

William S. Meisel, Ph.D.

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Backed by over 30 years of experience in Artificial Intelligence, including advanced speech and natural language interpretation technology and resulting products and markets, Dr. Meisel has been an independent consultant and publisher since 1991. Meisel ran a speech recognition company for a decade, and wrote the first technical book on machine learning early in his career.

Meisel is President of TMA Associates and editor of *LUI News*, a paid-subscription no-ads newsletter that covers commercial applications of the Language User Interface (LUI), published for over a decade (formerly *Speech Strategy News*). He is the recent author of a comprehensive Vendor Guide and Market Analysis, “Specialized Digital Assistants and Bots” (see www.tmaa.com). Meisel provides consulting services in the area of commercial applications of language technology.

Meisel is also Executive Director of the Applied Voice Input Output Society (AVIOS), a not-for-profit industry organization. In that role, is the program organizer for AVIOS’s [*Conversational Interaction Conference*](#).

Meisel published a book for the general public, [*The Software Society: Cultural and Economic Impact*](#), in 2013. It discusses both the upside for closer interaction of digital systems with humans and the economic downside of fast technology advances in AI.

Prior to founding and running the speech recognition company (Speech Systems Incorporated) for ten years, Meisel created the Computer Science Division of a defense firm and built it up for ten years. Before that, Meisel was a professor of electrical engineering and computer science at USC, teaching courses in artificial intelligence and pattern recognition.

Meisel’s background includes a solid technical foundation. He has a BS from Caltech and a Ph.D. in Electrical Engineering and over 60 publications including a textbook (*Computer-Oriented Approaches to Pattern Recognition*), technical and marketing articles, and eleven issued patents. He is the editor of two books on the Voice User Interface.

EXPERIENCE

TMA Associates, Encino, CA, 1991 - Present: President of TMA Associates and Editor of *LUI News*, an industry newsletter published by TMA. Consulting and market research. TMA Associates does consulting on advanced speech natural language technology products, and AI technologies—market analysis, business planning, product design, product development, and financing sources. TMA has done consulting for dozens of clients, from large to small.

Applied Voice Input Output Society (Non-profit professional organization)
Executive Director (continuing), organizes AVIOS's [Conversational Interaction Conference](#).

Speech Systems Incorporated, Tarzana, CA, 1981 - 1991: Dr. Meisel founded SSI in 1981 to develop a continuous speech recognition system. He was Chairman of the Board and President for most of this period. SSI developed and sold speech recognition systems for general applications and developed a Radiology Reporting System as a turnkey product. The company changed its name to SyVox after Dr. Meisel left and sold its assets after 20 years of existence.

Technology Service Corporation, Santa Monica, CA, 1970 - 1981: Manager, Computer Sciences Division. TSC was a system integration and R&D firm. Dr. Meisel helped the company grow from five people to over 200; the company was eventually sold to Westinghouse. Dr. Meisel began his work in speech recognition at TSC through government contracts.

University of Southern California, Los Angeles, CA, 1967 - 1970: Assistant Professor, Electrical Engineering Department. Dr. Meisel helped set up the Computer Science Department. He introduced courses on Computer Design, Pattern Recognition, and Artificial Intelligence. Meisel wrote the first textbook on Computer Pattern Recognition.

EDUCATION

1967 Ph.D., Electrical Engineering, University of Southern California, with honors.
1966 M.S., Electrical Engineering, University of Southern California, with honors.
1964 B.S., Engineering, California Institute of Technology (Caltech), with honors.

PATENTS (CO-INVENTORS NOT LISTED)

“Speech Recognition System,” U.S. Patent # 4,718,096, Issued Jan. 5, 1988.
“Preprocessing System for Speech Recognition,” U.S. Patent # 5,054,085, Issued Oct. 1, 1991.
“Voice Activated Device and Method for Providing Access to Remotely Retrieved Data,” U.S. Patent # 5,752,232, issued May 12, 1998.
“Method and apparatus for time-synchronized translation and synthesis of natural-language speech,” US Patent # 6556972, issued April 29, 2003.
“Method and apparatus for translating natural-language speech using multiple output phrases,” US Patent # 6859778, issued February 22, 2005.
“Use of identification codes in the handling and management of communications,” US Patent # 7,197,640, issued March 27, 2007.
“System and method of writing and using scripts in automated, speech-based caller interactions,” US Patent # 8,503,665 B1, issued August 6, 2013.
“Dealing with switch latency in speech recognition,” U.S. Patent 8,886,545 B2, Issued November 11, 2014.
“Computer-based grapheme-to-speech conversion using a pointing device,” U.S. Patent # 8,930,192 B1, issued January 6, 2015.
“Method and apparatus for controlling play of an audio signal,” U.S. Patent 9,066,046, issued June 3, 2015.

