

**University of Western Ontario**  
**Psychology**  
**Psychology 9102B**  
**Knowledge Representation in the Human Mind and Brain**  
**Winter 2023**  
**Wednesdays, 1:00-4:00, Room TBA**

**Enrollment Restrictions**

Enrollment in this course is restricted to graduate students in Psychology, as well as any student that has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

**Instructor and Teaching Assistant Information**

Instructor: Ken McRae

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Office Hours: Wednesday, 11:00-1:00

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If you wish to talk or meet with me, just let me know.

**Course Description**

Mental representations of many types of knowledge are a central aspect of the vast majority of theories of the human mind and brain. In this course, we will take an in-depth look at use of representations in cognitive science. We will investigate and question current strongly-ingrained views of mental representations. To do so, we will cover issues including: what a mental representation is; theoretical perspectives on the properties and content of mental representations; retrieval versus constructive simulation-based theories of memory and knowledge; given that thought is a continuous flow through time, the roles that representations may or may not play in cognition; if all knowledge is context-dependent, then what roles should representations play in theories of human cognition; embodiment (grounded cognition) and its implications for knowledge representation; given that, for example, the weights in connectionist networks encode both knowledge and processing, the advantages and disadvantages of distinguishing between representations and processing; implications for interpreting imaging data; and whether representations indeed exist in the mind and brain.

## **Course Format**

This will be a fully in-person discussion-based course unless in-person classes are suspended by Western at that time. In the case that in-person classes are suspended, classes will occur by zoom (and will continue to be discussion-based).

## **Course Learning Outcomes/Objectives**

Knowledge representations play an absolutely central role in the vast majority of theories and empirical work in cognitive neuroscience. The students will understand and think critically about what mental representations are (the properties of representations that have been espoused by theorists; types of mental representations), the roles that mental representations play in theories, and how mental representations are retrieved/activated and used. The students also will learn about, and think critically about, theoretical alternatives to the storage and retrieval/activation of mental representations.

Upon completion of this course, students should be able to:

1. Understand, discuss, and think critically about theoretical ideas regarding knowledge representation in the human mind and brain.
2. Think critically about alternative ideas regarding the storage, retrieval, nature, and existence of mental representations.
3. Think critically about the links between empirical results and the interpretation of those results with respect to knowledge representation and dynamic processing.
4. Generate and communicate central ideas in the general field of knowledge representation.

## **Course Materials**

Students will read a series of articles and chapters. There is no textbook for this course.

## **Methods of Evaluation**

### Leading Weekly Discussions (25%)

One or two students will lead each week's discussion. The discussion leader should begin with a roughly 15-20 minute presentation outlining that week's topic. You are free to integrate any supplementary literature that you think will help to situate the topic for the class. Then, you will lead the class in a discussion about the key issues raised. Your presentation should demonstrate your knowledge of the literature on the chosen topic, and your ability to think deeply (and get others to think deeply) about the work.

### Class Participation (25%)

All students are expected to participate actively and respectfully. The quantity and quality of your participation will be graded.

### Weekly Discussion Questions (10%)

Every week, students will be asked to submit one discussion question to the discussion board located under "Forum" on OWL by Monday before 5:00 pm for that week's corresponding class. All students in the class will have access to the weekly submitted discussion questions. In addition, all students are responsible for reviewing the questions posted to OWL prior to Wednesday's class to ensure that there is a collective understanding of the viewpoints and questions elicited by the readings. Excellent questions will demonstrate critical thought in relation to the assigned reading(s) and should serve to stimulate a thoughtful and productive exchange of ideas.

### Final Project (40%)

The final project can take one of several forms, depending on a student's wishes. You will write a paper that will be a maximum of 10 pages, double-spaced, Times New Roman 12 point, with 2.54 cm margins (Title page and References are in addition to the 10 pages). The paper can be one of the following: (1) a theoretical review; (2) a research proposal; or (3) a position paper. Please meet with the instructor prior to March 8, 2023 to discuss your project. The final project is due on Wednesday, April 12, 2023 by midnight Eastern time. Ten percent will be deducted each day starting on April 13, 2023 at 12:01 am.

