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EDITORIAL

Editor's Message

Dan Fass

Dear reader:

This issue contains a paper by Richard Dearden et al. Richard was one of the grad students who won a poster prize at IRIS-PRECARN '98. The poster prize winners for IRIS-PRECARN '99 are listed on page 40 of this issue. (All of this work seems more robotics and AI, hence it doesn't seem suitable to publish their work in *CAI/IAC*.)

The issue also contains the second part of my article on the infrastructure of artificial intelligence R&D in Canada and the article on 25 years of CSCSI/SCEIO and *CAI/IAC* (actually 26 years now).

Also printed in this issue is the constitution of the CSCSI/SCEIO. It was last printed in the *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS* (March 1984, Vol. 3, No. 1, pp. 122-125). A reprinting seems long overdue. I hope that the 25 years article puts the constitution in a little perspective.

Incidentally, Article IV of the constitution would seem to need revising to include two officers: Past-President (added in 1988) and Editor of *CAI/IAC* (added 1990). Also with regard to Article IV, the first two officers are now commonly referred to as President and Vice-President. Perhaps the constitution should be altered to reflect this usage. The procedure in Article V does not seem to be followed. Perhaps the constitution needs changing here

Absent from this issue is the Book Reviews section edited by Graeme Hirst. Graeme is concerned about the state of *CAI/IAC* and no longer feels OK to ask people for book reviews the magazine. Graeme has had some kind of formal involvement with the magazine since June 1984, when he became editor of the CSCSI/SCEIO part of the old *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*. He served as editor of the *CAI Newsletter* from 1984-86, and as senior editor 1986-87. Graeme has continued ever since as book reviews editor. That's 15 years of service. Thank you Graeme!

I hope that the magazine can be restored to a state where Graeme feels like resuming the book reviews section. I won't be part of the restoration process because I'm stepping down as *CAI/IAC* editor. The new editor is Ann Grbavec, who is also from SFU. Please send Letters to the Editor, news, suggestions, and the like to Ann at agrbavec@cs.sfu.ca

Miscellaneous

Poor AI

In 1968, the submarine USS *Scorpion* exploded. Its crew of 99 were all killed. Later, declassified papers suggested that the submarine was "probably the victim of one of its own conventional torpedoes, which, after having been activated accidentally, was ejected. Unfortunately, the torpedo became fully armed and sought its nearest target, as it had been designed to do" (Neumann, 1995, p. 38).

The death in 1990 of an elderly Swedish woman was not noticed for 3 years because all her bills were being paid automatically. For the same reason, the death of a reclusive 51-year-old Dutch man went unnoticed for 6 months (Neumann, 1995, p. 190).

Poor Interface Design

In 1989, a ship aran aground on a Florida coral reef close by the Fort Jefferson National Monument. The ship's captain, Zdravko Beran, the captain of a ship, blamed the accident on "a confused officer and to a bad user interface. Apparently, an officer, Zvonko Baric, incorrectly changed course because the steering mechanism on the ship operated in the opposite fashion from most such controls" (Neumann, 1995, p. 59).

.. continued on page 42

Bayesian Q-Learning

Richard Dearden, Nir Friedman, and Stuart Russell

Résumé

Une approche Bayesienne est proposée pour solutionner le problème du balencement de l'exploration (choix d'action pour découvrir de nouveau aspects du monde) sans exploitation (utilisant la connaissance déjà acquise) (Thrun, 1992). Certaines incertitudes, explorant la validité de chaque action posée, sont explicitement discutées, facilitant ainsi un raisonnement, concernant ces incertitudes quand au besoin d'agir d'une façon spécifique.

Abstract

A Bayesian approach is proposed to the problem of balancing exploration (choosing actions to discover new things about the world) against exploitation (using knowledge already possessed) (Thrun, 1992). Uncertainty about the value of each action is explicitly represented, allowing reasoning about that uncertainty when there is a need to select an action to perform.

Introduction

Intelligent agents are often required to act without complete information about the effects of their actions. For example, consider a mobile robot performing a "turn left" action. It may not know the actual angle it will turn through, or the chance of its wheels slipping on different surfaces. Such an agent needs to be able to update its knowledge and potentially change its policy based on the results of actions it performs. Reinforcement learning algorithms such as Q-learning (Watkins & Dayan, 1992) are commonly applied to these types of problems. While lack of space prevents us from describing these algorithms in detail, in essence, Q-learning operates by keeping for each possible state of the world a local estimate of the value of doing each action in that state, and updating these values based on the results of the actions it selects. An important feature of the algorithm is that it is model free: rather than learning a model of the world, it directly learns the value of each action in each state. Although we will describe our algorithm operating in a finite state space, these ideas apply equally in continuous domains. For a survey of reinforcement learning algorithms, see Kaelbling et al. (1996).

An important problem for reinforcement learning algorithms is how to balance exploration – choosing actions to discover new things about the world – with exploiting the knowledge we already have (Thrun, 1992). If we care about the agent's performance while it is learning, these two goals are in competition with one another and an ideal agent should trade off between them, doing exploratory actions when it knows little about the world and maximising its current performance when it is more confident. Many approaches to this problem have been proposed (see Thrun, 1992 for a survey). Most of these choose an action based on the current estimate of its value (for example choosing the best action with some probability and a random action otherwise). These approaches don't take into account how confident we are in our current estimates of the values of the actions. When we are confident about the values of all the actions we should choose the best one. If we are uncertain about values, exploring actions that currently appear sub-optimal provides potentially valuable information.

We propose a Bayesian approach to this exploitation-exploration problem. By explicitly representing our uncertainty about the value of each action, we can reason about that uncertainty when we need to select an action to perform. This approach requires considerably more computation than traditional reinforcement learning techniques. We see our algorithm being useful when performing actions in the world is very expensive and there is plenty of time for computation available between decisions. An example of a problem with these characteristics might be control of an automated factory.

Representing Uncertainty

There are a variety of possible approaches to representing uncertainty about the values of the actions. We treat each observation as a sample from some unknown normal distribution, and attempt to reconstruct this distribution from the values we observe. To do this, we keep a distribution over possible normal distributions – that is, a distribution over the mean and variance of the

unknown distribution – for each state and action. As we observe more samples of a particular action's value in a state, we should grow more confident about the parameters of the unknown distribution, and so the variance of our estimate of the distribution's mean will reduce.

Kaelbling (1993) has suggested a similar approach to representing uncertainty that is based on computing a 95 percent confidence interval over the observed values of each action. One problem with her *interval estimation* algorithm is that it only represents local uncertainty. The value of an action is computed using the mean values of future states that have been reached by doing that action, so the confidence intervals don't take into account the fact that the values of the future states themselves may be uncertain, and that therefore doing this action, while it won't gain us a great deal of information now, may lead to states where exploration has greater potential value. By using a probability distribution over the value of future states, and explicitly reasoning about the uncertainty in that distribution when we compute the values of future states, our uncertainty about the value of this action reflects any uncertainty we may have about the future states that it leads to, allowing us to do *global exploration*. Meuleau and Bourgine (1998) also take into account global uncertainty in this way, but again use confidence intervals to represent uncertainty. We have found that a full Bayesian approach using a probability distribution performs better than confidence interval based methods in more complex domains. We believe that this is because we make better use of the available data, so we learn faster when there are relatively few observations to base decisions on.

Selecting Actions

A method for representing uncertainty about actions is only of value if we select actions based in some way on that uncertainty. The confidence interval based approaches mentioned above do this by selecting the action with the highest upper range of the confidence interval. The idea is that the mean of the confidence interval represents the value of doing the action, and the width of the interval is an *exploration bonus* that encourages exploration of uncertain actions. Our approach differs from these in that we select actions based on the value of the information we can expect to gain by doing them. In essence, we ask the question "How much would I be willing to pay to find out the true value of this action?" We call this quantity the *value of perfect information* (Russell & Wefald, 1991).

To compute the value of perfect information for an action, we note that the value is only non-zero if the information we gain would change the current best action. That is, it is worth nothing to learn the true value of a currently sub-optimal action if that action's true value is still less than the value of the current best action. Similarly, it is worth nothing to learn that the current best action is actually better than the estimated value of the next best action. Since the action we perform won't change as a result of learning this information, it has no value to us. If new information does change the best action, then the value of the information is proportional to the size of the change. The gain from learning the true (mean) value V of the best action A_1 is $E[A_2] - V$ if $V < E[A_2]$ and zero otherwise, where A_2 is the second best action. The gain from learning the true value V of some other action A is $V - E[A_1]$ if $V > E[A_1]$ and zero otherwise.

Now that we know the gain from learning the true mean value V of some action, we must multiply that by the probability that the action actually has value V. We compute this from our current distribution over the mean of that action. Taking the integral of this quantity over all possible mean values of the action gives us an estimate of the value of exploring by taking the action. We also subtract the cost of performing this action instead of the one we currently believe to be best, since this is the cost we incur by choosing to do an apparently sub-optimal action now. We compute this measure for every action, and perform the action that has the highest value.

The full version of this paper (Dearden et al., 1998) includes several experiments. We found that in all but the smallest of domains this method is as good as or better than other model-free algorithms. This is due to an action selection scheme that makes much more use of available information than other methods. The algorithm is computationally demanding, but we note that in most applications of reinforcement learning, performing actions is much more expensive than computation time. We are currently applying this approach in model-based reinforcement learning, where the agent learns a model of the world as well and uses the model to assist it in learning the value of each state and action.

Bibliography

Dearden, R. W., N. Friedman, and S. J. Russell (1998). Bayesian Q-Learning. *Proc. Fifteenth National Conference on Artificial Intelligence*, pp. 761-768.

Kaelbling, L. P., M. L. Littman, and A. W. Moore (1996). Reinforcement Learning: A Survey. *Journal of Artificial Intelligence Research*, Vol. 4, pp. 237-285.

Kaelbling, L. P. (1993). *Learning in Embedded Systems*. Cambridge, MA: MIT Press.

Meuleau, N., and P. Bourgine (1998). Exploration of Multi-States Environments: Local Measures and Back-Propagation of Uncertainty. *Machine Learning*.

Russell, S. J., and E. H. Wefald (1991). *Do the Right Thing: Studies in Limited Rationality*. Cambridge, MA: MIT Press.

Thrun, S. B. (1992). The Role of Exploration in Learning Control. In D. A. White and D. A. Sofge (Eds). *Handbook of Intelligent Control: Neural, Fuzzy and Adaptive Approaches*. New York, NY: Van Nostrand Reinhold.

Watkins, C. J., and P. Dayan (1992). Q-Learning. *Machine Learning*, Vol. 8, No. 3, pp. 279-292, 1992.

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AI for AI

AI finds yet another application ... in AI!

Ajenstat, J., B. van Doormaal, J. Bigue, D. Bisant, D. Brown, and R. Marchand (1993). AI for AI — Artificial Intelligence for Artificial Insemination. In *Proceedings of AIFA Conference on Artificial Intelligence for Agriculture and Food (Equipment and Process Control)*. Nanterre, France: EC2, pp. 275-284.

Abstract

The application of genetic theories has proven very efficient over the years; the Canadian cow has multiplied its average production of milk by a factor of two (200%) in twenty-five years. As standards have moved up accordingly, Artificial Insemination Centers have to select young or proven saw as so that the average performance of the population is increased. Artificial intelligence methods, including expert systems in deductive and inductive modes, case-based reasoning (CBR) and neural networks, offer the possibility to further improve the classification and forecast of elite sires, thus serving as an aid for decision making. From the research point of view we propose the concept of triangulation. This means that, when using various methods, similarity of results reinforces their validity while contradictions suggests the need for further analyses. The different methods are discussed according to their distinctive merits and in relation to the models of artificial insemination.

(The authors were from the Université de Québec, Montréal)

The Infrastructure of Artificial Intelligence R&D in Canada, Part 2

Dan Fass

(Part I in *CAI/IAC*, Spring/Printemps 1999, No. 43, pp. 18-25.)

Résumé

Cet article présente une brève histoire du domain de l'intelligence artificielle, se concentrant particulièrement sur la situation au Canada. Il décrit ensuite les sociétés et organismes canadiens qui s'occuppent de promouvoir l'IA (comme par exemple la SCEIO/CSCSI), le soutient pour l'IA au Canada venant du secteur privé et du gouvernement fédéral (tel que CIAR [Institut canadien pour la recherche avancée], PRECARN [Réseau de recherche appliqué préconcurrentielle] et IRIS [l'Institut de robotique et d'intelligence des systèmes]), diverses politiques initiées durant les années 80 et le tout début des années 90 (tel que l'atelier sur l'IA organisé par le Conseil de science en 1983), les institutions fédérales s'occuppant de la recherche en IA (comme Industrie Canada) et certaines initiatives provinciales (tel que le Conseil de recherches de l'Alberta).

Abstract

This article presents a brief history of AI with special reference to Canada. It then describes Canadian societies and organizations involved in promoting AI (such as CSCSI/SCEIO), private-sector and federal-level public support for Canadian AI (e.g., CIAR, PRECARN, and IRIS), various policy initiatives in Canadian AI during the 1980s and very early 1990s (for example, the 1983 Science Council workshop on AI), federal institutions that are involved in AI research in some way (such as Industry Canada), and provincial initiatives in AI (e.g., the Alberta Research Council).

5. Mainly R&D Community-Led Policy Initiatives in AI (1983-1991)

As mentioned in the introduction, there were a considerable number of policy initiatives in AI in Canada during the 1980s and early 1990s. One way to divide up these initiatives is in terms of who, broadly, initiated them. Two groups suggest themselves and are described in Sections 5-6. This section describes the first group which consists largely of AI policy initiatives by the Canadian AI R&D community during 1983-1985.

Several of these initiatives originated from a three-day workshop on AI run by the Science Council of Canada during 19-21 January 1983 (Science Council, 1983). Although the workshop wasn't itself initiated by members of the Canadian AI R&D community, it had plenty of involvement from them. The workshop was attended by a cross-section of 60 people from academia, industry, and government. Those in academia came from departments of computer science, psychology, linguistics, engineering, and communications. Those from industry included representatives from Gandalf Technologies, Bell-Northern Research, Novacap Investments, the Financial Post, Globe and Mail, and Southam News. Those from government included representatives from the Department of Industry, Trade, and Commerce; Science Council of Canada; Treasury Board; Public Works Canada; Bureau des Traductions; Defence Research Establishment Canada; and NRC.

According to then CSCSI/SCEIO President Nick Cercone, in a letter to NSERC President Gordon MacNabb, cc'd to the President of the Science Council Stuart Smith, Cercone's invitation to the workshop came at the last minute (Cercone, 1984, p. 115). Cercone said that the workshop agenda was already finalized and the omission from the agenda of CSCSI/SCEIO suggested that the Science Council was unaware of its existence, though by 1983 the organization was 10 years old (cf. Cercone, February 1983, p. 6). Cercone was finally granted five minutes to speak about CSCSI/SCEIO activities only after repeated attempts to present his case to the workshop chair (Cercone, 1984, p. 115).

Alan Mackworth and Ray Reiter circulated at the workshop a discussion paper called, "Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada" which was published in the February 1983 issue of the *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS* (Mackworth & Reiter, 1983, pp. 11-14). The discussion paper suggested that NSERC had underfunded computer science and that the academic computer science community in Canada had neglected AI (Ibid., p. 12). It was proposed that NSERC should declare AI "a high priority field" and should, among other things, increase funding for research and graduate student support and provide state-of-the-art computing facilities for AI researchers (Ibid., p. 13).

In the workshop proceedings, a policy for supporting AI in Canada was outlined and some policy recommendations were made. The participants all felt strongly that the Canadian government should provide a strong, long-term commitment to Canadian AI R&D and "not wait until proven applications or breakthroughs emerge" (Science Council, 1983, p. 62, p. 67). The participants recommended that academic research be supported by the creation of one to three AI centres possibly from special NSERC funding (Ibid., pp. 62-63). Another recommendation was the establishment of a centre to focus on applied research for the industrial sector, to be funded by government and industry with close connections to Canadian universities (Ibid., p. 65, p. 68).

(The Science Council of Canada, established by an Act of Parliament in 1966, was closed down in 1992.)

At the workshop, Nick Cercone made a commitment to produce a survey of AI in Canada. (This was not the first time a study of AI in Canada had been proposed. Ted Elcock and Zenon Pylyshyn had suggested to the NRC back in 1973 that such a study be made, but the NRC declined to fund it. And at the 1981 CSCSI/SCEIO AGM, Alan Mackworth also suggested a study be done (Perrault, 1982, p. 5).

A survey questionnaire was published in the February 1983 issue of the CSCSI/SCEIO Newsletter (pp. 15-26). "The response [to the questionnaire] was less than overwhelming, due to a combination of the length of the questionnaire and the inertia of the CSCSI/SCEIO membership" (Cercone & McCalla, 1983, p. 10). The 85-page results of their survey, entitled "CSCSI/SCEIO: Directions for Canadian Artificial Intelligence," were collated 15 February 1984 and published in the March 1984 issue of the *Newsletter of the CSCSI/SCEIO, CMCCS/ACCHO, and CIPPRS* (McCalla & Cercone, 1984, pp. 19-104). A review of AI in Canada based on the survey was published in *AI Magazine* (McCalla & Cercone, 1985).

The 85-page report represented "a comprehensive overview of the state of artificial intelligence in Canada" at the time (McCalla & Cercone, 1984, p. 20). All CSCSI/SCEIO members (approximately 280 of them) were sent the questionnaire. Sixty responses were received, representing 103 individuals (McCalla & Cercone, 1984, p. 27).

After McCalla and Cercone's report appeared, there was discussion at the 1984 CSCSI/SCEIO conference and in the pages of 1985 issues of *CAI/IAC* about whether "CSCSI/SCEIO should take a more active role in providing input to government and industry policy decisions in areas affecting and affected by AI" (*CAI/IAC*, June 1985, pp. 5-6).

Another initiative from the Canadian AI R&D community came from the Canadian Society for Fifth Generation Research, whose membership overlapped considerably with that of CSCSI/SCEIO and whose activities were extensively reported in *Canadian AI/IA au Canada*. In 1985, the society produced "Towards a Canadian 5th Generation Research Plan," that called for investment in the academic and industrial sectors of AI R&D, published as a supplement to the March 1985 issue of *Canadian AI/IA au Canada*.

The final AI policy initiative reviewed in this section is the 1986-1991 Associate Committee on AI (ACAI). This committee had elements of involvement from the AI R&D community and from federal government. It was initiated by people from the former but was sponsored by the NRC, which is a branch of federal government (see Section 7).

ACAI was formed by the NRC in December 1986 (NRC, 1988, p. 4). It formed after discussions in the summer of 1986 between the NRC, Fraser Mustard (President of CIAR), Gordon McCalla (CSCSI/SCEIO President at the time), and Dick Peacocke (CSCSI/SCEIO Past-President at the time).

