

## A Personal History of ICS, 1974 – 1998

by Harvey J. Greenberg

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Department of Mathematical Sciences

University of Colorado at Denver and Health Sciences Center

I shall describe what I remember about the origins of the *INFORMS Computing Society* (ICS) with help from colleagues (see Acknowledgements below). It began with informal conversations among Jerry Brown, Milt Gutterman, and others at the 1974 San Juan ORSA meeting. Following the ACM structure (and some other organizations), they discussed the formation of a *Special Interest Group* (SIG) within ORSA (which did not yet have any formal structure for a SIG). Samuel Gorenstein started the official ball rolling at the 1975 Las Vegas ORSA-TIMS meeting. He was with IBM, and his background was queueing theory. He wanted to include people in *mathematical programming systems* – a natural interface of OR and CS. I was eager to be involved.

Let me set the stage. The OR/CS interface has its own history, stemming from the 1950s. It was then that Martin Beale and Bill Orchard-Hays introduced sparse matrix techniques and associated matrix management. Eventually (about 1970), the numerical analysts latched on, and they were mostly within what was then the emerging computer science community. (There were no academic departments of computer science until the 1960s, and it was George Forsythe, a numerical analyst, who coined the term “computer science.”) IBM used linear programming to debug its model 7090, and Bill wrote Control Data Corporation’s assembler (COMPASS) so he could complete his linear programming system on schedule. Queueing theory and scheduling were also in their early stage of development and part of the OR foundations. Computer scientists used these to develop heuristics in designing operating systems. In the mid-1970s expert systems became the hype, and I remember hearing a few people talk at an ORSA meeting about the AI/OR interfaces. I saw it as ironic because AI had such leaders as Herbert Simon, not only to become a Nobel Laureate in Economics, but also a recipient of the ORSA John von Neumann Prize for Theory. Seeing classical OR problems, like scheduling, approached in a “new” way struck me as some loss of history. It is perhaps reflective that the AI community does not now consider itself a subset of CS, as it was then. Things evolve, and some interfaces get lost.

One of the most important contributions to the early development of the OR/CS interface (and to CS more generally) was a rigorous standard for numerical testing of algorithms. In 1973, Ric Jackson, John Tomlin, Larry Haverly, and others met at Stanford’s newly created Stanford Optimization Laboratory, which focused on computations. That meeting set a ball in motion that resulted in the first set of real test problems and guidelines. About the same time there was a healthy competition between two groups: Californians Gordon Bradley, Jerry Brown, and Glenn Graves and Texans Fred Glover, Darwin Klingman, and several students (notably, Dick Barr and Dave Karney). They were each presenting network solvers that not only implemented algorithms smartly, but also applied advanced data structures that made a major difference. (They pushed speeds to where network flows could be solved about 100 times faster than using a commercial LP solver!) In the process, they raised the standards for numerical testing and comparative analysis. That influenced not only the OR community, but also a wider CS community.

The OR/CS interface was alive and productive in the 1970s, but ACM began to distance itself from OR. They had a Special Interest Group in Mathematical Programming (SIGMAP), but that was eventually dechartered (circa 1980). ACM also took simulation as its own, which was not only a loss to the OR identity, but also to the scope of simulation research. Further detachments in interfaces like algorithm design and analysis would add confusion to notation and related concepts. Perhaps one of the people who personified the OR/CS interface was Richard Karp. He received both the ACM Turing Award and the ORSA John von Neumann Prize for Theory – the only one to receive top awards in both CS and OR. Building its own identity, ACM continued to distance itself from organizational units that explicitly embraced the OR/CS interface. (As evidence of its continued dissociation with OR, the *Communications of ACM* had a Department (what we call an Area) of Operations Research. That is gone.) In summary, the CS side of the stage is that the premier society, ACM, was releasing ties with OR, creating a void for a community who worked in the interfaces.

On the OR side, it was long before the merger of ORSA and TIMS. (In fact, ORSA just started to combine its meetings with TIMS in the mid-1970s.) ORSA had a few Technical Sections (TS), and they wanted to allow orderly growth. So, in response to our efforts to become a TS, they invented a 2-tier system – begin as a *Special Interest Group* (SIG), then when you meet our criteria, you can petition to become a TS. The main criterion was having at least 300 members for more than one year (the number 300 could be off). A SIG could charge dues, hold special conferences, and meet at our semi-annual ORSA-TIMS meeting. There were no clusters run by SIGs or TSs yet, so having some influence about sessions in the OR/CS interface was a big deal. A SIG could not carry over any money raised from dues or conferences from one year to the next. Also, a SIG could not have its own journal; that was a privilege reserved for a Technical Section.

