.

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 7 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 **two important deadlines for your proposal:**

1. **Submit your idea (2 points 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 February 14th. Late responses will not be accepted*** and the portion of your overall grade (2 points) will be added to the final proposal.
2. **Submit a first draft of your proposal and providing feedback to peers (2 points of the total 30).** This draft of your proposal is due ***on March 7th***. After submitting your proposal you will have one week to provide feedback to 3 peers via Quercus on their drafts by ***March 14th***. Writing is an inherently social and iterative processes that is greatly improved by both giving and receiving such feedback!
3. **Submit a final draft of your proposal (26 points of the total 30).** Finals drafts of proposals are due ***on March 21st***. 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 10-15 minutes to pitch their idea (with 8-10 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.

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>

Plagiarism

Plagiarism is using another writer’s words or ideas without the proper acknowledgement.

Know what plagiarism is so you can avoid it: <http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize> If you have any questions about whether what you are doing constitutes plagiarism, contact the instructor.

Academic Integrity

The University of Toronto takes cases of academic misconduct seriously. The UofT Code of Behaviour on Academic Matters (<http://www.artsci.utoronto.ca/osai/code/the-code-ofbehaviour-on-academic-matters>) is a detailed document describing policies regarding misconduct, which includes:

- quoting another person’s ideas in your work without clear acknowledgement

- using or possessing an unauthorized aid or obtaining unauthorized assistance in taking an exam or writing a paper
- submitting forged or altered documentation for excuses for missed exams

Any of these offenses will result in referral to the central academic integrity office and consequences that the University deems appropriate after investigation.

Accessibility

University of Toronto is committed to accessibility. If you require accommodations for a disability or have an accessibility concern about this course, please contact Accessibility Services as soon as possible:

<http://www.studentlife.utoronto.ca/as>

That Other Kind of Psychology

These years can be challenging, both in and out of the classroom. University of Toronto offers services to assist students facing a wide range of emotional and psychological challenges:

<http://www.studentlife.utoronto.ca/hwc>

Schedule, Topic, Questions, Reading and Sign up

Date	Topic, Question, Reading & Sign up
Jan. 10	<p>Introduction overview, presentation topics, writing and presentation tips, brief methods, welcome!</p>
Jan. 17	<p>Brain development <u>Question:</u> <i>What are some general principles of human brain development?</i></p> <p>Reading</p> <ol style="list-style-type: none"> Innocenti, G. M., & Price, D. J. (2005). Exuberance in the development of cortical networks. <i>Nature Reviews Neuroscience</i>, 6(12), 955-965. Stiles, J., & Jernigan, T. L. (2010). The Basics of Brain Development. <i>Neuropsychology Review</i>, 20(4), 327-348. <p>Presenters</p> <p>_____</p>
Jan. 24	<p>Structural brain development <u>Question:</u> <i>How does brain structure change across development?</i></p> <ol style="list-style-type: none"> 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. 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>Presenters</p> <p>_____</p>
Jan. 31	<p>Plasticity <u>Question:</u> <i>How does experience shape brain function?</i></p> <ol style="list-style-type: none"> 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. 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> <p>_____</p>
Feb. 7	<p>Specialization, Vision <u>Question:</u> <i>Is visual and face perception innate?</i></p>

1. Gomez, J., Barnett, M., & Grill-Spector, K. (2019). Extensive childhood experience with Pokémon suggests eccentricity drives organization of visual cortex. *Nature Human Behaviour*, 3(6), 611-624.
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. *Proceedings of the National Academy of Sciences*, 117(11), 6163.

Presenters

Feb. 14

Attention

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

1. Murphy, J. W., Foxe, J. J., & Molholm, S. (2016). Neuro-oscillatory mechanisms of intersensory selective attention and task switching in school-aged children, adolescents and young adults. *Developmental Science*, 19(3), 469-487.
2. 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.

Research abstracts due

Presenters

Feb. 21

Reading week

Feb. 28

Statistical Learning

Question: *Does statistical learning change with development?*

1. Finn, A.S., Kharitonova, M. Holtby, N.*, & Sheridan, M.A. (2019). Prefrontal and hippocampal structure predict statistical learning ability in early childhood. *Journal of Cognitive Neuroscience*.
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.

Presenters

March 7

Declarative Memory

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

1. Selmecky, D., Fandakova, Y., Grimm, K. J., Bunge, S. A., & Ghetti, S. (2019). Longitudinal trajectories of hippocampal and prefrontal contributions to episodic retrieval: Effects of age and puberty. *Developmental Cognitive Neuroscience*, 36, 100599.
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

March 14 **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., Ettliger, 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. Friederici, A. D., Mueller, J. L., Sehm, B., & Ragert, P. (2013). Language Learning without Control: The Role of the PFC. *J Cogn Neurosci*.

Research proposals peer feedback due

Presenter(s)

March 21 **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. Wilhelm, I., Rose, M., Imhof, K. I., Rasch, B., Buchel, C., & Born, J. (2013). The sleeping child outplays the adult's capacity to convert implicit into explicit knowledge. *Nature Neuroscience* 16(4), 391-393.

Research proposals due

Presenter(s)

March 28 **Data blitz #1**

April 4 **Data blitz #2**