

What a Long Strange Trip It's Been

Dana Nau
University of Maryland

Contributors: more people than I can remember

The Occasion



Symposium support provided by the Department of Computer Science, the Institute for Systems Research and the Institute for Advanced Computer Studies

A Symposium in Honor of Professor Dana Nau

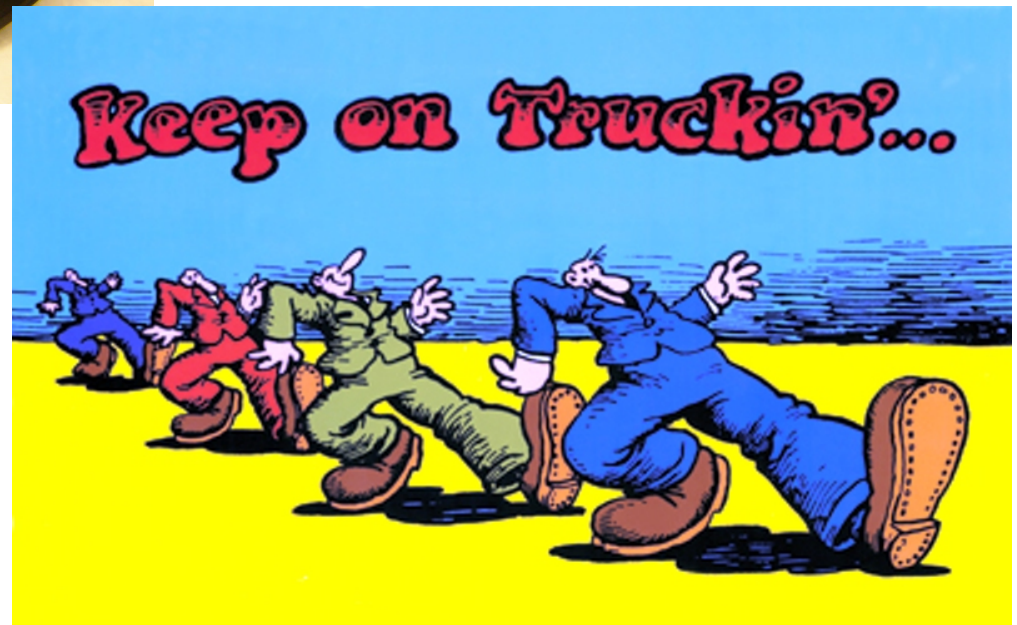


University of Maryland
Computer Science Instructional Center
Room 1115
May 24-25, 2012

Dana Nau is one of the world's foremost researchers in Artificial Intelligence. Some of Dana's best-known accomplishments include (1) discovering game-tree pathology, which has led to subsequent research by dozens of other researchers over the past three decades; (2) co-authoring the strategy-generation algorithm that enabled the Bridge Baron program to win the 1997 world championship of computer bridge; (3) leading the development of the SHOP and SHOP2 automated-planning systems, which have been used in many hundreds of projects in industry, government, and academia; (4) developing new algorithms for game-theoretic analysis of classical problems such as the prisoner's dilemma and its variants. Dana is one of the three authors of *Automated Planning: Theory and Practice* - the best known book on automated planning. In addition to his research work, Dana is an avid bicyclist and a terrific teacher.

The Title of this Talk

Truckin', Grateful Dead, 1970



Why I Chose the Title

Would it be OK for you to give your talk on Thursday 24 from 3 to 4 pm? Could you please send us a title?

a high level retrospective of your work ... you have made significant contributions to 4-5 major areas, so about 10 minutes on each ...



I didn't realize I was invited to give a talk! ... What kind of thing would you like?

How to keep it from being deadly boring?



Instead of technical details, I'll tell stories!

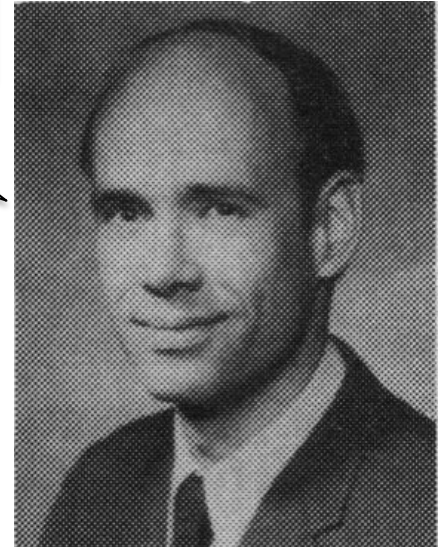
How I Got My PhD Topic

- Computer programs for chess, checkers, etc., use *game-tree search* to decide what move to make
 - » About 35 years ago:



In game-tree search,
why does searching deeper
produce better decisions?

