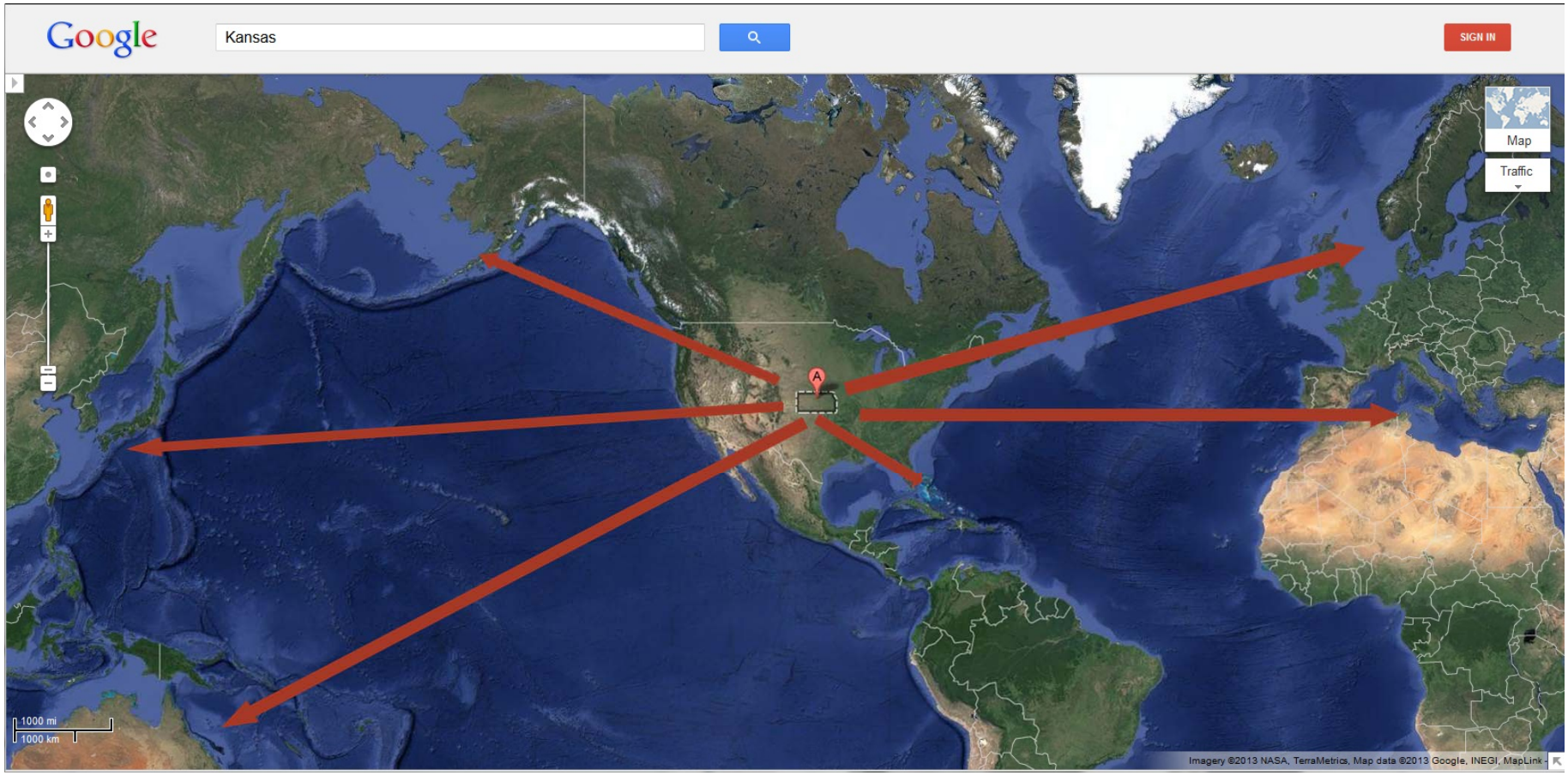
IT WAS 40 YEARS AGO TODAY…

(that I learned to program in Fortran IV)

David Schmidt

Kansas State University

First, thank you for visiting!



"Kansas: equally far away from everywhere!"

--Dave Gustafson , Kansas State CS professor

This talk

- Our community, our conferences: what we accomplished
- What I learned, what I tried to do, and what I should have done better
- Some photos, some stories

What we've done in 40 years….

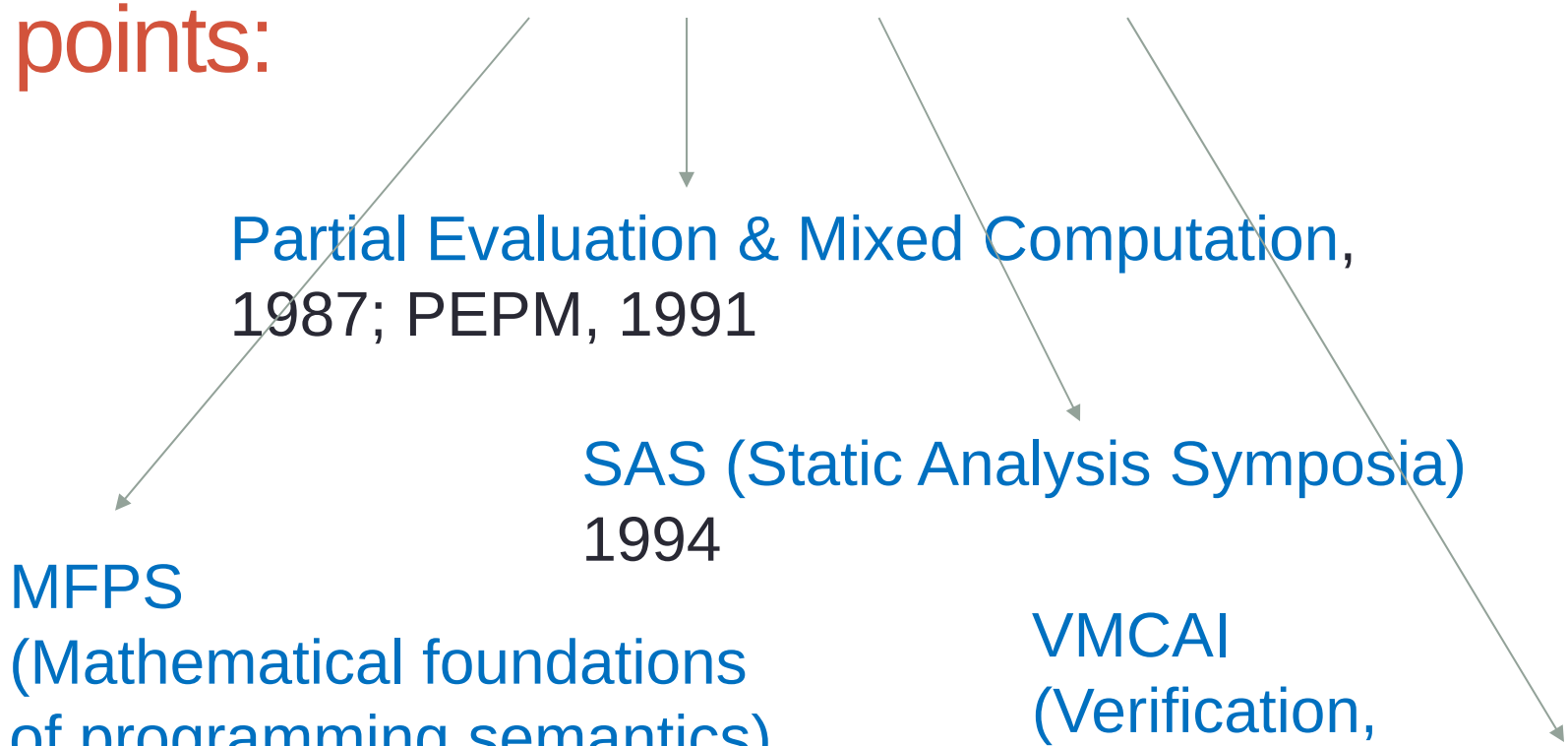
People say that Artificial Intelligence became successful when its achievements weren't called "Artificial Intelligence" anymore --- they moved into the mainstream.