“Speech recognition accuracy improvement through speaker categories,” U.S. Patent 9,305,553, issued April 5, 2016.

PUBLICATIONS AND TALKS

Books:

- *The Software Society: Cultural and Economic Impact*, Trafford Press, 2013.
- “The Personal Assistant Model: Unifying the Technology Experience,” chapter in *Mobile Speech and Advanced Natural Language Solutions* (Amy Neustein and Dr. Judith Markowitz, Editors), Springer, 2013.
- *Speech in the User Interface: Lessons from Experience* (Editor), Trafford Press, 2010.
- “Life on-the-Go: The Role of Speech Technology in Mobile Applications,” chapter in *Advances in Speech Recognition: Mobile Environments, Call Centers and Clinics*, Neustein, Amy (Ed.), 2010, Springer.
- *VUI Visions: Expert Views on Effective Voice User Interface Design*, (Editor), Trafford Press, 2006.
- *Computer-Oriented Approaches to Pattern Recognition*, Academic Press, 1972.
- Voice Compass International 2008-2009 (co-author among several authors).
- *How to Build a Speech Recognition Application: Second Edition: A Style Guide for Telephony Dialogues*, with David P. Morgan and Bruce Balentine (2001).
- *The Telephony Voice User Interface: Speech Recognition, Text-to-speech, and Speaker Verification over the Telephone*, TMA Associates, 1998.
- The Advanced Speech Technology Market: Recognition, Text-to-Speech, and Compression, (Market Study), TMA Associates, 1995.
- *Trends in Speech Recognition '92* (Market Study), TMA Associates, 1992.
- *New Components and Subsystems for Digital Design*, edited with W.C. Liles and M.D. Teener, Technology Service Corporation, 1975.

Articles/Papers/Talks/Workshops:

Workshop: *Building An Application-Specific Intelligent Assistant*, to be held at [AI World](#), Dec. 11, 2017.

Building Digital Assistants and Bots: Vendor Guide and Market Analysis, June 2017, 400 pages, <https://aitrends.com/research-bots/>

“Natural language options in customer service,” Conversational Interaction Conference, April 2017.

Building Specialized Digital Assistants and Bots, Presentation and directing workshop, AI World, November 7, 2016.

Specialized Digital Assistants and Bots: Vendor Guide and Market Analysis, June 2016.

“Creating an effective company digital assistant,” presentation, SpeechTek, April 24, 2017.

“Despite ups and downs, U.S. stock market is a haven in an uncertain world,” [NY Daily News](#), Feb. 11, 2016

“Will Artificial Intelligence someday dominate humans?” [NY Daily News](#), January 25, 2016

“Can Anything Slow Technology’s Job Takeover?” [Millennial Magazine](#), December 7, 2015

“Infotainment through Conversational Apps: Possibilities and Challenges,” SpeechTEK, August 2015.