I'll try to
figure it out.



Alan Biermann,
my PhD advisor

How I Got My PhD Topic

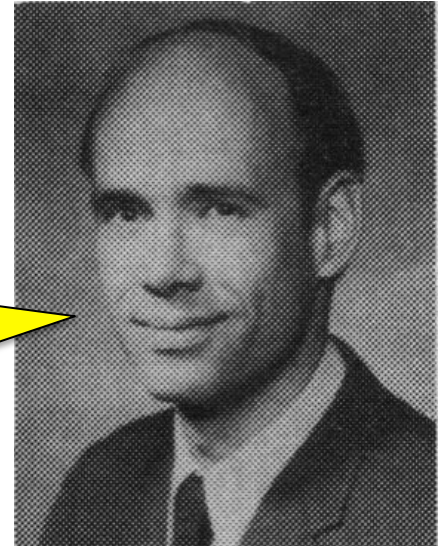
A few months later:

This isn't working! In my examples, deeper search is producing *worse* decisions.

I'm not getting anywhere. I should try a different topic.

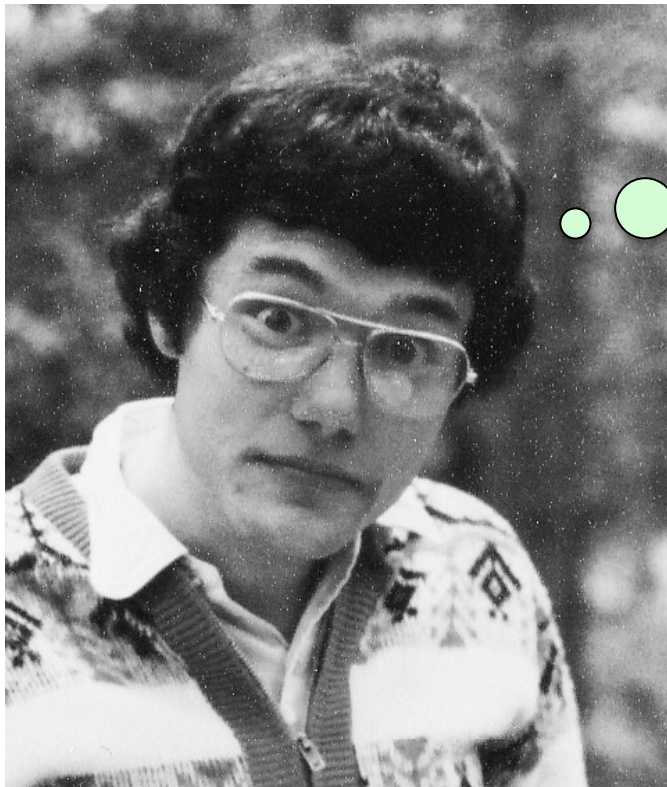
I think you're doing good work. I'd like to see you continue it.

Umm ... OK ...



How I Got My PhD Topic

A couple months later:



Wow! There's this big class of game trees where the deeper you search, the worse your decision will be!

Pathological
game trees

Coming to Maryland

Why is he falling asleep during my interview talk? Am I that boring?



Several months later:

Oh, I see ...



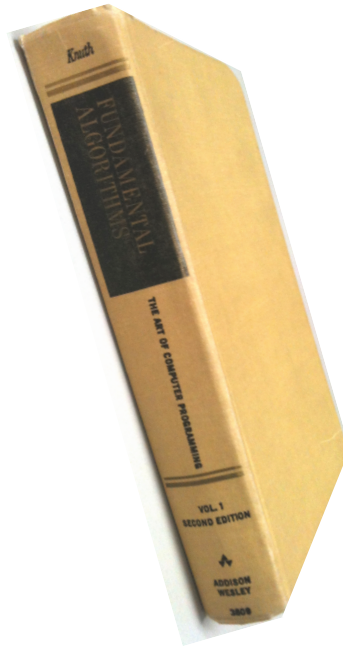
Because of a sleep disorder, Laveen Kanal *always* fell asleep at lectures

He became my mentor, and we worked together for many years

My First Semester Teaching



You're scheduled to teach *Data Structures*. Here's the book you'll use:



What's a "data structure"?



