

Advanced Theory: Uncertainty & Info

This half term course continues 619, applying its methods to the study of decision making under uncertainty and information. To better understand this course and the theory prelim, it will help to concurrently take, or at least sit in, on 610, which meets in the classroom right after this. As with 619, the curriculum is quite self-serving, since I know and understand my own work best. I also happen to believe it yields more surprising or deep results than some of the similar published papers in the field.

For a grade, the major course credit hurdle is a final exam, worth 50% of the grade, scheduled by the University in the exam period.

The syllabus refers to the ff. texts.

- Morris DeGroot, Optimal Statistical Decisions. 1970.
- DJ: Sudhakar Dharmadhikari and Kumar Joag-dev, Unimodality, Convexity, and Applications. Academic Press, 1988.
- HR: Jack Hirshleifer and John Riley, The Analytics of Uncertainty and Information, Cambridge University Press, 1992.
- Samuel Karlin. Total Positivity, vol. 1, Stanford University Press. 1968.
- MO: Marshall and Olkin, Inequalities: Theory of Majorization and its Applications, Academic Press, 1979.
- SS: Moshe Shaked and George Shanthikumar, Stochastic Orders and their Applications, Academic Press, 1994.
- ★ Donald Topkis, Supermodularity and Complementarity, Princeton University Press, Frontiers of Economic Research Series, 1998.

- = very early reference on subject material
- = good modern background reading
- ★ = required reading, possibly in Topkis
- ⊙ = required reading, and ideal fireside reading to boot.
- ◇ = related good reading, but I will skip it due to time pressures

I. The Value of, and Demand for, Information (≈ 3 lectures)

- HR, §5.1–2: “Information and Informational Decisions.”
- ★ David Blackwell (1953), “Equivalent Comparison of Experiments,” *Annals of Mathematics and Statistics*, **24**: 265–272.
- Roy Radner and Joseph Stiglitz (1984), “A Nonconcavity in the Value of Information” in Bayesian Models in Economic Theory, Elsevier Science Publishers, New York, Marcel Boyer And Richard Kihlstrom, eds., pp. 33–52.
- ★ Edward Schlee and Hector Chade (2001), “Another Look at the Radner-Stiglitz Nonconcavity in the Value of Information,” forthcoming, *Journal of Economic Theory*.
- Erich Lehmann (1988), “Comparing Location Experiments”, *Annals of Statistics*, **16**: 521-33.
- ★ Susan Athey and Jonathan Levin (2000), “The Value of Information in Monotone Decision Problems”, MIT Working Paper.
- ★ Giuseppe Moscarini and Lones Smith (2000), “The Law of Large Demand for Information,” forthcoming in *Econometrica*.
- ★ Giuseppe Moscarini and Lones Smith (2000), “The Demand for Normal Information”, private notes (possibly locally handed out, maybe not).

II. Bayesian Social Learning [Learning with Myopic Agents] (≈ 3.5 lectures)

A. Sequential Learning from the Actions of Others (≈ 1.5 lectures)

□ KEY IDEAS: MARKOV-MARTINGALE BELIEF AND LIKELIHOOD PROCESSES;
STABLE STOCHASTIC DIFFERENCE EQUATIONS

- Abhijit Banerjee (1992), “A Simple Model of Herd Behavior,” *Quarterly Journal of Economics*, **107**: 797–817.
- Sushil Bikhchandani, David Hirshleifer, and Ivo Welch (1992), “A Theory of Fads, Fashion, Custom and Cultural Change as Informational Cascades,” *Journal of Political Economy*, **100**: 992–1026.
- Lones Smith and Peter Sørensen (2000), “Pathological Outcomes of Observational Learning,” *Econometrica*, **68**: 370–398.
- ★ Giuseppe Moscarini, Marco Ottaviani, and Lones Smith (1997), “Social Learning in a Changing World,” *Economic Theory*, **11**: 657–665.

B. Social Learning from Samples and Aggregates (≈ 1 lecture)

- Margaret Bray and David Kreps (1987), “Rational Learning and Rational Expectations,” in Feiwel, G., ed., Kenneth Arrow and the Ascent of Economic Theory (1987).
- Lones Smith (1991), “Error Persistence, and Experiential Versus Observational Learning,” Tel Aviv Working Paper, and unpublished manuscript.
- ★ Lones Smith and Peter Sorensen (1996), “Momentum and Mean Reversion in Rational Social Learning”, MIT mimeo.

- ★ Xavier Vives (1993), “How Fast do Rational Agents Learn?” *Review of Economic Studies* **60**: 329–347.