- “Company-Specific Virtual Assistants: Necessities and Possibilities,” Mobile Voice Conference, April 2015.
- Keynote Panel: “Taking advantage of innovations in speech and natural language technology,” Mobile Voice Conference, April 2015.
- “Enterprise Virtual Assistants,” talk at SpeechTEK, August 2014.
- “The Evolution of Speech Recognition: Meeting the demand for natural language interaction is becoming easier—and essential,” *Speech Technology* magazine, Fall issue 2014.
- “Natural language as a means of unifying applications and features,” talk at *Mobile Voice Conference*, March 2014.
- “The Power of Voice in Mobile Marketing,” talk at *Mobile Voice Conference*, March 2014.
- “The Power of a Human-Computer Partnership” (one-hour keynote address), *Human Capital Media Summer School*, July 16, 2013.
- “Call Centers and Company Personal Assistants,” *Speech Technology Magazine*, May 20, 2013.
- “The Personal Assistant Model: Unifying the Technology Experience,” chapter in *Mobile Speech and Natural Language Solutions*, Amy Neustein and Judith Markowitz (eds.), 2013.
- “The Personal Assistant Model: Technology Implications,” invited talk at Mobile Human-Computer Interface Conference, San Francisco, September 24, 2012.
- “The ‘Tipping Point’ for Speech Technology: Strategic Impact and Company Opportunities,” *Mobile Voice Conference*, March 2012.
- “The Changing Perception and Reality of Speech Recognition,” *Speech Technology Magazine*, March/April 2012.
- “The Mobile Phone as Personal Assistant and the Role of Speech Technology,” SpeechTEK, August 2011.
- Panelist: “The evolution of the mobile phone: Where from here?,” Mobile Voice Conference, January 2011.
- Keynote panel: “Keynote Panel: Mobile devices as personal assistants” (Moderator), Mobile Voice Conference, January 2011.
- “Life on-the-Go: The Role of Speech Technology in Mobile Applications,” contribution to *Advances in Speech Recognition: Mobile Environments, Call Centers and Clinics*, Neustein, Amy (Ed.), 2010, Springer.
- “The Untapped Potential for Speech-Automated Services,” SpeechTEK 2010, August 3, 2010.
- Panelist on “Which speech applications will drive the mobile market?,” Mobile Voice Conference, March 23, 2010.
- Panelist at *Conversations with Devices*, moderated by Wired Magazine, San Francisco, January 2010.
- “The Role Of Speech Technology In Mobile Applications,” chapter in *Advances in Speech Recognition: Mobile Environments, Call Centers and Clinics*, Amy Neustein (editor), Springer, 2010.
- “The return of the Voice Web: Contact centers as voice sites,” SpeechTEK Conference, August 2009.
- “Key messages from the conference: New paradigms or more of the same?” Voice Search Conference, March 2009.
- “Trust in the call center,” presentation, Nuance Conversations 2008, Orlando, Florida, October 27, 2008.

- “Closing debate: Lessons we should take from the conference,” panel discussion, *Voice Search Conference 2008*, San Diego, March 10-12, 2008.
- “The Voice Search Paradigm in Call Centers: Just Say It!,” *Voice Search Conference 2008*, San Diego, March 10-12, 2008.
- “A helping hand in voice search,” *Speech Technology* magazine, January-February 2008, p. 4.
- “Dealing with change in customer care,” presentation, Nuance Conversations 2007, Boca Raton, FL, October 22, 2007.
- “Turbulent change drives Communications and the Voice User Interface,” presentation, SpeechTEK, New York, NY, August 20, 2007.
- “Advertising in Telephone Speech Applications,” talk at SpeechTEK West, February 21-23, 2007.
- “Opening Keynote: The customers speak out! (panel),” organizer and moderator, SpeechTEK West, February 21-23, 2007.
- “Speech recognition,” in *Wireless Communications: The Future*, William Web, Wiley, 2007.
- VUI Visions: Expert Views on Effective Voice User Interface Design*, (Editor), Trafford Press, 2006.
- “Speech Technology: Finally, a Competitive Necessity,” *Speech Technology Magazine*, January/February 2006, p. 30.
- “Selecting call center vendors,” tutorial presented at SpeechTEK 2005 (New York), August 2005.
- “Preparing for the tsunami: Will voice search engines flood call centers?” presented at SpeechTEK 2005 (New York), August 2005.
- “Is there a ‘Speech Industry’?” *Speech Technology Magazine*, July/August 2005, p. 51.
- “Choosing a vendor and evolution strategy for evolution strategy for contact center applications contact center applications,” Tutorial presented at SpeechTek West 2005, San Francisco, California, February 2005.
- “Speech Technology: Science Fiction Gives Way To Real Value,” *Speech Technology* magazine, January/February 2005, p. 28.
- “Telephony ROI: A broader look at returns to the organization,” presented at SpeechTEK Fall, NY, October 2004.
- “Chairman’s overview,” *Voice World Europe*, London, England, May 5, 2004.
- “Applications: What companies are doing and planning to do with speech technology,” (in “Applications and Markets” Tutorial), AVIOS-SpeechTEK 2004, San Francisco, CA, March 25, 2004.
- “Conference Overview: Industry Trends,” *Telephony Voice User Interface Conference*, Miami, Florida, February 5-6, 2004.
- “Expanding telephone self-service options—Their role in the call center,” *Call Center West 2003*, November 17-19, 2003, Los Angeles, CA.
- “Telephony Voice User Interface Conference,” *The Phonetician*, 2003-II, p. 28.
- “Analyst Wrap-Up Session (Panel),” *SpeechTek 2003*, September 29-October 2, 2003, New York, NY.
- “Creating a speech strategy (Moderator),” *SpeechTek 2003*, September 29-October 2, 2003, New York, NY.
- “Creating an enterprise telephone speech strategy (half-day tutorial),” *SpeechTek 2003*, September 29-October 2, 2003, New York, NY.