This has happened with language-semantics techniques:

- *denotational semantics*: from "extending BNF to semantics" (Scott) to compiler generators
- *abstract interpretation*: now, even IT people use it (e.g., "*Secure Programming with Static Analysis: The Expert Guide to Static Analysis for Software Security*", by B. Chess and J. West, Addison-Wesley, 2007)
- *partial evaluation-based program transformation*: in every compiler writer's toolkit
- *model checking*: used by Intel, Boeing, Airbus, …

In the 1970s, these were "theories" in the scientific sense, but now they are in the mainstream --- The people in this room helped make it possible!
Research progress is a community effort.

Our communities formed within conference series. My own reference points:



MFPS

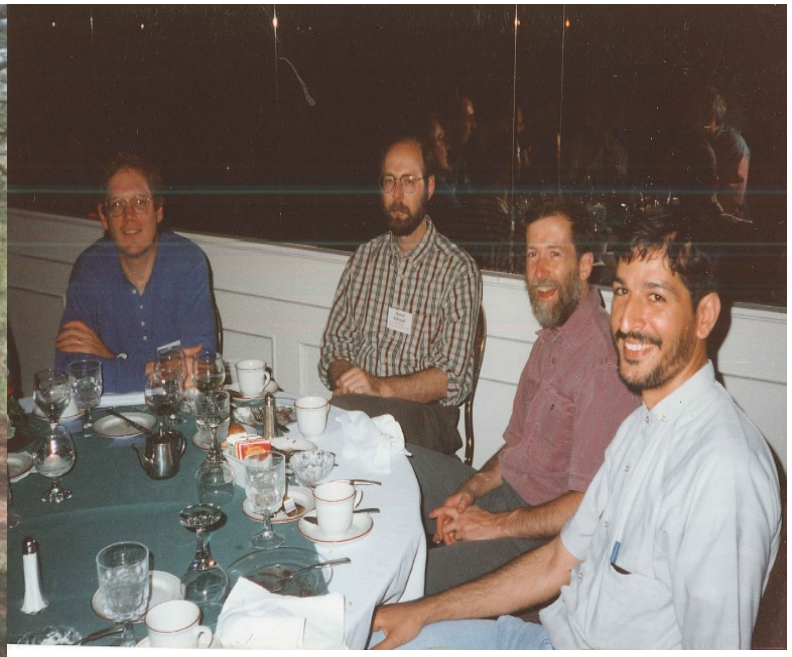
- Austin Melton's scheme to bring Dana Scott to Kansas State University
- Dana would come only if Steve Brookes and Carl Gunter were invited, too.
- Others came to the resulting ad-hoc workshop: Mike Mislove, Jimmy Lawson, David Benson, Michael Main...
- Austin edited an LNCS proceedings! He revived a community that had almost “died” after the completion of the *Compendium of Continuous Lattices* handbook.

Subsequent meetings: Tulane, CMU,…

I pushed hard to broaden MFPS's scope into "semantics theory and applications".

MFPS, Tulane, 1987:

lots of folks, many are here



Mike Main, me, Phil Mulry, Husain Ibraheem

Me, Bob Tennent,
Steve Brooks,
Samson's head

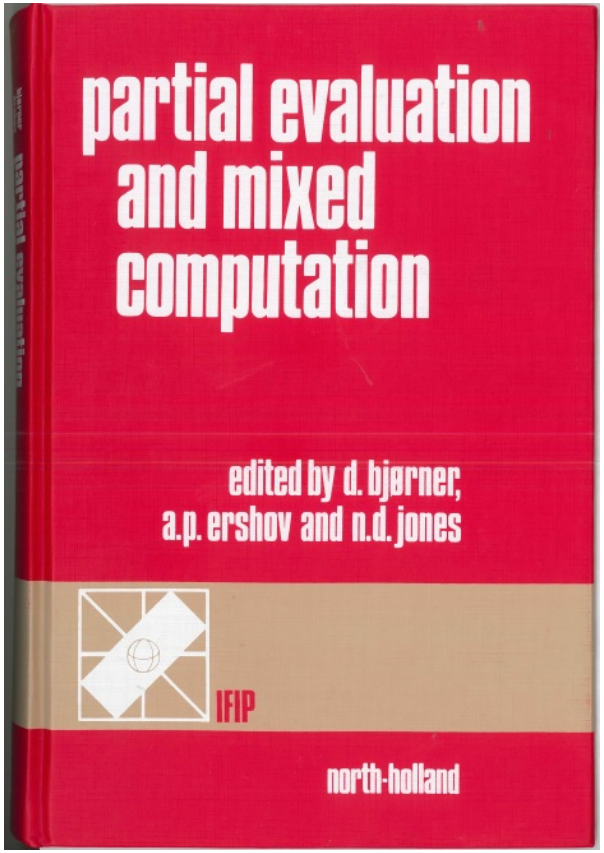
Later, the MFPS meetings returned to mostly domain theory, and I regret not pushing harder on Mike Mislove to maintain the theory + applications balance.

I also regret not lobbying harder to retain Springer LNCS as the conference's publisher.

On a personal level: I returned to Kansas as a result of the first meeting. This was the beginning of the Kansas languages *group*. Thanks to MFPS, I made connections with Phil Mulry, Dave Naumann, Bob Tennent (who sent John Hatcliff), Michael Huth (who came to Kansas *twice*, once as a post-doc and once as faculty), and others.

Gammel Avernæs, Oct. 1987

- Dines Bjørner, Andrei Ershov, and Neil Jones organized the first partial evaluation workshop, one week at an isolated conference site. There were a dozen scientists from the USSR.
- Lots of amazing talks, lots to eat and drink
- Creation of a new research community



See the PEMC book for a listing of the participants.

Consequences of PEMC

- A banquet with Peter Sestoft as a "comedy partner“
- *Many* spin-offs: TOPPS/DIKU lab and others, PEPM conferences, Atlantique Project (Carolyn Talcott)
- Personal level:

1. most significant meeting of my academic life w.r.t. people & topic
2. multiple visits to Denmark and DIKU, learning about p.e. (Andrzej Filinski, Robert Glück, Thomas Jensen, Torben Mogenson, Mads Rosendahl, Peter Sestoft, etc). Olivier Danvy and Karoline Malmkjær come to Kansas.
3. multiple contacts with Charles Consel and Thomas Jensen in Rennes
4. I loved the "applied semantics" aspect of the Futamura projections.

me and Alberto Pettorossi at PEMC

SAS (early meetings, from the DBLP listing --- please squint to read)-:

3. SAS 1996: Aachen, Germany

- Radhia Cousot, David A. Schmidt (Eds.): **Static Analysis, Third International Symposium, SAS'96, Aachen, Germany, September 24-26, 1996, Proceedings.** Springer 1996 Lecture Notes in Computer Science ISBN 3-540-61739-6 [contents]

2. SAS 1995: Glasgow, UK

- Alan Mycroft (Ed.): **Static Analysis, Second International Symposium, SAS'95, Glasgow, UK, September 25-27, 1995, Proceedings.** Springer 1995 Lecture Notes in Computer Science ISBN 3-540-60360-3 [contents]

1. SAS 1994: Namur, Belgium

- Baudouin Le Charlier (Ed.): **Static Analysis, First International Static Analysis Symposium, SAS'94, Namur, Belgium, September 28-30, 1994, Proceedings.** Springer 1994 Lecture Notes in Computer Science ISBN 3-540-58485-4 [contents]