The use of Associate Committees has been recognized by the NRC since 1917 (Eggleston, 1978, p. 6), the year after the NRC itself came into being (Ibid., p. 1). Associate Committees "act as a focal point and forum in Canada for issues of national concern to the engineering and scientific communities" (NRC, 1989, p. v). At the time ACAI was formed, there were 22 other Associate Committees, some of which had been around since 1945, 1948, and 1952 (NRC, 1987). ACAI was shut down in 1991.

The main objective of the committee was "[t]o act as a focal point and forum for issues related to the development and application of artificial intelligence (AI) in Canada" (NRC, 1987, p. 6). The committee chose three areas of activity as its priority:

* [E]ncourage closer collaboration between AI users and the AI research community in university and government laboratories * Provide advice to

the federal government on strategic planning for AI and other information technologies * Provide advice to the NRC in the development of its application-oriented research and development program in computer technology and AI (NRC, 1988, p. 7).

The third of these priorities was assigned to a sub-committee. This was the second sub-committee created by ACAI. Soon after it was formed, ACAI established a first sub-committee on the social context of AI, "recognizing that artificial intelligence carries with it, not only important technical and economic considerations, but also considerations of a social nature" (NRC, 1979, p. v).

ACAI produced a report in 1989 on the social context of AI (NRC, 1989). Before being shut down in 1991, it also oversaw and published in summary form a 212-page report called "Artificial Intelligence in Canada: A Description by Members of the ACAI" (ACAI, 1991). The report is described at some length in the next section because it was commissioned by Industry, Science and Technology Canada (ISTC) (cf. ACAI, 1991, p. 179), and hence is best categorized as a federal government initiative.

ACAI also produced WorldWatch on AI applications and development, which consisted of abstracts of AI papers from more than 4,000 journals and 1,000 conferences (April 1989, p. 39). Excerpts from WorldWatch were printed in *Canadian AI/IA au Canada* from April 1989 to summer 1991.

ACAI also helped and encouraged Nöel Lazure of the Translation Bureau (part of the Official Languages and Translation Sector of the Department of the Secretary of State) to create a two-volume, 12,000 term French-English vocabulary of artificial intelligence (Lazure, 1988a, 1988b) (Lazure, 1988a, p. v, p. vii). It sold over 800 copies by February 1991.

6. Studies of AI by Federal or Provincial Government (1983-1991)

The second group of policy initiatives in Canadian AI during the 1980s and early 1990s consists of those initiated by federal or provincial governments. In all the federal initiatives, the studies were requested from members of industry with AI R&D experience.

The first such federal initiative was the five-volume Cognos Report, produced in 1983-1984 for the Secretary of State and Department of Communications. The Report recommended an AI strategy for Canada and was studied by the government of the time (Pylyshyn, 1984). The report was produced by CogniCom Inc., a consulting group of Canadian academic researchers headed by Zenon Pylyshyn, consisting of himself and six others (see Section 2).

Two further reports apparently initiated by federal government were those by Cognos Advanced Technology (1985) and Cognos Advanced Technology and Applied AI Systems (1986). The first of these was entitled, "Machine Translation and Natural Language Processing: Opportunities for Artificial Intelligence in Canada." It was prepared in 1984 by Zenon Pylyshyn and Richard Kittredge and published in February 1985. (For a recent historical review of machine translation R&D in Canada, see Macklovitch, 1997). The second was called "Expert Systems: Their Applications in the Canadian Transportation Sector" and was prepared for the Director General of Research and Development at Transport Canada. It was published in January 1986.

A fourth federal report was contracted by the Department of Supply and Services, which asked the Nordicity Group and CAIP Corporation to study potential AI applications in federal government. Their findings were made available in August 1986 (Nordicity Group & CAIP Corporation, 1986). The Nordicity Group was an Ottawa-based research management consulting company on communication and information technologies, and CAIP Corporation was an Ottawa-based company that implemented applications of AI technology (CAIP involved Cognicom in their part of the study). The study identified more than 40 potential AI applications. It also proposed that procurement strategy be developed that would stimulate demand for Canadian AI products and services.

The fifth and final federal report was the 212-page "Artificial Intelligence in Canada: A Description by Members of the ACAI" (ACAI, 1991). The report was commissioned by Industry, Science and Technology Canada (ISTC), conducted by Price Waterhouse, and overseen and published in summary form by the Associate Committee on Artificial Intelligence.

The report was published in January 1991, but according to the preface, the report was completed in July 1990. The report describes the results of a survey that was conducted even earlier. The discussion in the report is based on the contents of 312 questionnaires received

before 27 November 1989 (ACAI, 1991, p. 180). By the end of December 1989, there were 383 survey participants. The response rate was 37% (Ibid.). Appendix 1 of the 1991 ACAI report contains a description of the survey. This appendix is a summary of the original report prepared for Industry, Science and Technology Canada (ACAI, 1991, p. 179).

The survey was known as the Canadian AI Capability Survey and was conducted by Price Waterhouse on a commission from the Technology Policy Branch of Industry, Science and Technology Canada. The survey indicated that there were "more than 1000 full-time and several hundred part-time individuals in Canada involved in AI research, development, and application in more than 300 organizations across Canada" at the time (ACAI, 1991, p. 3).

The only provincial government to have initiated a study of AI was the 1984-1986 government of Québec. The Ministère des communications of the Québec government solicited a report from Richard Parent in 1984 (Parent, 1984) and the Ministère published a listing of useful reference materials about artificial intelligence in Québec in May 1986.

Another useful treatment of the history and promise of AI was a series of TV programs produced by TV Ontario, called "Fulfilling the Dream," that involved a substantial number of important figures in AI, including a substantial number of Canadian researchers (Zenon Pylyshyn, personal communication, 6 December 1998).

7. Federal Institutions Concerned with Artificial Intelligence R&D

Industry Canada is and has been involved in Canadian AI in many different ways. It has a Council of Science and Technology Advisors (CSTA) that includes a member, Dr. Robert Moses, with experience in AI. Moses began as a specialist in emergency medicine, but switched into AI and expert systems and by 1979 was involved in a project called McLeyvier, an expert system-based music system.

Industry Canada includes Strategis (http://strategis.ic.gc.ca), which provides its information resources online. Strategis coordinates some of its advanced technology resources (including information technology) with ITAC.

A search of Strategis for "artificial intelligence" returns 584 hits (search performed 25 October 1998). Of these hits, 301 were names of academic research centres and people with expertise in AI listed in Strategis's National Expertise Index which features many CSCSI/SCEIO members (for the English version see http://strategis.ic.gc.ca/sc_innov/cite/engdoc/search.html). A separate search of this database produced lists of 306 [sic] people and centres with skills in AI, 130 in expert systems, and 210 in robotics. People not in the index can submit their names and skills (http://strategis.ic.gc.ca/sc_innov/cite/engdoc/reg_e.html for English version).

Also among the 584 hits were 32 Canadian companies with expertise in AI listed in the Canadian Company Capabilities (CCC) database. A separate search of this database (http://strategis.ic.gc.ca/sc_coinf/ccc/engdoc/search.html) returned 44 Canadian companies with expertise in expert systems and 109 in robotics. Companies not in the database can register for it (http://strategis.ic.gc.ca/sc_coinf/ccc/engdoc/homepage.html).

The Strategis search also returned 47 hits from the Industrial Research and Development Companies Directory. A separate search of this directory, which is presently a prototype hosted by the NRC (http://www.nrc.ca/programs/indcan/demo/searchrd.html), returned 52 Canadian companies with expertise in AI, seven in expert systems, and 31 in robotics.

Some of the other hits are on patents and trademarks that concern artificial intelligence. These are from databases of the Canadian Intellectual Property Office (CIPO).

Industry Canada runs a program called Technology Partnerships Canada that was created to help companies in particular industrial areas move their pre-commercial products to the market place.

Industry Canada conducts research on new information technologies at the National Research Council and the Communications Research Centre. This research is aimed at developing and testing new technologies for transfer to industry and at developing international standards for communications systems.

The National Research Council runs 16 research institutes, including the Institute for Information Technology (IIT) (http://www.iit.nrc.ca). Work in applied artificial intelligence began in early 1987 in the Knowledge Systems Laboratory in the Division of Electrical Engineering. During the 1990s, the Division of Electrical

Engineering became the Institute for Information Technology and the Knowledge Systems Laboratory became the Interactive Information Group, the Integrated Reasoning Group, and the Seamless Personal Information Networking Group. There are currently five groups within IIT, but AI work is concentrated in the three groups that originated from the Knowledge Systems Laboratory.

IT is a member of the Canadian Technology Network (CTN) (http://ctn.nrc.ca/ctn/ctn.html), also part of NRC, which provides expertise to small and medium-sized technology businesses in Canada.The NRC also runs the Industrial Research Assistance Program (IRAP), which, together with the CTN, provides technology assistance to small and medium-sized businesses (http://www.nrc.ca/irap). IRAP grants are typically given for the development of new high-tech products involving an element of technological risk.

The Communications Research Centre (http://www.crc.ca) in Ottawa, ON has a Network Services and Interfaces Laboratory where Thomas Whalen does a variety of NLP work (see http://debra.dgbt.doc.ca/).

The Department of National Defence (DND) and Transport Canada are also engaged in AI research. At the DND, AI techniques are being used in decision support systems under development at the Research and Development Branch, Val Bélair, PQ. Other National Defence Establishments have monitored AI technology in the past (ACAI, 1991, p. 6, pp. 70-71).

Transport Canada does some AI work at its Transportation Development Centre. "Starting from its initial AI research and development activities in 1983, the development and implementation of relatively complex expert systems is now widespread throughout the department, and becoming more so in the transportation sector as a whole" (ACAI, 1991, p. 8). Some 15 expert systems had been developed or were approaching completion in 1988 (ACAI, 1991, p. 9). "Currently Transport Canada is spending over $2 million annually on AI R&D, primarily for expert system development" (ACAI, 1991, p. 9).

One current project concerns marine transportation. A tracking system for marine search and rescue that uses AI techniques has been developed. It is currently being upgraded. According to Strategis, other AI work at Transport Canada involves air transportation: in 1994, the Air Traffic Services Research and Experimentation Centre of Transport Canada, Gloucester, ON, conducted work on voice recognition, human machine interfaces, artificial intelligence and expert systems.

Two more branches of federal government that support AI R&D is Energy, Mines and Resources Canada and the Government Consulting Group. "In the execution of its mandate, Energy, Mines and Resources Canada (EMR) conducts research involving artificial intelligence in a wide variety of application areas" (ACAI, 1991, p. 6) including photo interpretation and satellite data processing, advanced process control, discovery methodologies for geochemical and mineral deposits (Ibid., pp. 72-84). EMR has commissioned reports on the potential applications of AI in such areas as automated cartography and the remote measurement of the thickness of Arctic ice (Zenon Pylyshyn, personal communication, 6 December 1998). "AI activities at the Canada Centre for Remote Sensing (CCRS) are very extensive" (ACAI, 1991, p. 7).

> The Government Consulting Group (GCG), a successor organization to the Bureau of Management Consulting (BMC), continues the previous commitment and active interest in Strategic Technologies, including AI as a major component (ACAI, 1991, p. 7).

Another part of the federal government that has supported AI is the International Development Research Centre (IDRC).

> In 1970 Canada's Parliament created the International Development Research Centre to stimulate and support research in developing countries. The IDRC began supporting AI projects in 1986. The IDRC has held regional seminars on AI applications in Africa and the Far East and has also supported expert system development projects in Peru, Argentina, the Philippines, and Indonesia. Researchers from each of these countries identified, designed, conducted, and managed their own research projects. Drawing from this experience, the IDRC is developing a program for advanced computer technologies that support decision-making for sustainable development and environmental protection (Mikolajuk, 1996, p. 81).

8. Provincial Institutions Concerned with Artificial Intelligence R&D

Many provinces have begun some kind of high-technol-

ogy initiative that provides funding support for applied and in some cases theoretical AI work. Below are some example initiatives from British Columbia, Alberta, New Brunswick, Ontario, and Québec.

Alberta. The Alberta Research Council (ARC) (http://www.arc.ab.ca) was founded in the early 1920s as a Crown Corporation. "It is the largest and oldest Canadian provincial research organization" (p. 29 of CAI/IAC, April 1988, pp. 29, 32-35). In 1985, ARC formed the Advanced Technologies Department "to lead in the diversification of the Alberta Economy through applied research and contract activities in artificial intelligence and automation technologies" (*CAI/IAC*, autumn 1989, ad between pp. 30-31). The Advanced Technologies Department was renamed as the Advanced Computing & Engineering Department. In 1989, the department had 40 employees (ACAI, 1991, p. 8), led by Ernie Chang.

ARC currently has 500 employees, including an Advanced Systems Applications business unit (http://www.arc.bc.ca/ac/index.html) that does work in intelligent systems engineering using sensing, modelling, and control techniques (http://ac.arc.ab.ca/programs). At least some of the modelling work seems based on evidential constraint reasoning (http://www.arc.bc.ca/ac/index.html).

British Columbia. The BC Advanced Systems Institute (http://www.asi.bc.ca/asi), which began in 1986, has a total annual budget of about $3 million and affiliations with about 50 companies (according to the results of a Strategis search). Part of its mandate is to respond to industry needs for technological solutions through "enhancing education opportunities in ... artificial intelligence and robotics" (*CAI/IAC*, September 1986, p. 12).

The Science Council of BC (http://www.scbc.org), which began in 1978, provides Technology BC matching grants for applied research and development in "Computers and Computing" including AI (see www.scbc.org/programs/index.html).

New Brunswick. "At the New Brunswick Research and Productivity Council researchers are using fuzzy logic to implement some portions of a control/alarm/advisory system for drag lines used in open-pit mining. They have also used fuzzy logic in a microprocessor-based temperature control system" ([Ernest Chang] ACAI, 1991, p. 91).

In 1990, New Brunswick created the University of New Brunswick Artificial Intelligence Laboratory (http://www.cs.unb.ca/profs/nickerson/aigroup/aigrsum1.html) "To help New Brunswick companies solve industrial problems using artificial intelligence techniques."

Ontario. The Ontario government provided some financial support for the founding of CIAR.

The Ottawa Centres of Excellence program founded the Information Technology Research Centre (ITRC) in 1987, supported by Ontario's Council Technology Fund. "The ITRC promotes fundamental and applied research in information technologies at the Universities of Toronto, Waterloo, Queen's, and Western Ontario" (ACAI, 1991, p. 4).

Québec. The centre de recherche informatique de Montréal (CRIM) is a non-profit corporation created in October 1983 by the four Montréal universities, and officially inaugurated in October 1985. It was expanded in 1988. CRIM designated AI as a research priority. In January 1993, $2.8 million of federal funding was announced for the creation of a software engineering services division.

The centre de recherche industrielle du Québec (CRIQ), created in 1969, helps provide businesses with industrial and technological information (http://www.criq.qc.ca/english/general_informations.html#CRIQ's Mission). CRIQ has two labs, one in Sainte-Foy, the other in Montréal. Their expertise includes artificial vision and robotics (see [Ernest Chang] ACAI, 1991, p. 91).

The Laboratoire de Recherche Appliquée en Linguistique Informatique (RALI) (http://www-rali.iro.umontreal.ca/Accueil.en.html) was created in 1995 (http://www.ledevoir.com/REDaction/PLAnete/PLA_170898/PLA_170898.html). In 1997, it adopted natural language processing work formally done at the Centre for Information Technology Innovation (Citi), which has been shut down. (Citi itself was formerly known as the Canadian Workplace Automation Research Centre (CWARC), which opened November 1985.)

9. Analysis and Summary Observations

This section has three parts. In Section 9.1., comparisons are made between this article and its three main sources of historical material. Section 9.2. some causal links are suggested between the recommendations made in certain 1980s documents about AI policy in Canada

and subsequent developments in that policy at the federal government level. In Section 9.3., Canada's AI R&D infrastructure is summarized.

9.1. Information Sources for This Article

This article draws on three main sources:

(1) many news items in *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*,

(2) the 85-page survey of Canadian AI conducted in 1983 by Gordon McCalla and Nick Cercone for CSCSI/SCEIO (McCalla & Cercone, 1984, pp. 19-104), and

(3) the 212-page survey of Canadian AI conducted in 1989 by Price Waterhouse and published by the Associate Committee on Artificial Intelligence (ACAI, 1991).

These three sources and this article differ in a number of ways. The articles in (1) are highly informative but give an atomized picture of Canadian AI R&D. Considerable work had to be done to piece together the information from these articles to make a coherent whole. Surveys (2) and (3) provide a coherent whole; their primary goal is to present a snapshot of AI in Canada at particular times.

There are two main differences between this article and the surveys. First, this article has a more historical perspective, noting major trends in AI in its section 2. Second, this article looks more actively at the efforts made by the Canadian R&D community to promote information technology generally (in Section 3) and AI particularly (Section 5). The two surveys are viewed as efforts to promote AI and are noted as events of historical significance in Sections 5 and 6.

This article most resembles those surveys in its Section 4 (description of federal and industrial funding support for Canadian AI R&D), Section 8 (description of provincial funding support for same), and Section 7 (federal institutions actively involved in conducting AI research). The interested reader will find more of the same kind of material in the 1983-1984 and 1989 surveys.

9.2. Causal Connections?

As we have seen, there have been many attempts to formulate a policy for Canadian AI. Many documents have been produced that made policy recommendations, including Mackworth and Reiter's (1983) discussion paper circulated at the 1983 AI workshop organized by the Science Council of Canada; the recommendations made in the proceedings of that workshop (Science Council, 1983); the 1983-1984 Cognos Report; the 1985 plan produced by the Canadian Society for Fifth Generation Research; and the 1986 report about potential AI applications in federal government, prepared by the Nordicity Group and CAIP Corporation. Did any of these documents influence subsequent AI R&D policy in Canada?

It is not easy to say for sure that a certain document influenced a certain policy unless some explicit statement was made by the policy-makers. However, certain recommendations made in two documents seem to so accurately foretell later government AI R&D policy that some kind of causal connection between documents and policy seems highly likely.

The first of these documents is the proceedings of the 1983 AI workshop organized by the Science Council of Canada. As noted in Section 5, the participants all felt strongly that the Canadian government should provide a strong, long-term commitment to Canadian AI R&D and "not wait until proven applications or breakthroughs emerge" (Science Council, 1983, p. 62, p. 67). Another workshop recommendation was the establishment of a centre to focus on applied research for the industrial sector, to be funded by government and industry with close connections to Canadian universities (Ibid., p. 65, p. 68).

The first of these recommendations seems to foreshadow IRIS, established 1989; the second, PRECARN, founded 1987.

