OBITUARY: *Sidney Jesse Yakowitz*

Sidney Jesse Yakowitz

Sid Yakowitz was born in San Francisco, California on 8 March 1937, and died on 1 September 1999 in Eugene, Oregon at the untimely age of 62. He had suffered for some time from health problems, including a weak heart and a poor circulation system.

Sid graduated with a B.S. in Electrical Engineering from Stanford University in 1960, and began his career as a Design Engineer at the Lawrence Radiation Laboratory, University of California, Berkeley. He had always suffered severely from asthma, and this was one of the reasons for his move to the drier climate of Arizona. He took an M.S. degree in Electrical Engineering at Arizona State University (ASU), Tempe in 1965, and served as a Faculty Associate for the following year, during which he earned an M.A. in Mathematics. He was awarded his Ph.D. in Electrical Engineering from ASU in 1967.

In 1966, he accepted appointment to an Assistant Professorship in the Department of Systems and Industrial Engineering (SIE) at the University of Arizona, Tucson; he served the department continuously as a dedicated member for the next 33 years, until his retirement in May 1999. He was promoted to an Associate Professorship in SIE in 1968, and to a full Professorship in 1977, co-founding the department's Algorithmic Laboratory with Marcel F. Neuts in 1987, and taking over its directorship after Marcel's retirement in 1996.

Sid was an intellectually curious researcher, with many areas of expertise: statistics and statistical inference, computational mathematics, game theory, decision analysis, water resources and dam theory, control problems, time series analysis, dynamic programming, machine learning, and most recently the analysis and control of epidemics. His 1982 paper with Szidarovszky on the existence of equilibria in Cournot oligopolies is one of the most cited works in the field of game theory. He was a voracious reader of the technical literature, and had an immense knowledge of the fields in which he worked. His familiarity with the various areas of applied mathematics was broad and deep; his friend and colleague in the SIE department, Ferenc Szidarovszky, has referred to Sid as a 'living lexicon of the literature'. He asserts that Sid would always know the right answer to a problem, or provide a reference that led to the answer. I know from personal experience what a stimulating collaborator he was: his questions were always penetrating, and his solutions to difficult problems unexpected and elegant.

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Sid was also a sensitive and knowledgeable lover of English and American literature. He read widely, was an amateur musician who played the violin, and greatly appreciated classical music. I still recall the expression of pleasure on his face, as we both listened to his daughter Jane playing the violin. She now plays in the Bach Society Chamber Orchestra at Yale University, where she is a student of mathematics.

Sid authored 4 books, listed below; a fifth book entitled 'An Introduction to Non-Numerical Computations' is to be submitted for publication posthumously. He was a prolific researcher, writing some 97 papers over a period of 32 years; details of these are also given below. He taught a variety of courses in the SIE department, and supervised 4 Ph.D. students in SIE, 2 in Hydrology, and 2 in Mathematics.

Sid was a member of the Institute of Electrical and Electronic Engineers, of the American Statistical Association, the Institute of Mathematical Statistics and the Society of Industrial and Applied Mathematics. He was the recipient of a DeMund and National Science Foundation Graduate Traineeship 1964–1966, and a National Academy of Science Postdoctoral Fellowship, held at the Naval Postgraduate School, Monterey, California in 1970–1971. He served as Associate Editor of *Water Resources Management* 1987–1993, the *Journal of the American Statistical Association* 1985–1988, and the *Journal of Statistical Planning and Inference* from 1998 until his death.

His expertise and good judgment were much valued as a member of the Rainfall/Runoff Committee of the American Geophysical Union 1981–1982, of the National Research Council Committee on Techniques for Estimating Probabilities of Extreme Floods 1987–1988, and of the National Academy of Science Committee for Selecting Minorities and Women for Graduate Assistantships 1989–1992. He was also an Engineering and Mines College Representative to the University of Arizona Promotion and Tenure Advisory Committee 1985–1988.

At the personal level, Sid was a devoted family man; he was immensely proud of his wife Diana's and his four children's achievements, and rarely missed the opportunity of drawing one's attention to them. He had a great gift for friendship: he invited me to visit him at Tucson when I was working at the University of California, Santa Barbara, and insisted that I stay with Diana and him in their home, where I was made to feel very much a member of the family. He later visited the Stochastic Analysis Group in the School of Mathematical Sciences of the Australian National University for six weeks in 1996–1997, and pursued his collaboration with Daryl Daley and myself on epidemic problems, and with Chris Heyde on long term dependence. We greatly enjoyed his good humour, and his enormous fund of jokes; we shall miss him very much. He has left behind him an impressive opus, and wonderful memories of his love of literature and music, and of his deep humanity.