- “Technology barriers to speech market growth,” 2nd Annual Research Symposium of the Human Language Technology Research Institute, University of Texas, Dallas, Dallas, TX, March 10-11, 2003.
- “Conversational Marketing: The Telephone as a Distinct Way to Create and Hold Customers,” Plenary talk, Telephony Voice User Interface Conference, Hotel del Coronado, Coronado, California, February 3-5, 2003.
- “Ask the Analyst: Where is Speech Technology Headed,” SpeechTek 2002, New York, NY (November 2002).
- Analyst’s Panel, *Conversations 2002*, Boca Raton, FL (October 2002).
- “Conversational Marketing: Speech Technology Makes the Telephone a New Medium,” *Speech Technology* magazine, September/October 2002, pp. 6-9.
- “Ask the Analyst: Where is Speech Technology Headed,” SpeechTek 2002, New York, NY (to be presented November 2002).
- “Voice in the Computing Infrastructure: Power Session” (Panel co-Moderator), Kelsey Group’s Vox 2002 Conference, San Francisco, CA (July 2002).
- “Business Opportunities Panel,” Annual Conference of the Applied Voice Input/Output Society 2002, San Jose, CA (May 2002).
- “Enterprise-Wide Speech Strategy,” Nuance V-World, Orlando, FL (April 2002).
- Analyst Panel: “Trends in Speech Technology,” SpeechWorks’ Global Speech Day, Boston, MA (May 21, 2002).
- “Telephone speech recognition: A business case overview” (Opening talk), Voice World Europe, London, UK (April 2002).
- “The Voice Web—How speech recognition changes telephony,” Vodafone Receiver #5 (March 2002).
- “Marketing as Conversation: The VUI as a new way to reach and hold customers,” Telephony Voice User Interface Conference 2002, Scottsdale, AZ (February 2002).
- “Market Overview: What, When, and How Much?,” Telephony Voice User Interface Conference 2002, Scottsdale, AZ (February 2002).
- “Telephone speech technology market trends,” SpeechTek 2001, October 24-26, 2001, New York, NY.
- “Applications and Alphabet Soup,” V-World conference, May 20-23, 2001, San Diego, California.
- “The Voice Web Opportunity,” *Speech Technology Expert* Ezine, May 1, 2001 (premier issue), VercomNet.
- “Market overview: Status and trends in the speech recognition market,” Proceedings of the 20th annual conference of the Applied Voice Input/Output Society (AVIOS 2001), April 2001, p. 1.
- “Business Models on the Voice Web: The changing face of telephony and its impact,” Telephony Voice User Interface Conference, featured talk, February 7-9, 2001, Scottsdale, Arizona.
- “Speech Recognition on the PC: Sideshow or Main Event?,” *Speech Technology Magazine*, January/February 2001, pp. 32-35.
- “The Voice Web: Speech recognition brings Internet-like opportunities to the telephone,” *Speech Technology Magazine*, November/December 2000, pp. 30-33.
- “Standards and the telephone speech recognition marketplace,” *SpeechWorks Conversation 2000 Conference*, Laguna Niguel, California, Sept. 17-20, 2000.
- “Telephone speech recognition—Present and Future,” *Philips Speech Solutions Conference Europe 2000*, Barcelona, Spain, 19-20 June 2000 (Keynote speech).