The second of the documents was the report produced by the Nordicity Group and CAIP Corporation (Nordicity Group & CAIP Corporation, 1986). The companies were commissioned by the Department of Supply and Services to study potential AI applications in federal government. They found more than 40 potential AI applications. It also proposed that procurement strategy be developed that would stimulate demand for Canadian AI products and services.

The recommendations about a procurement strategy would seem to have influenced the $10-million, 5-year Artificial Intelligence Research and Development Fund, announced by the federal government in April 1990 (see Section 4.8). The fund was "a procurement-based pro-

gram which will use the federal government as a test bed to assist in the development of private sector capabilities in artificial intelligence" (CAI/IAC, July 1990, p. 8).

9.3. Infrastructure Summary

The infrastructure of Canadian AI R&D gradually fell into place during the 1950s, 1960s, and 1970s. CIPS was founded in 1958, the Science Council of Canada in 1966, the first faculty with an AI background were appointed in the early 1960s and the first AI faculty in the mid-late 60s.

In the 1970s, the Canadian AI community gradually came together as new people were added — mainly faculty and graduate students. CSCSI/SCEIO was founded in 1973. Its members networked through the CSCSI/SCEIO newsletter, which appeared intermittently through the mid-late 70s, and the bilingual CSCSI/SCEIO conferences, which began in 1976. It is noteworthy that CSCSI/SCEIO pre-dated the establishment of AAAI by seven years, and that three CSCSI/SCEIO conferences were held before the first AAAI conference in 1982. Another development in Canada was the creation of NSERC in 1978. During this 70s, AI consolidated itself as a branch of computer science, though it had many critics within computer science itself.

During the 1980s, AI was much hyped and the Japanese Fifth Generation project, announced in late 1981, generated concern and in many cases a financial response from North American and European countries (see *CAI/IAC*, March 1995, p. 9).

There was considerable activity in Canada. The first Canadian AI company was incorporated in 1983. In 1982, CIAR was created, and the Science Council ran their two-day workshop on AI in 1983. Two major surveys in 1983-1984 (McCalla & Cercone, 1984) and 1989 (ACAI, 1991) gave a detailed picture of the stage of AI R&D in Canada. By the end of the 80s, the practical, economic importance of AI had been established, as had the viability of the distributed centres of excellence model, instigated by CIAR, and then PRECARN and IRIS. PRECARN was formed in 1987/1989 and IRIS was created in 1989 as part of the Federal Networks of Centres of Excellence (NCE) program, launched in 1989. The $10 million, 5-year Artificial Intelligence Research and Development Fund was announced in 1990. There was substantial involvement from the private sector in funding and decision-making in some initiatives, especially CIAR and PRECARN.

In a parallel development, the federal government funded research in robotics and automation techniques through STEAR (1987) and CSA (1989). (Later, CSA and PRECARN formed an alliance to integrate AI techniques into the CSA's robotics research.)

It was also during the late 1980s that the Associate Committee on Artificial Intelligence (ACAI) was formed; the *CSCSI/SCEIO Newsletter* was transformed into *CAI/IAC Magazine* through the efforts of Graeme Hirst, Roy Masrani, and others ; CSCSI/SCEIO membership peaked (see "Twenty Five Years of CSCSI/SCEIO and *CAI/IAC*" in this issue); and the Canadian federal government began to support AI projects abroad in the developing world.

In the 1990s, it could be argued that AI has been recognized as a mature discipline. AI techniques have been incorporated into the mainstream of advanced information technology and AI has been recognized as a subject to be pursued seriously if Canada is to remain abreast of developments in IT. It has had several rounds of federal funding as part of the NCE program, the latest being funding for PRECARN-II for 1996-2000 and IRIS-III for 1998-2005 (subject to a satisfactory mid-term evaluation). PRECARN-I was awarded $16 million by Industry Canada for 1989-1995; PRECARN-II received $19.4 million from Industry Canada for 1995-31 March 2000. A business plan is being written and submitted to Industry Canada for a PRECARN-III. This funding is likely to be granted because PRECARN administers IRIS, which has funding guaranteed until 2002 (and earmarked until 2005). As for IRIS, IRIS-I received $24.8 million for 1990-1994; IRIS-II received $25 million for 1994-1998; and IRIS-III has been given $17.5 million through to 31 March 2002, with further funding through to 31 March 2005 if the first half of IRIS-III is positively reviewed.

NCEs received an average $3.3 million a year from the NCE budget and a roughly similar amount in cash and kind from industry and other partners (*Contact*, 1998, p. 4). However, other Western countries are also funding AI R&D heavily. For example, during the years 1989-1994, the US federal government provided almost US$150 million per year in AI funding (i.e., close to US$900 million), with 80% coming from the Defense Department, according to a 1994 US Commerce Department report (see Charles, 1995, p. 70). If we combine known Canadian federal government funding for 1989-

1994 from PRECARN ($13.3m pro-rated), IRIS ($24.8m), and the Artificial Intelligence Research and Development Fund (assuming all $10m was spent), this equals approximately CDN$8.02 million per year (about CDN$48.1 million in total). In per capita terms, this means that the US outspent Canada in AI R&D by a factor of roughly 2.15 (assuming parity between the Canadian and US dollar which is, of course, not the case). Note that this comparison does not take into account other possible sources of Canadian funding for the period from, for example, NSERC.

The Fifth Framework program, or FP5 for short (http://www.cordis.lu/fp5/) is a Europe-wide R&D program in high technology for 1998-2002. It succeeds FP4, which ran 1994-1998. Its budget is 13,700 million euro. AI research falls largely under its theme 2 (Creating a User-Friendly Information Society), also known as the Information Society Technologies (IST) thematic programme, which is to receive 3,600 million Euros. (As of 5 September 1999, 1 Euro = 1.578 Canadian dollars, hence the IST programme is receiving around CDN$5,680 million for 1998-2002.)

Artificial intelligence has a modest but not insignificant presence at Industry Canada. A member of its Council of Science and Technology Advisors has AI experience. The terms "artificial intelligence" and "expert systems" appear in many of the databases of Strategis, Industry Canada's online resource. Strategis searches (and recent journal surveys) suggest that AI techniques are in considerable use in Canada and elsewhere.

There have been no significant policy documents in the 1990s. Perhaps the Canadian AI R&D community is satisfied with the existing infrastructure and sees no need to work to change it.

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Bibliography

ACAI [Associate Committee on Artificial Intelligence]. See National Research Council of Canada Associate Committee on Artificial Intelligence.

Amsler, Robert A. (1992). Literature, AI. In Stuart C. Shapiro (Ed.). *Encyclopedia of Artificial Intelligence, Second Edition.* New York, NY: John Wiley & Sons, pp. 844-850.

Canadian Society for Fifth Generation Research (1985). Towards a Canadian 5th Generation Research Plan. Drafted by Eric Manning, Nick Cercone, Ric Holt, John Mylopoulos, and Jean Vaucher (steering committee of CSFGR) for the membership. Approved by members ballots, 21 January 1985. Supplement to *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, March 1985.

Cercone, Nick (1984). Letter to Dr. Gordon M. MacNabb dated 10 January 1984. Published in the *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 3, No. 1, March 1984, pp. 115-117.

Cercone, Nick, and Gordon McCalla (1983). Questionnaire to Survey AI Research Interests and Opinions on a National AI Policy. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 2, No. 1, February 1983, pp. 15-26.

Charles, John (1995). US Lead Narrowing in AI. *IEEE Expert: Intelligent Systems & Their Applications*, Vol. 10, No. 1, February 1995, pp. 70-72.

CogniCom Inc. (1984). *Cognos Report.* Prepared by CogniCom Inc. for the Secretary of State and Department of Communications. Five volumes.

Cognos Advanced Technology (1985). *Machine Translation and Natural Language Processing: Opportunities for Artificial Intelligence in Canada.* Prepared by Cognos Advanced Technology, February 1985. Available [in 1991] from the Department of Communications and the Department of the Secretary of State, Ottawa.

Cognos Advanced Technology and Applied AI Systems (1986). *Expert Systems: Their Applications in the Canadian Transportation Sector.* TP 7328E. Prepared by Cognos Advanced Technology and Applied AI Systems for the Director General, Research and Development, Transport Canada, Ottawa, January 1986.

Contact (1998). Publication of NSERC, Ottawa, ON. Fall 1998, Vol. 23, No. 3.

Arthur J. Cordell (1985). *The Uneasy Eighties: The Transition to an Information Society.* Ottawa, ON: Science Council of Canada, March 1985.

Feigenbaum, Edward A., and Joshua Feldman (1963). *Computers and Thought.* New York, NY: McGraw-Hill.

Eggleston, Wilfred (1978). *National Research in Canada: The NRC 1916-1966.* Toronto, ON: Clarke, Irwin & Company Ltd.

Gabriel, A. (1992). LISP. In Stuart C. Shapiro (Ed.).

Encyclopedia of Artificial Intelligence, Second Edition. New York, NY: John Wiley & Sons, pp. 819-842.

Greenblatt, R., G. Coret, and M. Kreeger (1992). LISP Machines. In Stuart C. Shapiro (Ed.) *Encyclopedia of Artificial Intelligence, Second Edition.* New York, NY: John Wiley & Sons, p. 843.

Hayes-Roth, Frederick (1997). Artificial Intelligence: What Works and What Doesn't? *AI Magazine*, summer 1997, Vol. 18, No. 2, pp. 99-113.

Lazure, Nöel (1988a). *Vocabulaire de l'Intelligence Artificielle = Artificial Intelligence Vocabulary (Bulletin de terminologie = Terminology bulletin ; 184), Volume 1 = Vocabulaire Anglais-Français / English-French Vocabulary.* Text in French and English. Issued by the Translation Bureau, Terminology and Linguistic Services Branch, Canadian Government Publishing Centre, Ottawa, ON.

Lazure, Nöel (1988b). *Vocabulaire de l'Intelligence Artificielle = Artificial Intelligence Vocabulary (Bulletin de terminologie = Terminology bulletin ; 184), Volume 2 = Lexique Français-Anglais / English-French Glossary.* Texte en français et en anglais. Publié par le Bureau des traductions, Direction générale de la terminologie et des services linguistiques, Centre d'édition du gouvernement du Canada, Ottawa, ON.

Perrault, C. Raymond (1982). CSCSI/SCEIO Annual Meeting: August 28, 1981. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, March 1982, pp. 4-5.

Mackworth, Alan, and Ray Reiter (1983). Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada. Paper circulated at workshop on AI organized by the Science Council of Canada, 19-21 January 1983. Published in the *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 2, No. 1, February 1983, pp. 11-14.

Macklovitch, Elliott (1997). MT R&D in Canada. In Virginia Teller and Beth Sundheim (Eds.). *Proceedings of Machine Translation Summit IV, Machine Translation: Past, Present, Future*, San Diego, CA, 29 October–1 November 1997, pp. 200-210.

MacNabb, Gordon (1984). Letter to Stuart Smith dated 23 November 1983. Published in the *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 3, No. 1, March 1984, pp. 109-113.

McCalla, Gordon, and Nick Cercone (1984). CSCSI/SCEIO: Directions for Canadian Artificial Intelligence. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 3, No. 1, March 1984, pp. 19-104.

McCalla, Gordon, and Nick Cercone (1985). Artificial Intelligence in Canada: A Review. *AI Magazine*, Vol 5, No 4, Winter 1985, pp. 50-58.

McDermott, Drew, M. Mitchell Waldrop, Roger Schank, B. Chandrasekaran, John McDermott [and Ron Ohlander] (1985). The Dark Ages of AI: A Panel Discussion at AAAI-84. *AI Magazine*, Vol. 6, No. 3, Fall 1985, pp. 122-134.

Mikolajuk, Zbigniew (1996). The IDRC: Promoting AI in Developing Countries. *IEEE Expert*, Vol. 10, No. 6, December 1996, pp. 81-82.

Ministère des communications (1986). *L'intelligence artificielle au Québec — Références utiles.* Ministère des communications, Gouvernement du Québec, Québec, May 1986.

National Research Council of Canada (1987). Associate Committees 1987. Ottawa, ON: National Research Council of Canada, October 1987.

National Research Council of Canada (1988). Associate Committees 1988. Ottawa, ON: National Research Council of Canada, November 1988.

National Research Council of Canada Associate Committee on Artificial Intelligence (1989). *The Social Context of Artificial Intelligence: A Guideline and Discussion Paper.* NRCC No. 30187. Ottawa, ON: National Research Council of Canada, June 1989.

National Research Council of Canada Associate Committee on Artificial Intelligence (1991). *Artificial Intelligence in Canada: A Description by Members of the ACAI.* NRCC No. 31789. Ottawa, ON: National Research Council of Canada, January 1991. French version: Intelligence Artificielle au Canada — Memoire Preparé Par les Membres du Caia. Both can be ordered from NTIS (National Technical Information Service) Springfield, VA (www.ntis.gov). NTIS Order Number: MIC-91-05447INZ (English, microfiche only), N94-13820/3INZ (French).

Nordicity Group and Canadian Artificial Intelligence Products Corp. (1986). *Opportunities for the Use of Artificial Intelligence Systems within the Government of Canada.* Study by Nordicity Group and Canadian Artificial Intelligence Products Corp. for the Ministry of State for Science and Technology, Ottawa, August 1986.

Parent, Richard (1984). *Point de vue québecois sur l'intelligence artificielle.* Produced for le Ministère des communications du Québec, Québec. ISBN 2-550-1473-6.

PRECARN (1995). *PRECARN 1995 Annual Report.* Nepean, ON: PRECARN Associates Inc.

PRECARN (1997). *PRECARN 1997 Annual Report.*

Nepean, ON: PRECARN Associates Inc.

Pylyshyn, Zenon (1984). Company Report: CogniCom. *Canadian Artificial Intelligence Magazine*, No.1 (new series), September 1984, pp. 12-13.

Pylyshyn, Zenon (1998). Artificial Intelligence. In James H. Marsh (Ed.-in-Chief). *The Canadian Encyclopedia, Second Edition*. Edmonton, AB: Hurtig Publishers, p. 130.

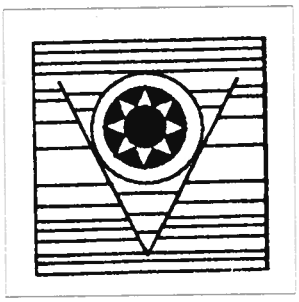
Schaeffer, Jonathan (1997). *One Jump Ahead: Challenging Human Supremacy in Checkers*. New York, NY: Springer-Verlag.

Schaeffer, Jonathan, Robert Lake, Paul Lu, and Martin Bryant (1996). Chinook: The World Man-Machine Checkers Champion. *AI Magazine*, Vol. 17, No. 1, pp. 21-29.

Science Council of Canada (1983). *A Workshop on Artificial Intelligence: A Proceedings*. Ottawa, ON: Science Council of Canada, August 1983.

Shapiro, Stuart C. (1992). Artificial Intelligence. In Stuart C. Shapiro (Ed.). *Encyclopedia of Artificial Intelligence, Second Edition*. New York, NY: John Wiley & Sons, pp. 54-57.

US Commerce Department (1994). *Critical Technology Assessment of the US Artificial Intelligence Sector*. Report PB 93-192409, Office of Industrial Resource Administration (OIRA), US Commerce Department, August 1994, 224 pp. Can be ordered from NTIS (National Technical Information Service) Springfield, VA (www.ntis.gov). NTIS Order Number: PB93-192409INP.



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Twenty Five Years of CSCSI/SCEIO and *Canadian Artificial Intelligence / Intelligence Artificielle au Canada*

Dan Fass

Résumé

La première partie de cet article présente une histoire de la Société canadienne pour l'étude d'intelligence par ordinateur/Canadian Society for Computational Studies of Intelligence (SCEIO/CSCSI) qui a commencé en 1973, et sa publication *Intelligence Artificielle au Canada/Canadian Artificial Intelligence* (*IAC/CAI*), qui a debuté en 1974, comme la *CSCSI/SCEIO Newsletter.* La deuxième partie de l'article présente et discute divers problèmes encourus par la SCEIO/CSCSI et l'*IAC/CAI*, particulièrement en rapport à la baisse du nombre de membres de la société depuis sa crête à la fin des années 80.

Abstract

The first part of this article gives a history of the Canadian Society for Computational Studies of Intelligence/ Société canadienne pour l'étude d'intelligence par ordinateur (CSCSI/SCEIO) was started in 1973, and its publication *Canadian Artificial Intelligence/Intelligence Artificielle au Canada* (*CAI/IAC*), which began in 1974 as the *CSCSI/SCEIO Newsletter.* The second part of the article presents and discusses various problems faced by CSCSI/SCEIO and *CAI/IAC*, notably the decline of the society's membership from its peak in the late 1980s.

1. Introduction

The Canadian Society for Computational Studies of Intelligence/Société canadienne pour l'étude d'intelligence par ordinateur (CSCSI/SCEIO) was formed in May 1973. CSCSI/SCEIO has since engaged in many activities, but the most frequent activity, and the one that perhaps best mirrors the activities of CSCSI/SCEIO as a whole, is its publication *Canadian Artificial Intelligence/Intelligence Artificielle au Canada* (frequently referred to hereafter as *Canadian AI/IA au Canada* or *CAI/IAC*), which began in February 1974 as the *CSCSI/ SCEIO Newsletter.* References in this article that consist of just a year plus month or season(s) enclosed in brackets, e.g., "(October 1987)", are to the issue of *CAI/ IAC* of that date.

This article is in two parts. The first part (Sections 2-4) is a historical review of the first twenty five years of CSCSI/SCEIO and *CAI/IAC*. It is intended to be a neutral description. The second part (Sections 5-8) is a presentation and analysis of various concerns that currently face CSCSI/SCEIO and *CAI/IAC*. It is a more personal, subjective view.

In the first part, Section 2 provides a brief overview of some of the main elements of CSCSI/SCEIO: its founding and administration, the composition and size of its membership over time, and its mandate as described in its constitution. Section 3 looks at the extent to which the mandate has been implemented. Section 4 provides a brief historical overview of *CAI/IAC*.

In the second part, five possible concerns for CSCSI/ SCEIO are outlined in Section 5. The most important of these concerns is the largely uninterrupted fall in CSCSI/SCEIO membership since the late 1980s. In Section 7, reasons are presented for the fall in membership in the 1980s and 1990s but, before this, reasons are presented in Section 6 for the earlier rise in CSCSI/ SCEIO membership in the 1970s and 1980s. In Section 8, some suggestions are made for dealing with the fall in membership by addressing the other four problem issues.

This article refers to many events in AI in Canada that are covered in depth in the article "The Infrastructure of Artificial Intelligence R&D in Canada," part 2 of which appears elsewhere in this issue (part 1 appeared in issue 43). For this reason, people may find it helpful to read the infrastructure article before reading this one.