Sid is survived by his mother Mary V. Yakowitz, his wife Diana, and four children April Yakowitz, Taibele Karen Wesley, Joel Yakowitz and Jane Yakowitz, as well as two grandchildren. His colleagues throughout the world extend their deepest sympathy to the family at their sad loss.

Australian National University, Canberra J. GANI
October 1999

From Professor Benjamin Kedem, University of Maryland:

I was deeply saddened by the death on September 1, 1999, of my dear friend Sid Yakowitz. Only three weeks earlier, on August 9, the two of us had dinner together in Baltimore where we attended the 1999 Joint Statistical Meeting; Sid gave a talk on stochastic optimization at the

meeting. At dinner, Sid told me of his heart condition, but the meal was great and he enjoyed it. After dinner we walked two blocks to my car, and it was clear that this required an effort on his part.

I first met Sid at the Joshi Festschrift Conference, held in London, Ontario, in May 1985, and we became instant friends. Sid had numerous friends and collaborators; his broad spectrum of interests and wide knowledge made him a valuable collaborator. We worked together in the early 1990s on a certain contraction mapping in spectrum analysis. Sid's contribution was both insightful and beautiful. His interest in my research had a tremendous impact on my career and I shall miss him greatly.

My heart goes out to Diana and the children.

From Professor Ferenc Szidarovszky, University of Arizona:
I had the privilege of being Sid Yakowitz's co-author in two books and many papers, and have only the happiest memories of working with him. He was always hard-working, reliable and fair. His excellent sense of humour made every minute of our co-operation a genuine pleasure. Our long-term co-operation in the SIE department, which led to joint books and publications, also resulted in my introducing him to real European coffee, and many fine Hungarian dishes such as potato casserole, and stuffed pepper, which he grew to love.

Sid was always honest and invariably spoke his mind. He never played games or compromised his honesty to please anyone. His frank critical comments helped me greatly in my teaching and research, and even often in my personal life. He was my best friend, and I miss him very much.

Publications of Sid Yakowitz

Books

[1] YAKOWITZ, S. (1969). *Mathematics of Adaptive Control Processes.* Elsevier, New York.
[2] YAKOWITZ, S. (1977). *Computational Probability and Simulation.* Addison-Wesley, Reading, MA.
[3] SZIDAROVSZKY, F. AND YAKOWITZ, S. (1978). *Principles and Procedures of Numerical Analysis.* Plenum Press, New York.
[4] YAKOWITZ, S. AND SZIDAROVSZKY, F. (1986). *An Introduction to Numerical Computations,* 1st edn. Macmillan, New York [2nd edn 1989].
[5] YAKOWITZ, S. *An Introduction to Non-Numerical Computations.* To be submitted posthumously.

Papers

[1] YAKOWITZ, S. AND SPRAGINS, J. (1968). On the identifiability of finite mixtures. *Ann. Math. Statist.* **39**, 209–214.
[2] YAKOWITZ, S. (1969). A consistent estimator for the identification of finite mixtures. *Ann. Math. Statist.* **40**, 1728–1735.
[3] YAKOWITZ, S. (1970). Unsupervised learning and the identification of finite mixtures. *IEEE Trans. Inform. Theory* **16**, 330–338.
[4] FISHER, L. AND YAKOWITZ, S. (1970). Estimating mixing distributions in metric spaces. *Sankhya A* **32**, 411–418.
[5] YAKOWITZ, S. AND FISHER, L. (1973). On sequential search for the maximum of an unknown function. *J. Math. Anal. Appl.* **41**, 234–359.
[6] YAKOWITZ, S. AND PARKER, S. (1973). Computation of bounds for digital filter quantization errors. *IEEE Trans. Circuit Theory* **20**, 391–396.
[7] YAKOWITZ, S. (1973). A stochastic model for daily river flows in an arid region. *Water Resources Research* **9**, 1271–1285.
[8] YAKOWITZ, S. (1974). Multiple hypothesis testing by finite-memory algorithms. *Ann. Statist.* **2**, 323–336.
[9] YAKOWITZ, S., DUCKSTEIN, L. AND KISIEL, C. (1974). Decision analysis of a gamma hydrologic variate. *Water Resources Research* **10**, 695–704.
[10] DENNY, J., KISIEL, C. AND YAKOWITZ, S. (1974). Procedures for determining the order of Markov dependence in streamflow records. *Water Resources Research* **10**, 947–954.

