

**EDWARD E. ZAJAC**

**I. BIOGRAPHY**

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Education

BME, Cornell University, 1950, with distinction. John McMullen Scholarship

MSE, Princeton University, 1952; Howard Crathorne Phillips Fellow.

Ph.D., Stanford University, 1954; National Science Foundation Fellow.

**II. EMPLOYMENT**

*July '99- Present:* Professor of Economics, Emeritus, University of Arizona

*July '91-July '99:* Professor of Economics, University of Arizona

*Dec. '83-July '91:* Professor of Economics and Head, Department of Economics, University of Arizona.

*1968-Dec. '83*

Bell Telephone Laboratories. First Head, Economics and Graphics Research Department and later (1978), Director of Economics Research Center. Primarily responsible for recruiting, building and leading a staff of approximately 25 research economists at Bell Laboratories. The Center's goal was to lead research in the areas of economics of greatest importance to the Bell System. Its principal applied output was consulting and policy-oriented studies in four main areas: (1) financial decision making, (2) regulation (welfare-optimum pricing; allocative effects of rate base, rate of return regulation; theory of natural monopoly and sustainability of prices; theory of contestability; the theory of productivity measurement, and incentive-compatible regulatory schemes), (3) demand and cost studies, and (4) efficient compensation and incentive mechanisms for production workers and salesmen. The Center undergirded its policy and consulting work by conducting basic research on a broad spectrum of topics including: the role of information in economic decisions; the effect of expectations on the path of an economy; the development of mathematical tools, especially stochastic analysis, for financial economics and the economics of uncertainty; the theory of group decision-making and voting; applications of game theory to behavioral models in economics; the theory of welfare (socially) optimum organization of industry; the theory of nonlinear pricing of a utility's products and services; the allocative effects of taxation policy; the economics of R&D; theoretical labor economics; and the foundations of econometric methodology.

Also carried out a program of individual economic research on regulation, public utility pricing and consumer surplus theory, economic justice, and the economics of R&D.

In addition to economic research, supervised a small (approximately three persons) computer graphics research effort. Principal achievement: A. J. Frank's invention of "blob" coding of two-dimensional images, now an international standard.

1967-1968

Head of Mathematical Physics Research Department, Bell Labs.

1966-1967

Visiting Professor of Electrical Engineering at the Polytechnic Institute of Brooklyn (now New York). Worked on the application of computer animation to science education films. Also designed and taught a course on computer graphics.

1965-1966

Member of a task force at AT&T planning the strategy of dealing with the FCC's comprehensive investigation of the Bell System.

1954-1965

Member of Technical Staff, Mathematics Research Center, Bell Labs. Research on elastic wave propagation, elastic stability, dynamics and kinematics of submarine and aerial cable, dynamical systems, attitude control of satellites, numerical analysis, and computer animation.

*Summers of '64, '65, '66*

Member of writing team preparing materials for the NSF-Sponsored *Engineering Concepts Curriculum Project* (co-directed by E.E. David and J.G. Truxal)

### III. HONORS AND AWARDS

#### Awards as a Student

National Science Foundation Fellow 1952-54

Elected to Sigma Xi, Phi Kappa Phi, Tau Beta Pi, and Pi Tau Sigma.

#### Professional recognition

Listed in Who's Who in Economics, a compendium of the world's most frequently cited economists.

## Computer Animated Films

### Pair of Paradoxes:

Cine Golden Eagle, 1967 (awarded by the Council on International Nontheatrical Events, to films selected to represent the United States in international film competitions).

Diplomas of Participation: 4th International Festival of Short Films, Krakow, Poland, 1967; 4th Canadian International Festival of Short Films, 1967; International Film Review, IFIP Congress, 71, Ljubljana, Yugoslavia.

### Simulation of a Two-Gyro Gravity-Gradient Attitude Control System:

Selected by the ACM SIGGRAPH 86 Art Show Committee for the Computer Art Retrospective, Aug. 1986.

Selected for the Computers and Art exhibit organized by Cynthia Goodman for the Everson Museum of Art, Syracuse University (Sept. 17-Nov., 8, 1987) and later sent on a tour of U.S. museums.

## IV. PUBLICATIONS

### A. SCHOLARLY BOOKS

Public Choice Essays in Honor of a Maverick Scholar: Gordon Tullock, co-edited with Price Fishback and Gary Libecap, Kluwer, Boston, (2000)

Political Economy of Fairness, Cambridge, Massachusetts, MIT Press, (1995, hard cover, 1996, paperback). Forthcoming in Arabic translation to be published by Dar Al-Kitab Al-Hadeeth of Amman, Jordan.