- “Where’s the Beef? Speech Technology Market Trends,” Featured speech at *AVIOS 2000* (Applied Voice Input/Output Society), San Jose, California, May 21-24, 2000.
- “Can Speech Recognition Give Telephones a New Face?” Voice 2000 supplement to *Business Communications Review*, November 1999, pp. 18-22.
- “Speech Technologies: Moving from technology-driven to customer-driven applications,” *Dialogic/Intel TechSummit 99*, San Diego, CA, November 17, 1999.
- “Voice-activated auto attendants: An overview,” *SpeechTEK ’99*, New York City, October 27, 1999.
- “Speech Recognition in the United States,” Keynote talk, Voice Messaging Association Meeting, Montreux, Switzerland, October 5, 1999.
- “The Telephony Voice User Interface: An overview,” featured talk at *The Telephony Voice User Interface Conference*, Scottsdale, AZ, January 28, 1999.
- “The Telephony Voice User Interface,” *CommUnity 99, 98* (part of *Net + Interop 99*), Las Vegas, NV, May 10-15, 1999.
- “Hearing is believing: Turning speech recognition into profitable products,” Panel at Technologic Partners’ *Technology Outlook* conference, December 7-8, 1998.
- “Speech recognition over the telephone: Possibilities and Pitfalls,” *CommUnity 98* (part of *Net + Interop 98*), October 20, 1998.
- “The Speech Recognition Market,” featured talk at the *Advanced Speech Applications and Technology Expo ’98*, San Jose, CA, July 28, 1998.
- “Overview of PC & Consumer product speech recognition development,” PC & Consumer Speech Recognition Developer’s Workshop at ASAT ’98, July 27, 1998.
- “Overview of telephone speech recognition development,” Telephone Speech Recognition Developer’s Workshop at ASAT ’98, July 27, 1998.
- “Telephones present a new face,” (interview), *Speech Technology Magazine*, June/July 1998, pp. 16-19.
- “Developments in the Telephony Voice User Interface,” Market Study, September 1997, Publisher: TMA Associates (400 pages).
- “Speech Recognition Market Overview,” keynote talk in Speech Technology Symposium, Voice Europe, London, October 6, 1997, England.
- “Telephone speech recognition market overview,” talk at SpeechTEK, Oct. 30, 1997, New York, NY.
- “Speech Recognition Products and Markets,” featured talk at *Advanced Speech Applications and Technology ’97*, April 15, 1997, San Francisco, California.
- “Speech on the Internet,” talk at *SpeechTek ’96*, October 23, 1996, New York, NY.
- “Can Speech’s Benefits Justify the Cost?,” *Speech Technology*, August/September 1996, p. 15-18.
- “The Telephony Voice User Interface: Progress and Hurdles,” featured talk at *AVIOS ’96* International Voice Technologies Applications Conference, San Jose, California, September 10-12, 1996. (Paper also included in Conference proceedings.)
- “Straight Talk about Speech Recognition,” *Business Communications Review*, August 1996, pp. 45-49.
- “Speech Recognition Market Overview,” featured talk at *Advanced Speech Applications and Technology Conference and Exposition* (ASAT ’96), San Jose, California, April 16-17, 1996.
- “Applications of speech recognition,” Invited “State of the art” lecture at the *IEEE Signal Processing Society Workshop on Automatic Speech Recognition*, Snowbird, Utah, December 10, 1995.