[11] PARKER, S. AND YAKOWITZ, S. (1975). A general method for calculating quantization error bounds due to round off in multivariate digital filters. *IEEE Trans. Circuits Systems* **22**, 570–572.
[12] SAGAR, B., YAKOWITZ, S. AND DUCKSTEIN, L. (1975). A direct method for the identification of the parameters of dynamic nonhomogenous aquifers. *Water Resources Research* **11**, 563–570.
[13] SZIDAROVSZKY, F., YAKOWITZ, S. AND KRZYSZTOFOWICZ, R. (1975). A Bayes approach for simulating sediment yield. *J. Hydrol. Sci.* **3**, 33–45.
[14] FISHER, L. AND YAKOWITZ, S. (1976). Uniform convergence of the potential function algorithm. *SIAM J. Control Optim.* **14**, 95–103.
[15] YAKOWITZ, S. (1976). Small sample hypothesis tests of Markov order with application to simulated and hydrologic chains. *J. Amer. Statist. Assoc.* **71**, 132–136.
[16] YAKOWITZ, S. AND NOREN, P. (1976). On the identification of inhomogenous parameters in dynamic linear partial differential equations. *J. Math. Anal. Appl.* **53**, 521–538.
[17] YAKOWITZ, S. (1976). Model-free statistical methods for water table prediction. *Water Resources Research* **12**, 836–844.
[18] YAKOWITZ, S., WILLIAMS, T. L. AND WILLIAMS, G. D. (1976). Surveillance of several Markov targets. *IEEE Trans. Inform. Theory* **22**, 716–724.
[19] SZIDAROVSZKY, F. AND YAKOWITZ, S. (1976). Analysis of flooding for an open channel subject to random inflow and blockage. *J. Hydro. Sci.* **3**, 93–103.
[20] DUCKSTEIN, L., SZIDAROVSZKY, F. AND YAKOWITZ, S. (1977). Bayes design of a reservoir under random sediment yield. *Water Resources Research* **13**, 713–719.
[21] SZIDAROVSZKY, F. AND YAKOWITZ, S. (1977). A new proof of the existence and uniqueness of the Cournot equilibrium. *Int. Econom. Rev.* **18**, 181–183.
[22] DENNY, J. AND YAKOWITZ, S. (1978). Admissible run-contingency type tests for independence and Markov dependence. *J. Amer. Statist. Assoc.* **73**, 117–181.
[23] YAKOWITZ, S., KRIMMEL, J. AND SZIDAROVSZKY, F. (1978). Weighted Monte Carlo integration. *SIAM J. Numer. Anal.* **15**, 1289–1300.
[24] SCHUSTER, R. AND YAKOWITZ, S. (1979). Contributions to the theory of nonparametric regression with application to system identification. *Ann. Statist.* **7**, 139–149.
[25] YAKOWITZ S. (1979). Nonparametric estimation of Markov transition functions. *Ann. Statist.* **7**, 671–679.
[26] NEUMAN, S. AND YAKOWITZ, S. (1979). A statistical approach to the inverse problem of aquifer hydrology: Part I. Theory. *Water Resources Research* **15**, 845–860.
[27] MURRAY, D. AND YAKOWITZ, S. (1979). Constrained differential dynamic programming and its application to multireservoir control. *Water Resources Research* **15**, 1017–1027.
[28] YAKOWITZ, S. (1979). A nonparametric Markov model for daily river flow. *Water Resources Research* **15**, 1035–1043.
[29] KRZYSZTOFOWICZ, R. AND YAKOWITZ, S. (1980). Large-sample methods analysis of gamma variates. *Water Resources Research* **16**, 491–500.
[30] YAKOWITZ, S. AND DUCKSTEIN, L. (1980). Instability in aquifer identification – theory and case studies. *Water Resources Research* **16**, 1045–1064.
[31] PEBBLES, R., SMITH, R. AND YAKOWITZ, S. (1981). A leaky reservoir model for ephemeral flow recession. *Water Resources Research* **17**, 628–636.
[32] MURRAY, D. AND YAKOWITZ, S. (1981). The application of optimal control methodology to non-linear programming problems. *Math. Programming* **21**, 331–347.
[33] SZIDAROVSZKY, F. AND YAKOWITZ, S. (1982). Contributions to Cournot oligopoly theory. *J. Econom. Theory* **28**, 51–70.
[34] YAKOWITZ, S. (1982). Dynamic programming applications in water resources. *Water Resources Research* **18**, 673–696.
[35] YAKOWITZ, S. (1983). Convergence rate of the state increment dynamic programming method *Automatica* **19**, 53–60.
[36] YAKOWITZ, S. AND RUTHERFORD, B. (1984). Computational aspects of discrete-time optimal-control. *Appl. Math. Comput.* **15**, 29–45.
[37] SZILAGYI, M., YAKOWITZ, S. AND DUFF, M. (1984). A procedure for electron and ion lens optimization. *Appl. Phys. Lett.* **44**, 7–9.
[38] MURRAY, D. AND YAKOWITZ, S. (1984). Differential dynamic programming and Newton's method for discrete optimal control problems. *J. Optim. Theory Appl.* **42**, 395–415.
[39] YAKOWITZ, S. (1985). Nonparametric density estimation, prediction and regression for Markov sequences. *J. Amer. Statist. Assoc.* **80**, 215–221.
[40] YAKOWITZ, S. (1985). Markov flow models and the flood warning problem. *Water Resources Research* **21**, 81–88.