My teaching evaluations that semester were pretty bad

But I did learn data structures!

Judea Pearl's Influence

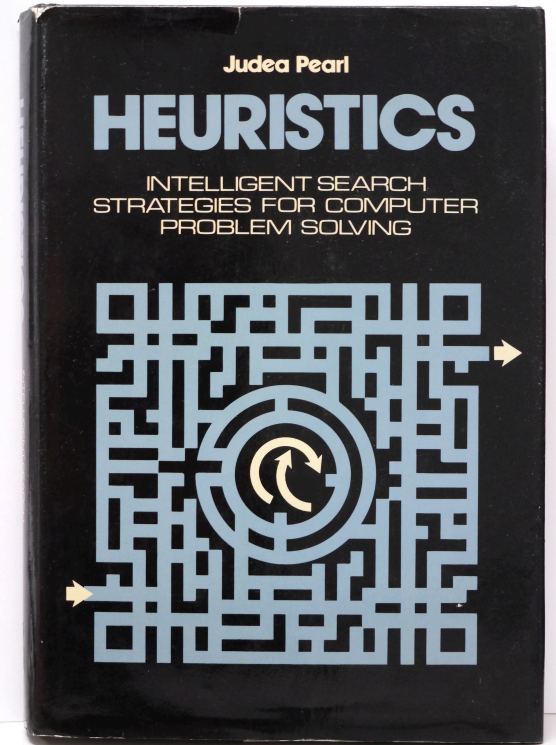
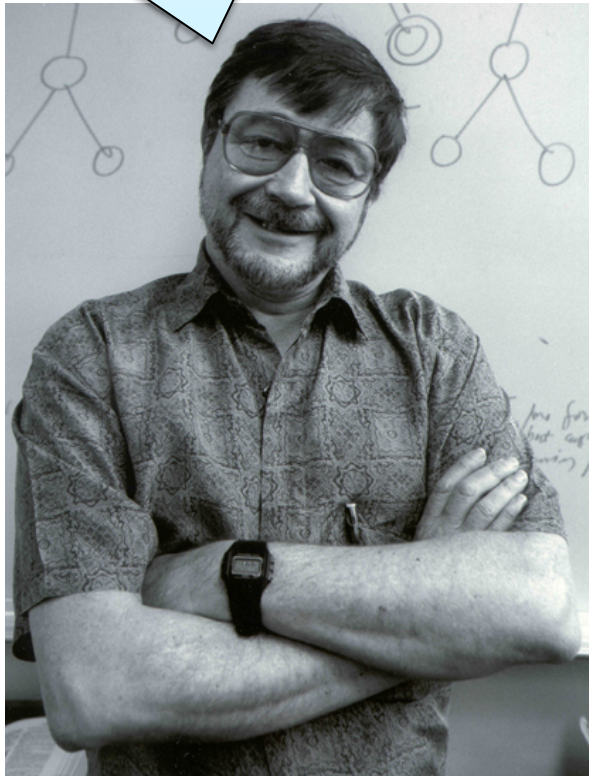
Telephone call from UCLA:

Jack Minker told me about your work on pathological game trees. During the last four days, I duplicated it.

This took me how many months, and he duplicated it in *four days*?

Pearl got a lot of people interested in the subject.

We built on each other's work.