3. WSA 1993: Padova, Italy

- Patrick Cousot, Moreno Falaschi, Gilberto Filé, Antoine Rauzy (Eds.): **Static Analysis, Third International Workshop, WSA'93, Padova, Italy, September 22-24, 1993, Proceedings.** Springer 1993 Lecture Notes in Computer Science ISBN 3-540-57264-3 [contents]

2. WSA 1992: Bordeaux, France

Michel Billaud, Pierre Cast?ran, Marc-Michel Corsini, Kaninda Musumbu, Antoine Rauzy (Eds.): Actes WSA'92 Workshop on Static Analysis (Bordeaux), September 1992, Laboratoire Bordelais de Recherche en Informatique (LaBRI), Proceedings. Published by Atelier Irisa, IRISA, Campus de Beaulieu, Series Bigre Vol. 81-82
Contents

1. JTASPEFL/WSA 1991: Bordeaux, France

Michel Billaud, Pierre Cast?ran, Marc-Michel Corsini, Kaninda Musumbu, Antoine Rauzy (Eds.): Actes JTASPEFL'91 (Bordeaux), October 1991, Laboratoire Bordelais de Recherche en Informatique (LaBRI), Proceedings. Published by Atelier Irisa, IRISA Campus de Beaulieu, Series Bigre Vol. 74

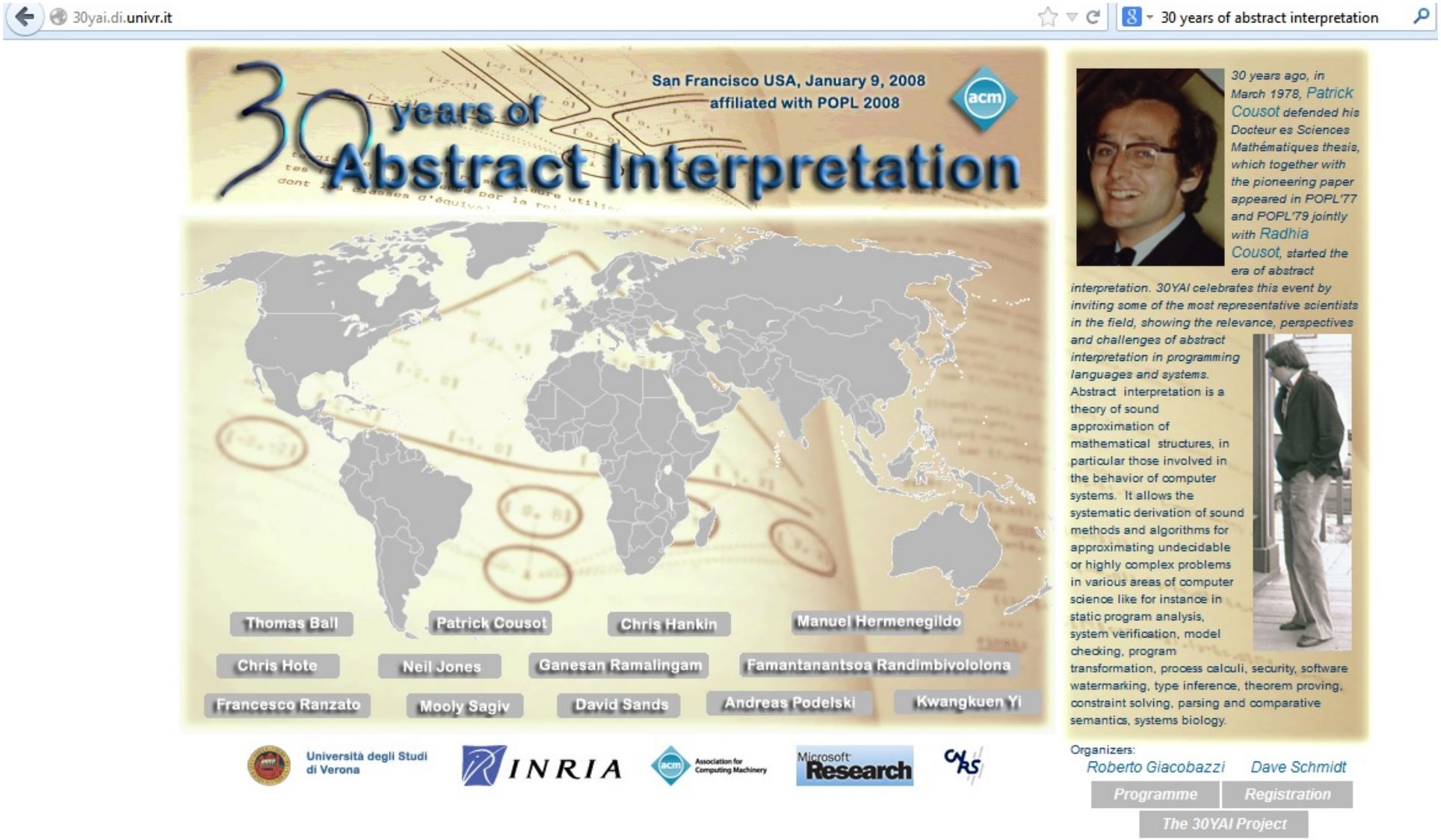
- I attended the first “SAS” meeting in Namur. I met Patrick Cousot. (I discussed with him my interest in his ICCL94 paper.) There were wonderful lunches and not enough time to eat them!

- I met many people at the next SAS meeting, in Glasgow. Patrick told me that my formulations were “a mess!” (that is, they were worthy of repair, which he did, of course). His and Radhia’s work were/are a major influence. I also enjoyed the Neilsons’ and Samson Abramsky’s applications.

- At the Aachen meeting, I met Bernhard Steffen and Tiziana Margaria and I later studied Bernhard’s MC=DFA formulation. This led to multiple visits to Dortmund, and I began to understand how Model Checking should be used.

- Many interactions with SAS people, at Paris (Cousots, Franceso Logozzo, Antoine Miné, Xavier Rival,…), at Rennes (Daniel Le Métayer, Charles Consel, Thomas Jensen), at Verona (Roberto Giacobazzi, Isabella Mastroeni), the Neilsons at Lyngby. I learned more than can fit on this slide!