[41] YAKOWITZ, S. AND SZIDAROVSZKY, F. (1985). A comparison of Kriging with nonparametric regression methods. *J. Multivariate Anal.* **6**, 21–53.
[42] YAKOWITZ, S., HUTTER, K. AND SZIDAROVSZKY, F. (1985). Toward computation of steady-state profiles of ice sheets. *Z. fuer Gletcherkund* **21**, 283–289.
[43] SCHUSTER, E. AND YAKOWITZ, S. (1985). Parametric nonparametric mixture density-estimation with application to flood frequency analysis. *Water Resources Bulletin* **21**, 797–804.
[44] YAKOWITZ, S. (1986). A stagewise Kuhn–Tucker condition and differential dynamic programming. *IEEE Trans. Automat. Control* **31**, 25–30.
[45] HUTTER, K., YAKOWITZ, S. AND SZIDAROVSZKY, F. (1986). A numerical study of plane ice sheet flow. *J. Glaciology* **32**, 139–160.
[46] YAKOWITZ, S., HUTTER, K. AND SZIDAROVSZKY, F. (1986). Elements of a computational theory for glaciers. *J. Comput. Phys.* **66**, 132–150.
[47] HUTTER, K., SZIDAROVSZKY, F. AND YAKOWITZ, S. (1986). Plane steady shear-flow of a cohesionless antigranulocytes material down an inclined plane – a model for flow avalanches: Part I. Theory. *Acta Mechanica* **63**, 87–112.
[48] HUTTER, K., SZIDAROVSZKY, F. AND YAKOWITZ, S. (1987). Plane steady shear-flow of a cohesionless antigranulocytes material down an inclined plane – a model for flow avalanches: Part II. Numerical results. *Acta Mechanica* **65**, 239–261.
[49] YAKOWITZ, S. (1987). Nearest neighbour methods in time-series analysis. *J. Time Series Anal.* **2**, 235–247.
[50] SZIDAROVSZKY, F., HUTTER, K. AND YAKOWITZ, S. (1987). A numerical study of steady plane antigranulocytes chute flows using the Jenkins–Savage model and its extensions. *J. Numer. Methods Eng.* **24**, 1993–2015.
[51] HUTTER, K., YAKOWITZ, S. AND SZIDAROVSZKY, F. (1987). Coupled thermomechanical response of an axisymmetrical cold ice-sheet. *Water Resources Research* **23**, 1327–1339.
[52] SEN, S. AND YAKOWITZ, S. (1987). A quasi-Newton differential dynamic programming algorithm for discrete-time optimal control. *Automatica* **23**, 749–752.
[53] KARLSSON, M. AND YAKOWITZ, S. (1987). Nearest-neighbor methods for nonparametric rainfall-runoff forecasting. *Water Resources Research* **23**, 1300–1308.