Fairness or Efficiency: An Introduction to Public Utility Pricing, Cambridge, Massachusetts: Ballinger Publishing Company, (1978). Japanese Translation, Keio Tsushin Ltd. Publisher (1987). Chapter 5, "Basic Ramsey Prices in the Regulated Sector," reprinted in S.H. Baker and C. Elliot, editors, Readings in Public Sector Economics, D.C. Heath (1990).

### B. REFEREED ARTICLES

"What Fairness-and-Denial Research Could Have Told the Florida Supreme Court (and Can Tell the Rest of Us)," The Independent Review, Vol. 6, No. 3, Winter 2002, pp. 377-397.

"Toward a Theory of Global Liberalization in Telecommunications with Implications for Convergence Regulation," (with Gene Mesher), in E. Bohlin, K. Brodin, A. Lundgren, and B. Thorngren, editors, Convergence in Communications and Beyond, North Holland, Amsterdam, 2000.

"The Telecommunications Act of 1996: A Policy Analysis Test Bed," S. L. Levin and E. Bohlin, editors, Telecommunications Transformation: Technology, Strategy, and Policy, IOS Press, Amsterdam, 1998.

"The Political Economy of Telecommunications in Malaysia and Singapore: a Structure-Conduct-Performance Comparative Analysis," with G. Mesher, Information Economics and Policy, Vol. 9, No. 3 (1997), pp. 183-202..

"Institutional Framing and Perceptions of Fairness," with R. M. Isaac and D. Mathieu, Constitutional Political Economy, Vol. 2, No. 3, (1991), pp. 329-370.

"Technological Winds of Creation and Destruction in Telecommunications: A Case Study," Studies in the Evolution of Technology and Market Structure in an International Context and other Papers in the Schumpeterian Tradition, edited by A. Heertje and M. Perlmen, University of Michigan Press (1990).

Dupuit-Marshall Consumer's Surplus, Utility, and Revealed Preference," Journal of Economic Theory, 20, No. 2, (April 1979), pp. 260-270.

Note on an "Extension of the Ramsey Inverse Elasticity of Demand Pricing or Taxation Formula," Journal of Public Economics 3 (1974) 181-184.

"A Geometric Treatment of Averch-Johnson's Behavior of the Firm Model: Reply," American Economic Review, Vol. LXII, No. 1, pp. 142, (March 1972). (Translation into Japanese in Kosoku Doro to Jidosho.)

Note on "Gold Plating" or "Rate Base Padding," Bell Journal of Economics and Management Science, Vol. 3, No. 1, (Spring 1972).

"Lagrange Multiplier Values at Constrained Optima," Journal of Economic Theory, Vol. 4, No. 2, (April 1972).

"A Geometric Treatment of Averch-Johnson's Behavior of the Firm Model," American Economic Review, LX, pp. 117-125, (March 1970). Translation into Japanese in Kosoku Doro to Jidosho. Excerpted in Public Policies Toward Business, edited by W. G. Sheperd, Irwin (1979.)

"Film Animation by Computer," New Scientist, 29, 346-349 (February 1967).

"Computer Animation, A New Scientific and Educational Tool," Journal of the Society of Motion Picture and Television Engineers, 14, 1006-1008 (November 1965).

Comments on "Stability of Damped Mechanical Systems and a Further Extension," American Institute of Aeronautics and Astronautics Journal, 3, 1749-1750 (September 1965).

"The Kelvin-Tait-Chetaev Theorem and Extensions," J. Astronautical Sciences, 11, No. 2 (1964).

"A Two-Gyro, Gravity-Gradient Attitude Control System," with J. A. Lewis, Bell System Technical Journal, 43 pp. 2705-2766 (November 1964).

"Computer-Made Perspective Movies as a Scientific and Communication Tool," Communications of the ACM, 7, 169-170 (March 1964).

"Note on Overly-Stable Difference Approximations," J. Math. and Physics, XLIII, No. 1, 51-54 (March 1964).

"Limits on the Damping of Two-Body Gravitationally Oriented Satellites," American Institute of Aeronautics and Astronautics Journal, 1, 498-499 (February 1963).

"Bounds on the Decay Rate of Damped Linear Systems," Quart. Journal Appl. Math., 20, 383-384 (January 1963).

"Damping of a Gravitationally Oriented Two-Body Satellite," American Rocket Society Journal, 32, 1871-1875 (December 1962).

"Stability of Two Planar Loop Elastics," Jour. of Appl. Mech., 29 136-142 (March 1962).

"Capture Problem in Gravitational Attitude Control of Satellites," Amer. Rocket Soc. Journal, 1464-1466 (October 1961).

"The Deflection and Buckling of a Beam Column with a One-Sided Constraint," Zeit. Ang. Math. und Phys., XII, 536-546 (1961).