2. A Brief Overview of CSCSI/SCEIO

Some key historical aspects of CSCSI/SCEIO are considered in this section. The founding and administration of the organization is described in Section 2.1., the size of its membership is reviewed in 2.2., and its mandate is described in 2.3.

2.1. Founding and Administration

CSCSI/CSEIO was founded at an informal workshop organized by the AI group at the University of Western

Ontario on 23-25 May 1973. To the 30 Canadian researchers who attended,

> It quickly became apparent that there was more interest in AI in Canada than any of us had imagined, and moreover, that geographical dispersion and a lack of any substantial centres of research prevented any kind of reasonable communication or collaboration. Accordingly, it was decided that some sort of professional society should be formed (Reiter, 1974, p. 3).

A Steering Committee was established with the following members. Ted Elcock of the Department of Computer Science, University of Western Ontario, was the first Chair of CSCSI/SCEIO. The first Secretary-Treasurer was John Hart from the same department.

Eight members were also appointed to the Steering Committee. They were from computer science, psychology, mathematics, and electrical engineering departments in BC, Alberta, Ontario, and Québec: George Baylor, Jean Gascon, and Zenon Pylyshyn (all from psychology departments); Wayne Davis, John Mylopoulos, and Richard Rosenberg (from computer science departments); Martin Levine (electrical engineering); and Tom Pietrzykowski (applied analysis).

The Steering Committee continued until 1978, when it was replaced by an Executive consisting of four positions: President, Vice President, Treasurer, and Secretary. The position of Past-President was added to the Executive in 1988 and the Editor of *CAI/IAC* was added in 1990. Executive positions have been filled by people from academia with the exception of Dick Peacocke (Bell-Northern Research), who was President 1986-1990; Grant Thomas (Price Waterhouse Canada) who was Treasurer for a few months in 1990 before resigning and moving to France; and Peter Patel-Schneider (AT&T Bell Labs, Mountain Hill, NJ) who was Secretary 1990-1994.

After the workshop, Elcock contacted the National Research Council (NRC) about the level of funding support provided by the NRC's Grants & Scholarship Council for computational studies of intelligence in Canada. A study grant of $2000 was requested, but was not granted. (The correspondence back and forth was published in the *CSCSI/SCEIO Newsletter* — see February 1974, pp. 5-14).

The first *CSCSI/SCEIO Newsletter* appeared in February 1974, edited by Ray Reiter. A CSCSI/SCEIO membership application was included on the last page. Annual dues were $3.

A second CSCSI/SCEIO workshop was held in Ottawa on 28-29 May 1975, which 77 people attended (Mylopoulos, 1976, p. 7). The participants were from university departments of computer science, psychology, engineering, and mathematics. There were some participants from government agencies (such as the National Research Council and the Department of National Defence) and from industry (e.g., Bell Northern and IBM).

Since those first workshops in 1973 and 1975, CSCSI/SCEIO has held its AGMs at its own biennial conferences. On years when those conferences do not take place, the AGM has been held at other conferences such as IJCAI and AAAI and, more recently, at IRIS-PRECARN annual conferences. For example, the 1985 CSCSI/SCEIO annual general meeting was held at IJCAI-85 in Los Angeles on Thursday 22 August 1985, which approximately 50 people attended. Similarly, the 1989 CSCSI/SCEIO annual general meeting was held on Thursday 24 August 1989 at IJCAI-89 in Detroit, Michigan. And the 1991 CSCSI/SCEIO annual general meeting was held on Thursday 18 July 1991 at AAAI-91.

The 1994 annual general meeting of CSCSI/SCEIO was held 18 May 1994 during AI/GI/VI '94 in Banff, Alberta. The 1996 annual general meeting was held Thursday 23 May 1996 at AI/GI/VI '96 in Toronto. The 1998 annual general meeting was held 18 June 1998 during AI/GI/VI '98 in Vancouver, BC. The 1997 AGM was held during the 1997 IRIS-PRECARN annual conference.

A draft constitution for CSCSI/SCEIO, prepared by Richard Rosenberg, was published in the August 1976 *CSCSI/SCEIO Newsletter* (pp. 2-5), but it wasn't until 1980 that a constitution was adopted for CSCSI/SCEIO (Cercone & McCalla, 1983, p. 3).

The delay was caused by extended discussion about whether or not to affiliate with the Canadian Information Processing Society (CIPS) or the Computer Science Association (CSA) — particularly CIPS. Discussion was under way as early as 1976. There was further discussion about affiliating with CIPS at the 1978 (annual?) general meeting of the CSCSI/SCEIO and, according to Mackworth (1999), CSCSI/SCEIO formally affiliated with CIPS in 1978 or 1979, probably the

former.

The main service CIPS provides CSCSI/SCEIO is maintenance of the organization's membership list. It charges a fee per CSCSI/SCEIO subscriber for this service.

2.2. Composition and Size of Membership

This section addresses two issues regarding the membership of CSCSI/SCEIO. The first issue is what kinds of people are members of CSCSI/SCEIO. The second is how the size of the membership has changed over the years.

With regard to the first issue, the first CSCSI/SCEIO workshop in 1973 was attended largely by people from academia. Of the 32 attendees, all but four were from university departments of computer science, psychology, philosophy, engineering, and medicine. Among the other four, three came from the Communications Research Centre, Ottawa, and the fourth was from the National Research Council (Reiter, 1974, pp. 8-10). The 77 attendees of the second workshop in 1975 had a similar composition, though some people came from industry (Mylopoulos, 1976, p. 7).

Ten years later, in the October 1987 issue of *CAI/IAC*, the membership of CSCSI/SCEIO was identified as consisting of people from the Canadian AI R&D community in industry and academia, and key people in the Canadian media and federal and provincial governments. A breakdown of the CSCSI/SCEIO membership for June 1988 shows that membership had indeed diversified from an academic base to a much broader base. The 714 members at the time consisted of (Peacocke, 1988):

	Regular	Student
University or College	127	91
Industry	219	5
Government	21	—
Unknown	195	55

With regard to the second issue --- how the size of membership has changed — I have only been able to uncover membership figures from March 1983 to April 1994. The following description of changes in the size of membership is for that period only.

CSCSI/SCEIO membership peaked at just under 900 in January 1988. It has fallen ever since, with, apparently, a sharp decline during 1992-1993 and another in late 1994. The only exception to the decline was a brief rise during a membership drive by Ian Witten in 1991.

Here are the membership figures for 1983-1994 in more detail. In March 1983, "there were approximately 280 members of the CSCSI/SCEIO" (McCalla & Cercone, 1984, p. 27). In March 1984, there were 283 members of CSCSI/SCEIO (Davis?, 1984, p. 1). There were 450 CSCSI/SCEIO members in December 1984 and 535 in March 1985. These mesh with figures, reported in the October 1988 issue of *CAI/IAC* (Goebel, 1988b, p. 7), that membership was 283 in March 1984, 650 in September 1985, 799 in March 1986, 853 in March 1987. Elsewhere, it was reported that membership was 900 or slightly above in spring 1987 and just under 900 in January 1988 (Goebel, 1988a).

In October 1988, membership had dropped to 713 (Peacocke, 1988) — the breakdown of this membership was given in 2.4.— and had fallen to "between 500 and 600 members" during 1991 (or from 1991, p. 6). Ian Witten's membership drive in 1991 added 100 members.

From a membership of 600-700 in late 1991, there was apparently a sharp decline during 1991-1992, then membership steadied between 1992 and 1994, and declined again in late 1994 or some time after that. At the 1994 CSCSI/SCEIO AGM, the following membership figures from CIPS were reported: 460 total members in July 1992, 482 in July 1993, and 470 in April 1994 (summer 1995, p. 3).

No figures are available for new members for the period April 1994–December 1998, though the number of membership renewals are. In 1994, there were 246 membership renewals (winter 1995, p. 2). At the 1995 CSCSI/SCEIO AGM, there were 170 renewals, according to CIPS (summer 1996, p. 3). According to Hamilton (1999), 150 members paid during 1996, 133 during 1997, and 146 members during 1998.

In December 1998, according to the CIPS membership database, there were 134 CSCSI/SCEIO members. There were 146 members in March 1999 and 99 members in September 1999. The preceding membership figures are presented in Chart 1.

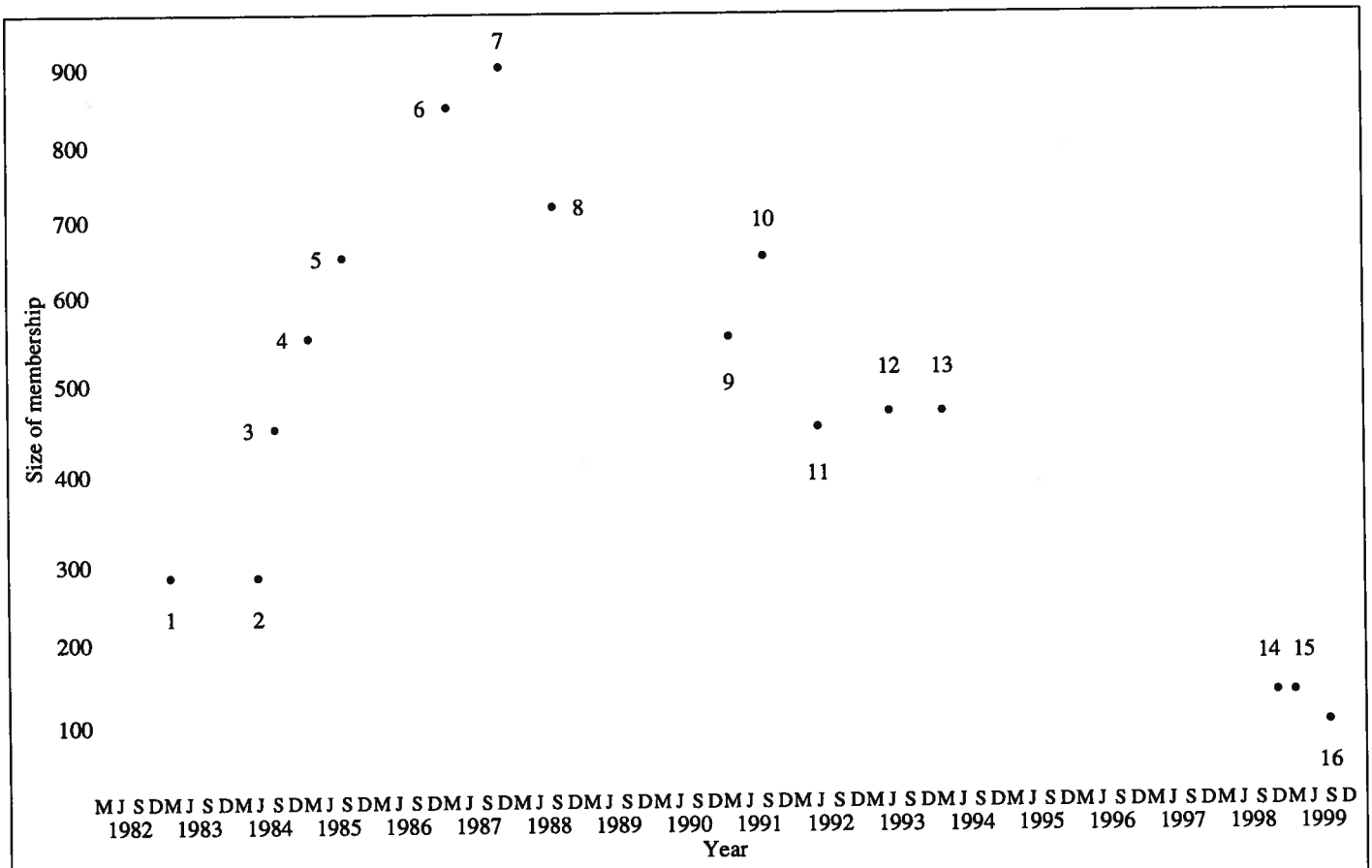


Chart 1: CSCSI/SCEIO Membership March 1983–September 1999
(Key: M = March, J= June, S = September, D = December)

1: 280 (Mar 83)	5: 650 (Sep 85)	9: ~550 (~spring 91)	13: 470 (Apr 94)
2: 283 (Jun 84)	6: 853 (Mar 87)	10: ~650 (~autumn 91)	14: 134 (Dec 98)
3: 450 (Dec 84)	7: <900 (Jan 88)	11: 460 (Jul 92)	15: 146 (Mar 99)
4: 535 (Mar 85)	8: 713 (Oct 88)	12: 482 (Jul 93)	16: 99 (Sep 99)

2.3. Mandate of CSCSI/SCEIO

The mandate of CSCSI/SCEIO was laid out in Article II of the proposed constitution (draft version 2 / 15 May 1976) prepared by Richard Rosenberg, published in the August 1976 issue of *CSCSI/SCEIO Newsletter* (pp. 2-5), and adopted in 1980. Article II was as follows (Rosenberg, 1976, p. 2):

ARTICLE II – PURPOSE

A. CSCSI/SCEIO is organized and will be operated exclusively for educational and research purposes in the interest area of the Computational Studies of Intelligence and in the furtherance thereof.

B. The Society will promote the interest of professionals by:

1. Setting up study groups which will investigate and report on relevant major issues.

2 Organizing both seminar and tutorial meetings.

3. Publishing the CSCSI/SCEIO newsletter containing information of interest to members.

4. Forging and maintaining informed links with Government and Industry.

5. Other appropriate means. No addition may contradict the main purpose stated in Article II.A. above.

The full CSCSI/SCEIO constitution is presented on pages 38-39 of this issue. The next section looks at the extent to which the mandate of CSCSI/SCEIO has been fulfilled over the last 25 years.

3. Fulfillment of the CSCSI/SCEIO Mandate

In this section, the clauses of Article II of the CSCSI/SCEIO constitution are reviewed to see to what extent they have been implemented (Sections 3.1.-3.7.). In Section 3.8., feedback from the membership on the mandate is reviewed. A summary is given in Section 3.9.

3.1. Computational Studies of Intelligence (Article II.A.)

Article II.A. of the CSCSI/SCEIO constitution states that "CSCSI/SCEIO ... will be operated ... in the interest area of the Computational Studies of Intelligence," as the society's name would suggest. Choosing the society's name was the only serious problem that arose at the inaugural 1973 meeting, as Ray Reiter explained:

> In deference to the psychologists and philosophers present, it was agreed not to use the term "Artificial Intelligence" since "natural intelligence", or "intelligence" is what it is all about. On the other hand, everyone was agreed on the computer as a methodological tool. Hence, the Canadian Society for Computational Studies of Intelligence/Societe Canadienne des Etudes d'Intelligence par Ordinateur. Clumsy, but a faithful description of the society's objectives (Reiter, 1974, p. 3).

However, over the years, there has been a decided focus within CSCSI/SCEIO on artificial intelligence rather than computational studies of intelligence, but they are not the same thing: the latter includes the former. Computational studies of intelligence refers to using the computer as a model and methodological tool for studying intelligence, i.e., the computer can be used as an abstract model for thinking about intelligence, as is done in philosophy and psychology, and not just for writing programs that exhibit "intelligent" behaviour, as in artificial intelligence.

There are many examples of CSCSI/SCEIO's shift to AI. For instance, when CSCSI/SCEIO left the joint *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS* in 1984, it took the name *Canadian Artificial Intelligence Newsletter*, rather than reverting to the name *CSCSI/SCEIO Newsletter*. In the first issue, CSCSI/SCEIO was described as "the Canadian society for the promotion of interest and activity in Artificial Intelligence" (September 1984, p. 2), rather than "the promotion of interest and activity in computational studies of intelligence."

Another example is that Gordon McCalla's and Nick Cercone's 1983-1984 survey was titled "CSCSI/SCEIO: Directions for Canadian Artificial Intelligence," not "Directions for Canadian Computational Studies of Intelligence."

3.2. Major Study Groups (Article II.B.1.)

Article II.B.1. of the CSCSI/SCEIO constitution says that the society will "[set] up study groups which will investigate and report on relevant major issues." CSCSI/SCEIO has been directly involved with the creation and work of one such study group, and indirectly involved in the creation and work of at least four others.

This study group in which it was directly involved was the survey of AI in Canada conducted by Gordon McCalla and Nick Cercone in and 1983-1984 (McCalla & Cercone, 1984). At the time, Cercone was President and McCalla was Vice-President of CSCSI/SCEIO and the membership was consulted for the survey. The title of the survey report emphasized the involvement of CSCSI/SCEIO. The title was "CSCSI/SCEIO: Directions for Canadian Artificial Intelligence."

The four or more study groups in which CSCSI/SCEIO was indirectly involved were not sanctioned by CSCSI/SCEIO or conducted in its name as McCalla and Cercone's survey report was, but instead contained major contributions from active CSCSI/SCEIO members working on behalf of other organizations or acting in a private capacity.

One such "study group" was CSCSI/SCEIO members Alan Mackworth (CSCSI/SCEIO President 1980-1982, Vice-President 1978-1980) and Ray Reiter (past *CSCSI/SCEIO Newsletter* Editor), who produced the discussion document, "Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada," which was circulated at a workshop on AI organized by the Science Council of Canada, 19-21 January 1983

(Mackworth & Reiter, 1983).

Another such "study group" was CogniCom Inc., a consulting group of the following Canadian academic researchers, all of whom were CSCSI/SCEIO members: Richard Kittredge, John Mylopoulos, Zenon Pylyshyn, Ray Reiter, John Tsotsos, Robert Woodham, and Steve Zucker. CogniCom Inc. produced the five-volume Cognos Report on AI for the Secretary of State and Department of Communications in 1983-1984 (CogniCom, 1984).

A third study group was the The Fifth Generation Society, also known as the Canadian Society for Fifth Generation Research (CSFGR/SCRSCG) (July 1987, p. 12), whose members overlapped considerably with those of CSCSI/SCEIO. In 1985, it produced a draft Canadian Fifth Generation Plan which was published as a supplement to *CAI/IAC*. The plan was drafted by the Society's Steering Committee which included, among others, Nick Cercone (CSCSI/SCEIO President 1982-1984) and John Mylopoulos (CSCSI/SCEIO President 1978-1980).

A fourth study group was the Associate Committee on Artificial Intelligence (ACAI), which was formed by the NRC in December 1986 (NRC, 1988, p. 4). It formed after discussions in the summer of 1986 involving Gordon McCalla (CSCSI/SCEIO President at the time) and Dick Peacocke (CSCSI/SCEIO Past-President at the time) (summer 1991, p. 2). The main committee of ACAI contained representatives from academia and industry, many of whom were also CSCSI/SCEIO members. The committee also consisted of members from the NRC, PRECARN and the Canadian Labour Congress.

