led to more progress than studying n-cubed algorithms. In particular, the work on higher order derivatives, order-of-magnitude reasoning, and summarizing continuous processes might help in this direction.

Other Remarks on the Sessions

The discussion sessions were valuable because we heard so many ideas in a short period of time and had some opportunity to voice our reactions. The workshop also gave all of us an opportunity to lead and participate in technical debates, which is an art that none of us has mastered. Sometimes too few people were involved in the discussions, sometimes points were repeated over and over without any new insights being gained, and (dare I say it?) sometimes the unrelenting sessions of debate in a hot stuffy room seemed to produce more drowsiness than insight! As always in artificial intelligence, with its closeness to philosophy, it was easier to talk in abstract terms than to make descriptions and comments concrete. However, these comments aside, the sessions were good.

One suggestion we would make to future workshop organizers is to have at most two moderators for each session. In cases where there were three moderators, it seemed that not all of the moderators had enough time to direct the discussion to the points that they were interested in. As well, the sessions seemed to be less coherent and organized than those with two moderators.

Besides those already listed as moderators, the participants were as follows: John de Haan, Brian Nixon, Marc Romanycia, Abdul Sattar, Andre Trudel, Zhang Ying, and Rayan Zachariassen.

Conclusion

Thinking back to the workshop, we find that the specific details blur. We each recall stimulating and thought-provoking exchanges of ideas on topics that included, but were not restricted to, the discussion topics. We had the opportunity to meet other Canadians interested in KR research, in most cases for the first time. We established academic and social contacts and look forward to encountering the workshop participants again in the coming years.

The breadth of topics discussed at the workshop revealed the vast number of issues facing KR researchers and the interdependencies among researchers in all the subfields of AI. The diversity of the topics reflects the wide range of interests of the participants. In fact, each of us found only a few other participants fully conversant with the exact issues we are facing in our own research. As a result, we realize that we are not alone in Canada, but that Canada contains only a small portion of the world-wide research community.

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Banquet Speech
Alan Mackworth

One of the pleasures of getting older is that one can be mildly retrospective on occasions like this without seeming to be too pompous. When I was asked to give this banquet speech, I started to worry, "Am I now doomed to give political speeches on the rubber chicken circuit? I'd better get that draft for my next paper drawn up quickly and keep writing code in case I have been asked to do this because someone thinks I'm past it!" Luckily, I've rediscovered the joys of implementation and discovered, in addition, that Prolog is a mixed blessing, as we implement the logic of depiction. But you've had a full day of technical talk so I won't give our logic of depiction talk — besides most of you have heard it.

As a senior statesman, I can't compete with Fraser Mustard, the President of CIAR or with Zenon Pylyshyn, the Director of the AIR Program. They have much more grey hair. But I was asked to give an address to this collection of Young Turks on the nature of scientific life, the universe and everything. Now, you have heard more from Werner Israel about the state of the universe than I will ever know, so I'll skip that topic.

But rather, I'll allow myself a non-technical retrospective and prospective look, and risk giving some advice. Twenty years ago (or even five years ago), a gathering like this would simply not have been possible for many reasons, some of which I'll consider. It also strikes me that if such a gathering had occurred it would have been a gathering of young men only. Times have certainly changed for the better.

Another sign of change is obvious to those of us with twenty years of hindsight. The fact that you, men *and* women, are here at all is evidence of it. The story starts with a Monty Pythonesque line, something like, "When I was a lad, I had to walk thirty miles to school in snowshoes and bare feet." When I graduated from the University of Toronto in 1966, I had to leave the country for computer science graduate studies. In fact being "good" at something and leaving the country, or being outside it, were synonymous. That was the sixties state of mind in Canada; it still persists in many circles. All of us had to leave Canada to do graduate work in the 1960's. Some of us actually returned.

In the 1970's, as grad schools in computer science were formed and developed, artificial intelligence was still considered a subject that was studied outside the country. A brief anecdote illustrates the point. David Lowe graduated from UBC in 1978 with an NSERC Fellowship. He wanted to go to Stanford, but NSERC would only allow fellowship holders to leave if there were, certifiably, no equivalent opportunities in Canada. I had to write a very delicate letter explaining how the University of Toronto and the University of British Columbia were very good but, in David's area, he would be better off at Stanford. There's a happy ending. Last year, we hired David back from the Courant Institute as a CIAR Scholar at UBC.