"Bending Impact Waves in Beams," with W. Flugge, Ingenieur-Archiv, 28, 59-70 (1959).

"Dynamics and Kinematics of the Laying and Recovery of Submarine Cable," Bell System Technical Journal, 36 1129-1207 (September 1957), J. of Am. Soc. of Naval Eng. 531-542 (August 1958).

## C. CHAPTERS IN SCHOLARLY BOOKS, PROCEEDINGS, AND REPORTS.

### C.1 Textbooks

"Stability," Chapter 8 of The Man-Made World, McGraw-Hill, (1971). (My original text subsequently expanded and revised by anonymous editors for later editions.)

### C.2 Proceedings and Reports

"An Analysis of U.S. and Arizona Telecommunications Policy", Arizona Issue Analysis #143, Goldwater Institute, Phoenix, Arizona, (October 1996)

"Telecommunications: An Example of Policy Gone Awry?" Entrepreneurship and Innovation: The Impact of Deregulation on Airlines, Financial Markets and Telecommunications, edited by G. Lipecap, Vol. II, JAI Press Series, Advances in the Study of Entrepreneurship, Innovation, and Economic Growth, (1988).

"Deregulatory Challenges and Opportunities for the Nineties," Proceedings-Twelfth Annual Rate Symposium, sponsored by American University, University of Missouri-Columbia, and the Missouri Public Service Commission, (February 16-19, 1986), Arlington, Virginia, (1986).

"Efficiency and Justice in the Regulatory Process: A Program for Social Science Research," with Isaac, R. Mark, Proceedings from the Telecommunications Deregulation Forum, sponsored by the Karl Eller Center for the Study of the Private Market Economy, College of Business and Public Administration, University of Arizona, (June 5-6, 1986), Tucson, Arizona.

"Who Wins and Who Loses? An Economic Justice Overview and Research Agenda," Telecommunications and Equity: Policy Research Issues, Proceedings of the Thirteenth Annual Telecommunications Policy Research Conference, edited by J. Miller, Elsevier Science Publishers B.V., North Holland, (1985).

"Perceived Economic Justice: The Example of Public Utility Regulation," Cost Allocation: Methods, Principles and Applications edited by H. Peyton Young, Elsevier Science Publishers B.V., North Holland (1985).

"Is Telephone Service an Economic Right?," Energy and Communications in Transition edited by H. M. Trebing, MSU Public Utilities Studies, Michigan State University (1981), pp. 94-109.

"Regulatory Challenges and Opportunities for the Eighties," Proceedings of the 1980 Rate Symposium on Problems of Regulated Industries, Kansas City, Missouri, (February 10-13, 1980).

"Some Preliminary Thoughts on Subsidization," Papers and Proceedings, Conference on Communication Policy Research, Office for Telecommunications Policy, Washington, D.C., (1972).

"Computing Displays and Programming Language," with K. C. Knowlton, Chapter 9 in Human Communication: A Unified View, edited by E. E. David and P. B. Denes, McGraw-Hill, (1972).

"The Hourglass Instead of the Funnel," in Educational Technology, IX, pp. 28-29 (February 1969). Also reprinted in Technology and Education, edited by L. Lipsits, Educational Technology Publications, pp. 82-87, (1971).

"A Generalized Window-Shield Routine," with B. L. Behler, UAIDE Proceedings of the Eighth Annual Meeting pp. 351-388, (November 1969).

"Motion Picture Animation," Article in Computer Graphics, edited by F. Gruenberger, Academic Press, pp. 199-208 (1967).

"Programmed Pictorial Display," Proceedings of the 1964 Symposium on Digital Computing, Bell Laboratories, Holmdel, N.J. (January 1964).

"Some Simple Solutions Relating to Magnetic Attitude Control," Proceedings, Fourth U.S. National Congress of Applied Mechanics, Univ. of California (1962).

"Propagation of Elastic Waves," Chapter 64, Handbook of Engineering Mechanics, Ed. W. Flugge, McGraw-Hill (1962).

"Antennas for Hard Radio Communications Systems - A Preliminary Study," with Morgan, S. P., Shock, Vibration and Associated Environments, Office of the Secretary of Defense, Research and Engineering, Bulletin No. 29, Part III, 224-232 (July 1961).

"Some Remarks on Hardening Guidance," Proceedings of Symposium on Protective Construction, Rand Corp., 455 (May 1957).

#### D. RECENT BOOK REVIEWS

Robert Fogel, 2000, *The Fourth Great Awakening & the Future of Egalitarianism*, University of Chicago Press, review in *Journal of Economic History*, vol. 60 (Dec. 2000), 1171-72.