Before being shut down in 1991, ACAI oversaw and published in summary form a 212-page report called "Artificial Intelligence in Canada: A Description by Members of the ACAI" (ACAI, 1991).

3.3. Seminar and Tutorial Meetings (Article II.B.2.)

Article II.B.2. of the CSCSI/SCEIO constitution says that the society will "[organize] both seminar and tutorial meetings." The desire for such meetings was strongly felt at the second CSCSI/SCEIO workshop in 1975, where the hope was expressed that the workshop would develop into a regular annual or biennial conference.

And the following year, the first CSCSI/SCEIO conference was held 25-27 August 1976 at UBC. The second CSCSI/SCEIO conference was held 19-21 July 1978 in Toronto, which attracted 125 people. The third CSCSI/SCEIO conference was held 14-16 May 1980 at the University of Victoria, which 142 people attended. The financial statement for the 1980 conference shows a grant from NSERC for $2500 (Davis, 1980).

The fourth CSCSI/SCEIO conference was held 17-19 May 1982 at the University of Saskatchewan, Saskatoon, in conjunction with the 1982 national conference of CIPS. Eighty people attended.

The fifth CSCSI/SCEIO conference was held 15-17 May 1984 at the University of Western Ontario in London, Ontario.

The sixth CSCSI/SCEIO conference was held 21-23 May 1986 at the École Polytechnique de Montréal in Montréal, for which 375 people registered (June 1986, p. 17).

The seventh CSCSI/SCEIO conference, Artificial Intelligence '88, was held in conjunction with Graphics Interface '88 and Vision Interface '88 on 6-10 June 1988 (July 1987, p. 15). The grand title for the conference as a whole was "Conference '88" (Hamilton, 1988, p. 46). Attendance was 158 for AI '88 and 300 for Conference '88 as a whole (Ibid.). This was the first AI/GI/VI conference.

The eighth CSCSI/SCEIO conference was held 22-25 May 1990 at the University of Ottawa.

The ninth CSCSI/SCEIO conference was held 11-15 May 1992 in Vancouver, British Columbia. It included a one-day workshop on the commercialization of AI technology in Canada, held on 11 May. It was called AI/GI/VI '92, short for Artificial Intelligence '92, Graphics Interface '92 and Vision Interface '92.

The tenth CSCSI/SCEIO conference was held 16-20 May 1994, in Banff, Alberta. It was known as CSCSI '94 and AI '94. The conference was part of AI/GI/VI '94.

The eleventh CSCSI/SCEIO conference was held 21-24 May 1996 in Toronto, Ontario. It was known as AI '96 and was part of AI/GI/VI '96.

The twelfth CSCSI/SCEIO conference was held 18-20

June 1998 in Vancouver, BC. It was known as AI '98 and was part of AI/GI/VI '98. 290 people attended the conference as a whole.

CSCSI/SCEIO has sponsored other workshops and conferences. It organized the workshop Theoretical Approaches to Natural Language Understanding (TANLU) that took place 28-30 May 1985 at Dalhousie University, Halifax. The workshop was attended by about 80 researchers (Hirst, 1985, p. 15).

CSCSI/SCEIO was a co-sponsor, with IJCAI Inc. and the American Association for Artificial Intelligence (AAAI), of the 14th International Joint Conference on Artificial Intelligence (IJCAI-95), which took place in Montréal, 20-25 August 1995. IJCAII, AAAI, and CSCSI/SCEIO agreed to "share benefits or losses in the proportion 40%, 40% and 20%" (De Mori, 1994). The conference was a financial success and provided CSCSI/SCEIO with $11,465.94 in windfall profits (van Beek, 1996).

3.4. *CSCSI/SCEIO Newsletter* (Article II.B.3.)

Article II.B.3. of the CSCSI/SCEIO constitution says that the society will "[publish] the CSCSI/SCEIO newsletter containing information of interest to members."

The *CSCSI/SCEIO Newsletter*, which is now *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, is described at length in Section 4.

CSCSI/SCEIO has also sponsored another publication, *Computational Intelligence* (CI) journal. The journal is described in Section 3.6.

3.5. Links with Government and Industry (Article II.B.4.)

Article II.B.4. of the CSCSI/SCEIO constitution says that the society will "[forge and maintain] informed links with Government and Industry."

CSCSI/SCEIO engaged quite actively in discussion with government and industry in the 1980s. As noted in Section 2.1., immediately after its formation, CSCSI/SCEIO contacted the NRC about the level of funding for computational studies of intelligence in Canada.

In 1983, then CSCSI/SCEIO President Nick Cercone asserted that the organization was a spokesperson for Canadian AI when he insisted that he be granted time to speak at the January 1983 workshop on AI organized by the Science Council of Canada.

In 1983-1984, Cercone engaged in a debate with the then President of NSERC, Gordon MacNabb, about funding levels for AI provided by NSERC.

In 1986, CSCSI/SCEIO was heavily involved in establishing ACAI, which contained many representatives of AI from academia and industry.

CSCSI/SCEIO appears not to have forged many links with government and industry since then. The formation of PRECARN in 1987/1989 provided a linkage between government and industry on AI, and IRIS (formed in 1989) involved AI R&D workers in academia and industry. The direction of AI research in IRIS is set by the IRIS Research Committee which consists of researchers and some PRECARN representation (Mackworth, 1999). The direction of research is also set by the researchers themselves, but CSCSI/SCEIO as an organization has no input.

3.6. Other Appropriate Means (Article II.B.5.)

Article II.B.5. of the CSCSI/SCEIO constitution says that the society will use "[o]ther appropriate means" to promote the interest of its members, as long as they do not "contradict the main purpose stated in Article II.A. of the constitution."

Two particular examples of "other appropriate means" come to mind. The first example is the affiliations that CSCSI/SCEIO has formed with other non-profit organizations promoting information processing and AI, notably CIPS (see Section 2.1.) and IJCAII (International Joint Conferences on Artificial Intelligence Inc.), the international organization headquartered in the US (October 1987, p. 4). CSCSI/SCEIO and IJCAII co-sponsored IJCAI-95 with AAAI (the American Association for Artificial Intelligence) (see Section 3.3.).

The second example is publications that CSCSI/SCEIO has sponsored other than its own newsletter: CSCSI/SCEIO was involved in the creation of *Computational Intelligence* (*CI*) journal, originally to be called *Computational Studies of Intelligence* (cf. McCalla & Cercone, 1984, pp. 128-141). The first issue of *CI* appeared in Spring 1985, sponsored by CSCSI/SCEIO and the National Research Council. The editors, who serve at the discretion of the CSCSI/SCEIO Executive and

membership (McCalla & Cercone, 1984, p. 131), were (and remain) Nick Cercone and Gordon McCalla (Randy Goebel was added as a co-editor in 1998). Later, *CI* switched publishers from its original publisher, NRC, to Blackwell (summer 1991, p. 2; Turney, 1998).

3.7. Other CSCSI/SCEIO Activities

In 1991, Janice Glasgow suggested the creation of CSCSI/SCEIO distinguished service awards. Awards were given to John Mylopoulos in 1992, Alan Mackworth in 1994, and Nick Cercone in 1996. No award was given in 1998.

3.8. Feedback on the Mandate from the Membership

Some sense of how the membership of CSCSI/SCEIO has viewed the organization's mandate can be gathered from the survey of AI in Canada conducted by Gordon McCalla and Nick Cercone in 1983-1984 (McCalla & Cercone, 1984). In the questionnaire used in the survey, respondents were given the opportunity to comment on the present and future role of CSCSI/SCEIO. Their answers throw light on what CSCSI/SCEIO members think of the organization's mandate and on ways they would like to see it changed.

Their views on the organization's mandate can be seen in the answers respondents gave when "[they] were asked to comment on the roles they saw as most important for the CSCSI/SCEIO, in order of priority" (Ibid., p. 66). The most important roles were providing information to AI researchers (68%), hosting a Canadian AI conference (63%), representing Canada to the worldwide AI community (52%), providing information to government agencies other than NSERC (50%), providing information to NSERC (47%), providing information to private industry (43%), co-ordinating AI policy in Canada (40%), and providing information to the general public (38%) (Ibid., p. 68).

In a different analysis of the same data, McCalla and Cercone looked at which roles were mentioned as among the top three priorities seen as the role of CSCSI/SCEIO. They found that the roles grouped into three classes.

> In the top class there is "provider of information to the AI research community", standing by itself (at 60 percent) as far away the most preferred role. In the next equivalence class are four roles in the 30 to 45 percent range, in descending order "host of a Canadian AI conference", "representative of Canada to the worldwide AI community", "provider of information to NSERC", and "provider of information to other government agencies". In the bottom equivalence class are roles which range from 3 percent to 18 percent, in descending order "co-ordinator of Canadian AI policy", "provider of information to private industry", and "provider of information to the general public (Ibid., p. 70).

To summarize this data, in 1983-1984, CSCSI/SCEIO members seemed to view the organization's mandate as largely informational: to provide information to AI researchers via publications and conferences.

The views of the CSCSI/SCEIO membership on what might be changed in its mandate can be seen in the answers respondents gave when "[they] were asked to make suggestions about future roles for the CSCSI/SCEIO and many of them did" (Ibid.). Some were "quite satisfied" with the organization; others were critical, but the general mood was constructive.

> The suggested areas for change were numerous. They can be categorised into 5 basic groupings: changes in the image of the CSCSI/SCEIO, changes in the publications, changes in the conference, suggestions for other roles, and changes in organisational structure....
>
> The most numerous group of suggested changes pertain to improving the CSCSI/SCEIO's image in various ways (Ibid., p. 71).

Among these suggested changes was doing more aggressive public relations work, so that when someone thinks 'AI' in Canada, they should also think 'CSCSI/SCEIO' (cf. Ibid.). Other changes proposed including trying to influence government more, being more nationalistic (not looking so much to the US), and fostering better communication.

"A fourth group of responses suggested other possible roles for the CSCSI/SCEIO" (Ibid., p. 73). Among the roles suggested was that it act as a clearinghouse, setting up pilot AI projects in industry or collaborative projects involving several AI centres, and providing AI information, referrals, and the like. Another suggested role was that CSCSI/SCEIO represent Canadian AI abroad, perhaps by trying to obtain the right to send a

Canadian representative to the AAAI board (Ibid.).

> There was a fifth set of reactions that questioned CSCSI/SCEIO's current organisational structure in relation to achieving its goals: .... Some people ... questioned whether CSCSI/SCEIO could (or even should) achieve its goals: "CSCSI hasn't enough manpower to fulfill all its goals"; "are there enough AI people to justify a separate Canadian organisation such as CSCSI"; "the CSCSI is not perceived as a 'live' entity -- apart from the conferences it doesn't 'do' anything -- I'm not sure it really can. It's not anyone's fault" (Ibid., p. 74).

3.9. Review

One major departure from the mandate would seem to be the interest area of CSCSI/SCEIO (Article II.A. of its constitution) seems to have changed over the years from "computational studies of intelligence" to artificial intelligence.

With respect to Article II.B., CSCSI/SCEIO has by-and-large filled its mandate, especially in providing seminar and tutorial meetings (II.B.2). It has been involved in a number of study groups (II.B.3.), though only directly in one, which produced the 1983-1984 survey of AI in Canada. A number of efforts were made to forge links with government and industry (II.B.4.) in the 1980s, but those efforts seem to have slackened off in the 1990s. The *CSCSI/SCEIO Newsletter* has appeared on a regular basis, with increasingly high production values, since 1974, but has appeared a little irregularly in the mid-1990s.

The one time the membership was polled for its views on CSCSI/SCEIO, it was generally OK with the role of the organization, though some thought that it should be more aggressive and suggested various ways that it might expand its role. All their reported suggestions would seem to fall within the existing mandate of CSCSI/SCEIO.

4. A Brief Historical Overview of *Canadian Artificial Intelligence Magazine / Intelligence Artificielle au Canada*

This section examines the *CSCSI/SCEIO Newsletter*, which was named in Article B.II.3. of the CSCSI/SCEIO constitution. The first issue of the newsletter, which is now known as *CAI/IAC*, appeared in 1974 and has been produced more or less continuously ever since.

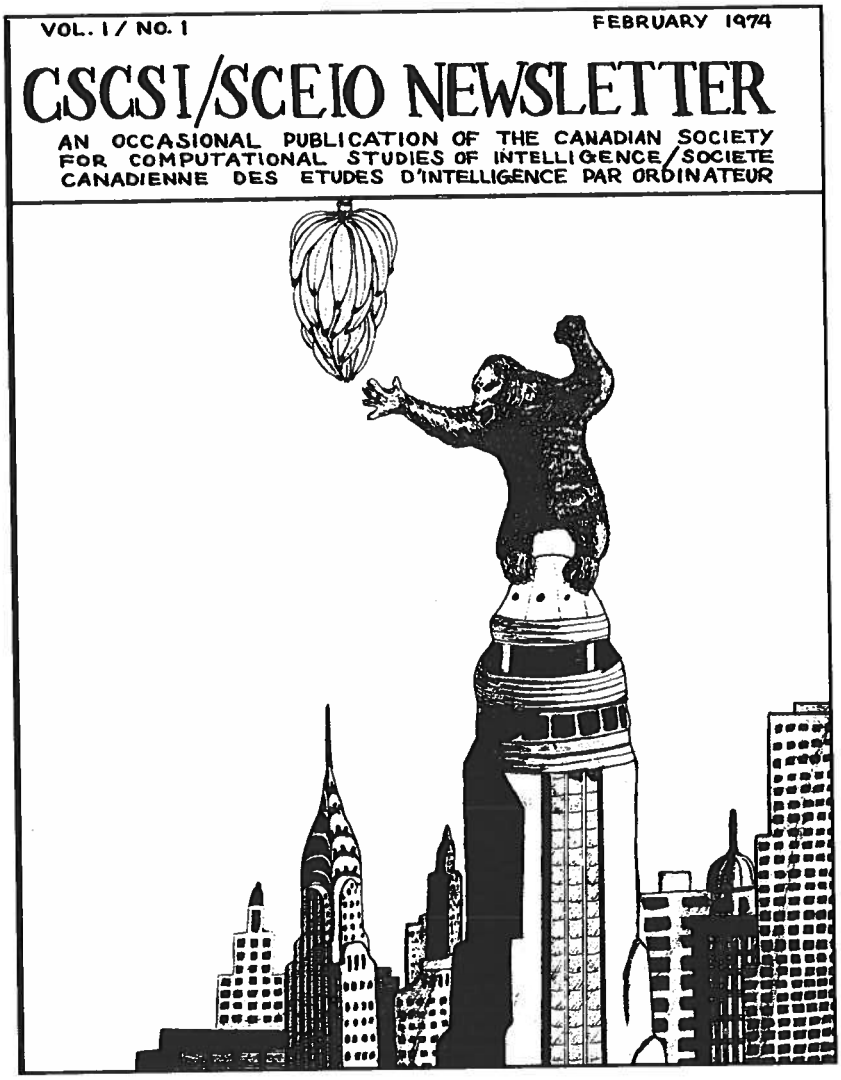
Five historical aspects of *CAI/IAC* are presented below. In Section 4.1., a listing is given of changes of names and editors of the publication presently called *CAI/IAC*. Changes of frequency of publishing *CAI/IAC* are noted in 4.2. Changes of content in the publication are noted in 4.3. The purpose of *CAI/IAC* is reviewed in 4.4. and the issue of electronic methods of distribution is presented in 4.5.

4.1. Changes of Name and Editor

The first publication of the CSCSI/SCEIO was known as the *CSCSI/SCEIO Newsletter* (cf. October 1987, p. 4), which first appeared in February 1974. The cover graphic, which had the title "(GRASP KING-KONG BANANAS)", is shown on the next page. Ray Reiter was the first editor, and the newsletter was produced at UBC. The editorship and place of production changed during the first few years of the newsletter. The second issue was edited by A. K. Dewdney and A. R. Dixon at the University of Western Ontario in February 1975. Alan Mackworth was editor-in-chief of the third issue which was produced at the University of Toronto by Gordon McCalla, Lucio Melli, and Ray Perrault in August 1976. Len Schubert and Jeff Sampson edited the fourth issue (December 1977) at the University of Alberta. Doug Skuce edited the fifth issue (December 1978) at the University of Ottawa.

There was a big change in about 1980. The *CSCSI/SCEIO Newsletter* became part of the *Newsletter of CSCSI/SCEIO, CM-CCS, and CIPPRS*. The first issue appeared probably in about March 1980 (I have not been able to find out the date of this issue, so March 1980 is an educated guess). There was a minor name change from the fourth issue on: *CM-CCS* was replaced by *CMCCS/AACHO*. (By the way, CM-CCS/CMCSS stands for Canadian Man-Computer Communications Society, AACHO stands for L'Association Canadienne des Communications Entre L'Homme et L'Ordinateur, and that CIPPRS stands for Canadian Image Processing and Pattern Recognition Society.)

The Editor-in-Chief was Wayne Davis of the University of Alberta, Edmonton, which is where the newsletter was produced. The editor of the CSCSI/SCEIO part from Volume 1, Number 1 (March 1980?) until Volume 3, Number 1 (March 1984) was Gordon McCalla, who was also Vice-President of CSCSI/SCEIO 1982-1984 and then President 1984-1986. Graeme Hirst at the University of Toronto took over from McCalla for Volume 3, Number 2 (June 1984). The CSCSI/SCEIO



part was more than 100 pages long because it contained Gordon McCalla's and Nick Cercone's 85-page survey of Canadian AI. At that point, the CSCSI/SCEIO part split from the rest of the newsletter, which became the *Newsletter of CMCCS/AACHO and CIPPRS* (vol. 3, No. 3, March 1985).

The CSCSI/SCEIO part became the *CAI Newsletter.* Hirst was editor from issue 1 (September 1984) through to issue 9 (September 1986), then became senior editor through to issue 13 (October 1987). Greg Ioannou was hired as day-to-day managing editor from issue 10 (January 87) to issue 13 (October 1987).

After Hirst stepped down, Marlene Jones was senior editor from issue 14 (January 1988) to issue 21 (October 1989). Sheila McIlraith was editor from issue 14 (January 1988) to issue 17 (October 1988). Jones and McIlraith were at the Alberta Research Council, Calgary.

Roy Masrani, also at the Alberta Research Council, was editor from issue 18 (January 1989) to issue 34 (spring/summer 1994), hence he overlapped with Jones for issues 18-21. Jan Mulder sometimes shared some of the editing duties with Roy Masrani (autumn 1991, p. 2).

CAI Newsletter became *CAI Magazine* in the April 1989 issue (p. 3), shortly after Roy Masrani took over. Many people are probably unaware of the change because when Graham Hirst took over as editor, the cover prominently displayed the words "Canadian Artificial Intelligence." The word "Newsletter" received decidedly second billing and was dropped from the December 1985 issue (no. 6). There was a further name change for the June 1986 issue (no. 8): the title became *Canadian Artificial Intelligence/Intelligence Artificielle au Canada* and has remained the same ever since. So people use *CAI/IAC* to refer to both the newsletter and the magazine.

