Syllabus

ECON 405: NEUROECONOMICS
University of Southern California
Spring 2023

Schedule: Mon-Wed 10:00 – 11:50 a.m.
Class Location: **SOS B4**

Instructor: Prof. **Giorgio Coricelli**
Office Hours: Wed 12:00 p.m.
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Office Hours: Mon/Wed 8:30-10:00 a.m.

Prerequisites for the course: ECON 303

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:

Janurary

Mon 9	Lecture 1: Introduction (CH 1)
Wed 11	Lecture 2: Experimental methods in Cognitive Neuroscience (CH 5)

Mon Jan 16 Martin Luther King Jr. Day

Wed 18	Lecture 3: The computation of stimulus values in a simple choice I (CH 8)
Mon 23	Lecture 4: The computation of stimulus values in a simple choice II (CH 8)
Wed 25	Lecture 5: Neural foundation of economic preferences (CH 8)
Mon 30	Lecture 6: Reward processing mechanisms I (CH 15)

February

Wed 1	Lecture 7: Reward processing mechanisms II (CH 15). **Problem set 1 assigned**
Mon 6	Lecture 8: Multiple systems for value learning (CH 21)
Wed 8	Lecture 9: Summary of lectures 1-8. **Problem set 1 due before class.** Discussion
Mon 13	**Midterm 1**
Wed 15	Lecture 10: Decision Theory: Risk and uncertainty I (CH 9)

Mon Feb 20 President Day

Wed 22	Lecture 11: Decision Theory: Risk and uncertainty II (Appendix Prospect theory)
Mon 27	Lecture 12: Neural correlates of Risk and uncertainty I (CH 9, R)

March

Wed 1	Lecture 13: Neuroeconomics of Emotion (CH 12, R)
Mon 6	Lecture 14: Neural basis of intertemporal choice (CH 10).
Wed 8	Lecture 15: Decision Biases in the Brain (CH 24). **Problem set 2 assigned**

Spring recess March 12-19

Mon 20	Lecture 16: Summary of lectures 10-15. **Problem set 2 due before class.** Discussion
Wed 22	**Midterm 2**
Mon 27	Lecture 17: The social brain I (CH 27, R)
Wed 29	Lecture 18: Experimental Game theory (CH 2)

April

Mon 3	Lecture 19 Experimental Game theory II (CH 2)
Wed 5	Lecture 20: Measuring social preferences (CH 11)
Mon 10	Lecture 21: Altruism, Fairness and Trust in economic exchange (CH 11, 25 R)
Wed 12	Lecture 22: The neural Basis of Strategic Choice I (CH 25, R)
Mon 17	Lecture 23: Neural basis of social comparison and social conformity (CH 11, R). **Problem set 3 assigned**
Wed 19	Lecture 24: Neuro-finance (R)
Mon 24	**Class Presentation, day 1**
Wed 26	**Class Presentation, day 2, &** Summary of lectures 18-24. **Problem set 3 due before class.** Discussion

May

Final exam Monday May 8, 8-10 a.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