Cognitive Neuroscience
PSY 685
Fall 2023

Time:	Thurs 1:30-4.10pm
Room:	IResearch Hall 202
Instructor:	James Thompson
	Room 2056
	David King Hall
	email: jthompz@gmu.edu tel: 703-993-9356

Office Hours: Thurs 12.00pm – 1.00pm or by appointment (email only)

Objectives: Cognitive Neuroscience is an interdisciplinary field that combines the fields of neuroscience and cognitive psychology. This field has developed and uses new approaches and technologies for invasive and noninvasive imaging and stimulating of human brain structure and function. This course aims to provide students with a strong foundation in the theories and findings of Cognitive Neuroscience. Each week of this course will focus on a specific cognitive function, and will address in depth important theories and experimental results that help define the brain basis of cognitive function.

Required Readings:
Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind (see Blackboard)

Readings for this semester will consist of chapters and journal articles that will be posted on Blackboard. There will usually be one chapter and one or two articles per week to read. **Students are expected to read all material each week ahead of class**.

Class Format: This will be a seminar format class. During each class we will read and discuss topics covered in the readings that address the neural basis of a particular cognitive function.

As many of the concepts that will be covered may be new to most of you, I expect everyone to have read the assigned papers before the class. A willingness and ability to do extensive research outside the assigned reading, seek assistance if you are finding any area difficult, and participate in class discussion, is essential. It is assumed that students in the class have at least a strong upper-level undergraduate understanding of cognitive psychology.

Assessment: Assessment will consist of a) leading class discussion of two topics (25%); b) participation in class discussions each week (25%); and c) a final paper (50%).

a) Lead the discussion of topics (25%) For this assessment, sign up for two topics(from two different weeks) and lead the discussion of the topic(s). During each discussion, spend 5-

10mins initially outlining the topic and then provide the class with 3-4 questions/prompts to facilitate the discussion. You can post these ahead of the class via Blackboard. Ensure that all members of the class have an opportunity to contribute to the discussion. ***If you are finding the topic you have chosen challenging, please contact me well ahead of the scheduled class time and we can discuss it.***

b) Participation in class discussions (25%). You are expected to read each of the papers for each week and participate in class discussions of those papers.

c) Final paper (50%). Pick a topic from weeks 2-14, or any combination of weeks, and write a paper discussing the **combination** of theory and empirical findings ***central*** to that topic. Your final paper should go beyond/deeper than the papers/chapter we discuss in class, but should (at the very least) include a discussion of those readings. Please consult with me if you have any questions about the topic of your final paper.

Technology: Materials will be distributed via email, in class, and via Blackboard. Students will need to be able to read and refer to the papers during class.

Important Dates: Last day to add: Aug 28. Last day to drop Sep 2. Thanksgiving Nov 22-26

Grades: A (100-90); B (89-80); C (79-70); D (69-60); F (below 59)

Attendance: While you will not be graded on attendance, this is a graduate-level course and you are expected to attend and contribute to class discussion each week.

Honor Code: All exams must follow the guidelines of the GMU Honor Code. George Mason University has an Honor Code, which requires all members of this community to maintain the highest standards of academic honesty and integrity. Cheating, plagiarism, lying, and stealing are all prohibited. All violations of the Honor Code will be reported to the Honor Committee. See honorcode.gmu.edu for more detailed information. Students may consult with other students and use books, notes, and other sources in preparing for exams. However, when taking exams, no books, notes, or student interaction will be allowed. Cheating and plagiarism of any sort will not be tolerated.

Students with Disabilities: If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Center C(DRC) at 703-993-2474. All academic accommodations must be arranged through that office.

Access to Computers
Students must have access to their GMU Email account. Students should feel free to communicate with me via email. Updates and notifications will be sent to the class email list using your GMU email address. If you need to use university facilities, you can find out about location and hours of university facilities at http://www.labs.gmu.edu/ or ask at the information

desk at the Johnson Center. I will ONLY use your GMU Email address to contact you. Please use and check this address frequently. You may forward your GMU email to another address if you like, but please ensure that you are receiving the email to your GMU Email address.

Cancellation Policy In case class needs to be canceled due to an unexpected event, students will be informed via email as soon as possible. Make-up sessions will be arranged for canceled classes.