Peter Turney and Suhayya Abu-Hakima took over as editors for issue 35 in autumn 1994. Both were at the National Research Council, Ottawa. Turney continued as editor until issue 40 (autumn 1996). Abu-Hakima stepped down after issue 42 (summer 1998). Dan Fass edited issues 43 (Spring 1999) and 44 (Autumn 1999). As of issue 45, the editor will be Ann Grbavec.

To summarize, in its first five years, what is now known as *CAI/IAC* changed editorship and place of production every year. Since Graeme Hirst took over, the changes have been relatively infrequent. *CAI/IAC* was edited in Toronto for three years (1984-1987), Calgary for six years (1988-1994), and Ottawa for four years (1994-1998).

4.2. Changes of Frequency of *CAI/IAC*

The first five issues of *CSCSI/SCEIO Newsletter* came out once per year (February 1974, February 1975, August 1976, December 1977, December 1978). The frequency increased to twice a year from March 1980 (?), after the *CSCSI/SCEIO Newsletter* became the *Newsletter of CSCSI/SCEIO, CM-CCS, and CIPPRS*, with Gordon McCalla as editor of the CSCSI/SCEIO part.

In 1984, Graeme Hirst began to put out *CAI/IAC* four times a year. There was a drop from four issues to three issues in autumn 1991 (p. 2), "the result of recessionary times which resulted into a drop in membership and a sharp increase in mailing costs" (Ibid.). There was a drop in advertising revenue at the same time (autumn 1991, p. 5), hence fiscal reasons caused the reduction of the magazine to three issues during the 1991 fiscal year (winter 1994, p. 2). Several people at the 1991 CSCSI/SCEIO AGM thought that going to three issues was acceptable (autumn 1991, p. 6). It was announced in autumn 1992 that *CAI/IAC* would now be published three times a year (autumn 1992, p. 3).

There have been two particularly noticeable slowdowns in the publication of *CAI/IAC*. The first slowdown was during 1993-94 when there was an issue in winter 1993 (no. 31), summer 1993 (no. 32), winter 1994 (no. 33), and spring/summer 1994 (no. 34). The second slowdown was during 1996-99.

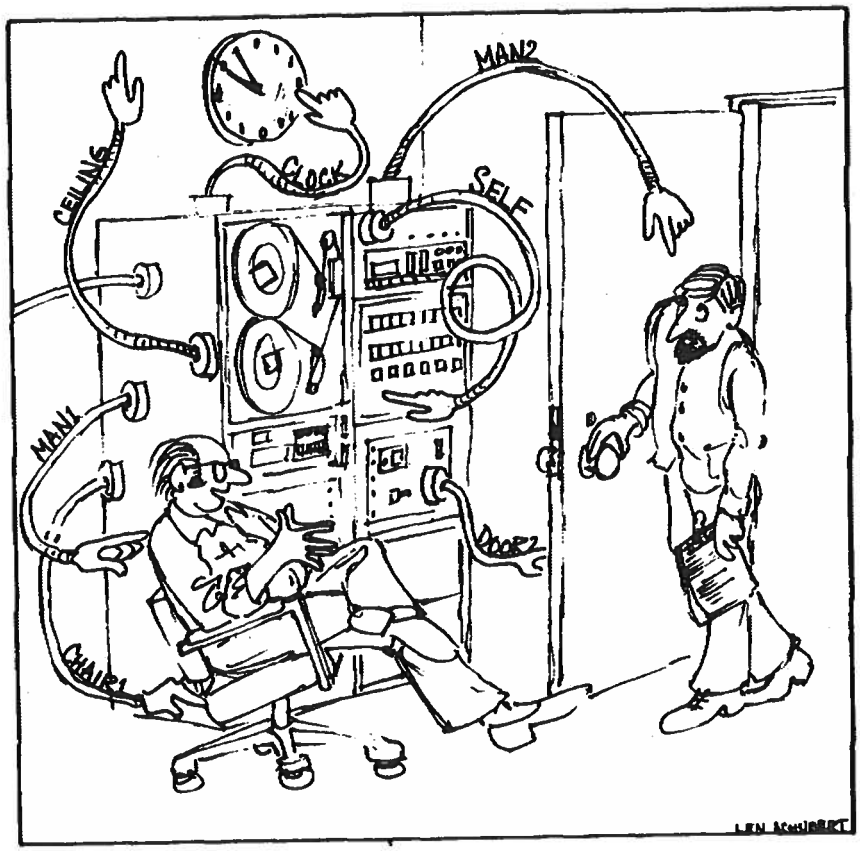
4.3. Changes of Content

Certain types of content have remained constant throughout the 25 years of *CAI/IAC*. Right from the beginning, there were calls for papers, conference programs, conference reports and descriptions of AI research across Canada. In the early days in the 1970s, there was a heavy emphasis on descriptions of AI projects at Canadian universities, and also AI courses taught at them. There was news about the development of CSCSI/SCEIO, for example, reports of its AGMs and the publication of correspondence between CSCSI/SCEIO and other organizations such as the National Research Council. There were some excellent cartoons. One of them, by Len Schubert (1977), is reprinted on the following page.

In the early-mid 1980s under Graeme Hirst, the content of *CAI/IAC* became more varied. In the September 1984 issue (p. 2), contributions were welcomed in English or French on any matter related to artificial intelligence, including articles of general interest; descriptions of recent research and courses; reports of recent conferences and workshops, announcements of forthcoming activities; calls for papers; books for review (and books for review); announcements of new AI companies and products; opinions, counterpoint, polemic, controversy; abstracts of recent publications, theses, and technical reports; humour, cartoons, artwork; advertisements (rates upon request), and anything else concerned with AI.

Conference CFPs, programs, and reports continued to be published, as did descriptions of AI projects and technical reports on AI topics. Descriptions began to appear of AI work by consulting firms such as Cogni-Com Inc. (September 1984, pp. 12-13); AI work at companies such as Bell-Northern Research (September 1984, p. 15; October 1988, pp. 32-34) and Applied AI Systems, Inc. (June 1985, p. 18; July 1988, pp. 27-28); and hardware companies such as LISP Canada Inc. (December 1984, p. 16).

The issues of *CAI/IAC* that Hirst edited contained a great deal of news about developments in the infrastructure of Canadian AI R&D (e.g., the creation of the Canadian Institute for Advanced Research and *Computational Intelligence* journal, news of the Canadian space program). There were lots of small news items about AI companies, AI products, and so forth. There was news from abroad, especially from Japan after the announcement of the Fifth Generation Project in 1982, and from the U.S. A series of Canadian AI survey and policy documents were published such as "Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada" (Mackworth & Reiter,



"I think I've found a way to make my knowledge representation truly meaningful."

1983), "CSCSI/SCEIO: Directions for Canadian Artificial Intelligence" (McCalla & Cercone, 1984), and "Towards a Canadian 5th Generation Research Plan" (Canadian Society for Fifth Generation Research, 1985). Various directories were begun in the wake of McCalla and Cercone's (1984) survey of AI. A directory of Canadian AI businesses appeared in the September 1985 issue (pp. 25-26) and was updated in March 1986 (p. 23). A list of Canadian AI graduate programs was published in the December 1985 issue and was updated in March 1986 (p. 23). Several years later, the summer 1991 issue contained a list of Canadian AI grad students (pp. 8-12), but was not continued.

When Marlene Jones took over from Graeme Hirst as Senior Editor of *CAI/IAC*, beginning with the January 1988 issue, the division of *CAI/IAC* into sections such as Communications and Feature Articles was established that has been used in most issues since.

There was plenty of advertising right through the 1980s, but that dropped off in the mid-1990s. Production values rose during the late '80s. The cover was glossy and, after November 1990, often featured high-quality artwork or photographs.

When CSCSI/SCEIO had more money in the late 80s and early 90s, freelance writers Connie Bryson and Grant Buckler were hired to research and write longer, more accessible articles on applications of AI. The first of these was an article by Buckler about expert systems developed by two railway companies, Canadian National and Canadian Pacific (April 1987, pp. 16-17). Bryson conducted a series of interviews with notable figures in Canadian AI. There were interviews with Gordon MacNabb (April 1989, pp. 9-12), Len Schubert (July 1989, pp. 9-12), Fraser Mustard (November 1990, pp. 6-10), Graeme Hirst (October 1989, pp. 8-10), Marlene Jones (January 1990, pp. 11-12). There were profiles of Mark Fox (April 1990, pp. 7-8), Ray Reiter (winter 1993, pp. 8-11) and Nick Cercone (winter 1993, pp. 2-5). Bryson even came to write reports about research at Canadian AI centres, for example, McGill's Vision Group (Autumn 1991, pp. 20-21).

While Roy Masrani was editor, Peter Turney initiated and edited a series of Canadian AI Success Stories. The

first of these, written by Turney, appeared in the Autumn 1992 issue. The reporting of news about AI products and the like continued.

From April 1989 to summer 1991, excerpts from WorldWatch were printed in *CAI/IAC*. WorldWatch consisted of abstracts of AI papers from more than 4,000 journals and 1,000 conferences (April 1989, p. 39).

Under the editorship of Suhayya Abu-Hakima and Peter Turney, beginning in autumn 1994, all but one of the issues of *CAI/IAC* have been a special issue on a particular topic. They were on AI and molecular biology in Canada (autumn 1994, no. 35), artificial intelligence and the Information Superhighway (summer 1995, no. 37), machine learning (winter 1996, no. 38), equipment diagnostics (spring/summer 1996, no. 39), software agents (autumn 1996, no. 40), AI in network management (autumn/winter 1997, no. 41), and AI and logic (summer 1998, no. 42). The articles have been of high quality, looking like those in an academic journal. Production values have been very high, with continued high-quality artwork and photographs. There has not been much news about AI products and the like.

4.4. The Purpose of *CAI/IAC*

A sense of the purpose of *CAI/IAC* can be derived from two sources. The primary source is its editors, hence the first part of this section presents the views of various editors of *CAI/IAC*. A secondary source is feedback obtained from the membership of CSCSI/SCEIO. This feedback has been from two sources. The first such source is responses to the 1983-1984 survey of Canadian AI conducted by Gordon McCalla and Nick Cercone (McCalla & Cercone, 1984). The second is responses to a *CAI/IAC* questionnaire conducted by Roy Masrani in 1989.

According to Graeme Hirst, editor or senior editor of *CAI/IAC* during 1984-1987, its mandate was to "report on all aspects of AI in Canada, or of special interest in Canada. It will report on all aspects of AI in Canada, or of special interest to Canada" (Hirst, 1984). Roy Masrani, editor of *CAI/IAC* from 1989 to 1994, quoted this when he took over (April 1989, p. 3).

To Hirst, the *CAI/IAC Newsletter* had a different role from an academic journal. He said, "A refereed journal is for communicating archival research results. The magazine is a newsmagazine ... [containing material you wouldn't find in a journal, such as] what Precarn is up to, what NSERC is up to, new product announcements, and so on" (Hirst, quoted in Bryson, 1989, p. 9).

Marlene Jones, senior editor of *CAI/IAC* during 1988-1989, saw the role of the publication as providing information about what people in the Canadian AI community were doing. "Canadian AI magazine also carries articles on more global issues such as AI in the resource industries, Precarn, CIAR, Canada's space industry.... Canadian AI magazine is where these things get pulled together" (Jones, quoted Bryson, 1990, p. 13).

When Suhayya Abu-Hakima and Peter Turney took over as editors, beginning in autumn 1994, they wrote in an editorial, "New Directions for *Canadian Artificial Intelligence Magazine*," that "[O]ur mandate remains as it has been since issue #1, to report on all aspects of AI in Canada, or of special interest in Canada, and to provide a forum for reporting Canadian AI to the world" (Turney & Abu-Hakima, 1994).

Turney (1998) points out that he and Abu-Hakima took over as editors just as the worldwide web was becoming popular. They decided to move away from the kind of content that was becoming available on the web, such as reports of AI activities at certain labs, and toward special issues which had content that, even if available on the web, would require effort to gather. Turney and Abu-Hakima also elected to emphasize applied AI research because articles about applied AI are not generally accepted for academic journals and because they wanted to appeal to readers in industry.

As noted previously, all but one of the issues they edited were special issues. The issues looked very much like the special issues of an academic journal (even though their content was generally applied rather than theoretical), though they were not refereed like papers for an academic journal. Abu-Hakima and Turney's intention was to match the quality level set by *AI Magazine* in the US (Turney, 1998). The issues of *CAI/IAC* they edited contained less AI news than previous issues, hence their overall conception would seem to differ from Graeme Hirst's, who felt that *CAI/IAC* should be a news magazine.

In Section 3.8., results were presented from Gordon McCalla's and Nick Cercone's 1983-1984 survey of AI in Canada, and it was noted that CSCSI/SCEIO members seemed to feel strongly that the organization's role was primarily informational — to provide information to AI researchers.

One group of survey responses generally related to "enhancements in the publications produced by the CSCSI/SCEIO" (McCalla & Cercone, 1984, p. 72). McCalla and Cercone list four types of response among this group. Two of these are relevant to *CAI/IAC*. One was to improve *CAI/IAC* by making it more frequent and regular and by providing explanations of research projects suitable for a more general audience. Another was to make use of electronic media: "several suggestions were made about having an electronic journal or electronic newsletter or electronic conference" (Ibid., p. 73).

Roy Masrani included a questionnaire in the April 1989 issue of *CAI/IAC* (English on p. 19, French on p. 33). The results were reported in the October 1989 issue (p. 3). There were 25 responses (approximately 4% of subscribers) roughly equally divided between industry and university; 4 responded in French. 44% thought the magazine very relevant; 54% thought it somewhat relevant. 80% saved the magazine for future reference; 16% passed it on to others.

> The sections of interest to readers were (in decreasing order of interest): Feature Articles, Research Reports, AI News, Publications, Conference Reports, Conference Announcements, World Watch, and Humor. Readers want the Book Reviews section to be expanded and the magazine to take a more industrial slant with reviews of tools and case studies of expert systems projects. Technical articles were deemed by some to be of little use (Masrani, 1989, p. 3).

4.5. New Distribution Methods / Electronic Publishing

Interest in electronically publishing *CAI/IAC* first arose in February 1983 when Usenet was proposed as the distribution vehicle. Alan Mackworth proposed setting up a Usenet newsgroup called can.ai for the general discussion of AI issues and another newsgroup called can.ai.cscsi for discussion of CSCSI/SCEIO (Mackworth, 1983).

Alan Mackworth suggested that such a newsgroup "would serve as an electronic newsletter, bulletin board and soapbox" (Ibid.). He also suggested that "a database of researchers and projects in the discipline" be established (Ibid.). These newsgroups were set up, but have since been closed down. (According to *CAI/IAC* (summer 1995, p. 6), Mackworth suggested publishing CAI online as far back as December 1984. This may refer to his February 1983 proposal.)

As noted in 4.2., among the responses to McCalla's and Cercone's (1984) survey were several suggestions about "having an electronic journal or electronic newsletter or electronic conference" (Ibid., p. 73).

The growth of the World Wide Web in the early 1990s led to a renewal of interest in electronically publishing *CAI/IAC*. The CSCSI/SCEIO web site was started by Peter Turney in the first half of 1994 with the blessing of then-President Janice Glasgow (Turney, 1998). Turney and Abu-Hakima argued for all-electronic distribution of the magazine when they first became editors. They proposed all-electronic distribution at the 1995 CSCSI/SCEIO AGM. A decision was made there to publish *CAI/IAC* in both electronic and hard copy versions. The electronic version was to be made available on the CSCSI/SCEIO web site. People who opted for the electronic version were to get reduced membership rates and were to contact Peter Turney with their user name, password, and CSCSI/SCEIO membership number (winter 1996, p. 3).

A major argument in favour of *CAI/IAC* become entirely web-based is that electronic publishing is cheap. *CAI/IAC* continually costs more than revenues, especially when income from advertising is low. Considerable money could be saved by not having to print hard copies and post them to members. Turney (1988) notes that PDF (Portable Document Format) is an attractive format for electronically publishing the magazine because "PDF files are easier to read on-line than PostScript (the Acrobat viewer is nicer than Ghostview) and PDF files are typically much smaller than compressed PostScript files."

However, others have criticized this proposal with two main arguments. First, there are readers who like hard-copy versions of the publication, notably library users and people who like to keep copies on their bookshelves. Second, there's a host of questions to deal with about web access. Do all people who might want to read *CAI/IAC* have web access? How should security be implemented to ensure that only CSCSI/SCEIO members have access to current issues?

Web versions of the current issues has been put on the web and password protected. Passwords consist of the first letters from people's printed first and last names in the subscription of CSCSI/SCEIO members plus the

first six numbers of their subscription. The address of the CSCSI/SCEIO web site is http://cscsi.sfu.ca

5. Five Possible Concerns for CSCSI / SCEIO

The remaining sections constitute the second part of this article: a somewhat subjective analysis of various concerns that face CSCSI/SCEIO and *CAI/IAC*, and what might be done about them. This section outlines five possible problems facing CSCSI/SCEIO. The first, and most serious, is the declining membership of CSCSI/SCEIO. The second and third concerns are mandate-related: CSCSI/SCEIO's shift of focus from the computational study of intelligence to AI and CSCSI/SCEIO's "clumsy" and perhaps inappropriate name. The fourth and fifth concerns are administrative: the sometimes irregular production of *CAI/IAC* and CSCSI/SCEIO's troubled relationship with CIPS.

(1) Declining Membership

As was seen in Section 2.2., membership has fallen drastically since 1988, apart from a brief recovery due to a major publicity drive mounted by Ian Witten when he was CSCSI/SCEIO President 1990-1992.

(2) Shift from "Computational Studies of Intelligence" and "Artificial Intelligence"

As was noted in Section 3.1., it would seem that the interest area of CSCSI/SCEIO has come to be AI rather than the more general computational study of intelligence.

(3) "Clumsy" and Perhaps Inappropriate Name

As was also noted in Section 3.1., the only major difficulty encountered at the first CSCSI/CSEIO workshop in May 1973 was choosing a name. The one chosen, the Canadian Society for Computational Studies of Intelligence/Société canadienne pour l'étude d'intelligence par ordinateur, has been described as "[c]lumsy, but a faithful description of the society's objectives" (Reiter, 1974, p. 3).

If the focus of CSCSI/SCEIO has changed from the computational study of intelligence to AI, then the name is arguably inappropriate as well as clumsy.