- “The business outlook for speech recognition,” *Speech Recognition Seminar*, The Interface Lab, Center for the Study of Language and Information, Stanford University, November 8, 1995 (Featured speech).
- “What makes a successful speech recognition product?” *Proceedings AVIOS 1995*, American Voice Input/Output Society, San Jose, CA, September 12-14, 1995.
- “Speech Recognition Market Overview,” (Featured Session) *Advanced Speech Applications & Technology Conference*, April 4-5, 1995, San Francisco, California, Advanstar Expositions.
- “Issues in Market Acceptance of Speech Recognition,” *Proceedings AVIOS 1994*, American Voice Input/Output Society, San Jose, CA, September 20-22, 1994.
- “Speech Recognition Markets & Trends,” *Advanced Speech Applications & Technology Conference*, June 14-15, 1994, San Jose, California, Advanstar Expositions.
- “Executive Briefing on Speech Recognition,” *VOICE '94 Conference and Exhibition*, sponsored by Advanstar Communications, Anaheim, California, April 19-21, 1994.
- “The Second Wave,” keynote speech at *Speech Recognition Applications: What Works, What's Next?*, a conference sponsored by Probe Research Inc., San Francisco, February 24-25, 1994.
- “Speech recognition on personal computers and workstations,” *Voice '93 Fall*, Atlanta, Georgia, November 2-4, 1993.
- “Talk to your computer,” *Byte Magazine*, October 1993, pp. 113-120.
- “User acceptance of restrictions on speaking style in speech recognition applications,” *Proc. AVIOS '93*, September 28-30, 1993, pp. 163-168 (American Voice Input/Output Society).
- “Consumer, computer, and industrial speech recognition applications,” *Voice '93 Spring*, March 30-April 1, 1993, San Diego.
- “Speech Recognition eases its way into the mainstream,” *Upside*, February 1993, pp. 34-42.
- “US speech recognition technology and market,” *Voice Systems Worldwide*, Tokyo, July 7-9, 1992.
- “Neural networks and decision trees in speech recognition.” *Proc. Speech Tech*, New York, N.Y., Media Dimensions Inc., 203-207, Feb. 1992.
- “Automating Operator Services with Speech Recognition.” *Proc. Voice Systems Worldwide Japan*, Tokyo, Japan, Media Dimensions Inc., August 1992.
- “The SSI Large-Vocabulary Speaker-Independent Continuous Speech Recognition System,” *Proc. of ICASSP 91 - 1991 International Conference on Acoustics, Speech and Signal Processing*, Toronto, Canada, May 14-17, 1991, pp. 337-340 (with M.T. Anikst, S.S. Pirzadeh, J.E. Schumacher, M.C. Soares, D.J. Trawick).
- “Efficient Representation of Speech for Recognition,” *Speech Technology*, Feb./March 1991 (with Mark Anikst).
- “Experiments with Tree-Structured MMI Encoders on the RM Task,” *1990 DARPA Workshop on Speech and Natural Language*, June 1990 (with Anikst, M.T., K-F. Lee, M. C. Soares).
- “MedTrans™ 200: Radiology Reporting using Speech Recognition,” *Proc. International Conference on Computerization of Medical Records*, Kansas City, Mo., March 1990.
- “Language Engineering in a Large-Vocabulary Continuous Speech System,” *Proc. Speech Tech '90*, April 1990, pp. 359-363.
- “Neural Networks in a Commercially Available Speech Recognition System,” *Proc. Speech Tech '90*, April 1990, pp. 16-19 (with M.T. Anikst).

- “A Continuous Speech Recognizer Using Two-Stage Encoder Neural Nets,” *Proc. International Joint Conference on Neural Networks*, Washington D.C., January 1990, pp. II-306 - II-309 (with Anikst, Mark, Newstadt, R.E., S.S. Pirzadeh, J.E. Schumacher, P. Shinn, M.C. Soares, D.J. Trawick).
- “Parsimony in Neural Networks,” *Proc. International Joint Conference on Neural Networks*, Washington D.C., January 1990, pp. I-443 - I-446.
- “A Phonetically-based Speech Recognition System,” *Speech Technology*, Apr/May 1989, pp. 44-48 (with Fortunato, M.P., and Michalek, W.D.)
- “A Large Vocabulary Natural Speech Recognition System,” *Proc. Speech Tech '88*, April 1988.
- “Adding Intelligence in Speech Recognition,” *Proc. American Voice Input/Output Society*, June 1987.
- “A Natural Speech Recognition System,” *Proceedings SpeechTech '87*, April 28-30, 1987.
- “Toward the Talkwriter,” in G. Bristow, Ed., *Electronic Speech Recognition*, Collins, London, 1986.
- “Empirical Artificial Intelligence in Speech Recognition,” *Proceedings Artificial Intelligence and Advanced Computer Technology Conference*, April 1985.
- “Computer Transcription of Natural Speech,” *Proceedings Speech Tech '85*, April 1985.
- “Speech-to-Text Systems: The Users' Needs,” *Proceedings of the First International Conference on Speech Technology*, Brighton, UK, October 1984.
- “Voice-Aided Training,” *Proceedings of the Interservice/Industry Training Equipment Conference*, Orlando, FL, December 1981, pp. 128-133.
- “The Role of Pattern Recognition in the Computer Aided Classification of Mass Spectra,” *Analytica Chimica Acta*, with M. Jolley, S.R. Heller, and G.W.A. Milne, 1979.
- “An Algorithm for Constructing Optimal Binary Decision Trees,” *IEEE Trans. on Computers*, with H.J. Payne, September 1977.
- “Empirical approaches to Air Quality and Meteorological Modeling,” Proc. NATO CCMS Expert Panel on Air Pollution, Riso, Denmark, June 6, 1974.
- “Variable Kernel Estimates of Multivariate Densities,” *Technometrics*, with Leo Breiman and E. Purcell, May 1977.
- “General Estimates of the Intrinsic Variability of Data in Nonlinear Regression Models,” *Journal of the American Statistical Association*, with Leo Breiman, June 1976.
- “The Application of Repro-Modeling to the Analysis of a Photochemical Air Pollution Model,” with A. Horowitz and D.C. Collins, Final Report on EPA contract 68-02-1207, December 1973.
- “Repro-Modeling: An Approach to Efficient Model Utilization and Interpretation,” *IEEE Trans. On Systems, Man, and Cybernetics*, Vol. SMC-3, No. 4 (July 1973), pp. 349-358, with David C. Collins.
- “A Partitioning Algorithm with Application in Pattern Classification, Piecewise-Constant Approximation, and the Optimization of Decision Trees,” with D.A. Michalopoulos, *IEEE Trans. on Computers*, January 1973.
- “Repromodeling in the Practical Utilization of Complex Environmental Models,” with D.C. Collins, presented at the Modeling in Environmental Systems Analysis Session, Joint Automatic Control Conference, Stanford University, August 17, 1972.
- “Traffic Restrictions for Air Pollution Episode Control – A Pilot Study,” with D.C. Collins, and M.D. Teener, Annual Meeting of the Air Pollution Control Association, Miami, Florida, June 1972.