Stephen B. Adams and Orville R. Butler, 1999, *Manufacturing the Future: A History of Western Electric*, Cambridge University Press, review in *Journal of Economic History*, vol. 59 (Sept. 1999), 832-833.

Michael Crew, editor, 1996 *Pricing and Regulatory Innovations under Increasing Competition*, Kluwer, Boston, review in *Public Choice*, vol. 98, 474-476 (1999)

Vincent Mosco, 1996, *Political Economy of Communications*, Sage Publications, review forthcoming in *Information Economics and Policy*, vol. 10, 389-401 (1998)

Jon Elster, editor, 1996, *Local Justice in America*, Russel Sage Foundation, reviewed in *Journal of Institutional and Theoretical Economics*, vol. 153, 2, pp. 419-421 (1997).

Arlindo Villaschi, 1994, *The Newly Industrialized Countries and the Information Technology Revolution: The Brazilian Experience*, Avebury, reviewed for *Information Economics and Policy*, vol. 9, 3, pp. 266-269 (1997).

H. Peyton Young, 1994, *Equity: In Theory and Practice*, Princeton University Press, Princeton, NJ; reviewed for *Public Choice*, 82, pp.396-399 (1995)

Norman Frohlich and Joe A. Oppenheimer, 1992, *Choosing Justice: An Experimental Approach to Ethical Theory*. University of California Press, Berkeley; reviewed for *Public Choice*, 77, pp.669-672 (1993).

Michael T. Hannan and Glenn R. Carroll, 1992, *Dynamics of Organizational Populations*, Oxford University Press, Oxford; reviewed for the *Journal of the American Statistical Association*, 88, pp. 1171-72 (1993).

Robert W. Crandall and Kenneth Flamm, editors, 1989, *Changing the Rules: Technological Change, International Competition, and Regulation in Communications*, The Brookings Institution, Washington, D.C. reviewed for the *Journal of Policy Analysis and Management*, 9, pp. 569-572 (Fall, 1990).

Robert B. Horwitz, 1989, *The Irony of Regulatory Reform: The Deregulation of American Telecommunications*, Oxford University Press, reviewed for the *Annals of the American Academy of Political and Social Science*, 509, pp. 198-99 (May 1990).

Also, anonymous reviewer of several scholarly books on economics published by the MIT Press and the Cambridge University Press.

## V. RECENT INVITED SCHOLARLY PRESENTATIONS (1991-present)

"Toward a Theory of Global Liberalization of Telecommunications," presented at the Public Choice Society meetings, New Orleans, March 14, 1999.

"Toward a Phenomenological Theory (or Theories) of Local Justice/Fairness," presented at the Public Choice Society meetings, New Orleans, March 13, 1998.

"The Telecommunications Act of 1996: A Policy Analysis Test Bed," presented at the International Telecommunications Society Conference, Calgary, Canada, June 17, 1997.

"A Normative Analysis of the Telecommunications Act of 1996," presented at the Public Choice Society annual meeting, San Francisco, March 21, 1997.

"An Analysis of U. S. and Arizona Telecommunications Policy," presented at the Goldwater Institute, Phoenix, Arizona, Sept. 11, 1996.

"Political Economy of Telecommunications," presented at Carlos III University, Madrid, May 28, 1996.

"Political Economy of Telecommunications," presented at the General Research Colloquium telecast to all locations of AT&T and Lucent Bell Labs, Murray Hill, New Jersey, May 24, 1996.

"How to Level the Playing Field: A Survey of Positive Theories of Fairness," presented at the annual meeting of the Arizona State University chapter of Sigma Xi, May 4, 1994.

"Toward a Positive Theory of Social Regulation," presented at the Wharton School, Management and Policy Seminar, March 28, 1994.

"A Survey of Fairness Research, presented at the New Mexico State University Symposium on Public Utility Regulation, Santa Fe, New Mexico, March 15, 1993.

"In Fairness, Smaller is Cheaper," presented at the Collective Choice Center Symposium, University of Maryland, May 8, 1992.

"Toward an Economic History of the Bell System and Bell Laboratories," presented at AT&T Bell Laboratories, Nov. 6, 1991.

"Institutional Framing and Perceptions of Fairness," presented at AT&T Bell Laboratories, October 4, 1991 and New York University Department of Economics Theory Seminar, October 18, 1991.

## **VI. GRANTS**

Department of Defense (1995-97): Co-principal investigator for "Modeling the Deployment of Telecommunications Technology," \$80,000.

National Science Foundation: Principal investigator for 1987 award of \$24,000 to fund the Fifteenth Annual Telecommunications Policy Research Conference.

Markle Foundation: Principal investigator for 1987 award of \$30,000 to fund the Fifteenth Annual Telecommunications Policy Research Conference.