How I Lost My First Year's Work



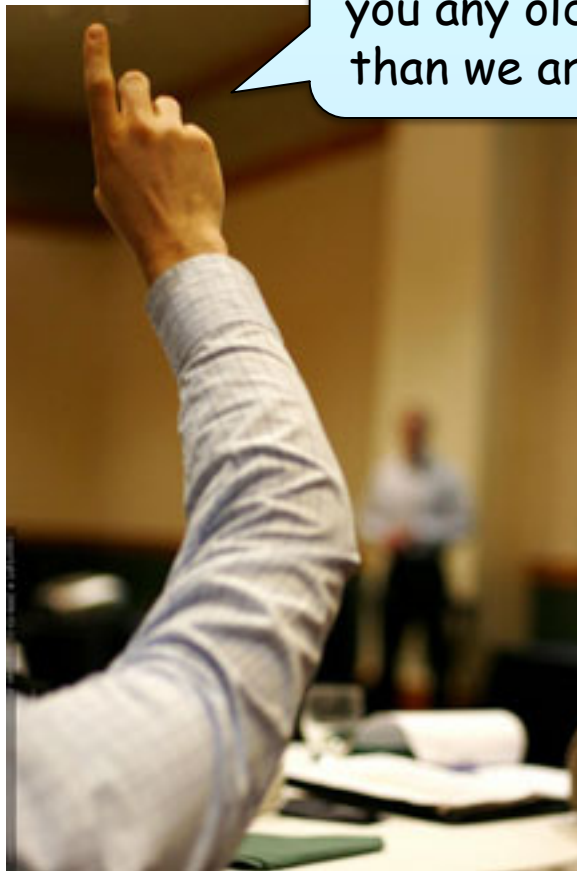
Our departmental computer was a PDP 11/45.

After I had been here a year, the disk crashed.

Nobody had made any backups.

Looking My Age

- Several of you have told me I look a lot younger than I really am
- That's nothing new ...



Looking My Age

- To try to look older, I grew a beard
- It looked scruffy, but it *did* make me look older!



Manufacturing Planning

We recently started a big project on automated manufacturing. Can you make recommendations on how AI techniques could be useful?

Sure!

I guess I'll need to learn about manufacturing, fast!

NIST

Several months later:

Wow, look at all these interesting planning problems!



Manufacturing Planning

- For a year or two, I was discontent at UMD
- Several reasons; one is that traditional academic departments have difficulty appreciating interdisciplinary work

I think I want to move to NIST.

You're better off if you stay in academia and consult for NIST.



Laveen was right.

- When I got a major NSF award, the CS Dept got a lot more supportive
- Institutional changes
 - » Improvements to the CS Department
 - » Creation of two interdisciplinary research institutes: ISR and UMIACS
- UMD is now a *great* place for interdisciplinary research

Getting into AI Planning

- People in different fields think differently
 - » If you want to work in more than one field, you need to adapt
- In AI, people in different *subfields* think differently

Jim, why don't these AI planning researchers appreciate my work on manufacturing planning?



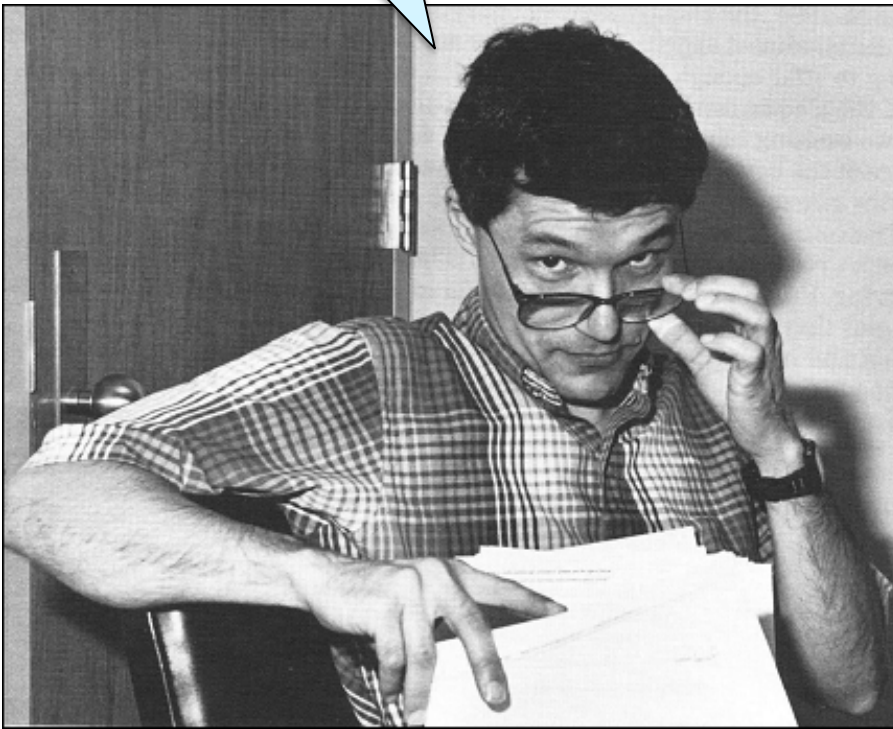
Here's how AI planning researchers think ...



