

Mathematics and Democracy: Designing Better Voting and Fair-Division Procedures

Politics G53.2170
New York University
Spring 2009
Class: Mon. 6:20 – 8:20 PM

S. J. Brams
19 West 4th St., Rm. 309
(212) 998-8510; steven.brams@nyu.edu
Office Hrs.: Mon. 4 - 6 PM

Introduction

Mathematics and Democracy (M&D) is meant to show how mathematics can illuminate two essential features of democracy:

- how individual preferences can be aggregated to give a social choice or election outcome that best reflects the interests of the electorate; and
- how public and private goods can be divided in a way that respects due process and the rule of law.

Whereas questions of aggregation are primarily the focus of *social choice theory*, questions of division are the focus of *fair division*.

Democracy, as used in this course, will generally mean representative democracy, in which citizens vote for representatives, from a president on down. Some attention, however, will be devoted to referendums, in which citizens vote directly on propositions, as they did in assemblies in ancient Greece.

M&D will emphasize the procedures, or rules of play, that produce outcomes. By making precise properties that one wishes a voting or fair-division procedure to satisfy and by clarifying relationships among these properties, mathematical analysis can strengthen the intellectual foundations on which democratic institutions are based. But because there may be no procedures that satisfy all the properties one might desire, M&D will analyze trade-offs among the properties; practical problems of implementation, and experience with procedures that have been tried out, will also be discussed.

Required Books and Assignments

The main text will be *Mathematics and Democracy*, which is available in paperback. Four other books that complement this text, or provide useful background, are required.

1. Steven J. Brams (2008). *Mathematics and Democracy: Designing Better Voting and Fair-Division Procedures*. Princeton University Press.
2. McGann, Anthony (2006). *The Logic of Democracy: Reconciling Equality, Deliberation, and Minority Protection*. University of Michigan Press.
3. Norris, Pippa (2008). *Driving Democracy: Do Power-Sharing Institutions Work?* Cambridge University Press.
4. Riker, William H. (1986). *The Art of Political Manipulation*. Yale University Press.
5. Taylor, Alan D, and Allison M. Pacelli (2008). *Mathematics and Politics: Strategy, Voting, Power, and Proof*, 2nd ed. Springer.

The requirements of the course include short papers and a longer paper on the design and analysis of a democratic institution or a related topic. Readings from the books listed in the Bibliography—particularly from the “voting and fair division” section—will be recommended throughout the course.

- Jan. 26: Introduction
- Feb. 2: Brams, chs. 1-2; McGann, chs. 1-2
- Feb. 9: Brams, ch. 3-4; McGann, chs. 3-5
- Feb. 23: Brams, ch. 5; McGann, chs. 6-9
- March 2: Brams, ch. 6; Norris, chs. 1-3
- March 9: Brams, ch. 7; Norris, chs. 4-6
- March 23: Brams, ch. 8; Norris, chs. 7-9
- March 30: Brams, chs. 9-10; Taylor and Pacelli, chs. 1, 7
- April 6: Brams, chs. 11-12; Taylor and Pacelli, chs. 5, 11
- April 13: Brams, ch. 13; Taylor and Pacelli, chs. 2-3
- April 20: Brams, ch. 14; Taylor and Pacelli, ch. 8; Riker, chs. 1-6
- April 27: Brams, ch. 15; Taylor and Pacelli, ch. 9; Riker, chs. 7-12
- May 4: Final papers due

Bibliography

General Topics of Institutional Design

Acemoglu, Daron, and James A. Robinson (2006). *Economics Origins of Dictatorship and Democracy*. Cambridge University Press.

Aggarwal, Vinod K. (ed.) (1998). *Institutional Designs for a Complex World: Bargaining, Linkages, and Nesting*. Cornell University Press.

Brams, Steven J. (1985/89). *Rational Politics: Decisions, Games, and Strategy*. CQ Press/Academic.

Brennan, Geoffrey, and Alan Hamlin (2000). *Democratic Devices and Desires: Theories of Institutional Design*. Cambridge University Press.