As ACM distanced itself from OR, ORSA embraced the interface. Even before the CS SIG was official, we saw sessions at meetings, and in 1978, *Operations Research* published a special issue on the OR/CS interfaces (vol. 26, no. 5), showing a significant range of interfaces that reflects the vision we all had. So, we became the CS SIG, with Sam Gorenstein elected by acclamation to be our first Chair.

I became the second Chair in 1977, followed by Gordon Bradley in 1978. Gordon introduced our *Newsletter*, with much help from Jerry Brown.

During the 1970s, our membership grew to more than 500 and was still growing. A group of us, which included Gordon Bradley, Jerry Brown, Karla Hoffman, Ric Jackson, Dick Nance, Dick O'Neill, and me, prepared the proposal for the CS SIG to become a Technical Section, and CSTS was born officially in 1980, near the end of Ric Jackson's term as Chair. Working with the Mathematical Programming Society, Ric formed the Committee On Algorithms (COAL), and CS SIG members, like John Tomlin, contributed to the first set of OR test problems and guidelines for testing algorithm implementations. During this early period Ric recalls inspirational discussions with Darwin Klingman. Although Darwin did not serve as Chair, he was a great supporter of CSTS. He received the TIMS Franz Edelman Award for an outstanding application of information technology, disciplined by his training in operations research.

Dick O'Neill became Chair of CSTS in 1980, at which point we had 600 members from diverse areas of the OR/CS interface. His successor, Karla Hoffman, recalls productive discussions with John Mulvey who, like Darwin, did not hold an office, but was a great supporter. Our membership was holding stable at about 600+. Jerry Brown succeeded Karla, and he introduced wine and cheese at our meetings. This was no small thing at the time, as the ORSA establishment did not wholeheartedly approve. Of course, it soon became ubiquitous, which we all enjoy today.

In 1983 Joe Graves was chair. His successor, Phyllis Martin, served two terms as Chair of CSTS, and I succeeded her (for a second term). I chaired a committee to plan the first CSTS Symposium: *Impacts of Microcomputers on Operations Research*. (The proceedings were published by North-Holland, part of Elsevier Science, as volume 5 in the *ORSA Publications in Operations Research Series*, edited by Saul Gass.) The Committee was composed of Saul Gass, Karla Hoffman, Warren Langley, and me. It was held at the University of Colorado at Denver in 1985, and I believe that the proceedings papers are still insightful today. This evolved into what is now the ICS biannual symposium. The subsequent three symposia were at Williamsburg, at the suggestion of Bill Stewart who handled local arrangements. It was perhaps an omen of our continued success that the weather was sunny at the first of these, most unusual for January.

In 1986, while Don Kraft was Chair-Elect of CSTS, we created the *CSTS Prize for Research* in the interfaces of OR & CS. I was fortunate to be its first recipient for my development of the ANALYZE software system, which provided an artificially intelligent environment for analyses of linear and integer programs.

I organized a committee to build the case for what became the *ORSA Journal on Computing* (now the *INFORMS Journal on Computing*). I was fortunate to have great help from the Committee: Karla Hoffman, Bob Jeroslow, Don Kraft, and Bill Pierskalla. They were a diverse group of outstanding researchers who provided important advice as we wrote the proposal to the ORSA Publications Committee. Meanwhile, Kluwer offered to publish the journal (without any further proposal-writing), but I wanted the choice of publisher left to the CSTS membership at the next ORSA-TIMS meeting.

In 1987, under John Tomlin's leadership as the CSTS Chair-Elect, the attending members chose to have it be an ORSA journal, rather than be private (perhaps affiliated, like *OR Letters*). If ORSA Council had chosen not to approve the journal at that meeting, we would have gone private. Thanks to Carl Harris, Tom Magnanti, and Bill Pierskalla, ORSA did approve the inauguration of the *JoC* in 1987. I was its founding editor, and we published the first issue in 1989. I left the editorship in 1992, while Ramesh Sharda was still the CSTS Chair; Bruce Golden became the *JoC*'s second editor, and the third (and current) editor is David Kelton. Ramesh Sharda initiated the Kluwer OR/CS Interface Series; the first issue, published in 1993, was *A Computer-Assisted Analysis System for Mathematical Programming Models and Solutions: A User's Guide for ANALYZE*, by Harvey J. Greenberg.