- “Ramp Control to Relieve Freeway Congestion Due to Traffic Disturbances,” with H.J. Payne and M.D. Teener, Technology Service Corporation report No. 034, April 1972.
- “A Test of an Algorithm for Continuous Piecewise Linear Approximation,” with M.D. Teener and D.C. Collins, Technology Service Corporation Report No. 033, March 1972.
- “Structural Languages and Biomedical Signal Analysis using Interactive Graphics,” with D.C. Collins, Proc. 1972 San Diego Biomedical Symposium, February 2-4, 1972.
- “Methods Toward the Prognosis of Life Expectancy in Uterine Cancer,” with I.P. Bottlik and S.S. Kurohara, Subconference on Computers in Biomedicine, Proc. 1972 Hawaii International Systems Science Conference, Honolulu, January 1972.
- “Quantification and the Definition of Optimality for Decision-Making,” Decision Analysis Workshop, Anaheim, California, October 1971.
- “The Efficient Representation of Functions for Pattern Classification and Feature Selection,” Proc. 1971 Systems, Man, and Cybernetics Conference: Joint National Conference on Major Systems, October 1971.
- “Optimization of Complex Systems with Respect to Multiple Criteria,” with R. Beeson, *Proc. 1971 Systems, Man, and Cybernetics Conference: Joint National Conference on Major Systems*, October 1971.
- “Multi-Objective Evaluation of a Traffic Control Strategy for the Reduction of Air Pollution,” with D.C. Collins, and M.D. Teener, XIX International Meeting of the Institute of Management Sciences, Houston, Texas, April 1971.
- “On Nonparametric Feature Selection,” *IEEE Transactions on Information Theory*, January 1971.
- “On the Design of Self-Programming Computers,” *Proc. 1969 Symp. American Society of Cybernetics*, October 1969.
- “On-line Optimization of Maintenance and Verification Schedules,” *IEEE Trans. on Reliability*, September 1969.
- “Potential Functions in Mathematical Pattern Recognition,” *IEEE Transactions on Computers*, September 1969.
- “Hazards in asynchronous sequential circuits,” *IEEE Trans. on Computers*, September 1969, with R.S. Kashef.
- “Reliability Techniques Using Digital Components with Asymmetrical Failure Probabilities,” with P. Schaeffer, *IEEE Trans. on Reliability*, May 1969.
- “Mean-Square Methods in Abstract Pattern Recognition,” *Information Science*, Vol. I, No. 1, December 1968.
- “Nets of variable-threshold elements”, *IEEE Transactions on Computers*, Vol. C-17, No. 7, July 1968.
- “Variable-threshold threshold elements”, *IEEE Transactions on Computers*, Vol. C-17, No. 7, July 1968.
- “Optimal Allocation of Redundance in Highly Redundant Modular Systems,” Proc. Hawaii International System Science Conf., University of Hawaii Press, January 1968.
- “A Numerical Integration Method Useful in Fourier Analysis,” *Communications of the ACM*, January 1968.
- “A note on Internal State Minimization of Incompletely Specified Sequential Networks,” *IEEE Trans. on Electronic Computers*, Vol. EC-16, No. 4, August 1967.
- “Locomotion Automata,” USC EE report 146, October 1965, abstract published in *IEEE Trans. Info. Theory*, April 1966, with R. B. McGhee.