SCHEDULE

Aug 24 **Introduction/Neuroanatomy refresher**
Chapter 2 Structure and Function of the Nervous System. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Aug 31 **Cognitive Neuroscience methods**
Chapter 3 Methods of Cognitive Neuroscience. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Petersen, Fox, Posner, Mintun, Raichle (1988). Positron emission tomographic studies of the cortical anatomy of single-word processing. Nature.

Sep 7 **Perception**
Chapter 5 Sensation and Perception. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Barlow (1961). Possible principles underlying the transformations of sensory messages. W.A. Rosenblith (ed) Sensory Communication.

Fletcher PC, Frith CD. (2009). Perceiving is believing: a Bayesian approach to explaining the positive symptoms of schizophrenia. Nat Rev Neurosci., 10:48–58.

Sep 14 **Object, Face, and Word Recognition**
Chapter 6 Object Recognition. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Rust & DiCarlo (2012) Balanced Increases in Selectivity and Tolerance Produce Constant Sparseness along the Ventral Visual Stream. Journal of Neuroscience.

White, Palmer, Boynton, Yeatman (2019). Parallel spatial channels converge at a bottleneck in anterior word-selective cortex. PNAS.

Sep 21 **Attention**
Chapter 6 Object Recognition. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Desimone, Duncan (1995). Neural mechanisms of selective visual attention. Annual Review of Neuroscience

Sep 28 **Working Memory**

Goldman-Rakic (1995) Cellular basis of working memory. Neuron.

Harrison, Tong (2009) Decoding reveals the contents of visual working memory in early visual areas. Nature.

Rose, LaRocque, Riggall, Gosseries, Starrett, Meyering, Postle (2016). Reactivation of latent working memories with transcranial magnetic stimulation. Science.

Oct 5 **Memory**

Chapter 9 Memory. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Wimmer, Liu, Vehar, Behrens, Dolan (2020). Episodic memory retrieval success is associated with rapid replay of episode content. Nature Neuroscience

Schacter, Addis, Hassabis, Martin, Spreng, Szpunar (2012). The Future of Memory: Remembering, Imagining, and the Brain. Neuron.

Oct 12 **Language**

Chapter 11 Language. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Hickok, Poeppel (2007). The cortical organization of speech processing. Nature Reviews Neuroscience

Mariën, Keulen, Verhoeven. (2019). Neurological Aspects of Foreign Accent Syndrome in Stroke Patients. J Commun Disord.

Oct 19 **Motor Function and Action**

Chapter 8 Action. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Cisek, P., & Kalaska, J. F. (2010). Neural mechanisms for interacting with a world full of action choices. Annual Review of Neuroscience, 33, 269–298

Oct 26 **Cognitive Control**

Chapter 12 Cognitive Control. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind.

Shenhav, Musslick, Lieder, Kool, Griffiths, Cohen, Botvinick. (2017). Toward a Rational and Mechanistic Account of Mental Effort. Annu Rev Neurosci.

Nov 2	**Value-based decision-making** Schultz, Dayan, Montague (1997). A neural substrate of prediction and reward. Science. O'Doherty, Dayan, Friston, Critchley, Dolan (2003). Temporal Difference Models and Reward-Related Learning in the Human Brain Daw, Gershman, Seymour, Dayan, Dolan (2011). Model-Based Influences on Humans' Choices and Striatal Prediction Errors. Neuron.
Nov 9	**Emotions** *Chapter 10 Emotion*. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind. Adolphs, Mlodinow, Barrett. (2019) What is an emotion? Curr Biol
Nov 16	**Social Cognition** *Chapter 13 Social Cognition*. Gazzaniga, Ivry, Mangun (2014). Cognitive Neuroscience: the biology of the mind Gangopadhyay, Chawla, Dal Monte, Chang (2021). Prefrontal–amygdala circuits in social decision-making. Nature Neuroscience.
Nov 23	**Thanksgiving Recess**
Nov 30	**Neural population dynamics** Ebitz, Hayden (2021). The population doctrine in cognitive neuroscience. Neuron Shine, Breakspear, Bell, Ehgoetz Martens, Shine, Koyejo, Sporns, Poldrack (2019). Human cognition involves the dynamic integration of neural activity and neuromodulatory systems. Nature Neuroscience.