



# Canadian Artificial Intelligence

# Intelligence Artificielle au Canada

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**1986**

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An official publication of CSCSI,  
the Canadian Society for  
Computational Studies of  
Intelligence

Une publication officielle de la  
SCEIO, la Société canadienne  
pour l'étude de l'intelligence  
par ordinateur

**INSIDE / À L'INTÉRIEUR :**

Laboratory for AI in Education at  
Laval University  
Laboratoire d'IA en éducation  
à l'Université Laval  
Montreal Conference Report  
Rapport sur la conférence  
de Montreal



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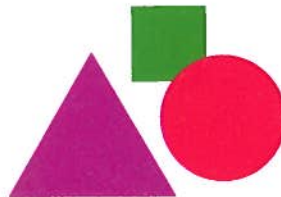
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## Canadian Society for Computational Studies of Intelligence

Founded 1973

CSCSI is the Canadian society for the promotion of interest and activity in Artificial Intelligence. It conducts workshops and fully refereed national conferences, publishes this magazine, sponsors the journal *Computational Intelligence*, and coordinates activities with related societies, government, and industry.

To join CSCSI, use the membership form in this issue. Non-Canadian members are welcomed.

CSCSI is affiliated with the Canadian Information Processing Society and International Joint Conferences on Artificial Intelligence, Inc.

## Société canadienne pour l'étude de l'intelligence par ordinateur

Fondée 1973

SCEIO est la Société canadienne encourageant l'intérêt et la recherche en Intelligence Artificielle. Elle organise des ateliers ainsi que des conférences nationales avec évaluation des articles soumis. Elle publie ce magazine, subventionne le journal *Intelligence Informatique*, et coordonne toute interaction avec, des sociétés parallèles, le gouvernement, et l'industrie.

Pour devenir membre de la SCEIO, veuillez utiliser le formulaire d'inscription de ce numéro. Les non-canadiens sont bienvenus.

La SCEIO est affiliée à l'Association canadienne informatique, et aux International Joint Conferences on Artificial Intelligence, Inc.

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## Canadian Artificial Intelligence

Founded in 1974 as *CSCSI/SCEIO Newsletter*

[En français, page 9]

*Canadian Artificial Intelligence* is published quarterly by CSCSI/SCEIO, and is a benefit of membership in the society.

*Canadian A.I.* solicits contributions in English or French on any matter related to artificial intelligence, including:

- Articles of general interest.
- Descriptions of current research and courses.
- Reports of recent conferences and workshops.
- Announcements of forthcoming activities.
- Calls for papers.
- Book reviews (and books for review).
- Announcements of new AI companies and products.

## Intelligence Artificielle au Canada

- Opinions, counterpoints, polemic, controversy.
- Abstracts of recent publications, theses, and technical reports.
- Humour, cartoons, artwork.
- Advertisements (rates upon request).
- Anything else concerned with AI.

Please send submissions, either on paper or by electronic mail, to the editor at the address on the previous page. On-line submissions are preferred, but they should not contain justification spaces or hyphenated line breaks as these just have to be edited out before typesetting; 'plain typing' is best.

*Canadian A.I.* is published in March, June, September, and December. Material for publication is due on the 15th of the preceding month.



## Presidents' reports

### 1. Gord McCalla, Outgoing President

As I look back over the two years of my presidency and the previous two years of my vice (presidency, that is), it is hard to believe how the Canadian AI scene in general and CSCSI/SCEIO in particular has changed. From a small, informal grouping of around 100 people four years ago, CSCSI/SCEIO has grown into a diverse conglomeration of over 800 people. No longer merely a repository for academics and graduate students, the Society is now home to people from industry and government as well. The Society's newsletter has been transformed into a slick, entertaining, quarterly which actually appears on time! The Society's conferences have been attracting more and more attendees, with the Montréal conference being the biggest yet. The Society has hosted its first special-purpose workshop (the Theoretical Approaches to Natural Language Understanding workshop last year in Halifax), and is now sponsor to the brand-new international AI journal *Computational Intelligence / Intelligence informatique* (published by the National Research Council of Canada). CSCSI/SCEIO now spans the country, with meetings of various sorts having been held in the Maritimes, Quebec, Ontario, the Prairies, and British Columbia over the years; and is finally beginning to make inroads into French Canada, with French language articles in both *Canadian A.I. / I.A. au Canada* and the Montréal conference proceedings.

No less dramatic than the CSCSI/SCEIO transformation has been the transformation of AI in Canada. I can still vividly remember the time (even four years ago) when "AI" was almost a dirty word in many academic circles, and was a non-existent word outside of academe. (As a Prairie lad, I should clarify this — the meaning of "AI" as we refer to it was non-existent; other meanings certainly were widely understood, especially in rural Canada). During the four years I served on the CSCSI/SCEIO executive, things

have changed drastically: the term now has meaning both inside and outside of academe.