Now, in the 1980's across Canada we have first class research groups in knowledge representation, vision, robotics and natural language. You are in Canada doing AI graduate studies simply because Canadian AI is excellent. We have the researchers, the infrastructure, the facilities and, most important of all, fresh talent, namely, you. The CSCSI, *Computational Intelligence, Canadian Artificial Intelligence*, international conferences and workshops, good NSERC support, Precarn, and the CIAR AI and robotics program are all part of the infrastructure. They demonstrate the vitality of the community. None of them happened by themselves. They need people like Roy Eagleson, Bart Selman, and all their helpers, the organizers of the two CIAR student workshops, to make them happen. Keep it up; it's up to you.

CIAR itself has been a major player. By choosing AI and robotics (AIR) as its first (and still flagship) program, it confirmed the intellectual and strategic importance of our area. Besides AIR, programs in cosmology, evolutionary biology, population health, superconductivity, and law and society among others have been established. There are about one hundred fellows, scholars and associates associated with these programs. The slogan, "An Institute Without Walls" is not empty. It describes CIAR. Without the Institute's support, AI in Canada could have been fatally weakened; with it, we are flourishing. Any ideas or proposals for future activities such as this are welcomed by Zenon and his program committee: let us know.

The AIR program is structured around the three poles: perception, cognition and action, with an orthogonal discipline dimension spanning computer science, engineering, psychology and neurophysiology. The first two student workshops have covered perception and cognition (knowledge representation). Should the next student workshop be on action (robotics)?

Knowledge representation is the core of AI. The rest of AI, areas such as vision, natural language and planning, can be seen as merely applied KR. But, as you have discovered in preparing for this workshop, KR is not an area with a single accepted paradigm. Even the proof-theoretic FOL approach has its major challengers: non-monotonic and higher-order logics, theory revision, model-theoretic approaches, connectionism, situated automata theory, and schema theory to mention but a few.

A few years ago, I wrote a question-answer "Catechism for the Neat AI Person" (*Canadian AI,* No. 2, 1984) which started as follows:

> To be chanted by Apostles
> of the Unification Church, and their Disciples
> Q: What is First-order Logic?
> A: It is the one and only Knowledge Representation Language with a precise semantics. All other KRLs are false pretenders, or disguised and disfigured variants of FOL.
> Q: What is a semantic net?
> A: A semantic net is to a set of wffs as Lucifer is to Gabriel.

There followed a printed exchange with Brian Nixon (who is here tonight) on the meaning of "catechism". My "exegesis" of the catechism repeated the old drunk-and-the-keys joke and pointed out that:

"The story illuminates the fundamental tension in any science between theory and reality. That gap produces the underlying dialectic that drives the scientific process. (Of course, the story is usually told by experimentalists to ridicule theoreticians who promote sterile formalisms with unrealistic restrictions.)

"The theory-reality gap in AI is a chasm. Actually, it is many chasms. In knowledge representation there are plenty of streetlights, but they are all far removed from the key. It is important for the drunks under any given streetlight to keep up their spirits as they grovel around. This they do by singing hymns and chanting catechisms. Given the political and sociological nature of scientific activity it is also important that new drunks coming onto the scene be convinced that there is only one true streetlight and that its wattage is increasing. Other streetlights are either pale reflections of ours or total

Alan Mackworth gives a witty banquet speech while workshop coordinator Bart Selman looks on.

mirages. The declarative-procedural controversy is a classic case study in behaviour of this kind. There is only one way to enter God's kingdom.

"So, my harmless little catechism was a not-very-funny parody designed to remind us that AI paradigms are like religious sects that must keep up the faith even when faced by overwhelming isolation and rejection or, as is more common these days, tempted by Mammon."

Amusingly, McDermott's "Critique of Pure Reason" in *Computational Intelligence* reads like a lapsed Catholic's attack on the Church! Hayes' response, "A Critique of Pure Treason", explicitly carries forward the betrayal theme and Woods remarks on the loss of faith.

To the practical AI person, who thinks that foundational and theoretical debates (such as you are having) are a waste of time, a word of warning is necessary. The prototypical working scientist may often safely ignore foundational treatises and debates. Smugly ensconced in the enfolding security of a received framework, he twiddles symbols or knobs, enjoying the simple pleasures of puzzling out nature's secrets. Tempting as that idyll may be, the prototypical researcher in AI should renounce it. For us, it is premature — both illusive and elusive.

The underlying subtext here (as post-modernists say) is the *social* nature of research. Just don't forget that the key may not be under the brightest streetlight; you might do better going off into the dark with a flashlight. You might have to ignore or rewire your supervisor's streetlight.

So what are the challenges facing you for the 1990's?

First, find a key. There are many — to each his own door key. Only work on topics that excite you. Use workshops like this to build a network of colleagues who stimulate you and stay in touch. "Only connect." (E.M. Forster's phrase does *not* mean connectionism is the key!)

Second, if you can arrange it, study in a foreign country. It's still an excellent way to broaden the mind. For those of you living in the-centre-of-the-universe-as-we-know-it, Toronto, come and work with us in B.C. — it's a foreign country.

