

Syllabus

ECON 405: NEUROECONOMICS
University of Southern California
Spring 2025

Schedule: Mon-Wed 8:30 – 9:50 a.m.

Class Location: **SOS B44**

Instructor: Prof. **Giorgio Coricelli**

Office Hours: Wed 12:00 p.m.

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Textbook: *Neuroeconomics*, Decision Making and the Brain, 2nd Edition, Edited by Glimcher and Fehr, 2014. Additional readings (see list below) will be uploaded online.

Throughout the course, the primary goals are to:

- Learn about the academic field of neuroeconomics, its major theories, results, and debates
- Become a critical consumer of research findings by learning the methodological standards for evaluating the soundness of such studies
- Develop the ability to effectively write and speak about decision theories, results, and debates
- Acquire some practical skills for designing and analyzing an experiment in the field of neuroeconomics

Description of the course:

The first part of the course will focus on neuroscience as a new lens on decision-making. We will focus primarily on studies of the neural basis of human behavior. This part will include a special focus on (i) the reward system; (ii) reinforcement learning; (iii) the neural basis of choice under risk and uncertainty; (iv) intertemporal choices; (v) preferences and relative rewards; (vi) the role of emotion in decision-making. The second part will focus on (i) Experimental Game theory; (ii) social preferences; (iii) strategic choice; and (vi) neuro-finance

Problem sets: Due at the beginning of class on the due date

Class presentation: Students will be divided into groups. Students in each group will be assigned a specific topic and a related experimental data set (data from class experiments) to be analyzed to be presented in class.

Exams: Two midterms, and a final exam

Grading:

Problem sets, class presentation and class participation	20%
Midterm 1	20%
Midterm 2	20%
Final exam	40%

Grade Determination and Final Examination Details:

Tests and final exams are marked on a numerical (percentage) basis, and then converted to letter grades.

A+ 95 - 100	B+ 80 - 84	C+ 65 - 69	D+ 50 - 54
A 90 - 94	B 75 - 79	C 60 - 64	D 45 - 49
A- 85 - 89	B- 70 - 74	C- 55 - 59	F 0 - 44

Course Outline:

The objective of this course is to introduce basic and advanced elements of Neuroeconomics. The topics to be covered and the required readings (Chapters from the Textbook **Neuroeconomics (CH)** and **Readings (R)**) are:

January

Mon 13	Lecture 1: Introduction (CH 1)
Wed 15	Lecture 2: Experimental methods in Cognitive Neuroscience (CH 5)

Mon Jan 20 Martin Luther King Jr. Day

Wed 22	Lecture 3: The computation of stimulus values in a simple choice I (CH 8)
Mon 27	Lecture 4: The computation of stimulus values in a simple choice II (CH 8)
Wed 29	Lecture 5: Neural foundation of economic preferences (CH 8)

February

Mon 3	Lecture 6: Reward processing mechanisms I (CH 15)
Wed 5	Lecture 7: Reward processing mechanisms II (CH 15). Problem set 1 assigned
Mon 10	Lecture 8: Multiple systems for value learning (CH 21)
Wed 12	Lecture 9: Summary of lectures 1-8. Problem set 1 due before class. Discussion

Mon Feb 17 President Day

Wed 19	Midterm 1
Mon 24	Lecture 10: Decision Theory: Risk and uncertainty I (CH 9)
Wed 26	Lecture 11: Decision Theory: Risk and uncertainty II (Appendix Prospect theory)

March

Mon 3	Lecture 12: Neural correlates of Risk and uncertainty I (CH 9, R)
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Wed 5 Lecture 13: Neuroeconomics of Emotion (CH 12, R)
Mon 10 Lecture 14: Neural basis of intertemporal choice (CH 10).
Wed 12 Lecture 15: Decision Biases in the Brain (CH 24). **Problem set 2 assigned**

Spring recess March 16-23

Mon 24 Lecture 16: Summary of lectures 10-15. **Problem set 2 due before class.** Discussion
Wed 26 **Midterm 2**