Getting into AI Planning

- How Jim Hendler and I typically interacted:

Why do we keep having so many arguments?

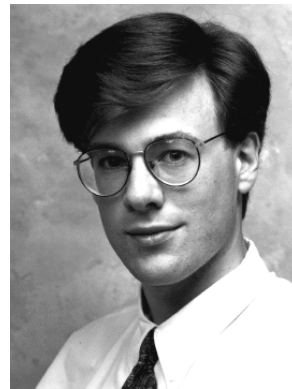
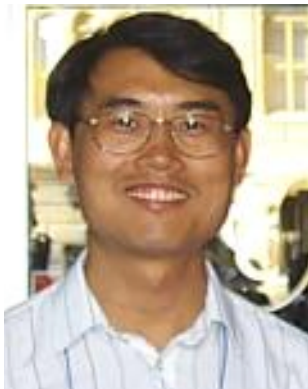


Remember, I studied with Roger Schank. Research is done by arguing!



Finding Good Students

- Around this time, I started getting some excellent PhD students
 - » I have pictures of most of them, but not all
- If you have pictures of any of the others, please let me know!

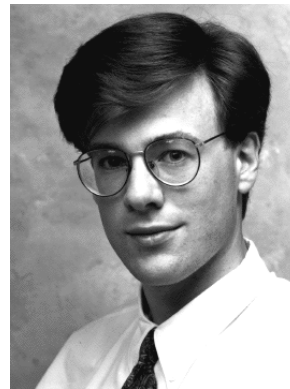
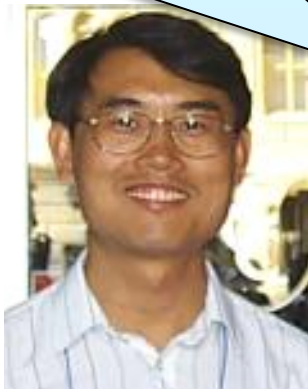
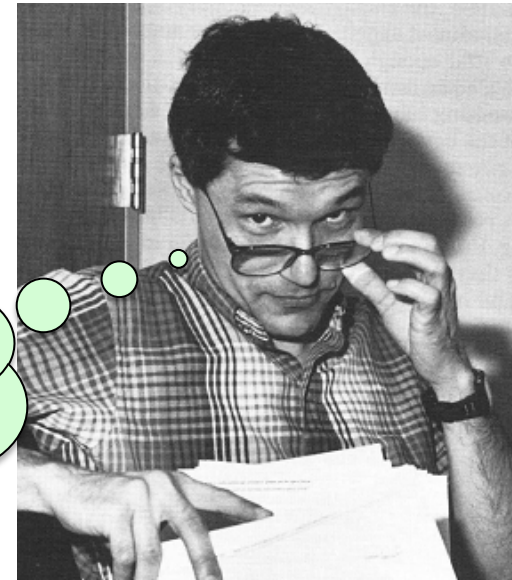


Finding Good Students

- Most of them were Computer Science students, but not all of them

Hi, I'm a grad student in Mechanical Engineering. I understand you do research on automated manufacturing?

I think *he* knows more about manufacturing than *I* do!



Computer Bridge

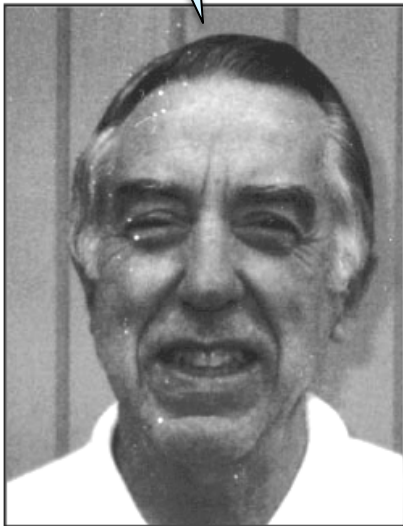
Can you develop some AI techniques to improve my computer bridge program?