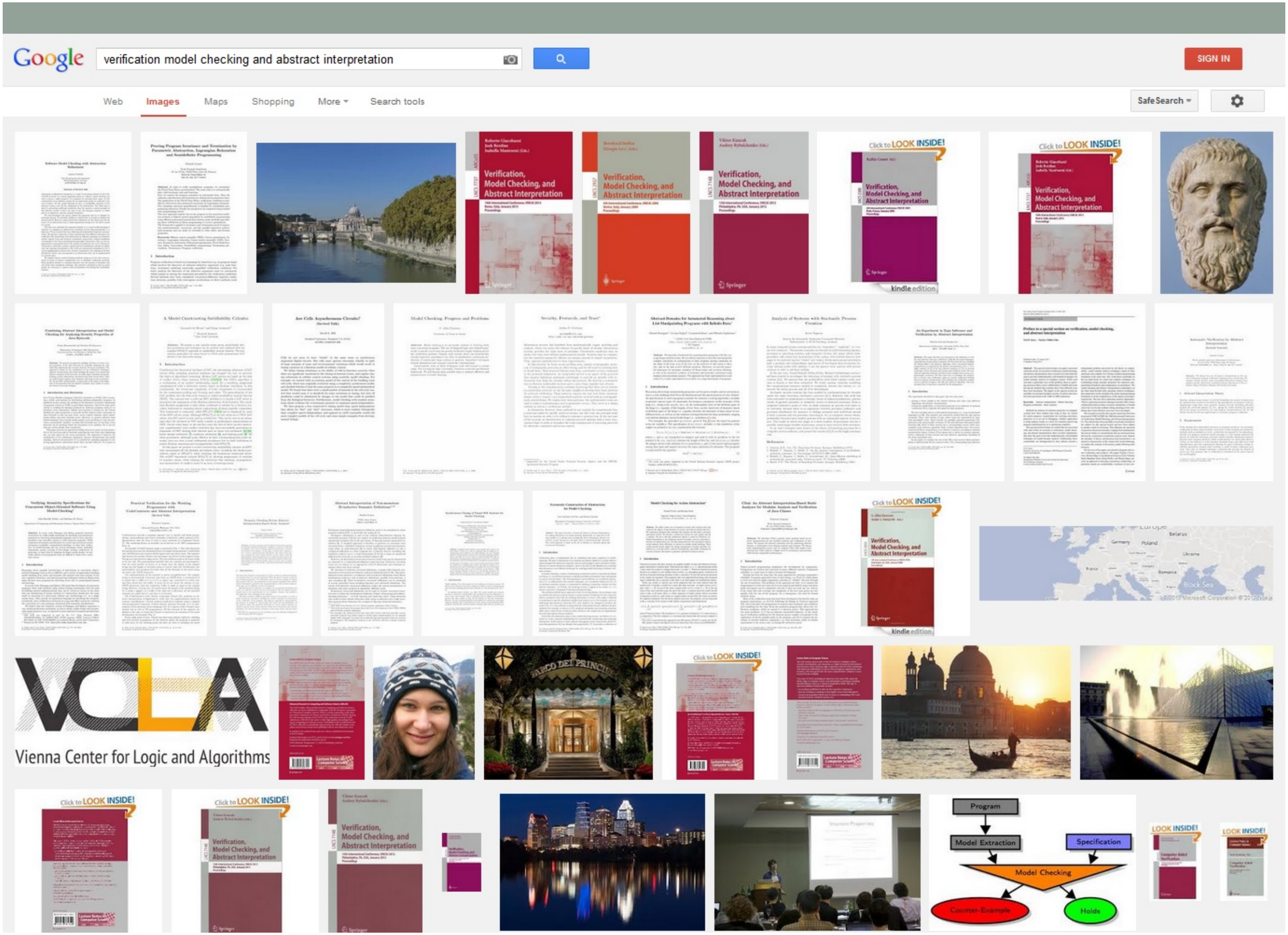
- It was gratifying to see SAS establish a community and broaden it. (For me, this was where I wanted MFPS to go --- into “applied semantics”)



Roberto Giacobazzi organized this meeting, and I helped.

VMCAI

- Started at a workshop on Long Island in 1997. My student, Husain Ibraheem, presented a paper. (*I met a student on the train who announced the demise of denotational semantics!*)
- Email next year from Tino Cortesi: *"Dave, Please agree to be on steering committee for new conference series, VMCAI. No questions, please, just say yes. --Tino"*
- I did say yes. Lots of work! I am a member of the *Board of Directors* of the *VMCAI Corporation*. But the result is a surprisingly successful series of meetings, now co-located with POPL each January. New friends: Radha Jagadeesan, Kedar Namjoshi, Allen Emerson, ….
- Quite a balancing act --- MC people, static analysis people, ACM people. But there has been some true cross-fertilization.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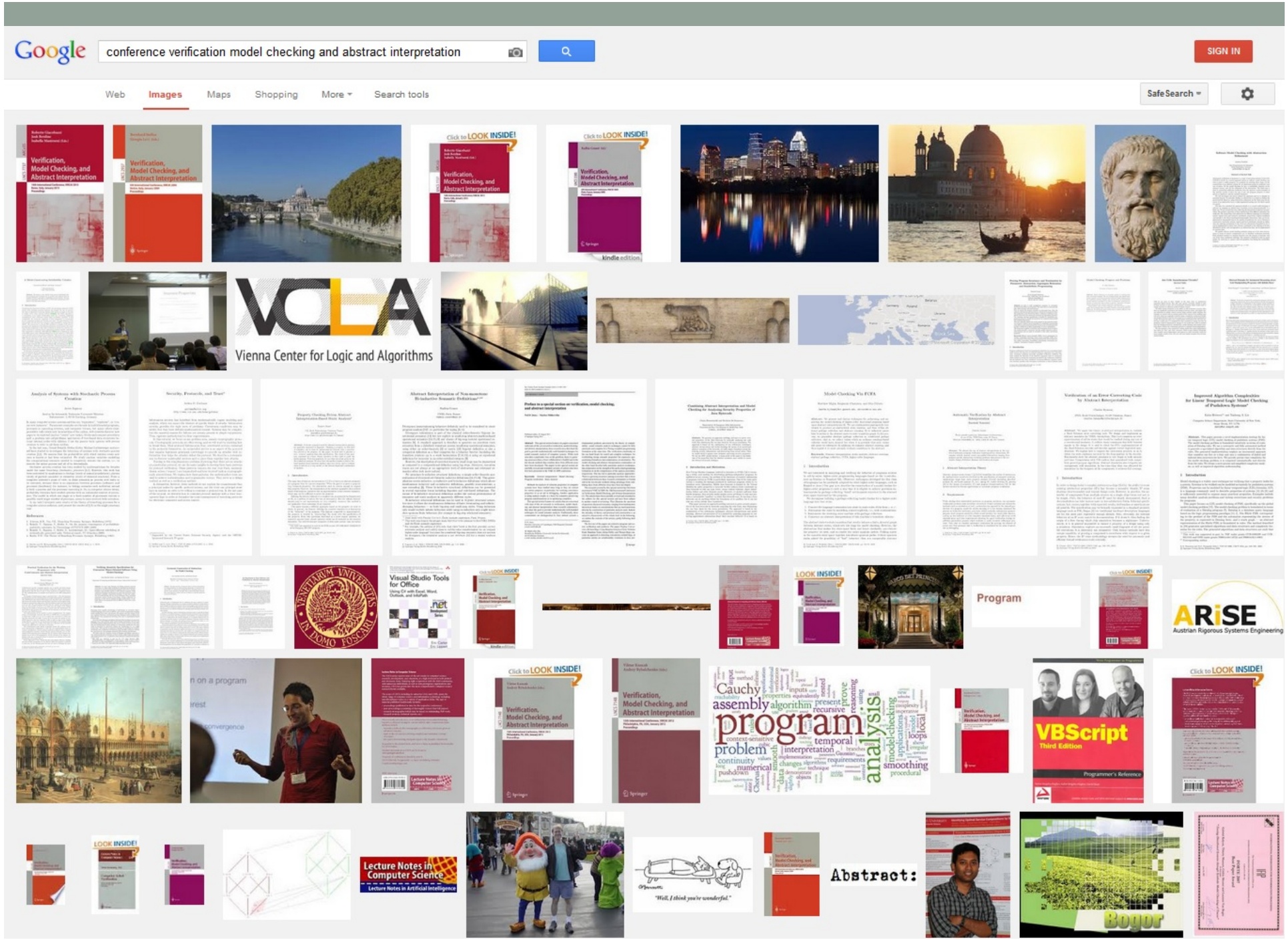
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Third Edition
Programmer's Reference
Lecture Notes in Computer Science
Lecture Notes in Artificial Intelligence
Abstract:
Bogor

Summary

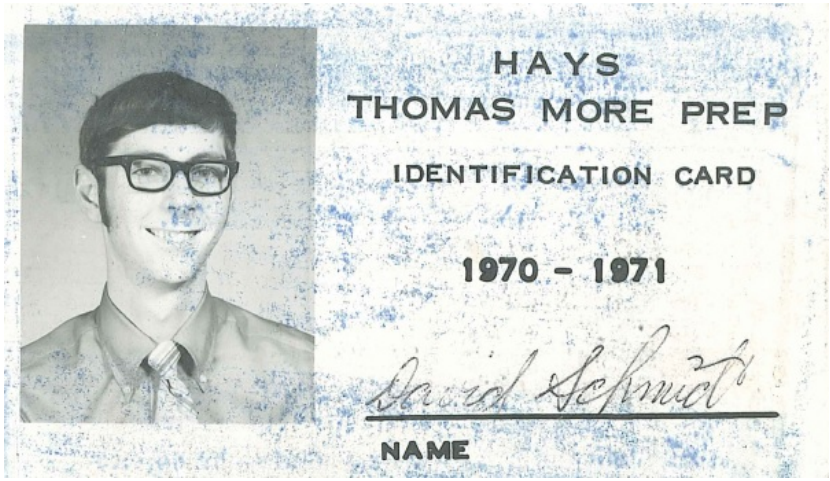
These conferences have been important and satisfying because they stimulated research and generated communities, doing it better than the more well-known “umbrella meetings” (PLDI, POPL, LICS).