- Cooter, Robert D. (2000). *The Strategic Constitution*. Princeton University Press.
- Congleton, Roger D., and Birgitta Swedenborg (eds.) (2006). *Democratic Constitutional Design and Public Policy: Analysis and Evidence*. MIT Press.
- Dahl, Robert A. (1998). *On Democracy*. Yale University Press.
- Diamond, Larry (2008). *The Spirit of Democracy: The Struggle to Build Free Societies Throughout the World*. Times/Henry Holt.
- Dominguez, Jorge II, and Anthony Jones (eds.) (2007). *The Construction of Democracy: Lessons from Practice and Research*. Johns Hopkins University Press.
- Estlund, David M. (2008). *Democratic Authority: A Philosophical Framework*. Princeton University Press.
- Gaertner, Wulf (2006). *A Primer in Social Choice Theory*. Oxford University Press.
- Goodin, Robert E. (ed.) (1996). *The Theory of Institutional Design*. Cambridge University Press.
- Grofman, Bernard, and Donald Wittman (eds.) (1989). *The Federalist Papers and the New Institutionalism*. Agathon.
- Hinich, Melvin J., and Michael C. Munger (1997). *Analytical Politics*. Cambridge University Press.
- Hodgson, Geoffrey M. (1998). *Evolution and Institutions: On Evolutionary Economics and the Evolution of Economics*. Edward Elgar.
- Koremenos, Barbara, Charles Lipson, and Duncan Snidal (eds.) (2004). *The Rational Design of International Institutions*. Cambridge University Press.
- Levi, Margaret *et al.* (eds.) (2008). *Designing Democratic Government: Making Institutions Work*. Russell Sage Foundation.
- Mueller, Dennis C. (ed.) (1997). *Perspectives on Public Choice: A Handbook*. Cambridge University Press.
- Mueller, Dennis C. (2003). *Public Choice III*. Cambridge University Press.
- North, Douglas C. (1990). *Institutions, Institutional Change, and Economic Performance*. Cambridge University Press.
- Nurmi, Hannu (1998). *Rational Behaviour and the Design of Institutions: Concepts,*

- Theories, and Models.* Edward Elgar.
- Nurmi, Hannu (2006). *Models of Political Economy.* Routledge.
- Ostrom, Elinor. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press.
- Ostrom, Elinor (2005). *Understanding Institutional Diversity.* Princeton University Press.
- Primo, David M. (2007). *Rules and Restraint: Government Spending and the Design of Institutions.* University of Chicago Press.
- Putnam, Robert H. (1994). *Making Democracy Work: Civic Traditions in Modern Italy.* Princeton University Press.
- Reynolds, Andrew (ed.) (2002). *The Architecture of Democracy: Constitutional Design, Conflict Management, and Democracy.* Oxford University Press.
- Reynolds, Andrew, Ben Reilly, and Andrew Ellis (eds.) (2005). *Electoral System Design: The New International IDEA Handbook.* Stockholm: International Institute for Democracy and Electoral Assistance.
- Riker, William H. (1982). *Liberalism Against Populism: A Confrontation Between the Theory of Democracy and the Theory of Social Choice.* W. H. Freeman.
- Sertel, Murat R., and Semih Koray (eds.) (2003). *Advances in Economic Design.* Springer-Verlag.
- Shepsle, Kenneth A., and Mark S. Bonchek (1997). *Analyzing Politics: Rationality, Behavior, and Institutions.* W.W. Norton.
- Shapiro, Ian (2003). *The State of Democratic Theory.* Princeton University Press.
- Shapiro, Ian, and Stephen Macedo (eds.) (2000). *Designing Democratic Institutions.* New York University Press.
- Shapiro, Ian, Stephen Skowronek, and Daniel Galvin (eds.) (2006). *Rethinking Political Institutions: The Art of the State.* New York University Press.
- Stromberg, Roland N. (1996). *Democracy: A Short, Analytical History.* Armonk, NY: M. E. Sharpe.
- Sunstein, Cass R. (2001). *Designing Democracy: What Constitutions Do.* Oxford University Press.