Yes, I think so.

But I need to find someone who plays bridge.

Stephen?

Stephen Smith started graduate school at age 16, on a full fellowship.



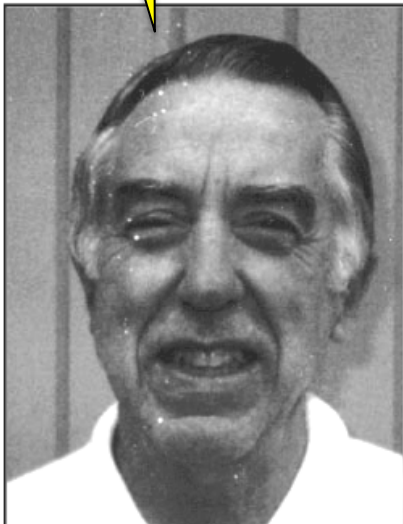
Computer Bridge

Several years later:

Why is this taking so long?

Because our first idea didn't work.

But we'll try another one.



The entire project took 7 years.

The final version combined HTN planning and game-tree search.

It won the world computer bridge championship.

SHOP and SHOP2

I want to give my AI class a programming project on AI planning

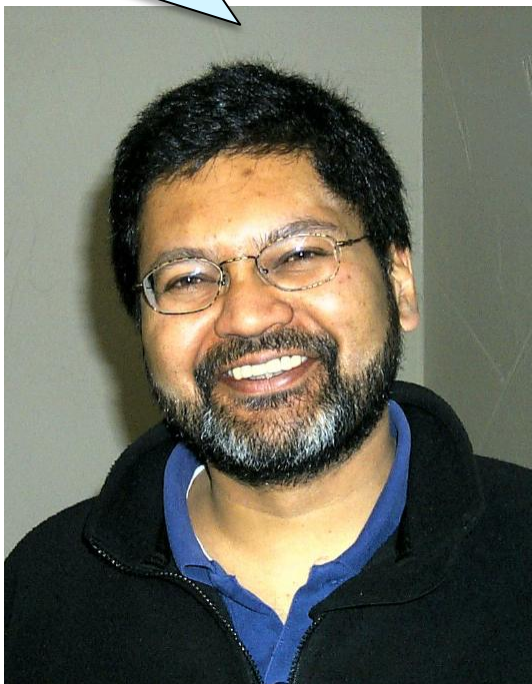
What's the simplest planning algorithm that can actually *do* something?



SHOP and SHOP2

- *2000 International Planning Competition*

The SHOP planner was disqualified. It produced an incorrect solution for one of the planning problems.



Fahiem and I weren't actually smiling

SHOP and SHOP2

- *2002 International Planning Competition*

An award for Distinguished Performance goes to SHOP2, by Dana Nau and his large team of students.

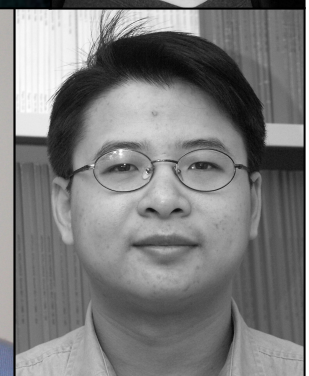
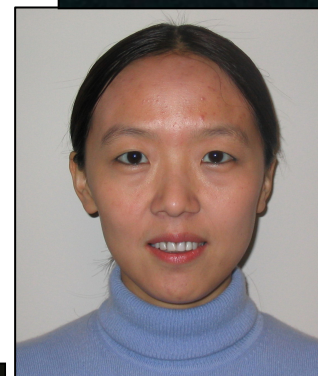
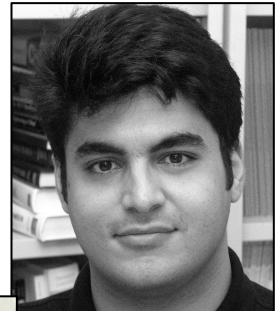


Five students,
one postdoc,
all great!