Slightly more personal “reflections”

I started small….

(My sister is now department head of philosophy at William and Mary College, Williamsburg, Virginia.)

Easter Sunday, 1957



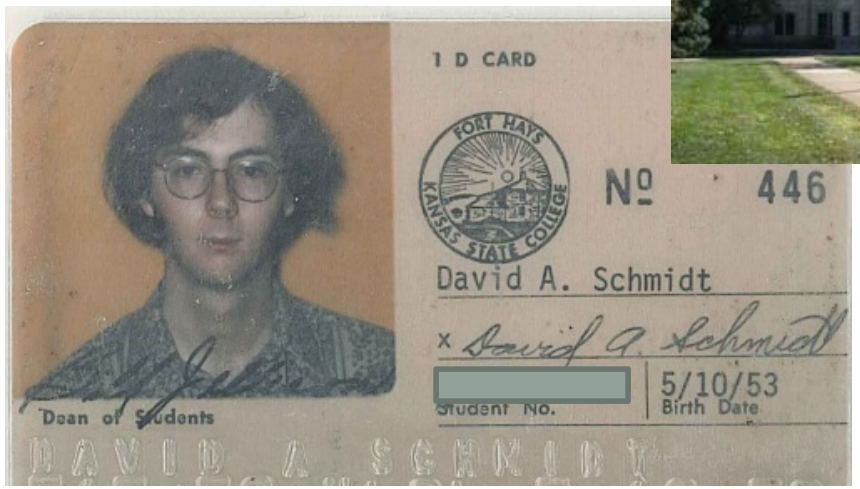
Last year of high school

I went to college, interested in computers, but Fort Hays (Kansas) State University had no computing major.

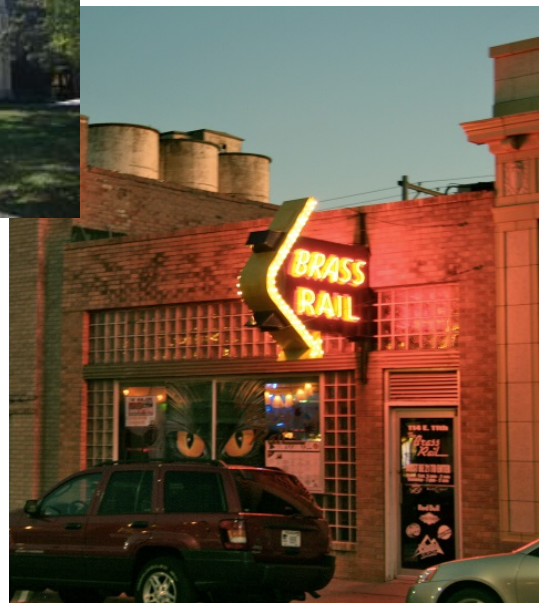
I did math, which in the end was better for me (multiple courses in algebra and symbolic logic).

Albertson Hall, the math building

1971



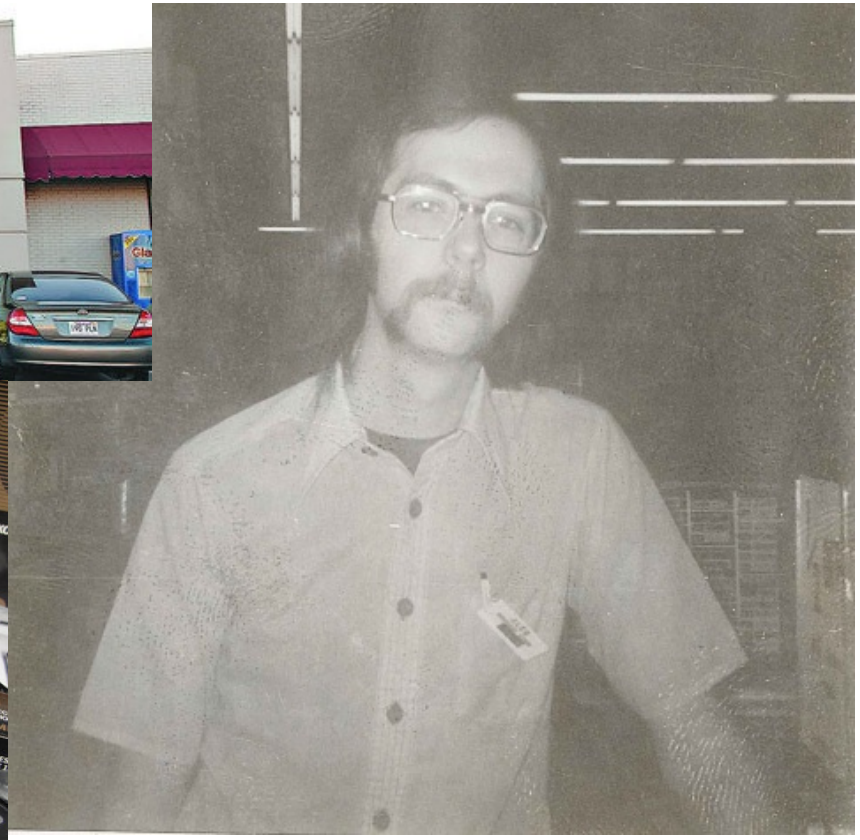
The Brass Rail: study hall (ask for "red beer")