Third, do not spurn applications as second-rate work. The best theory is informed by practice and vice versa. Some of you should move into applied work in Canadian industry or government labs. Or, even better, be unCanadian — take a risk. Start your own small AI company like Bev Smith and Brian Schaefer have done

at Acquired Intelligence in Victoria. The climate is ripe. Precarn, a CIAR spinoff, is encouraging the formation of industrial research consortia and collaborative university teams. We eagerly await the results of its first competition. One of the healthiest aspects of Canadian AI is that we are not dependent upon massive military project-oriented funding. Let's keep it that way. Search out AI applications in Canada's resource-based, manufacturing, or high-tech industries, and in the service sector.

Fourth, those of you who want an academic research and teaching career will already realize that U. of Toronto, Simon Fraser, McGill, Alberta and UBC will not be the only centres of research strength in AI. Sally forth, strike out and build AI labs on your own! Learn from our generation's mistakes. Politics and science cannot be separated nor have they ever been. But the term "political

scientist" has taken on a new meaning. Remember, politics can be a constructive art.

Fifth, as free trade in goods becomes established in the 90's, we'll also get free trade in people and even, God forbid, in ideas. The world is shrinking. We'll see a reversal of the outflow of the 60's and 70's. As we've seen, in the 80's we first stabilized the Canadian research community and then grew it — keeping and attracting all of you here. In the 90's, if we keep it together, we'll see a substantial flowering of AI in Canada and major inflow from all over the world including the U.S.

Sixth, and finally, all this is far too serious. The best research comes from a spirit of playfulness. Don't forget the words to the song that Cyndi Lauper should have sung, "AIers just wanna have fun!"

CSCSI '88 Conference

by Howard Hamilton

Conférence SCEIO '88

RÉSUMÉ: SCEIO '88 fut la septième dans une série de conférences bisannuelles canadiennes sur l'intelligence artificielle. Six communication invitées et 37 communications arbitrées furent données durant les trois jours de la conférence. Les sujets touchés inclurent le traitement des langues naturelles, le raisonnement, la perception, les systèmes à base de connaissances et les applications.

8 - 10 June 1988, Edmonton, Alberta

CSCSI'88 was the seventh in a series of biennial conferences on artificial intelligence in Canada. Its predecessor was AI-86 in Montreal. CSCSI '88 was held at the Edmonton Convention Center in conjunction with two other conferences, Vision Interface '88 and Graphics Interface '88, under the grand title of Conference '88. The architecture of the Edmonton Convention Center is unusual: one enters at normal downtown street level and then immediately rides a series of escalators down to the useful portion of the building, which is in the river valley. I kept trying to estimate how many million dollars worth of building I passed before reaching the useful areas!

I enjoyed the conference. Why? During his talk on the first morning of the conference, Mark Young gave the following example:

enjoy_conference(X) <-- studious(X)
enjoy_conference(X) <-- party_animal(X)

This example suggests two possible reasons for my enjoyment and I will claim that the first applies to me. As evidence, I can point out that I attended almost every session and almost every talk during those sessions. (Anyone wishing to suggest the other explanation will have to find their own evidence.) As well, I enjoyed frequent encounters with people I knew because the conference was relatively small (158 people for CSCSI'88 and 300 for Conference '88 as a whole). I kept noticing how much smaller and friendlier the conference was than

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AAAI-87 in Seattle. On the other hand, at AAAI-87 I met the authors of several papers I had recently read, which did not happen at CSCSI '88.

What did the conference offer the "studious"? Six invited talks and 37 talks based on refereed papers were given during the three days. The invited talks were as follows:

- Wolfgang Bibel (UBC): "Finding Proofs, Programs and Plans"
- David Etherington (AT&T Bell Labs): "Non-Monotonic Reasoning: Is the Answer Harder than the Question?"
- Charles Morgan (U. of Victoria): "Bets, Logic and Monotonicity"
- Geoff Hinton (U. of Toronto): "Connectionist Symbol Processing"
- David Lowe (UBC): "Recognizing Objects with Curved Surfaces and Moving Parts"
- Renato De Mori (McGill): "Neural Networks, Markov Models and Programming in Automatic Speech Recognition"

Alone of the invited speakers, Wolfgang Bibel provided a printed version of his presentation for publication in the proceedings. I wish the others had done so too, but I suppose that that is not one of their responsibilities.

Of the invited talks, I most enjoyed those by David Etherington and Charles Morgan, perhaps because they were speaking on subjects close to my interests. David Etherington's talk surveyed previous work in nonmonotonic reasoning and outlined current research topics. According to Etherington, the question is: "How should