Mon 31 Lecture 17: The social brain I (CH 27, R)

April

Wed 2 Lecture 18: Experimental Game theory (CH 2)

Mon 7 Lecture 19 Experimental Game theory II (CH 2)
Wed 9 Lecture 20: Measuring social preferences (CH 11)

Mon 14 Lecture 21: Altruism, Fairness and Trust in economic exchange (CH 11, 25 R)
Wed 16 Lecture 22: The neural Basis of Strategic Choice I (CH 25, R)

Mon 21 Lecture 23: Neural basis of social comparison and social conformity (CH 11, R). **Problem set 3 assigned**
Wed 23 Lecture 24: Neuro-finance (R)

Mon 28 **Class Presentation, day 1**
Wed 30 **Class Presentation, day 2, & Summary of lectures 18-24. Problem set 3 due before class.**
Discussion

May

Final exam Monday May 12, 11 a.m.-1 p.m.

List of readings (R):

- R1. Fiorillo CD, Tobler PN, Schultz W (2003) Discrete coding of reward probability and uncertainty by dopamine neurons. *Science* 299 (5614), 1898
- R2. Tom et alii (2007). "The neural basis of loss aversion in decision making under risk". *Science*. 26 January 2007: Vol. 315 no. 5811 pp. 515-518
- R3. Preuschoff, P Bossaerts, and S R Quartz. Neural differentiation of expected reward and risk in human subcortical structures. *Neuron*, 51(3):381–390, 2006.
- R4. Ming Hsu et alii (2006). Neural Systems Responding to Degrees of Uncertainty in Human Decision-Making. *Science*. 9 December 2005: Vol. 310 no. 5754 pp. 1680-1683
- R5. On the relationship between emotion and cognition, by Pessoa, *Nature Review Neuroscience*, 2008
- R6. The somatic marker hypothesis: A neural theory of economic decision, by Bechara and Damasio, *Games and Economic Behavior*, 2002
- R7. Coricelli G, Dolan RJ, Sirigu A (2007). Brain, emotion and decision-making: the paradigmatic example of regret. *Trends in cognitive sciences* 11 (6), 258-265
- R8. Rizzolatti G., Fadiga L., Gallese V., Fogassi L. Premotor cortex and the recognition of motor actions. *Cogn. Brain Res.*, 3 (1996), 131-141.
- R9. Amodio, D. M., & Frith, C. D. (2006). Meeting of minds: The medial frontal cortex and social cognition. *Nature Reviews Neuroscience*, 7, 268-277
- R10. Sanfey, A.G. (2007). Social decision-making: Insights from Game Theory and Neuroscience. *Science* 318, 598-602.
- R11. Fehr E and Camerer CF (2007). Social neuroeconomics: the neural circuitry of social preferences. *Trends in Cognitive Sciences*, 11, 419-427.
- R12. King-Casas et alii (2005). Getting to Know You: Reputation and Trust in a Two-Person Economic Exchange. *Science* 1 April 2005: Vol. 308 no. 5718 pp. 78-83
- R13. Coricelli, G., and Nagel, R. (2009). "Neural correlates of depth of strategic reasoning in medial prefrontal cortex". *Proceedings of the National Academy of Sciences USA*, 106, 23, pp. 9163-8.
- R14. Klucharev V, Hytönen K, Rijpkema M, Smidts A, Fernández G (2009) Reinforcement learning signal predicts social conformity. *Neuron*. 15;61(1):140-51.
- R15. Bault, N., Joffily, M., Rustichini, A., Coricelli, G. (2011). "Medial prefrontal cortex and striatum mediate the influence of social comparison on the decision process". *Proceedings of the National Academy of Sciences USA*. PNAS Sep 20;108(38):16044-9.
- R16. In the Mind of the Market: Theory of Mind Biases Value Computation during Financial Bubbles, by DeMartino et al, 2013 *Neuron*