1972

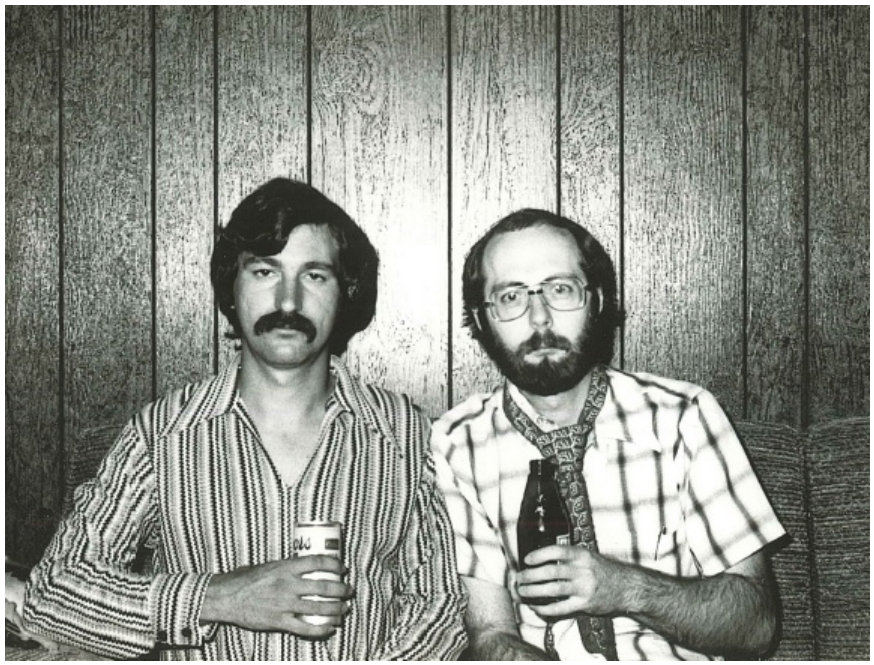
1972 + 40 = 2012

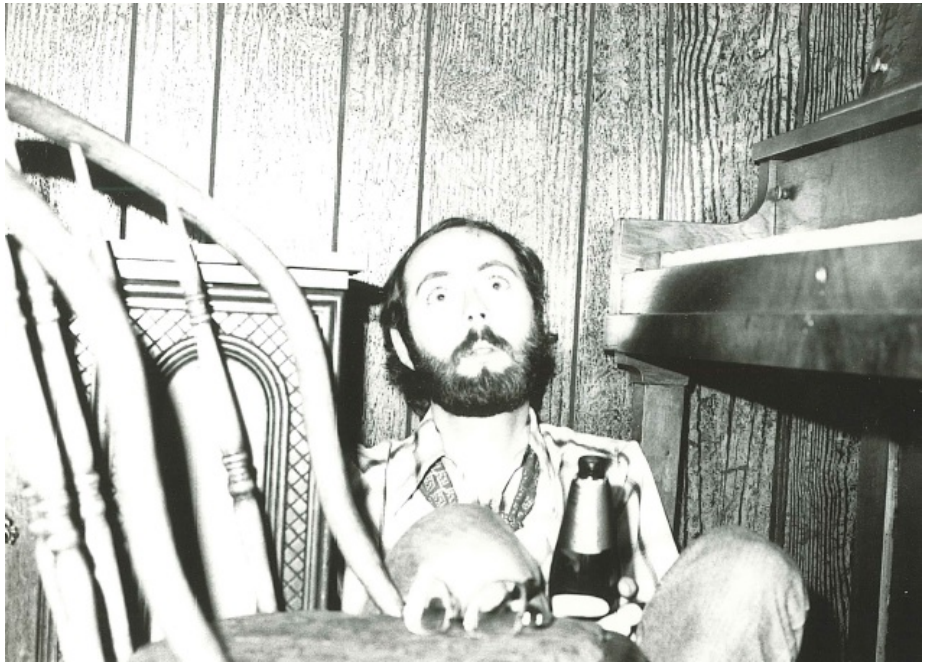
I learned to teach by selling cameras in a department store….



1974(?)

We worried about Vietnam…

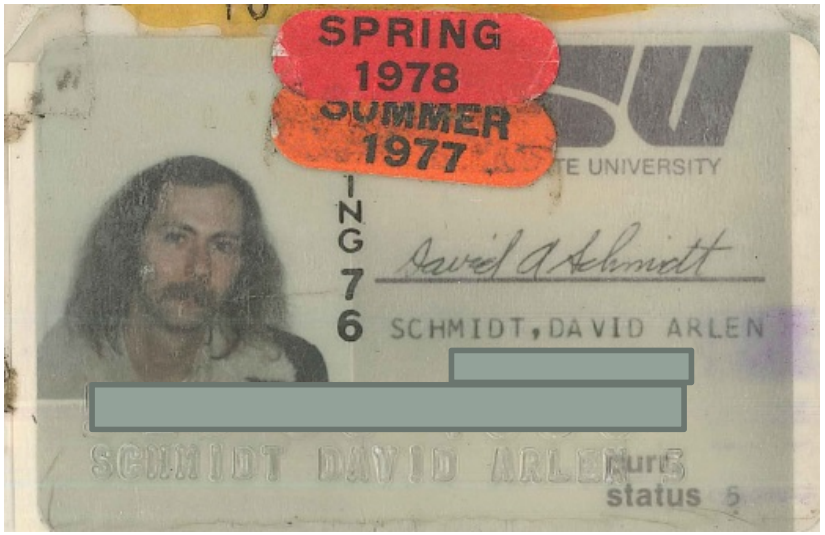




… we barely avoided the trip overseas.

Then I discovered computing science… I started M.S. studies at Kansas State in 1976.

I was a teaching assistant for Beth Unger. I know no computing terminology, no technology --- only Fortran IV and COBOL.

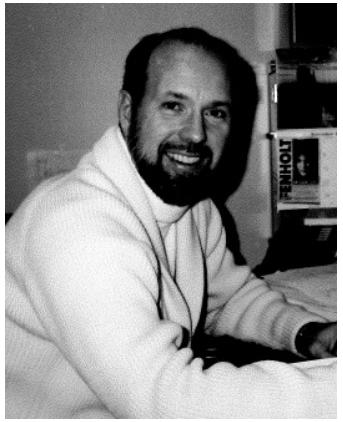


Why I decided to attempt a Ph.D.

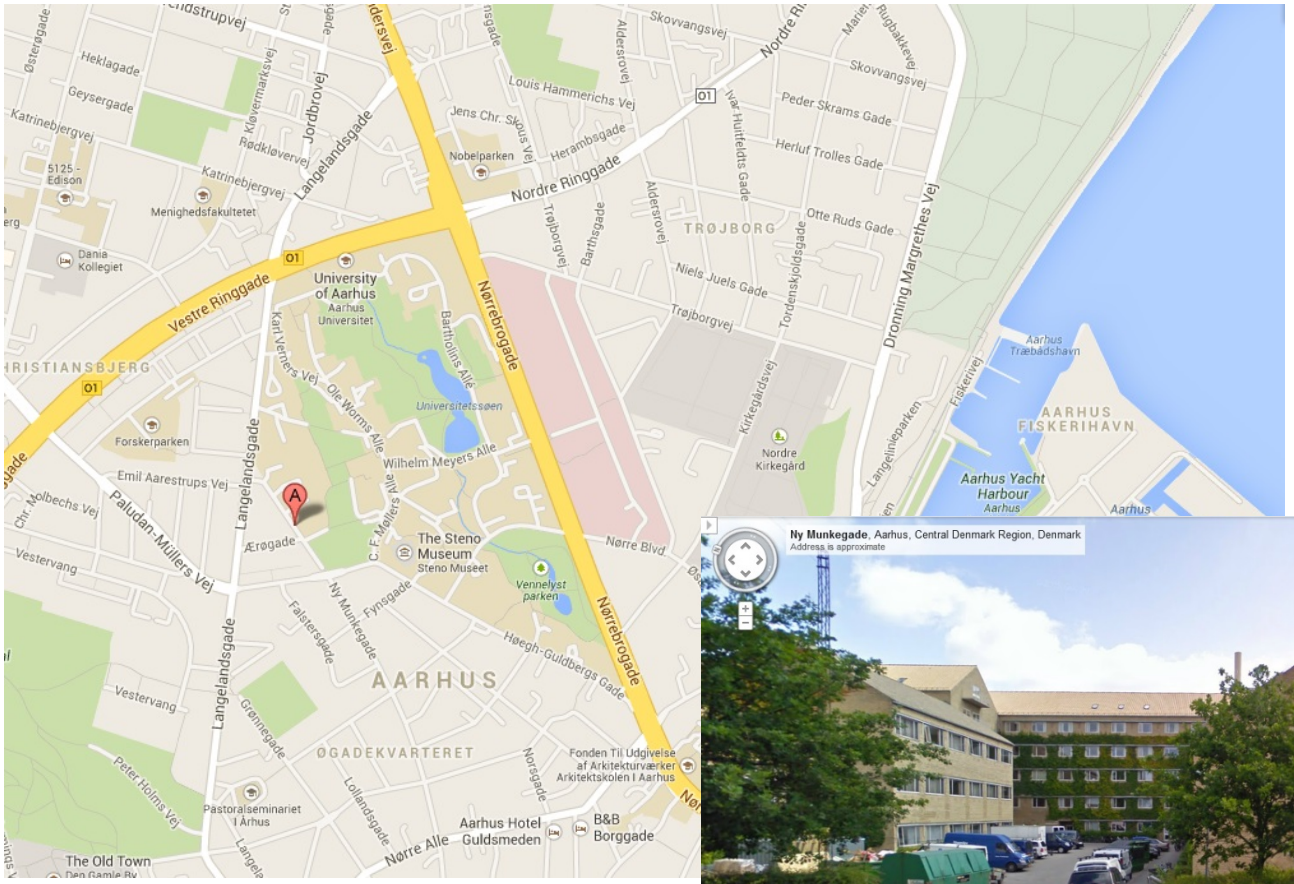
1. I could be paid to teach
2. I could sleep late each morning
3. I felt a “fire in my belly” to do research!