- Tsebelis, George (2002). *Veto Players: How Political Institutions Work*. Princeton University Press.
- Weale, Allbert (2007). *Democracy*, 2nd ed. Palgrave Macmillan.
- Weaver, R. Kent, and Bert A. Rockman (eds.) (1993). *Do Institutions Matter? Government Capabilities in the United States and Abroad*. Brookings Institution.
- Weimer, David L. (ed.) (1995). *Institutional Design*. Boston: Kluwer Academic.
- Weingast, Barry R., and Donald A. Wittman (eds.) (2006). *The Oxford Handbook of Political Economy*. Oxford University Press.
- Williamson, Oliver E. (1996). *The Mechanisms of Governance*. Oxford University Press.
- Woodruff, Paul (2005). *First Democracy: The Challenge of an Ancient Idea*. Oxford University Press.

Voting and Fair Division

- Amy, Douglas J. (2000). *Behind the Ballot Box: A Citizen's Guide to Voting Systems*. Praeger.
- Benjamin, Martin (1990). *Splitting the Difference: Compromise and Integrity in Ethics and Politics*. University Press of Kansas.
- Bates, Robert H., et al. (1998). *Analytic Narratives*. Princeton University Press.
- Braham, Matthew, and Frank Steffen (eds.) (2008). *Power, Freedom and Voting: Essays in Honor of Manfred J. Holler*. Springer.
- Brams, Steven J. (1978/2008). *The Presidential Election Game*. Yale University Press/A K Peters.
- Brams, Steven J. (1990). *Negotiation Games: Applying Game Theory to Bargaining and Arbitration*. Routledge.
- Brams, Steven J., and Peter C. Fishburn (1983/2007). *Approval Voting*. Springer.
- Brams, Steven J., and Alan D. Taylor. (1996). *Fair Division: From Cake-Cutting to Dispute Resolution*. Cambridge University Press.
- Brams, Steven J., and Alan D. Taylor (1999). *The Win-Win Solution: Guaranteeing Fair Shares to Everybody*. W.W. Norton.

- Colomer, Josep M. (ed.) (2004). *Handbook of Electoral System Choice*. New York: Palgrave.
- Cox, Gary W. (1997). *Making Votes Count: Strategic Coordination in the World's Electoral Systems*. Cambridge University Press.
- Diamond, Larry, and Marc F. Plattner (eds.) (2006). *Electoral Systems and Democracy*. Johns Hopkins University Press.
- Dowding, Keith, Robert E. Goodin, and Carole Pateman (eds.) (2004). *Justice and Democracy*. Cambridge University Press.
- Ellickson, Robert C. (1991). *Order without Law: How Neighbors Settle Disputes*. Harvard University Press.
- Elster, Jon (1992). *Local Justice: How Institutions Allocate Scarce Goods and Necessary Burdens*. Russell Sage Foundation.
- Elster, Jon (ed.) (1995). *Local Justice in America*. Russell Sage Foundation.
- Emerson, Peter (eds.) (2007). *Designing an All-Inclusive Democracy: Consensual Voting Procedures for Use in Parliaments, Councils and Committees*. Berlin: Springer.
- Felsenthal, Dan S., and Moshé Machover (1998). *The Measurement of Voting Power: Theory and Practice, Problems and Paradoxes*. Edward Elgar.
- Filippov, Mikhail, Peter C. Ordeshook, and Olga Shvetsova (2004). *Designing Federalism: A Theory of Self-Sustainable Federal Institutions*. Cambridge University Press.
- Fleischacker, Samuel (2004). *A Short History of Distributive Justice*. Harvard University Press.
- Franck, Thomas M. (1995). *Fairness in International Law and Institutions*. Oxford University Press.
- Gallagher, Michael, and Paul Mitchell (eds.) (2008). *The Politics of Electoral Systems*. Oxford University Press.
- Gersbach, Hans (2005). *Designing Democracy: Ideas for Better Rules*. Springer.
- Goodwin, Barbara (1992). *Justice by Lottery*. University of Chicago Press.
- Grillidi Cortona, Pietro, et al. (1999). *Evaluation and Optimization of Electoral Systems*. SIAM [Society of Industrial and Applied Mathematics].