In 1989, Milt Gutterman succeeded John Tomlin as the CSTS Chair. The years 1988-92 were devoted to building a greater membership base, but I focused on the *JoC*, so I cannot recall the details. Although I cannot remember everyone who led the CSTS during the 1990s, I think I have correctly identified the Chairs. Membership peaked at 900<sup>+</sup> in 1996, dropping to about 600 in 1998. Here is

where my memory fades because I was not as active as I had been. I do know that CSTS became ICS in 1998, at the very end of Dick Barr's term as Chair. Dick was the architect of the petition and presented it to Council just before he handed over the gavel to Harlan Crowder.

I hope someone else adds to this personal history and that ICS keeps an ongoing archive. I probably missed some people who served well between 1976 and 1998, and I apologize to them for that omission.

In conclusion, there have been recent diversions from what I still think is an important, viable interface to pursue. I believe it is, and always has been, the ICS mission to articulate and lead the development of interfaces between operations research and computer science. It is not just a fact of history, but a matter of necessity, that these communities interact. OR has much to bring to the table of such new fields as computational biology, and we have seen too many opportunities slip away out of neglect. I hope current and future ICS members agree with this mission statement and that its leaders will actively pursue its goals. I emphasize that from the beginning, we saw the interfaces broadly – applying OR methods like queueing and scheduling to operating system design; applying CS methods, like database theory and information structures, to OR problems; developing special foundations and tools, like intelligent systems and simulation.

#### ACKNOWLEDGEMENTS

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#### DEDICATION

This is dedicated to the memories of Samuel Gorenstein (1923-2005), Milton Gutterman (1929-2005), Carl Harris (1940-2000), Robert Jeroslow (1942-1988), and Darwin Klingman (1944-1989).

## Time line

- 1974 Jerry Brown, Milt Gutterman, and others begin talking about a Special Interest Group
- 1975 Sam Gorenstein organizes meeting at Las Vegas ORSA-TIMS
- 1976 **CS SIG born**, Sam is Chair
- 1977 Harvey Greenberg Chair
- 1978 Gordon Bradley Chair
  - *Newsletter* born (Edited by Gordon with help from Jerry Brown)
- 1979 Ric Jackson Chair
  - **CSTS born**
- 1980 Dick O’Neill Chair
- 1981 Karla Hoffman Chair
- 1982 Jerry Brown Chair
  - wine & cheese tradition starts
- 1983 Joseph Graves Chair
- 1984 Phyllis Martin Chair
- 1985 Phyllis Martin Chair (2<sup>nd</sup> term)
  - First CSTS Symposium held at University of Colorado at Denver; Organized by Saul Gass, Harvey Greenberg (Chair), Karla Hoffman, and Warren Langley
- 1986 Harvey Greenberg Chair (2<sup>nd</sup> term)
  - First CSTS Prize awarded (to Harvey Greenberg)
- 1987 Don Kraft Chair
  - *ORSA Journal on Computing* born (Harvey Greenberg 1<sup>st</sup> editor); Proposal developed by Harvey Greenberg (Chair), Karla Hoffman, Bob Jeroslow, Don Kraft, and Bill Pierskalla
- 1988 John Tomlin Chair
- 1989 Milton Gutterman Chair
  - 1<sup>st</sup> issue of *ORSA Journal on Computing*
  - 2<sup>nd</sup> CSTS Symposium held at Williamsburg, VA, organized by Ramesh Sharda (Chair), Bruce Golden, Ed Wasil, Osman Balci, and Bill Stewart
- 1990 Milton Gutterman Chair (2<sup>nd</sup> term)
- 1991 Ramesh Sharda Chair
- 1992 Ed Wasil Chair
  - Bruce Golden becomes 2<sup>nd</sup> *JoC* Editor
  - 3<sup>rd</sup> CSTS Symposium held at William and Mary College, organized by Ramesh Sharda, Osman Balci (Chair), and Stavros Zenios
- 1993 Osman Balci Chair
  - Kluwer OR/CS Interface Series inaugurated – Edited by Ramesh Sharda; first issue is *A Computer-Assisted Analysis System for Mathematical Programming Models and Solutions: A User’s Guide for ANALYZE*, by Harvey J. Greenberg
- 1994 Bill Stewart Chair
  - 4<sup>th</sup> CSTS Symposium held at Williamsburg, VA, organized by Stephen Nash and Ariela Sofer
- 1995 John Hooker Chair
  - merged with ORSA AI section (new bylaws written)
- 1996 Robert Fourer Chair
  - 5<sup>th</sup> CSTS Symposium held at Southern Methodist University, organized by R. Barr (Chair), R. Helgason, and J. Kennington
- 1997 Richard Barr Chair
  - **ICS born**
- 1998 Harlan Crowder Chair