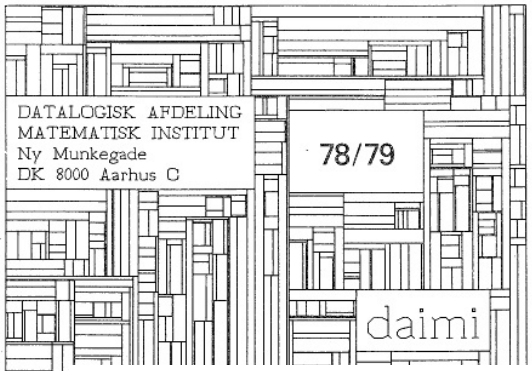
How I met Neil Jones (it was “dumb luck”!)

- I told Bill Hankley my intention to get a Doctor’s degree; Bill said I should “take a course in computability theory from either Jones or Muchnick at the Univ. of Kansas.’’
- I phoned Neil (because “J” comes before “M”!), and contacted him just as he was leaving for Aarhus for the summer.
- I met Neil in person 3 months later, and he hired me as a Research Assistant.



DAIMI, Ny Munkegade, Århus, 1979-80





Mogens Nielsen, Associate Professor
Lærkevej 18
8382 Hinnerup

Private phone :
Office number : B 2.19
Office phone :

Departmental duties:
Teaching Dat. 2.

Field of interest:
Theoretical computer science.

Peter David Mosses, Associate Professor
Rosenvangs Alle 9
8260 Viby J.

Private phone : (06) 147342
Office number : B 2.12
Office phone : 195

Departmental duties:
Second part "Semantics" course. SIS Project. Guidance of Master's theses.

Field of interest:
Formal semantics of programming languages. Compiler-generating systems. Programming language design. Algebraic specifications.

Ole Lehrmann Madsen, Research Assistant
Ørnedalen 16
8520 Lystrup

Private phone : (06) 224651
Office number : 2.36
Office phone : 163

Departmental duties:
Teaching, research.

Field of interest:
Compilers, programming languages, concurrency, system description languages.

Karen Kjær Møller, Secretary
Trygsvej 3
8230 Aabyhøj

Private phone : (06) 158797
Office number : 2.10
Office phone : 172

Aarhus was ideal for learning…

- Smart people: Neil, Peter Mosses, Robin Milner (visiting), Nigel Derrett, Flemming and Hanne Nielson (students)
- Unmatched library of journals, texts, and conference proceedings
- Neil taught me denotational semantics and data-flow analysis and organized a compiler-generation workshop
- I used Neil's approach to calculate a Krivine machine. (Olivier noted this work some years later.) I learned Action Semantics and CCS.

Edinburgh, 1982-83

- Robin lacked two postdocs for SERC research projects; Neil suggested me for doing theorem proving using LCF.
- I shared an office with Colin Stirling. *("Hoare logic is the greatest achievement of computing science!")*
- Met many people: Alberto Pettorossi, Stewart Anderson, Alan Bundy, Rod Burstall, Matthew Hennessy, Alan Mycroft, Gordon Plotkin, Alley Stoughton, Mike Smyth, Muffy Thomas, etc..

Robin receives his Turing Award in Kansas City. I was there.

Ground Zero: The Fiddler's Arms, Grassmarket

Colin, me, Mojmir Kretinsky

"Intensive" Friday-evening discussions generated more research (and more forgotten research!) than anywhere before or since.

Return to Kansas, 1986

This photo was taken in 1988, but Austin is missing….

COMPUTING AND INFORMATION SCIENCES

FRONT ROW: Myron Calhoun, Maarten van Swaay, David Gustafson, Maria Zamfir-Bleyberg, Elizabeth Unger. **BACK ROW:** Bill Hankley, Rod Howell, Masaaki Mizuno, Joe Campbell, David Schmidt, Virgil Wallentine.

Early challenges, early success

- Very friendly environment, but a somewhat lonely place to work (no critical mass, no internet, rudimentary email)
- Department head, Virg Wallentine, provided lots of support, even though he knew nothing of "denotational semantics"
- I worked like a maniac and invited lots of visitors (many round-trips to Kansas City airport!)
- I travelled as much as possible (Edinburgh, Glasgow, DIKU; later: Rennes, Paris, Verona, …)
- Crucial local interactions with Austin Melton, George Strecker, Masaaki Mizuno, and Rod Howell. Worked hard to integrate topology and category theory into language design/analysis/implementation. *("Work with what you got!")*

1991 onwards: A critical mass

- Olivier Danvy comes as a visiting professor
- Michael Huth and Jürgen Koslowski work as post-docs (also, Pascal Fradet comes from Rennes)
- Good students arrive: Anindya Banerjee, Kyung-Goo Doh, Susan Even, Adrian Fiech, John Hatcliff, Karoline Malmkjaer, ….
- Arrival of the WWW was a major help.
- When Olivier departed, Alley Stoughton took his place (later, Michael then Anindya then Matt Dwyer then John Hatcliff then Torben Amtoft, etc.!)
- Later: funded collaborations with U.C.Berkeley (Alex Aiken, Evan Chang, George Necula, …) and MIT (Daniel Jackson and Martin Rinard)

What the languages group accomplished at Kansas

- Within the Department, they set the model for team-oriented research, showed that “theory can get funded,” and they lifted the Dept. into the middle of the national rankings.
- In the research community, they contributed to program analysis, program transformation, software model checking, and program security.
- The group’s graduates have done well and have contributed to the community.
- The group is “Neil’s Kansas legacy.”

There was some socializing…

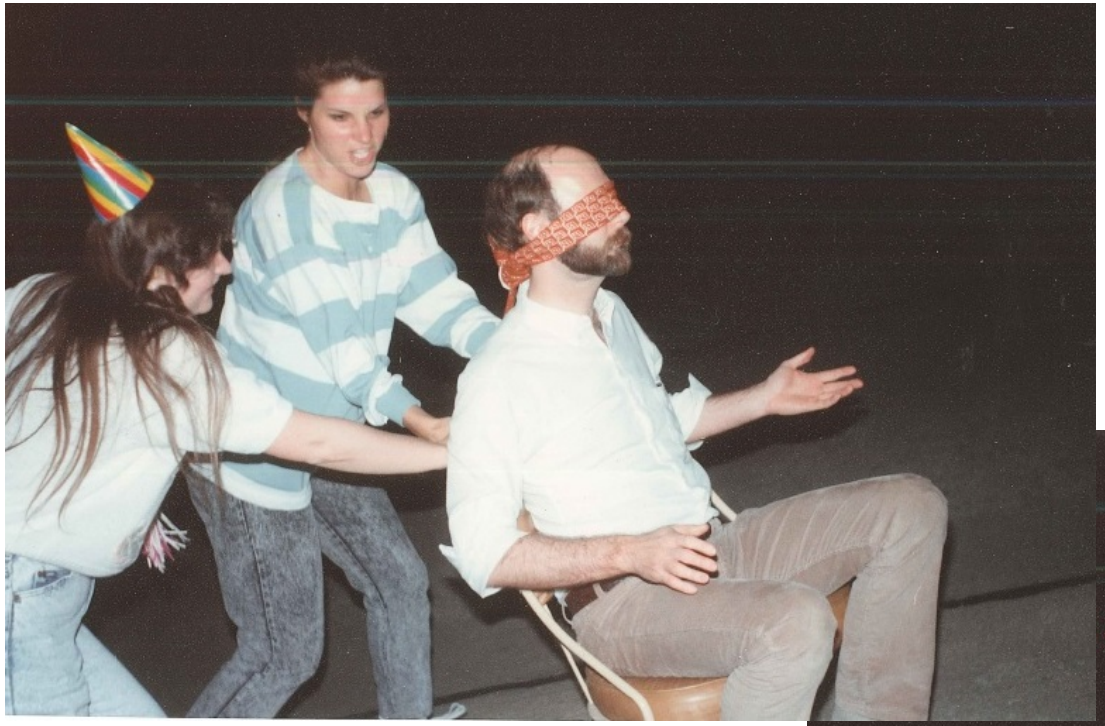
Younger versions of some of the people here today…

(where's the furniture?)

but when the party hats came out…

Masaaki Mizuno,
Chet Murthy (*2),
Dean Lass,
Jan Chomicki,
Anindya Banerjee,
Jürgen Koslowski

things sometimes got out of control….