- Hodge, Jonathan K., and Richard E. Klima (2005). *The Mathematics and Voting and Elections: A Hands-On Approach*. American Mathematical Society.
- Laruelle, Annick, and Federico Valenciano (2008). *Voting and Collective Decision Making: Bargaining and Power*. Cambridge University Press.
- LeDuc, Lawrence, Richard G. Niemi, and Pippa Norris (eds.) (2002). *Comparing Democracies 2: New Challenges in the Study of Elections and Voting*. Sage.
- LeGrand, Julian (1991). *Equity and Choice: An Essay in Economics and Applied Philosophy*. HarperCollins Academic.
- Mackie, Gerry (2003). *Democracy Defended*. Cambridge University Press.
- Manin, Bernard (1997). *The Principles of Representative Government*. Cambridge University Press.
- Medina, Luis Fernando (2007). *A Unified Theory of Collective Action and Social Change*. University of Michigan Press.
- Merrill, Samuel, III. (1988). *Making Multicandidate Elections More Democratic*. Princeton University Press.
- Moulin, Hervé J. (2003). *Fair Division and Collective Welfare*. MIT Press.
- Myerson, Michael (2002). *Political Numeracy: Mathematical Perspectives on Our Chaotic Constitution*. W. W. Norton.
- Norris, Pippa (2004). *Electoral Engineering: Voting Rules and Political Behavior*. Cambridge University Press.
- Nurmi, Hannu (1999). *Voting Paradoxes and How to Deal with Them*. Springer-Verlag.
- O'Leary, Brendan, Ian S. Lustick, and Thomas Callaghy (eds.) (2001). *Righting-sizing the State: The Politics of Moving Borders*. Oxford University Press.
- Poundstone, William (2008). *Gaming the Vote: Why Elections Aren't Fair (and What We Can Do About It)*. Hill and Wang.
- Przeworski, Adam (1991). *Democracy and the Market*. Cambridge University Press.
- Raiffa, Howard (2002). *Negotiation Analysis: The Science and Art of Collaborative Decision Making*. Harvard University Press.
- Regenwetter, Michel, Bernard Grofman, A.A.J. Marley, and Ilia M. Tsetlin (2006).

- Behavioral Social Choice: Probabilistic Models, Statistical Inference, and Applications.* Cambridge University Press.
- Robertson, Jack, and William Webb (1998). *Cake-Cutting Algorithms: Be Fair If You Can.* A K Peters.
- Rush, Mark E., and Richard C. Engstrom (2001). *Fair and Effective Representation: Debating Electoral Reform and Minority Rights.* Rowman and Littlefield.
- Saari, Donald G. (2001). *Decisions and Elections: Explaining the Unexpected.* Cambridge University Press.
- Saari, Donald G. (2008). *Disposing Dictators, Demystifying Voting Paradoxes.* Cambridge University Press.
- Schofield, Norman (2006). *Architects of Political Change: Constitutional Quandries and Social Choice Theory.* Cambridge University Press.
- Schofield, Norman, and Itai Sened (2006). *Multiparty Democracy: Elections and Legislative Politics.* Cambridge University Press.
- Simeone, Bruno, and Friedrich Pukelsheim (eds.) (2007). *Mathematics and Democracy: Recent Advances in Voting Systems and Collective Choice.* Springer.
- Taylor, Alan D. (2005). *Social Choice and the Mathematics of Manipulation.* Cambridge University Press.
- Thompson, Dennis F. (2002). *Just Elections: Creating a Fair Electoral Process in the United States.* University of Chicago Press.
- Tideman, Nicolaus (2006). *Collective Decisions and Voting: The Potential for Public Choice.* Ashgate.
- Tilly, Charles (2007). *Democracy.* Cambridge University Press.
- Van Mill, David (2006). *Deliberation, Social Choice and Absolutist Democracy.* Routledge.
- Vermede, Adrian (2007). *Mechanisms of Democracy: Institutional Design Writ Small.* Oxford University Press.
- Young, H. Peyton (1994). *Equity in Theory and Practice.* Princeton University Press.
- Young, H. Peyton (ed.) (1991). *Negotiation Analysis.* University of Michigan Press.