(4) Irregular Production of *CAI/IAC*

As was observed in Section 4.2., production of what is now *CAI/IAC* began as a yearly publication (1974-1980), then twice-yearly (1980-1984), then four times yearly (1984-1991), but then production had to be cut back to three times yearly (1991 on) and, since then, there have been two noticeable slowdowns, during 1993-94 and during 1996-98.

(5) Troubled Relationship with CIPS

The relationship of CSCSI/SCEIO to CIPS has been troubled ever since they were first affiliated in 1978 or thereabouts. Wayne Davis, a former President of CIPS, has been critical of CIPS (Davis, 1981), claiming that CIPS has ignored the needs of the academic and research communities. There was some correspondence back and forth about Davis's comments with Al Fowler, the then-President of CIPS (Fowler, 1982; Davis, 1982).

In the 1983-1984 survey of AI conducted by Gordon McCalla and Nick Cercone, some respondents were critical of CIPS. One said, "[CSCSI/SCEIO] should review its relationship to CIPS" (McCalla & Cercone, 1984, p. 74). Another said, "[we should] push for a true Canadian computer science organisation – I have nothing good to say about CIPS" (Ibid.).

This troubled relationship continued through the 80s and into the 90s (January 1990, p. 4; autumn 1991, p. 7). CIPS charges a fee for every CSCSI/SCEIO membership but has at times been slow to pay CSCSI/SCEIO money it owes, for example, it was slow to hand over $17,000 in membership revenues to CSCSI/SCEIO (winter 1994, p. 2) and has not been timely in approaching CSCSI/SCEIO members for membership renewals (summer 1994, p. 3; summer 1995, p. 3).

6. Reasons for 1970s-1980s Rise in Membership

This section looks for reasons for the rise in CSCSI/SCEIO membership in the 70s and 80s, particularly the steep rise in the mid-80s. The section begins by outlining the rise in membership, and then by looking at the changing state of AI in the world at large, and changes in CSCSI/SCEIO and *CAI/IAC* during the 1970s and 1980s.

Membership figures for CSCSI/SCEIO are not available prior to 1983. In March 1983, membership stood at 280 and was almost the same 15 months later (283 in June 1984). Over the next 28 months, however, membership

rose steeply. In the six months between June and December 1984, 167 new members were attracted, a rise of 59% (from 283 members to 450). A further 85 people joined in the next four months (there were 535 members in March 1985), and another 115 in the next six months (there were 650 members in September 1985). Another 203 people joined over the next 18 months (membership was 853 in March 1987). After this, the rise in membership began to slow, peaking at just under 900 in January 1988.

At the time membership peaked at 900 in January 1988, CSCSI/SCEIO would seem to have had a remarkably high percentage of all Canadian AI researchers as its members, who numbered around 1200 in mid-1989. This number is suggested by the findings of the survey of AI in Canada that was published under the title "Artificial Intelligence in Canada: A Description by Members of the ACAI" (ACAI, 1991). The survey was based on the contents of 312 questionnaires received before 27 November 1989 (Ibid., p. 180). It was reported that the survey "indicates that there are more than 1000 full-time and several hundred part-time individuals in Canada involved in AI research, development, and application in more than 300 organizations across Canada" (Ibid., p. 3).

To understand the rise in membership between 1984 and 1988, it is important to appreciate how the public perception of AI changed between 1973, when CSCSI/SCEIO was first founded, and 1984. It is also important to appreciate how CSCSI/SCEIO began to change from a relatively "introverted," inward-looking organization to a relatively "extraverted," outward-looking one during this time.

In 1973, AI was a relatively little-known subfield of computer science, sometimes viewed negatively by others in computer science. During the 1970s, CSCSI/SCEIO was for the most part preoccupied with internal matters such as sorting out its relationship to CIPS, establishing its biennial conferences, and agreeing upon a Constitution. The early *CSCSI/SCEIO Newsletter* allowed members to network among themselves about the computational study of intelligence, to exchange news about teaching courses, projects, technical reports, and the like.

In the early 1980s, AI became a subject of national importance with the announcement in 1982 of the Japanese Fifth Generation Project and the responses by the governments of many other Western countries (e.g., USA, UK, West Germany).

At this time, CSCSI/SCEIO underwent major changes. It became much more outward-looking. Certain CSCSI/SCEIO members promoted both the society and AI more forcefully to branches of government. In the case of CSCSI/SCEIO, Nick Cercone insisted that time be given for a presentation of CSCSI/SCEIO activities at the 1983 AI workshop organized by the Science Council of Canada. Also, Cercone and Gordon McCalla made a point of calling the survey of AI in Canada, "CSCSI/SCEIO: Directions for Canadian Artificial Intelligence" (McCalla & Cercone, 1984). The purpose of this survey was also to promote AI in Canada, as was Mackworth and Reiter's "Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada" (Mackworth & Reiter, 1983), which was circulated at the 1983 AI workshop.

These documents were published in the part of the newsletter CSCSI/SCEIO jointly put out with CMCSS/AACHO and CIPPRS. Almost immediately afterwards, CSCSI/SCEIO separated from the joint newsletter and started the *CAI/IAC Newsletter*, under Graeme Hirst's editorship. The newsletter began to be put out every three months. The years that Hirst was editor or senior editor (1984-late 1987) overlapped substantially with years that Nick Cercone and then Gordon McCalla were CSCSI/SCEIO President (1982-1984, 1984-1986). Many Canadian companies started AI work in the years 1983-1986, thereby creating new Canadian AI workers.

7. Reasons for 1980s-1990s Fall in Membership

This section seeks reasons for the largely uninterrupted fall in membership since the late 80s. It begins by describing the fall in membership. Then, changes are reviewed in the Canadian economy, the perception of AI in general, funding of AI in Canada, CSCSI/SCEIO, and *CAI/IAC*. It is noted that there were downturns in the Canadian economy and a backlash against AI. However, by contrast, there were positive developments in the funding of AI in Canada, and nothing obviously negative in many CSCSI/SCEIO activities such as *CAI/IAC*, Computational Intelligence journal, or the biennial conference it organized.

Attention is then turned to some of the concerns listed in Section 5. It is suggested that the problems with CIPS and the frequency of *CAI/IAC* may be responsible for a little attrition, but they don't explain the precipitous

decline in membership. Attention is then turned to CSCSI/SCEIO's mandate (though not to the particular mandate concerns raised in Section 5) and various ways in which people might be dissatisfied with mandate are considered.

In 1988, CSCSI/SCEIO membership began to decline. This decline was reversed temporarily by a subscription drive organized by Ian Witten while he was CSCSI/SCEIO President (1990-1992), which attracted 100 new members in 1991. Membership held steady between 1992 and 1994, but has declined ever since.

A recession in the late 1980s explains some of the decline. In the late 1980s and early 1990s, there was also a backlash against AI, which had been heavily promoted in the 1980s by the media and some entrepreneurs. The termination of the Japanese Fifth Generation project in 1992 may well have turned public attention away from AI, making it less of a "hot" topic. The recession and backlash forced some Canadian AI companies into bankruptcy. Attendance at the big AI conferences such as IJCAI and AAAI also declined (Mackworth, 1999).

The decline in CSCSI/SCEIO membership came at a time when the federal government began to put unprecedented amounts of money into AI R&D. IRIS-I, II, and III receive $67.3 million for 1990-2002, with further funding to 2005 if the first half of IRIS-III is positively evaluated. PRECARN-I and II receive $35.4 million for the period 1989-2000, and PRECARN-III should receive funding through to 2005. The five-year Artificial Intelligence Research and Development Fund, announced in 1990, provided $10 million. The combined sum from these three funding sources is $112.7 million for 1989-2002.

Presumably, this considerable injection of funds into Canadian AI has increased the number of full-time and part-time AI workers in the country from the 1989 survey of AI in Canada estimates of 1000 and several hundred, respectively (ACAI, 1991, p. 3). One would think this to be particularly true of industry and R&D firms. The 1989 survey estimated that there were 91 full-time AI workers in industry, 34 full-time in R&D firms, 175 part-time in industry, and 11 in R&D firms (Ibid., p. 182).

Many CSCSI/SCEIO activities continued through the late 80s and into the 90s with no obvious decline in quality. The *CAI/IAC Newsletter*, which became the *CAI/IAC Magazine* in April 1989, continued to be produced with very high production values. *Computational Intelligence* journal and the conferences sponsored by CSCSI/SCEIO have shown no decline in quality or participation in the 1990s.

What, then, might have caused the decline in CSCSI/SCEIO membership since the late 1980s? Peter Turney (1998) believes the decline has two causes. He suggests that "the drop from about 900 in 1988 to about 460 in 1992 was due to disillusionment with AI, but the drop from about 460 in 1992 to about 200 today is due to the Web." Turney's point about competition from the Web is a good one, which will be revisited at the end of this section. What does not seem to be a factor in the decline is the slowdown in the production of *CAI/IAC* during 1993-1994. The magazine came out every quarter until 1991, when the recession caused a sharp increase in mailing costs (autumn 1991, p. 2) and a drop in advertising revenue (Ibid.). The magazine then began to appear three times year, and did so regularly until 1995. However, membership had already fallen quite considerably by 1991 and, after stabilizing during 1992-1994, seems to have fallen again by 1995. The effect of the slowdown in production since 1996 is hard to assess, but it can hardly be a positive one.

Some of the problems with CIPS, notably its unreliability in approaching CSCSI/SCEIO members for membership renewals in the mid-1990s, may have been responsible for more attrition, but it's hard to know how many members failed to renew their memberships as a result.

Other factors Mackworth (1999) suggests are that a lot of "old-timers" who used to be heavily involved in promoting Canadian AI are now putting their energy into other activities, that a "me" attitude is more prevalent in the 90s than in previous decades, and that global competition makes it hard for Canadian companies to pay much attention to national AI.

Another possible factor in the decline of CSCSI/SCEIO's membership is that members are dissatisfied with the mandate in various ways and, as a result, don't think that CSCSI/SCEIO is worth supporting any longer. They could be dissatisfied with the mandate for a number of different reasons:

(1) they think the mandate of CSCSI/SCEIO is too limited,

(2) they agree with the CSCSI/SCEIO mandate but don't think that the organization is fulfilling that mandate,

(3) they think that CSCSI/SCEIO has achieved its mandate in promoting the computational study of intelligence/AI (i.e., it has achieved what it reasonably can be expected to achieve), or

(4) they think that the mandate is outmoded because the computational study of intelligence/AI is too large a subject to be adequately represented by a single national organization.

Possible dissatisfactions (1) and (2) are echoed in some of the responses people gave to McCalla and Cercone's 1983-1984 survey of AI in Canada. As was noted in Section 3.8., some people disagreed with CSCSI/SCEIO's mandate, though the responses published in the survey report can be viewed as wanting more within the existing mandate, rather than actually changing the mandate. This would seem to be in line with reason (1). For example, respondents suggested that CSCSI/SCEIO act as a clearinghouse, setting up pilot AI projects in industry or collaborative projects involving several AI centres, and providing AI information, referrals, and the like. Another suggested role was that CSCSI/SCEIO represent Canadian AI abroad, perhaps by trying to obtain the right to send a Canadian representative to the AAAI board (McCalla & Cercone, 1984, p. 73).

Other responses to the 1983-1984 survey were of the view that CSCSI/SCEIO was not fulfilling — and perhaps never could — fulfill its mandate. These responses seem to be in line with possible dissatisfaction (2). The survey report noted that, "Some people ... questioned whether CSCSI/SCEIO could (or even should) achieve its goals: "CSCSI hasn't enough manpower to fulfill all its goals"; "are there enough AI people to justify a separate Canadian organisation such as CSCSI"; "the CSCSI is not perceived as a 'live' entity -- apart from the conferences it doesn't 'do' anything -- I'm not sure it really can. It's not anyone's fault" " (McCalla & Cercone, 1984, p. 74).

With regard to possible dissatisfaction (3), Canadian AI is in a period of long-term, stable funding. AI research is more industrially-oriented, better-funded, but less curiosity-driven than before. Certain strands of AI have been selected for funding within PRECARN and IRIS, but not others. Also, AI is now a relatively mature discipline. This relative stability and maturity in the 1990s, can be seen it, might be argued, in the contrast between the contents of *CAI/IAC* in the mid-90s and mid-80s. The 1990s issues have consisted largely of applied AI research, seen in special issues on topics such as AI and molecular biology (autumn 1994), equipment diagnostics (spring/summer 1996), and AI and network management (autumn/winter 1997). In the mid-1980s, by contrast, there were articles on basic AI issues, e.g., about LISP machines versus PCs and about the possibility of a single AI programming language.

It could be argued that the lobbying efforts of the 1980s yielded results. In the article "The Infrastructure of Canadian AI R&D," which appears elsewhere in this issue and the previous one, I suggest that the seeds of PRECARN and IRIS can be seen in the proceedings of the 1983 AI workshop organized by the Science Council of Canada. Moreover, AI is an accepted branch of computer science now. One might realistically ask: what does "the promotion of interest and activity in Artificial Intelligence" (October 1987, p. 4) mean in present-day Canada?

With respect to possible dissatisfaction (4), Rich (1992) notes that AI has become specialized, as seen in the proliferation of narrow-focus publication forums such as workshops, conferences, and journals. It is possible that former CSCSI/SCEIO members are putting their energy and money into these more specialized AI organizations and publication forums.

8. Dealing with the 1980s-1990s Fall in Membership

In this section, we review the five concerns of Section 5. We look at how concern #1 (declining membership) might be met by dealing with the other four concerns. With respect to the administrative ones, putting a reasonable level of membership effort and society resources into *CAI/IAC* may help with the problems of the magazine. As for the problems with CIPS, a long-term solution is for CSCSI/SCEIO run its own membership services over the Web. With respect to the mandate concerns, the focus of CSCSI/SCEIO does seems to have permanently changed to AI, hence one suggestion would be to change the society's name to the Canadian Artificial Intelligence Society/Société Canadienne pour l'Intelligence Artificielle (CAIS/SCIA) would both reflect its true focus and solve the problem of having a clumsy and perhaps inappropriate name. The section finishes with some remarks about the role of national AI organizations and their publications.

With regard to *CAI/IAC*, it has traditionally been run by a volunteer editor with voluntary help from the membership and, sometimes, paid production support and paid writers. The various editors of *CAI/IAC* have done a wonderful job over the years, given that it's probably the most time-consuming position on the CSCSI/SCEIO Executive, is meant to come out on a frequent basis, and is highly visible. The Canadian AI community can help the magazine by contributing news, articles, and ideas (i.e., content). The CSCSI/SCEIO, particularly its Executive, can help by ensuring that work is offloaded to others, so that editors are not swamped. Some effort and considerable money could be saved by going all-electronic.

The solution to the problems with CIPS may be for CSCSI/SCEIO to take over the processing of its own membership subscriptions. It may be possible in the near future to do this near-automatically via the Web. It is worth keeping an eye on the development of appropriate technologies. This is not to say that CSCSI/SCEIO shouldn't retain a formal affiliation of some kind with CIPS.

In the survey of Canadian AI conducted by Gordon McCalla and Nick Cercone, many changes were suggested for improving CSCSI/SCEIO's image by doing more aggressive public relations work, so that when someone thinks "AI" in Canada, they should also think "CSCSI/SCEIO" (cf. McCalla & Cercone, March 1984, p. 71). It could be argued that the "clumsy" name Canadian Society for Computational Studies of Intelligence/Société canadienne pour l'étude d'intelligence par ordinateur (CSCSI/SCEIO) is a hindrance to achieving this aim, because "artificial intelligence"/"intelligence artificielle" is not part of the name of the society.

If the focus of CSCSI/SCEIO is artificial intelligence rather than the computational study of intelligence, as suggested in Section 5., then a lot might be gained by having a shorter, more instantly understandable, and perhaps more memorable name like Canadian Artificial Intelligence Society/Société Canadienne pour l'Intelligence Artificielle (CAIS/SCIA).

What is the role of national AI organizations such as CSCSI/SCEIO and AAAI? And what is the role of their publications such as *CAI/IAC* and *AI Magazine*? Some remarks by Elaine Rich are highly appropriate here. Rich wrote a thoughtful editorial on the broad role of national AI organizations when she took over as editor of *AI Magazine* (Rich, 1992). She does not write about the role national AI organizations can have in promoting the interests of AI workers in a country, but instead focusses on the kinds of information that a publication like *AI Magazine* can provide a national AI community. She suggests nine kinds of coverage that a publication like *AI Magazine* might provide:

(1) Survey articles: primers about subfields of AI that don't require specialized prior knowledge of the terminology and concepts of those subfields.

(2) Interacting ideas: suggestions about combining ideas from different AI camps to produce more powerful systems.

(3) Applications: news of successful and interestingly unsuccessful applications of AI.

(4) Related disciplines: reports about related disciplines that might contribute powerful ideas to AI.

(5) Core issues and debates: reports about the latest developments in topics basic to all of AI such as representation, architecture, methodology, and evaluation.

(6) Interesting events: information about events in which readers might want to participate and descriptions of events readers were unable to attend but would have liked to.

(7) Book reviews.

(8) AI in the world: news about how AI is affecting the wider scientific and business communities, how those communities perceive AI, and how that perception affects those working in AI.

(9) Philosophy, history, and the crystal ball: occasional reflection on what AI is trying to do, where it's been, how and why it's gotten to where it is, what correctable mistakes have been made, and where AI is going. Some well-considered speculation can be thought-provoking.

Rich (1992) noted that writing such articles might be a challenge because they aren't what AI people routinely write about. Such articles are more newsy, more speculative than those typically found in academic AI journals or on web sites. They fill a gap. Maybe they are what national AI organizations should be providing through their publications and invited talks and panels at conferences. Maybe people will subscribe to national AI organizations to receive this kind of information.

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References

ACAI [Associate Committee on Artificial Intelligence]. See National Research Council of Canada Associate Committee on Artificial Intelligence.

van Beek, Peter (1996). Canadian Society for Computational Studies of Intelligence: Treasurer's Annual Report for the 1995 Fiscal Year. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 39, Spring/summer 1996, p. 3.

Bryson, Connie (1989). Graeme Hirst: Of Magazines, Books and Natural Language Research. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 21, October 1989, pp. 8-11.

Bryson, Connie (1990). Marlene Jones: Prescription for a Healthier Canadian AI Community. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 22, January 1990, 11-13.

Canadian Society for Fifth Generation Research (1985). Towards a Canadian 5th Generation Research Plan. Drafted by Eric Manning, Nick Cercone, Ric Holt, John Mylopoulos, and Jean Vaucher (steering committee of CSFGR) for the membership. Approved by members ballots, 21 January 1985. *Supplement to Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, March 1985.

Cercone, Nick, and Gordon McCalla (1983a [?]). Questionnaire to Survey AI Research Interests and Opinions on a National AI Policy. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 2, No. 1, February 1983, pp. 15-26.