The front-office staff try to dispose of me once and for all !!!

I was rescued and Masaaki admits that it was his idea!

(whatever research that was done that evening has gone lost)

Olivier's pinball machine was a more constructive research alternative

Olivier, Sergey Kotov, Masaaki, and me

Anindya, Kyung-Goo, and Karoline

The “Eight Ball Deluxe” research machine.

My research was a mere reworking of what I learned and loved…

- Neil introduced me to denotational semantics and data-flow analysis and showed me how to do research. This was enough to keep me busy for my whole life.
- I loved the Scott-topology of domains and Mike Smyth's explanations of it. There are applications everywhere.
- I loved Peter Mosses's original formulation of Action Semantics, and I still visualize language semantics in terms of facet flows and combinators.
- Abstract interpretation was "right" from the beginning, and the Verona work on Galois-connection completeness is as beautiful as computing theory gets.
- Bernhard Steffen's characterization of MC = DFA just keeps giving and giving….

What I wish I could have done better

1. There is a need for a comprehensive book on abstract interpretation, but I never pushed hard enough to make it happen, by me or by others.

2. I now realize what Dines Bjørner was saying at Neil's Fest: the CS community has allowed the *science* in Computing Science to be *overwhelmed by technology* to the point that neither educators, practitioners, nor observers can distinguish the first from the second. I let this happen in my own Department --- Java, IDEs, graphics libraries, etc., dominate.

So, why did it come to this?

Aside from intensive (capitalistic) pressure from students and employers, the CS community has always lacked a *"cornerstone calculus"* that *all* its practitioners must learn, apply, and share.

Math relies on the differential and integral calculus to define its community. Physics uses Newton's and Maxwell's laws.

What is the cornerstone of CS? *Turing's machine? The GCC compiler? (What artifact defines our community/our shared culture?)*

The answer goes back to Gödel: *computing is the study of constructive proof, that is, the realization of specifications by algorithms, that is,* ***PROGRAMS = PROOFS****.*

Whether it's Hoare Logic, or Dijkstra's wp-calculus, or Martin-Löf's Intuitionistic Type Theory, we should be learning and using the cornerstone calculus at the beginning, not at the end.

Nearing the End (of the talk, not me!)

Neil's Two Rules (plus one more)

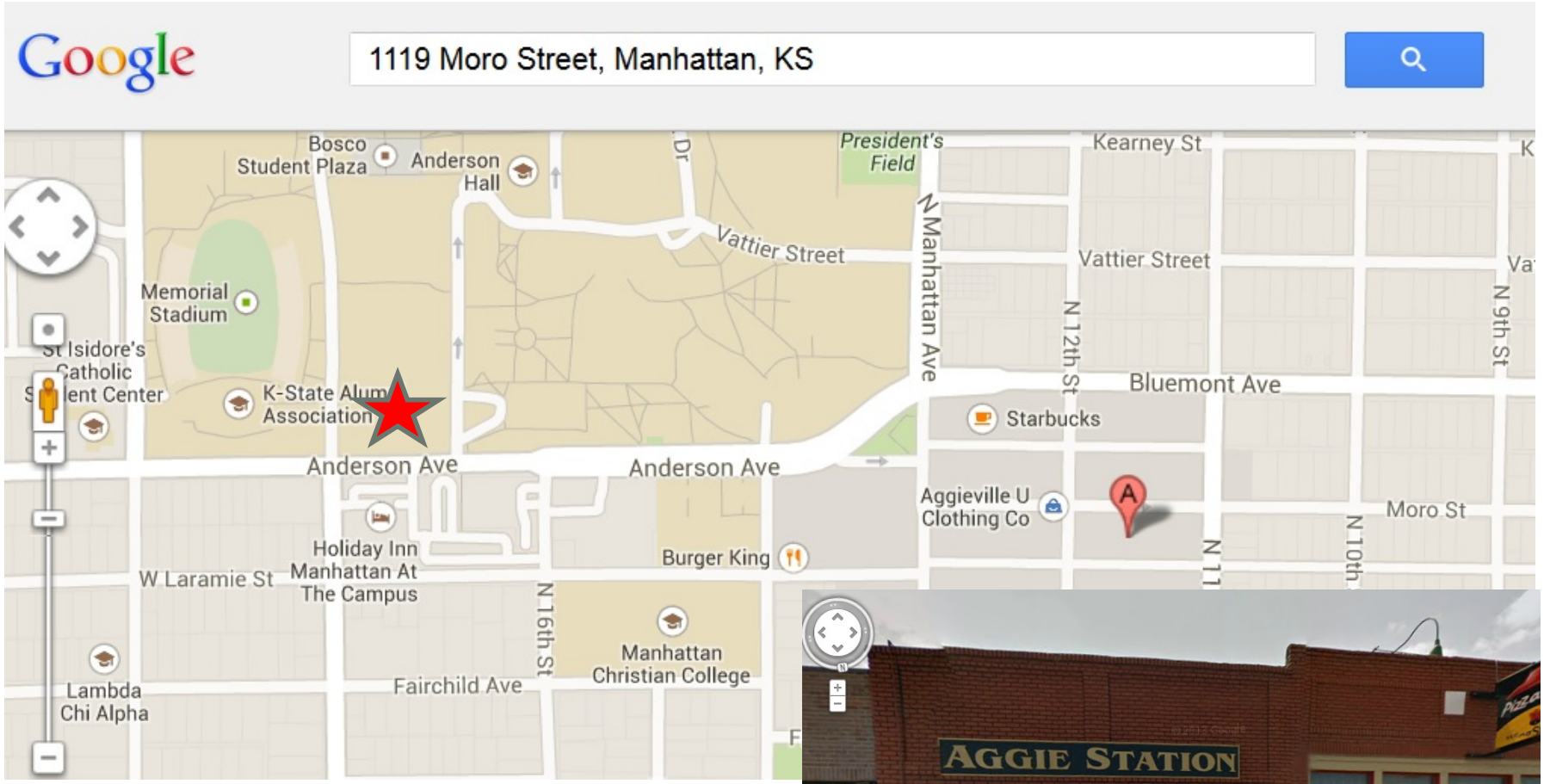
1. Be true to yourself. *("Do what you like.")*
2. Don't sweat the small stuff. ("*Will it matter five years from now?*")
3. Keep doing what you are supposed to be doing, even if you don't feel like doing it or you don't understand why you're doing it.

Finally, THANK YOU

- *to the Visitors*: for your invitations to visit and for explaining your ideas
- *to the Department Heads*, *Virg Wallentine and Gurdip Singh:* for your support through “thick and thin”
- *to the Locals*: for your camaraderie and tolerance of my all-too frequent complaining
- *to my Former Students*: for agreeing to work on non-trendy topics and for tolerating my management style
- *to Everyone*: for travelling from equally-far-away for this event!

My wife, Linda, can’t be here, but she says, “hello” (from South Africa)!

Maybe later today….



research at Aggie Station Tavern, 1119 Moro St. (A)