[54] KARLSSON, M. AND YAKOWITZ, S. (1987). Rainfall-runoff forecasting methods, old and new. *Stoch. Hydrol. Hydraul.* **1**, 303–318.
[55] GANI, J., TODOROVICH, P. AND YAKOWITZ, S. (1987). Silting of dams by sedimentary particles. *Math. Scientist* **12**, 81–90.
[56] NAOKES, D., HIPEL, K., MCLEOD, A. I. AND YAKOWITZ, S. (1988). Forecasting annual geophysical time series. *Int. J. Forecasting* **4**, 103–115.
[57] YAKOWITZ, S. (1988). Parametric and nonparametric density-estimation to account for extreme events. *Adv. Appl. Prob.* **20**, 13.
[58] SZIDAROVSZKY, F., HUTTER, K. AND YAKOWITZ, S. (1989). Computational ice-divide analysis of a cold plane ice sheet under steady conditions. *Ann. Glaciology* **12**, 170–178.
[59] YAKOWITZ, S. (1989). Algorithms and computational techniques in differential dynamic programming. *Control Dynamic Systems* **31**, 75–91.
[60] YAKOWITZ, S. (1989). Theoretical and computational advances in differential dynamic programming. *Control Cybernet.* **17**, 172–189.
[61] YAKOWITZ, S. (1989). A statistical foundation for machine learning, with application to Go-Moku. *Comput. Math. Appl.* **17**, 1095–1102.
[62] YAKOWITZ, S. (1989). Nonparametric density and regression estimation for Markov sequences without mixing assumptions. *J. Multivariate Anal.* **30**, 124–136.
[63] GANI, J. AND YAKOWITZ, S. (1989). A probabilistic sedimentation analysis for predicting reservoir lifetime. *Water Resources Management* **3**, 191–203.
[64] YAKOWITZ, S. AND LUGOSI, E. (1990). Random search in the presence of noise, with application to machine learning. *SIAM J. Sci. Statist. Comput.* **11**, 702–712.
[65] YAKOWITZ, S., GANI, J. AND HAYES, R. (1990). Cellular automaton modelling of epidemics. *Appl. Math. Comput.* **40**, 41–54.
[66] RUTHERFORD, B. AND YAKOWITZ, S. (1991). Error inference for nonparametric regression. *Ann. Inst. Statist. Math.* **43**, 115–129.
[67] YAKOWITZ, S. AND LOWE, W. (1991). Nonparametric bandit methods. *Ann. Operat. Res.* **28**, 297–312.
[68] DIETRICH, R. D. AND YAKOWITZ, S. (1991). A rule based approach to the trim-loss problem. *Int. J. Prod. Res.* **29**, 401–415.
[69] YAKOWITZ, S. (1991). Some contributions to a frequency location problem due to He and Kedem. *IEEE Trans. Inform Theory* **17**, 1177–1182.