SHOP and SHOP2

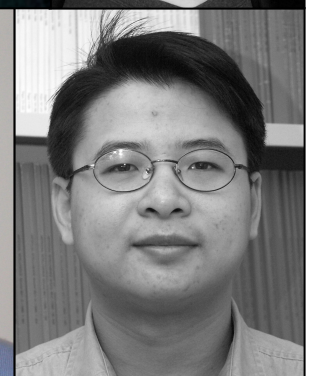
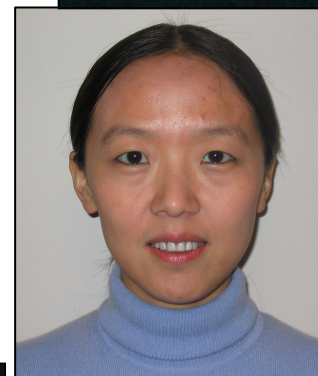
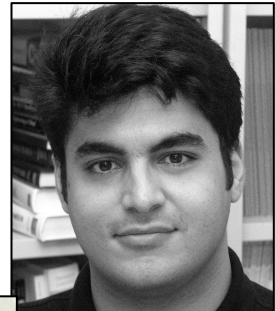
- On the web as open-source software
 - » My Computer Science colleagues understood this
 - » My Engineering colleagues didn't
- It turned out to be a great decision
 - » At least 13,000 downloads (I stopped counting)
 - » Used in hundreds (thousands?) of projects
 - » Dozens of people have contributed to the code
 - Here are a few of them



SHOP and SHOP2

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 - Here are a few of them
 - » One of them makes jokes even worse than mine!

Aha! Watt
Nau?



Writing a Book

It's frustrating
teaching *AI*
Planning without a
textbook. Maybe
I can write one?

Several chapters
(and months)
later:

I don't know enough
about this to do it
alone. Can I get
someone to do it
with me?



Getting Paolo Traverso Involved

I'm starting to write a textbook on AI planning. Would you like to write it with me?

Sure!

Four months later:

I haven't had time to work on the book.

I haven't either.

How will we ever get this done?



Getting Malik Ghallab Involved

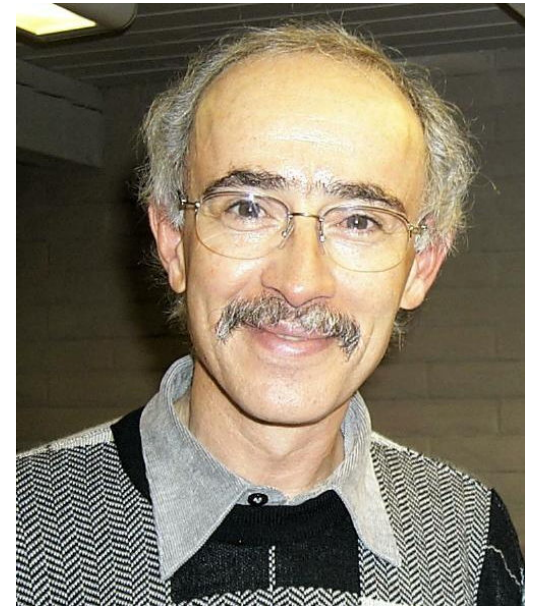
Malik's knowledge complements ours. Shall we ask him to write the book with us?

Malik, would you like to write a book with us?

Yes, but I can't start until 3 months from now.

Yes, good idea.

Oh no, more delays?



I Needn't Have Worried

Three months later:

I'd like to propose the following agenda ...

He doesn't just know planning, he knows scheduling!



Deciding on Content

2001:

We'll write chapters
on 32 topics: ...



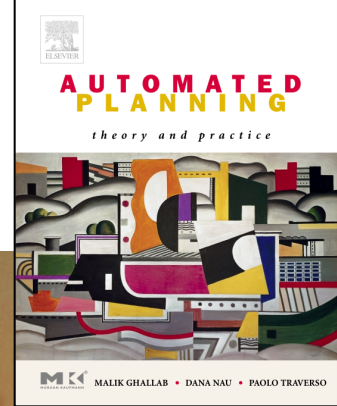
Deciding on Content

2003:

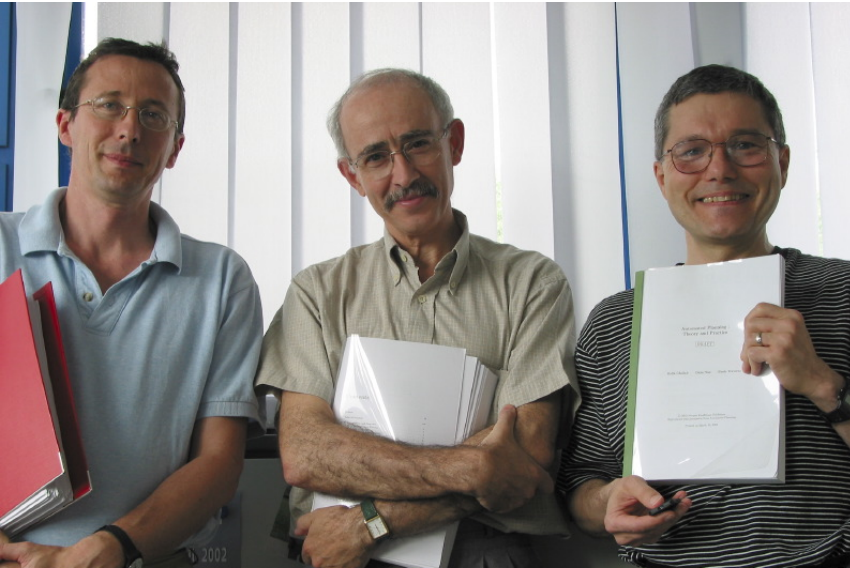
We can't finish all
these chapters by
the deadline!



Denouement



June 2003: first draft finished



June 2004: book signing



April 2008: Chinese translation



And now we're writing a sequel:

Planning and Acting

Game Theory

I'm going to enter a computer program in the 20th Anniversary *Iterated Prisoner's Dilemma* Competition.

OK, let me know how it works out.

Several months later:

My program did really well.

Wow, I should start paying attention!



Result: lots of papers by *Au and Nau*

Game Theory and Cultural Modeling

Here's a research program announcement on cultural modeling. Let's write a proposal!

Twenty years ago, I had a big personal disagreement with the program manager.

That's OK, at least he'll know who you are!



- VS was right, it wasn't a problem
- *Different problem:* someone sent the proposal to the wrong funding agency
- But eventually:



Laboratory for
Computational
Cultural Dynamics

Trento, Italy

Paolo, could I do a sabbatical at your lab?

That would be great!
Let's start making
arrangements



Making Arrangements

- Getting a Schengen visa was harder than we expected



Making Arrangements

I need someone to
keep all my projects
going while I'm gone

Ugur, when you finish your
PhD, would you like to stay
here as a research scientist?



An Unexpected Development

I'm going to Italy on sabbatical!

Um ...

Recently divorced man,
beautiful Italian women?
I need to be there to
keep an eye on him!

Am I ready
for this?

Can I go with you?

... OK!

Old flame, from
23 years earlier



It Was the Right Decision



Another Unexpected Development

- People are still working on extensions of my PhD work

We want to write a paper to submit to *Science*, and we want you to be the 1st author



I'll be surprised if we can get anything into *Science*, but it will be fun to try



It didn't get into *Science*.

It didn't get into *PNAS* either.

I finally convinced Matjaž that we should send it to *Artificial Intelligence*.

Game Theory and Cultural Modeling

LOCCD Laboratory for
Computational
Cultural Dynamics

I've been telling
people you're our
world-class expert
on game theory.

Um,
OK ...

I need to
learn more
game
theory!

I'll teach a
course on
it.

And I'll look
for a good
postdoc.



Game Theory and Cultural Modeling

Michele, want to see if there are any interesting connections between what I'm doing and your work in Cultural Psychology?



- It took a while to learn how to understand each other.
- But eventually:

This looks great!
Let's write some research proposals.



We now have an ongoing research project

What's the Next Plan?



Another Sabbatical!

I'm eligible for a sabbatical next January. Where shall we go?

I want to go someplace where they speak English.

How about Australia? I hear they speak an approximation of English.

That's probably what the British think about *us*!



Next January, we're going to Australia for six months

What to Make of All This?

- By nature, I'm an introvert
 - » I sometimes get uncomfortable trying to make “small talk”
 - » I need time alone
- But almost all of my research has been in collaboration with others
 - » The interactions produce better ideas
 - » I get more excited about working on them
 - » We've accomplished things together that I could never have done alone
- Thanks for all your support over the years
 - » I've loved working with you all
- And thank you all for this great birthday present!