C. Social Timing and Trade Timing in Equilibrium (≈ 1 lecture)

- ★ Faruk Gul and Russell Lundholm (1995), “On the Clustering of Agents’ Decisions: Herd Behavior versus the Endogenous Timing of Actions,” *Journal of Political Economy*, **103**: 1039-1066.
- Laurence Glosten and Paul Milgrom (1985), “Bid, Ask, and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders”, *Journal of Financial Economics*, **13**: 71–100.
- ★ Lones Smith [and soon-to-be Makoto Shimoji] (1997), “Do Rational Traders Frenzy?”, MIT Working paper.

III. Optimal Experimentation [Learning by Long-Lived Agents] (≈ 4 lectures)

A. Foundations (≈ 2 lectures)

□ STOCHASTIC DYNAMIC PROGRAMMING

- ★ Sheldon Ross, § IV-1
- ★ Easley, David and Nicholas Kiefer (1988), “Controlling a Stochastic Process with Unknown Parameter,” *Econometrica* **56**: 1045–1064.
- ★ Phillippe Aghion, Patrick Bolton, Chris Harris, and Bruno Julien (1991), “Optimal Learning by Experimentation,” *Review of Economic Studies* **58**: 621–654.
- Lones Smith and Peter Sørensen (2001), “Informational Herding and Optimal Experimentation,” under revision for *Review of Economic Studies*.

B. The Direction of Experimentation (likely omitted)

- ◇ Daniel Treffer (1993), “The Ignorant Monopolist: Optimal Learning with Endogenous Information,” *International Economic Review*, **34** (3): 565–81.

C. Optimal Stopping (≈ 0.5 lectures, time permitting)

- ★ Sheldon Ross, chapter IV: Positive Dynamic Programming
- Morris DeGroot, §13.3–13.6
- ★ Sheldon Ross, §I-5: “The Secretary Problem”
- ★ The Fundamental Theorem of Gambling: Excessive Functions: Billingsley, §8
- ◇ Bert Fristedt and Donald Berry (1988), “Optimality of Myopic Stopping Times for Geometric Discounting,” *Journal of Applied Probability*, **25**: 437–443.
- ◇ Michael Rothschild (1974), “Searching for the Lowest Price When the Distribution of Prices is Unknown,” *Journal of Political Economy*, **82**: 689–711.

D. Bandits: Implicit Cost Experimentation ($\approx .5$ lectures)

- ★ Sheldon Ross, § III-5
- ◇ Jeffrey Banks and Rangarajan Sundaram (1992), “Denumerable-Armed Bandits”, *Econometrica*, **60**: 1071–1096.

- ◇ Dirk Bergemann and Juuso Valimäki (1996), “Learning and Strategic Pricing”, *Econometrica*, **64**: 1125–1150.
- ★ Patrick Bolton, Chris Harris (1999), “Strategic Experimentation,” *Econometrica*, **67**: 349–74.
- ◇ Godfrey Keller and Sven Rady (1999), “Optimal Experimentation in a Changing Environment”, *Review of Economic Studies*, **66**: 475–507.

E. Explicit (Monetary) Cost Experimentation (≈ 1 lecture)

- ⊙ Giuseppe Moscarini & Lones Smith (2001), “The Optimal Level of Experimentation,” *Econometrica* **69**, 1629–1644.

IV. Matching Models (≈ 3 lectures)

A. Learning and Assortative Matching (≈ 1 lecture)

- Becker (1973), “A Theory of Marriage”, *JPE*.
- ★ Axel Anderson and Lones Smith (2001), “Assortative Matching, Reputation, and the Beatles Break-Up”, Michigan mimeo.

B. Search Models of Assignment (≈ 1.5 lectures)

- ★ Lones Smith [and unknown future coauthor?] (1995), “Cross-Sectional Dynamics in a Two-Sided Matching Model,” MIT Working paper.
- ★ Lones Smith (1997), “The Marriage Model with Search Frictions,” MIT Working Paper, under revision for *Journal of Political Economy*.
- ⊙ Robert Shimer and Lones Smith (2000), “Assortative Matching and Search,” *Econometrica*, **68**: 343–369.

C. The Inefficiency of Bilateral Search (≈ 1.5 lectures, time permitting)

- ★ Dale Mortenson (1982), “Property Rights and Efficiency in Mating, Racing, and Related Games,” *American Economic Review*, **72**, 968–979.
- ★ Robert Shimer and Lones Smith (2000), “Matching, Search, and Heterogeneity,” forthcoming *Advances in Macroeconomics*, **1**.
- ★ Lones Smith (1999), “Optimal Job Search in a Changing World,” *Mathematical Social Sciences*, **38** (1): 1–11
- ★ Robert Shimer and Lones Smith (2001), “Nonstationary Search,” mimeo.

D. Search-Matching Models of Walrasian Trade (≈ 0.5 lectures)

- ⊙ Lones Smith (1998), “A Model of Exchange Where Beauty is in the Eye of the Beholder,” MIT Working paper.