[70] YAKOWITZ, S., JAYAWARDENA, T. AND LI, S. (1992). Theory for automatic learning under partially observed Markov-dependent noise. *IEEE Trans. Automat. Control* **37**, 1316–1324.
[71] YAKOWITZ, S., HAYES, R. AND GANI, J. (1992). Automatic learning for dynamic Markov-fields with application to epidemiology. *Operat. Res.* **40**, 867–876.
[72] YAKOWITZ, S. AND KOLLIER, M. (1992). Machine learning for optimal blackjack counting strategies. *J. Statist. Plann. Inference* **33**, 295–309.
[73] YAKOWITZ, S. (1992). A decision model and methodology for the AIDS epidemic. *Appl. Math. Comput.* **52**, 149–172.
[74] YAKOWITZ, S. AND TRAN, L. T. (1993). Nearest neighbor estimators for random fields. *J. Multivariate Anal.* **44**, 23–46.
[75] YAKOWITZ, S. (1993). Nearest neighbor regression estimation for null-recurrent Markov time series. *Stoch. Proc. Appl.* **48**, 311–318.
[76] GANI, J. AND YAKOWITZ, S. (1993). Modeling the spread of HIV among intravenous drug users. *IMA J. Math. Appl. Medicine Biol.* **10**, 51–65.
[77] YAKOWITZ, S. (1993). A globally convergent stochastic approximation. *SIAM J. Control Optim.* **31**, 30–40.
[78] YAKOWITZ, S. (1993). Asymptotic theory for a fast frequency detector. *IEEE Trans. Inform. Theory* **39**, 1031–1036.
[79] LI, T. H., KEDEM, B. AND YAKOWITZ, S. (1994). Asymptotic normality of sample autocovariances with an application in frequency estimation. *Stoch. Proc. Appl.* **52**, 329–349.
[80] PINELIS, I. AND YAKOWITZ S. (1994). The time until the final zero-crossing of random sums with application to nonparametric bandit theory. *Appl. Math. Comput.* **63**, 235–263.
[81] KEDEM, B. AND YAKOWITZ, S. (1994). Practical aspects of a fast algorithm for frequency detection. *IEEE Trans. Commun.* **42**, 2760–2767.
[82] YAKOWITZ, S. (1994). Review of *Time series analysis of higher order crossings*, by B. Kedem. *SIAM Rev.* **36**, 680–682.
[83] YAKOWITZ, S. (1994). From a microcosmic IVDU model to a macrocosmic HIV epidemic. In *Modelling the AIDS Epidemic: Planning, Policy and Prediction*, eds E. H. Kaplan and M. L. Brandeau. Raven Press, New York, pp. 365–383.
[84] YAKOWITZ, S. AND MAI, J. (1995). Methods and theory for off-line machine learning. *IEEE Trans. Automat. Control* **40**, 161–165.
[85] GANI, J. AND YAKOWITZ, S. (1995). Computational and stochastic methods for interacting groups in the AIDS epidemic. *J. Comput. Appl. Math.* **59**, 207–220.
[86] YAKOWITZ, S. (1995). Computational methods for Markov series with large state-spaces, with application to AIDS Modelling. *Math. Biosci.* **127**, 99–121.
[87] LAI, T. L. AND YAKOWITZ, S. (1995). Machine learning and nonparametric bandit theory. *IEEE Trans. Automat. Control* **40**, 1199–1209.
[88] GANI, J. AND YAKOWITZ S. (1995). Error bounds for deterministic approximation to Markov processes, with applications to epidemic models. *J. Appl. Prob.* **32**, 1063–1076.
[89] YAKOWITZ, S. AND DIETRICH, R. (1996). Sequential design with application to the trim-loss problem. *Int. J. Production Res.* **34**, 785–795.
[90] TRAN, L., ROUSSAS, G., YAKOWITZ, S. AND VAN TROUNG, B. (1996). Fixed-design regression for linear time series. *Ann. Statist.* **24**, 975–991.
[91] JAYAWARDENA, T. AND YAKOWITZ, S. (1996). Methodology for the stochastic graph completion time problem. *INFORMS J. Comput.* **8**, 331–342.
[92] MORVAI, G., YAKOWITZ, S. AND GYÖRFI, L. (1996). Nonparametric inferences for ergodic, stationary time series. *Ann. Statist.* **24**, 370–379.
[93] YAKOWITZ, S., BLOUNT, M. AND GANI, J. (1996). Computing marginal expectations for large compartmentalized models with application to AIDS evolution in a prison system. *IMA J. Math. Appl. Medicine Biol.* **13**, 223–244.
[94] BLOUNT, S., GALAMBOSI, A. AND YAKOWITZ, S. (1997). Nonlinear and dynamic programming for epidemic intervention. *Appl. Math. Comput.* **86**, 123–136.
[95] GANI, J., YAKOWITZ, S. AND BLOUNT, M. (1997). The spread and quarantine of HIV infection in a prison system. *SIAM J. Appl. Math.* **57**, 1510–1530.
[96] MORVAI, G., YAKOWITZ, S. AND ALGOET, P. (1998). Weakly convergent nonparametric forecasting of stationary time series. *IEEE Trans. Inform. Theory* **44**, 886–892.
[97] YAKOWITZ, S., GYÖRFI, L., KIEFFER, J. AND MORVAI, G. (1999). Strongly consistent nonparametric forecasting and regression for stationary ergodic sequences. *J. Multivariate Anal.* **71**, 24–41.