## Published volumes from CSTS meetings

S.I. Gass, H.J. Greenberg, K.L. Hoffman, and R.W. Langley (eds.), *Impacts of Microcomputers on Operations Research*, Elsevier Science Publishing Co., New York, NY, 1986.

R. Sharda, B. Golden, E. Wasil, O. Balci, and W. Stewart (eds.), *Impacts of Recent Computer Advances on Operations Research*, Elsevier Science Publishing Co., New York, NY, 1989.

R. Sharda, O. Balci, and S. Zenios (eds.), *Computer Science and Operations Research: New Developments in their Interfaces*, Pergamon Press, Oxford, UK, 1992.

S.G. Nash and A. Sofer (eds.), *The Impact of Emerging Technologies on Computer Science and Operations Research*, Kluwer Academic Press, Norwell, MA, 1995.

R. Barr, R. Helgason, and J. Kennington (eds.), *Interfaces in Computer Science and Operations Research: Advances in Metaheuristics, Optimization, and Stochastic Modeling Technologies*, Kluwer Academic Press, Norwell, MA, 1997.

D.L. Woodruff (ed.), *Advances in Computational and Stochastic Optimization, Logic Programming, and Heuristic Search Interfaces in Computer Science and Operations Research*, Kluwer Academic Press, Norwell, MA, 1998.

## CSTS Prize awards (those in quotes are exact citations.)

1986 Harvey J. Greenberg “for A Fundamental Description of ANALYZE: A Computer-Assisted Analysis System for Linear Programming Models, *ACM Transactions on Mathematical Programming*, Vol. 9, No. 1, 1983, pp. 18-56.”

1987 Alex Meeraus for his development and applications of the Generalized Algebraic Modeling Language (GAMS).

1989 Fred Glover and Darwin Klingman “for results in Layering Strategies for Creating Exploitable Structure in Linear and Integer Programs, *Mathematical Programming*, Vol. 40, No. 2, 165-82, 1988.”

and to Marcel Neuts for his seminal works in computational probability, exemplified by his paper, Computer Experimentation in Applied Probability, *Journal of Applied Probability* 25A (Special Volume: *A Celebration of Applied Probability*, J. Gani, ed.), 31-43, 1988.

1991 John N. Hooker “for Input proofs and rank one cutting planes, *ORSA Journal on Computing* 1 (1989) 137-145.”

1992 Irvin J. Lustig, Roy E. Marsten, and David F. Shanno “for results in Computational Experience with a Primal-Dual Interior Point Method for Linear Programming, *Linear Algebra and its Applications* 152, 1991, pages 191-222.”

1993 Robert Fourer, David M. Gay, and Brian W. Kernighan “for their cumulative work, spanning over a decade, in the theory and practice of mathematical programming modeling languages.”

1994 Fred Glover for development and extension of the tabu search metaheuristic.

1995 John Forrest and Donald Goldfarb “for Steepest-Edge Simplex Algorithms for Linear Programming, *Mathematical programming* 57:3 (1993), pages 341-374.”

1996 Warren Adams and Hanif Sherali “for their research on the Reformulation-Linearization Technique as documented in a series of articles dating from 1986.”

1997 Dmitri P. Bertsekas and John N. Tsitsiklis “for their book *Neuro-Dynamic Programming* and the research behind it.”

1998 Ding-Zhu Du and Frank K. Hwang “for A proof of Gilbert-Pollack's conjecture on the Steiner ratio, *Algorithmica*, 7:121--135, 1992.”