Cercone, Nick, and Gordon McCalla (1983). Artificial intelligence in Canada. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 2, No. 2, November 1983, pp. 3-7.

CogniCom Inc. (1984). Cognos Report. Prepared by CogniCom Inc. for the Secretary of State and Department of Communications. Five volumes.

Davis, Wayne (1980). Financial Statement: CSCSI Conference 1980, Victoria B.C. *Newsletter of CSCSI/SCEIO, CM-CCS, and CIPPRS*, Vol. 1, No. 2, December 1980, p. 7.

Davis, Wayne (1981). The CIPS Connection. *Newsletter of CSCSI/SCEIO, CM-CCS, and CIPPRS*, Vol. 1, No. 3, September 1981, p. 1?

Davis, Wayne (1982). Editor's Reply (to A. G. Fowler). *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 1, No. 4, March 1982, p. 3.

Davis?, Wayne (1984). Separation. *Newsletter of CSCSI/SCEIO, CMCCS/ AACHO, and CIPPRS*, Vol. 3, No. 1, June 1984, p. 1.

Goebel, Randy (1988a). Treasurer's Report. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 14, January 1988, p. 4.

Goebel, Randy (1988b). Treasurer's Report. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 17, October 1988, pp. 7-8.

Fowler, A. G. (1982). Letter to the Editor, dated December 1, 1981. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 1, No. 4, March 1982, pp. 1-2.

Hamilton, Howard (1988). CSCSI '88 Conference. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 17, October 1988, pp. 46-49.

Hamilton, Howard (1999). Personal communication, 9 September 1999.

Hirst, Graeme (1984). A New Forum for Canadian AI. *Canadian Artificial Intelligence Newsletter*, No. 1 (new series), September 1984, p. 3.

Hirst, Graeme (1985). Workshop on Theoretical Approaches to Natural Language Understanding. *Canadian Artificial Intelligence Newsletter*, No. 5, September 1985, pp. 15-16.

Mackworth, Alan (1983). New group for AI in Canada. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 2, No. 1, February 1983, p. 14.

Mackworth, Alan (1999). Personal communication, 8 January 1999.

Mackworth, Alan, and Ray Reiter (1983). Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada. Paper circulated at workshop on AI organized by the Science Council of Canada, 19-21 January 1983. Published in the *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 2, No. 1, February 1983, pp. 11-14.

Masrani, Roy (1989). Executive Notes. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 21, October 1989, p. 3.

McCalla, Gordon, and Nick Cercone (1984). CSCSI/SCEIO: Directions for Canadian Artificial Intelligence. *Newsletter of CSCSI/SCEIO, CMCCS/AACHO, and CIPPRS*, Vol. 3, No. 1, March 1984, pp. 19-104.

De Mori, Renato (1994). IJCAI'95. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada*, No. 34, Spring/summer 1994, p. 19.

Mylopoulos, John (1976). Report on the CSCSI/SCEIO Workshop, Ottawa, Ontario, May 28-29, 1975.

CSCSI/SCEIO Newsletter, vol. 1, no. 3, August 1976, pp. 7-9.

National Research Council of Canada (1988). Associate Committees 1988. Ottawa, ON: National Research Council of Canada, November 1988.

National Research Council of Canada Associate Committee on Artificial Intelligence (1991). *Artificial Intelligence in Canada: A Description by Members of the ACAI.* NRCC No. 31789. Ottawa, ON: National Research Council of Canada, January 1991.

Peacocke, Dick (1988). Talking About AI. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada,* No. 17, October 1988, p. 3.

Reiter, Ray (1974). CSCSI/SCEIO – A Brief History. *CSCSI/SCEIO Newsletter,* vol. 1, no. 1, February 1974, pp. 3-10.

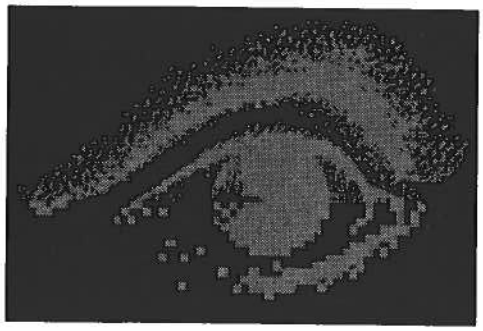
Rich, Elaine (1992). Ontogeny Recapitulates Ontogeny: AI and the *AI Magazine*. *AI Magazine*, summer 1992, vol. 13, no. 2, pp. 12-13.

Rosenberg, Richard (1976). Proposed Constitution for CSCSI/SCEIO: Draft Version 2 / May 15, 1976. *CSCSI/SCEIO Newsletter,* vol. 1, no. 3, August 1976, pp. 2-5.

Schubert, Len (1977). Cartoon with caption "I think I've found a way to make my knowledge representation truly meaningful." *CSCSI/SCEIO Newsletter,* December 1977, vol. 1, no. 4, p. 47.

Turney, Peter (1998). Personal communication, 31 December 1998.

Turney, Peter, and Suhayya Abu-Hakima (1994). New Directions for *Canadian Artificial Intelligence* Magazine. *Canadian Artificial Intelligence/Intelligence Artificielle au Canada,* No. 35, Autumn 1994, p. 2.



Graphics Interface 2000

Palais des Congrès

Montréal, Québec, Canada

15-17 May 2000

Call for Papers

Papers (20 double-spaced pages or fewer) must be received by 19 November 1999. Submissions this year will be made entirely electronically. Notification of acceptance or rejection will be mailed to the contact author by 1 February 2000. Camera ready copy of accepted papers is due 3 April 2000. Each paper will be allotted up to eight (8) pages in the proceedings. Extra charges will be made for papers exceeding the limit and for coloured photos.

Important Dates

Papers		Posters / Videos	
Papers due:	19 November 1999	Posters / Videos due:	7 March 2000
Notice of decision:	1 February 2000	Notice of decision:	10 April 2000
Camera ready papers due:	3 April 2000		

For the latest information on the Call for Papers, the submission process, and the 2000 conference, visit the Graphics Interface web site at :

http://www.dgp.toronto.edu/gi

Constitution of the CSCSI/SCEIO

Article I - Name

This organization shall be called the Canadian Society for Computational Studies of Intelligence/Société Canadienne des Études d'Intelligence par Ordinateur, hereafter referred to as CSCSI/SCEIO.

ARTICLE II – Purpose

A. CSCSI/SCEIO is organized and will be operated exclusively for educational and research purposes in the interest area of the Computational Studies of Intelligence and in the furtherance thereof.

B. The Society will promote the interest of professionals by:

1. Setting up study groups which will investigate and report on relevant major issues.
2 Organizing both seminar and tutorial meetings.
3. Publishing the CSCSI/SCEIO newsletter containing information of interest to members.
4. Forging and maintaining informed links with Government and Industry.
5. Other appropriate means. No addition may contradict the main purpose stated in Article II.A. above.

Article III – Membership

A. Membership is open to any person upon payment of dues as determined from time to time by the Executive Committee of CSCSI/SCEIO.

B. Applicants for membership shall submit their applications to the Secretary of CSCSI/SCEIO.

C. The membership of any member of CSCSI/SCEIO will be terminated if he or she:

1. fails to pay dues within 30 days of the date on which they are payable.
2. resigns his membership in CSCSI/SCEIO, such resignation being effective after 30 days notice to the Secretary.

Article IV – Officers

A. The governing body of CSCSI/SCEIO shall be the Executive Committee. Its members shall consist of the four officers of CSCSI/SCEIO: the Chairman; the Vice-Chairman, the Secretary and the Treasurer.

B. The duties of the Chairman include:

1. Calling and presiding at meetings of the Executive Committee and of CSCSI/SCEIO;
2. Appointing all standing and ad hoc committees;
3. Appointing ad hoc and standing committee Chairmen and others as required;
4. Appointing members to fill elective offices that may become vacant between elections through resignation or ineligibility of an incumbent officer.

C. The duties of the Vice-Chairman include:

1. Presiding at meetings in the absence of the Chairman;
2. Assuming the duties of the Chairman in the event of the Chairman's resignation or incapacity;
3. Assuming any duties delegated by the Chairman.

D. The duties of the Secretary include:

1. Keeping minutes of business meetings of CSCSI/SCEIO and of the Executive Committee;
2. Maintaining records and correspondence of CSCSI/SCEIO;
3. Notifying members of the Executive Committee of the time, place, and agenda of the committee meetings;

E. The duties of the Treasurer include:

1. Supervising the financial affairs of CSCSI/SCEIO;

2. Maintaining and reporting financial records of the CSCSI/SCEIO;

3. Reporting CSCSI/SCEIO finances annually.

F. The Chairman, Vice-Chairman, Secretary and Treasurer shall be elected by the members of CSCSI/SCEIO to terms of office of two years, beginning June 1 of even-numbered years.

Article V – Election of Officers

A. The Chairman shall appoint a nominating Committee by November 30th in each of odd-numbered year. This committee will nominate at least one candidate for each elective office and secure acceptance of nominees. The nominating committee shall inform the members of CSCSI/SCEIO of its slate of candidates, and solicit further nominations from the members at that time.

B. Ballots will be mailed first class from and returned to the Chairman not later than February 28th of each even-numbered year; they shall be mailed to all CSCSI/SCEIO voting members. Ballots shall state the last day for return of a voted ballot. This date shall be at least 30 days after the last ballots are mailed. Of the ballots returned, a plurality of votes cast for each office determines the winner of that office.

C. The ballots will be counted and all members of CSCSI/SCEIO shall be informed of election results no later than April 1 of each even-numbered year.

Article VI – Meetings

A. At least one business meeting of CSCSI/SCEI0 will be held every other year.

Article VII – Amendments

A.1. A resolution by a simple majority of the Executive Committee shall be sufficient to cause a constitutional amendment to be voted on by CSCSI/SCEIO members. An amendment can be proposed to the Executive Committee by any of its own members, or by any member of CSCSI/SCEIO.

2. A petition of 10% of the members shall be sufficient to cause a constitutional amendment to be voted on by CSCSI/SCEIO members. The right to petition shall be independent of any decisions taken in accordance with the above Article VII.A.1.

B. The proposed amendment shall be voted on by the following mail balloting procedure:

1. The ballots shall be mailed out by first-class mail from (and returned to) the Chairman. The ballot shall include (i) a copy of the proposed amendment including a specification of the date on which it will become effective; (ii) a copy of the article(s) in the existing bylaws that is (are) being proposed for amendment.

2. Only ballots received by the Chairman postmarked within 30 days after the last ballot was mailed but shall be valid.

C. The amendment shall become effective if it is approved by a two-thirds majority of all valid ballots.

Article VIII – Dissolution

In the event of dissolution of CSCSI/SCEIO, all assets of the Society will be transferred to the members. Dissolution shall be by constitutional amendment.

WWW: http://www.precarn.ca/

No News about PRECARN-III Proposal

There is still no news about the proposal PRECARN submitted to Industry Canada in October 1998 for a new, third phase of collaborative research extending through to 2005.

News from the 9th Annual IRIS-PRECARN Conference (1999)

PRECARN IX was held 7–9 June 1999 at the Regal Constellation Hotel, Toronto. Over 300 people attended the conference. The Marketplace featured 33 technology demonstrations and commercial exhibits from Canadian virtual reality companies and university researchers.

There were 37 entrants to the poster competition. The poster winners at the conference were:

Gold winner: **Haniel Croitoru**, Queen's University (poster title: *3D Computer Assisted Preoperative Planning of Distal Radius Osteotomies*);

Silver winner (tie): **Simon DiMaio**, University of British Columbia (poster title: *Position and Force Trajectory Programming within a Virtual Excavation Environment*);

Silver winner (tie): **Thomas Tang**, Queen's University (poster title: *Calibration and Point-Based Registration of Fluoroscopic Images*).

The Gordon M. MacNabb Scholarship Award winner is **Faustina Hwang**, Memorial University, Newfoundland. Hwang graduated from Memorial this spring with a 93% overall average in Electrical Engineering. Her Master's degree in Engineering is about techniques that will improve robots so they are better-suited to the needs of disabled persons.

10th Annual IRIS-PRECARN Conference (2000)

PRECARN X will be part of the 31st International Symposium on Robotics (ISR 2000), May 14-17, Montréal, Québec. Web pages for ISR 2000 are at http://www.precarn.ca/isr2000

ISR 2000 will also be associated with the Artificial Intelligence (AI) 2000, Graphics Interface (GI) 2000, and Vision Interface (VI) 2000 conferences. The CFPs for these conferences are printed in this issue. These conferences will be combined with a "Robotics of Tomorrow" Exhibition.

KR 2000

Breckenridge, Colorado, USA
12-15 April 2000

Seventh International Conference on Principles of Knowledge Representation and Reasoning

Explicit representations of knowledge manipulated by inference algorithms provide an important foundation for much work in Artificial Intelligence, including natural language dialogue systems, high level vision, robotics and other knowledge-based systems.

The KR conferences have established themselves as the leading forum for timely, in-depth presentation of progress in the theory and principles underlying the representation and computational manipulation of knowledge. The traditional very high standard of papers will be maintained at KR2000.

Expanding on that role, KR2000 will be a place for the exchange of news, issues, and results among the entire community of researchers in the principles and practices of knowledge representation and reasoning systems.

WWW: http://www.kr.org/kr/kr00

CSCSI
SCEIO

AI'2000 Call for Papers

Thirteenth Canadian Conference on Artificial Intelligence
14-17 May, 2000
Montreal, Quebec, Canada

Sponsored by: Canadian Society for Computational Studies of Intelligence (CSCSI) /
Société canadienne pour l'étude de l'intelligence par ordinateur (SCEIO)

Submitted papers must not exceed **5000 words** in length, including abstract and bibliography. Theoretical and position papers will be judged on their originality and contribution to the field of AI and applied papers on the importance and originality of the application. Acceptance also depends on the quality of the written presentation. Authors should list, in decreasing order of relevance, 1 to 3 of following keywords:

AI for ecommerce
AI on the Web
Applications (specify)
Case based reasoning
Cognitive modelling
Data mining
Diagnosis
Information integration
Intelligent agents
Knowledge acquisition
Knowledge representation
Language understanding and processing
Learning
Neural nets/connectionism
Perception
Planning
Problem solving
Reasoning (indicate subarea)
Robotics
Search
Speech processing
Theorem proving
Uncertainty
Other (specify)

The AI'2000 final program will include both plenary and poster sessions.

Electronic submission (in postscript or Microsoft Word format) is strongly encouraged, although hard copy submission is also permissible. A separate electronic abstract must be submitted giving in order the following information: (1) title of the paper, (2) full names, postal addresses, phone numbers, and email addresses of all authors, (3) an abstract of no more than 250 words and (4) keywords to classify the paper for review purposes, (5) contact author if other than the first author. As a condition of acceptance, the author or a co-author must present the paper at the conference. If the paper is being submitted to other conferences, either verbatim or in essence, authors must clearly indicate this on the cover page.

SUBMISSION DETAILS and DATES:

Paper submission deadline: **November 12, 1999**
For all other details, see: **http://cscsi.sfu.ca/conferences/ai2000/ai2000_cfp.html**

Call for Workshop Proposals: Please see the web site.

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Miscellaneous

Poor Interface Design (Contd.)

On 3 July 1988, the USS *Vincennes* shot down the civilian passenger Iran Air flight 655. All 290 people on board were killed. Considerable blame was apportioned to the design of the Aegis missile system user interface, which had been designed for tracking missiles, not airplanes. Apparently, the crew were feeling stressed because of a recent encounter with a boat. The missile system operator believed, erroneously, that the plane was descending when in fact is was ascending. The operator also misidentified the plane as an Iranian F-14 fighter that he had identified earlier, but was still sitting ion a runway.

The accident was attributed to human error. However, the design of the user interface also seems to have been at fault. "[A]ltitude information was not displayed on the main screen, and that there was no indication of the rate of change of altitude (or even of whether the plane was going up, or going down, or remaining at the same altitude)" (Neumann, 1995, p. 35).

Robotic Deaths

A number of people have been killed in robot accidents, violating Isaac Asimov's Four [sic] Laws of Robotics (see Neumann, 1995, pp. 64-65). On 4 July 1981, an industrial robot killed Kenji Urata, a worker at a plant in Hyogo, Japan operated by Kawasaki Heavy Industries. The robot, designed by Unimation of Connecticut, had been manufactured by Kawasaki under license. Urata had entered an off-limits zone to repair another robot, used for delivering production parts, that seemed not to be working. Urata "was pinned by the robot's claw against a machine for processing automobile gears" (Neumann, 1995, p. 65). Another worker who came on the scene could have shut down the machine by opening a fence. He elected to jump over the fence and set the machine to manual. "One report implied that the man was actually pinned by the second robot, which was delivering parts for the production-line activity. Subsequent reports noted possibly as many as 19 more robot-related deaths in Japan, six of which were later suspected of being triggered by stray electromagnetic interference affecting the robot" (Ibid.).

According to the national Center for Disease Control in Atlanta, the first documented robotic death in the U.S. occurred on 21 July 1984 in Michigan. A man, "[w]orking in a restricted area with automated die-casting machinery ... was pinned between the back end of a robot and a steel pole. He suffered cardiac arrest and died 5 days later" (Neumann, 1995, p. 65).

Tennis Ball Robots

JEEVES, a lightweight robot that has a large rotating brush that can gather as many as eight tennis balls at a time (Thrun, 1997, p. 47), competed in the 1996 Annual AAAI Mobile Robot Competition and Exhibition. According to Thrun's article, professional tennis coaches in the US use up on average $6500 of their clients' money picking up balls (Ibid., p. 52).

Gas-Powered Laptops

The Gas Turbine Laboratory at MIT is developing miniature gas turbine engines that, coupled with miniature electric generators, could replace batteries in devices such as laptop computers. One such prototype engine is the size of a laptop's battery pack, runs on butane, and provides 20 hours of computer use.

Lab director Alan Epstein says a turbine-driven power pack could be made about 25% smaller than today's lithium batteries and last twice as long between refuellings. The MIT model resembles a miniature jet engine and runs on butane. The U.S. Army, which is funding the research, is planning to use the new engines to power GPS receivers, night-vision goggles and other military gear (Andreeva, 1998). For more information, see http://web.mit.edu/aeroastro/www/labs/GTL/research/micro/micro

References

Andreeva, Nellie (1998). A Tiny Turbine to Power Your Laptop. *Business Week*, 13 July 1998, p. 139.

Neumann, Peter G. (1995). *Computer-Related Risks*. New York, NY: ACM Press / Reading, MA: Addison-Wesley Publishing Company.

Thrun, Sebastian (1997). To Know or Not to Know: The Utility of Models in Mobile Robotics. *AI Magazine*, Vol. 18, No. 1, Spring 1997, pp. 47-54.

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