Assignment	Date of Evaluation (if known)	Weighting
Leading Weekly Discussions	The date of a student's presentation	25%
Class Participation	Every class	25%
Weekly Discussion Questions	Every Monday by 5:00	10%
Final Project	April 12, 2023	40%
Total		100%

### Course Timeline: Note: The precise Topics and Readings are not yet set in stone.

Week	Date	Topics	Readings Due
1	January 11	Introduction to the course: What do YOU presently think about representations?	none
2	January 18	Metaphors	Casey, G., & Moran, A. (1989). The computational metaphor and cognitive psychology. <i>The Irish Journal of Psychology</i> , 10(2), 143-161. Roediger, H. L. (1980). Memory metaphors in cognitive psychology. <i>Memory &amp; Cognition</i> , 8(3), 231-246.

Week	Date	Topics	Readings Due
3	January 25	Properties of representations	Dietrich, E., & Markman, A. B. (2003). Discrete thoughts: Why cognition must use discrete representations. <i>Mind &amp; Language</i> , 18, 95-119.
4	February 1	fMRI: That is where the representations are stored	Rissman, J., & Wagner, A. D. (2012). Distributed representations in memory: Insights from functional brain imaging. <i>Annual Review of Psychology</i> , 63, 101-128. Mather, M., Cacioppo, J. T., & Kanwisher, N. (2013). How fMRI can inform cognitive theories. <i>Perspectives on Psychological Science</i> , 8, 108-113.
5	February 8	The constant temporal flow of the mind & representations	Spivey, M. (2007). <i>The Continuity of Mind</i> . Oxford University Press. Chapter 1. McClelland, J. L. (2010). Emergence in cognitive science. <i>Topics in Cognitive Science</i> , 2, 751-770.
6	February 15	fMRI: Dynamics, computations, representations	Davis, T., & Poldrack, R. A. (2013). Measuring neural representations with fMRI: practices and pitfalls. <i>Annals of the New York Academy of Sciences</i> , 1296, 108-134. Ghuman, A. S., & Martin, A. (2019). Dynamic neural representations: an inferential challenge for fMRI. <i>Trends in Cognitive Sciences</i> , 23, 534-536.
	February 22	Reading Week	None
7	March 1	Context, context, context	Elman, J. L. (2009). On the meanings of words and dinosaur bones: Lexical knowledge without a lexicon. <i>Cognitive Science</i> , 33, 547-582. Yee, E., & Thompson-Schill, S. L. (2016). Putting concepts into context. <i>Psychonomic Bulletin &amp; Review</i> , 23, 1015-1027.
8	March 8	All concepts are ad hoc	Casasanto, D. & Lupyan, G. (2015). All Concepts are Ad Hoc Concepts. In <i>The Conceptual Mind: New directions in the study of concepts</i> . E. Margolis & S. Laurence (Eds.) pp. 543-566. Cambridge: MIT Press.
9	March 15	Knowledge is in the connections	Elman, J. L. (1995). Language as a dynamical system. In R. F. Port & T. van Gelder, <i>Mind as Motion</i> , MIT Press (pp. 195-225).
10	March 22	Radical embodied cognitive science	Chimero, A. <i>Radical Embodied Cognitive Science</i> . Chapters 2 and 3.
11	March 29	Defending representations	Markman, A. B., & Dietrich, E. (2000). In defense of representation. <i>Cognitive Psychology</i> , 40, 138-171.
12	April 5	Predictive processing and representations	Williams, D. (2018). Predictive processing and the representation wars. <i>Minds &amp; Machines</i> , 28, 141-172.

## **Statement on Academic Offences**

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_grad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf)

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

## **Health/Wellness Services**

Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwoom/mentalhealth/> for a complete list of options about how to obtain help.

## **Accessible Education Western (AEW)**

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW), a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.