

Neuroeconomics

Pre-requisite: Behavioral and Integrative Neuroscience

Textbook: Neuroeconomics: Decision-Making and the Brain 2nd Edition, Elsevier.

Neuroeconomics is a seminar-style upper level course covering the neuroscientific, economic and psychological foundations of human and animal decision-making. Although aimed mostly at juniors and seniors in neural science and psychology, the course is also appropriate for economists and Stern students interested in the biological foundation of choice. The course begins with a review of the independent economic, psychological and neuroscientific approaches to decision-making before moving into the core insights of modern neuroeconomics. Topics covered include: Subjective Value Theory and its Representation in the Brain, Intertemporal Choice, Neural Foundations of Game Theory, Consumer Decision-Making, Neural Foundations of Prospect Theory, and Efficient Coding as an Explanation for Choice Inconsistency. Typically, class periods begin with a 1h lecture by the Professor covering one or more textbook chapters. This is followed by student presentations of relevant original research articles and open discussion of those articles.

Grading is based on in-class presentations (2-30m presentations per student), a single 90m midterm given 2/3 of the way through the course, and a ~15-page final paper which is expected to expand on one of the presentations made by the student.

Schedule of Classes:

Class 1

Introduction to Economics Theories of Choice: From Pascal to Game Theory
This class and the next will feature a 2h lecture and no student presentations.
Readings: Glimcher and Fehr (Textbook), Chapter: 1.
Foundations of Neuroeconomics, Chapter 3 – provided on blackboard.
Presentations for the First half of the class will be assigned this on this date.

Class 2

Introduction to Psychological Theories of Choice: From Allais to Prospect Theory
This class and the next will feature a 2h lecture and no student presentations.
Readings: Glimcher and Fehr (Textbook), Chapter: 3.
Foundations of Neuroeconomics, Chapter 4 – provided on blackboard.

Class 3

Anthropological Insights into Human Decision Making
Textbook: Chapter 7.

Student Presentations Begin:

Chen, M. K., Lakshminaryanan, V. & Santos, L. R. (2006). The evolution of our preferences: Evidence from capuchin monkey trading behavior. *Journal of Political Economy*, 114(3), 517-537.

Charnov, E. L. 1976. Optimal foraging, the marginal value theorem. *Theor. Pop. Biol.* 9:129-136.

Class 4

The Neurobiological Representation of Decision Values in Choice

Textbook: Chapter 13.

Student Presentations:

Platt, M.L. and Glimcher, P.W. (1999) Neural correlates of decision variables in parietal cortex. *Nature*. 400: 233-238.

Levy, I., Lazzaro, S., Rutledge, R.B., & Glimcher, P.W. (2011). Choice from non-choice: Predicting consumer preferences from blood oxygenation level-dependent signals obtained during passive viewing. *Journal of Neuroscience*, 31(1): 118-125

Class 5

Intertemporal Choice

Textbook: Chapter 10.

Student Presentations:

Kable, J.W. and Glimcher, P.W. (2010), An "as soon as possible" effect in human intertemporal decision making: Behavioral evidence and neural mechanisms. *Journal of Neurophysiology*, 103: 2513-2531.

Louie, K., and Glimcher, P.W. (2010). Separating value from choice: Delay discounting activity in the lateral intraparietal area. *Journal of Neuroscience*, 30(16): 5498-5507.

Class 6

Game Theory

Textbook: Chapter 2; Chapter 25

Student Presentations:

Dorris, M.C. and Glimcher, P.W. (2004) Activity in Posterior Parietal Cortex is Correlated with the Subjective Desirability of an Action. *Neuron*. 44: 365-378.

Kevin McCabe, Daniel Houser, Lee Ryan, Vernon Smith, and Theodore Trouard (2001) A functional imaging study of cooperation in two-person reciprocal exchange. *PNAS* 98 (20) 11832-11835.

Class 7

Dopamine, Reinforcement Learning and the Construction of Value

Textbook: Chapter 15

Student Presentations:

Bayer, H.M. and Glimcher, P.W. (2005) Midbrain Dopamine Neurons Encode a Quantitative Reward Prediction Error Signal. *Neuron*. 47: 129-141.

Eshel N, Bukwich M, Rao V, Hemmelder V, Tian J, Uchida N. [Arithmetic and local circuitry underlying dopamine prediction errors](#). *Nature*. 2015;525 (7568) :243-6

Class 8

Advanced Reinforcement Learning

Textbook: Chapter 16

Student Presentations:

Nathaniel D. Daw, Yael Niv, and Peter Dayan. Uncertainty-based competition between prefrontal and dorsolateral striatal systems for behavioral control. (2005) *Nat Neurosci*, 8(12):1704–1711

nd daw, jp o'doherty, b Seymour, p dayan, rj dolan (2006) [cortical substrates for exploratory decisions in humans](#). *nature* 441:876-879

Class 9 EXAM

Class 10

Perceptual Decision Making

Textbook: Chapter 19

Student Presentations

[Shadlen MN1](#), [Britten KH](#), [Newsome WT](#), [Movshon JA](#). (1996) A computational analysis of the relationship between neuronal and behavioral responses to visual motion. *J Neurosci*. 15;16(4):1486-510.

T. A. Hare, W. Schultz, C. Camerer, J. O'Doherty, A. Rangel. Transformation of stimulus value signals into motor commands during simple choice. *PNAS*, 2011, 108:18120-18125.

Class 11

Consumer Choice

No Textbook Reading this week, instead: Hilke Plassmann & Uma R. Karmarkar (2015), "Consumer Neuroscience: Revealing Meaningful Relationships Between Brain and Consumer

Behavior”, Cambridge Handbook of Consumer Psychology (edited by Michael Norton, Derek Rucker & Cait Lambertson), Cambridge: Cambridge University Press, 152-179.

Student Presentations:

Hilke Plassmann, John O’Doherty, Baba Shiv, Antonio Rangel (2008), “Marketing Actions Modulate the Neural Representation of Experienced Pleasantness”, Proceedings of the National Academy of Science of the United States of America (PNAS), 105(3), 1050-1054.

Venkatraman, V., Dimoka, A., Pavlou, P., Vo, K., Hampton, W., Bollinger, B., Hershfield, H., Ishihara, M., Winer, R. Predicting Advertising Success: New Insights from Neuroscience and Market Response Modeling. Journal of Marketing Research (52:4 (2015), 436-452).

Class 12

Neuropharmacology of Human Decision Making (Oxytocin)

Textbook: Chapter 14

M Kosfeld, M Heinrichs, PJ Zak, U Fischbacher, E Fehr (2005) [Oxytocin increases trust in humans](#). Nature 435 (7042), 673

Carsten K. W. De Dreu, Lindred L. Greer, Gerben A. Van Kleef, Shaul Shalvi, Michel J. J. Handgraaf (2011) Oxytocin promotes human ethnocentrism. Proceedings of the National Academy of Sciences Jan 2011, 108 (4) 1262-1266; DOI:10.1073/pnas.1015316108

Class 13

Other Regarding Preferences and the Neurobiology of Social Thinking

Textbook: Chapter 11.

Student Presentations

DJF De Quervain, U Fischbacher, V Treyer, M Schellhammer (2004) [The neural basis of altruistic punishment](#). Science 305 (5688), 1254

Chang SW, Brent LJ, Adams GK, Klein JT, Pearson JM, Watson KK, Platt ML (2013) [Neuroethology of primate social behavior](#). PNAS. 110: 10387-94.

Class 14 – Last Class

Neuro-Morality?

Reading: Greene, J.D. (2009) [The Cognitive Neuroscience of Moral Judgment](#). The Cognitive Neurosciences IV (ed. M.S. Gazzaniga). MIT Press, Cambridge, MA.

Papers Due

No Student Presentations.