Hordes of undergraduate and graduate students wanting to study AI are beating down the doors of universities (and the universities have responded by desperately trying to attract AI faculty, or by limiting enrolments of AI-oriented students). AI has infiltrated the "real world", and has been adopted as a favourite subject in the popular media. Satellite symposia on AI have become commonplace. Logic programming has become an independent subject of study in its own right (or wrong). Almost monthly, large reports are issued from consultants or government departments on the state of various areas of AI. The Canadian Institute for Advanced Research has funded a major AI project. The Canadian Society for Fifth Generation Research has come into being. Most of the major AI hardware and software companies have established offices in Canada. AI research and development has begun in the laboratories of various Canadian companies. AI start-up companies are a Canadian growth industry.

In the process, of course, the term "AI" has come to mean just about anything (although it probably isn't *quite* so de-valued as the term "expert system"). It is clear that there is a crying need for reliable and authoritative information on AI in this country, and it is in this regard that CSCSI/SCEIO will continue to make valuable contributions through its magazine, conferences, workshops, and reports, and its sponsorship of *Computational Intelligence / Intelligence informatique*. This educational role is, I believe, the fundamental reason for CSCSI/SCEIO's existence, and whatever else it may become involved in over the years, it should never forget this fact.

I would like to thank the people who have contributed to the Society over the past four years. I would especially like to thank the executive members, Wayne Davis (Treasurer), Mike Bauer (Secretary and SIG Representative to the CIPS board), John Tsotsos (Vice-President, and formerly Secretary), and Nick Cercone (Past President) for their efforts. Although I hate to

use the word in conjunction with "Treasurer", a special debt is owed to Wayne Davis, who has served selflessly as Treasurer for a decade now, keeping the Society out of the red, and maintaining the only set of records which deserve to be called records. Without him, I doubt that CSCSI/SCEIO could have survived. I would also like to express my gratitude to the conference and workshop organizers over the years of my mandate (reign?), including Ted Elcock, John Tsotsos, Richard Rosenberg, Nick Cercone, Renato de Mori, and Bill Havens, as well as all the people who helped with local arrangements, served on programme committees, chaired sessions, and participated in the conferences and workshops. One other person deserves a special vote of thanks: Graeme Hirst. Graeme has been single-handedly responsible for the transformation of the newsletter into *Canadian A.I. / I.A. au Canada*, and has been instrumental in making the Society much more professional than it had been traditionally (although we still manage to find ways of backsliding occasionally!). Unfortunately, he is stepping down as magazine editor; he will be a hard person to replace.

I join with the rest of the current executive in wishing the new executive good luck. Dick, Renato, Bill, and Randy: may you keep the Society riding firmly atop the AI wave, and may you avoid the problems which occasionally bedevilled your predecessors.

## 2. Dick Peacocke, Incoming President

I would like to take the opportunity as incoming president of CSCSI/SCEIO to add a few remarks to Gord's. The society has indeed been flourishing. These remarks are being written at the Montréal conference, the sixth Canadian conference on artificial intelligence which the society has held. It has turned out excellently. The workshop on theoretical issues in natural language, which was held last year in Halifax, Nova Scotia, was a great success, and we hope to continue having workshops in the years between national conferences. Membership and interest in the society has grown, we now have over 800 members, and we have seen the emergence of a superb new journal, *Computational Intelligence / Intelligence informatique*, sponsored by CSCSI/SCEIO and published by NRC.

The society newsletter has been published in a new format, as *Canadian A.I. / I.A. au Canada* magazine, with interesting contents, and it has

appeared on schedule since September 1984. The magazine is a key benefit of belonging to CSCSI/SCEIO. One of its major functions is to inform you about what's happening and who's doing what. I would like to encourage all members to submit descriptions of their AI-related activities to the magazine, to write philosophical or other pieces on their AI viewpoints, to publish abstracts of their technical reports, etc. Summaries of AI conferences are sought, as well as descriptions of the goals of AI projects that have been launched. Also welcomed are outlines of the objectives of AI companies, and opinions from industry and government on the roles they perceive for AI. Book reviews and cartoons are also needed, and with all these items we will be able to maintain the high standard set by the magazine. And most important of all, we need a new editor to succeed Graeme Hirst, who is obliged by his other work to step down at the end of the summer. If you are interested, please get in touch with me or him.

I too would like to express my thanks to all the people who have been active in serving CSCSI/SCEIO during the last two years, and in particular:

- To Gord McCalla and Nick Cercone who founded the new journal, tirelessly pursued the topic of publicizing Canadian AI, and made numerous other unsung contributions.
- To Wayne Davis who has resolutely managed the finances of CSCSI/SCEIO (for as long as I can remember).
- To Graeme Hirst for his outstanding work in making *Canadian A.I. / I.A. au Canada* so successful.
- To Johnny Ng and P.S. Mueller for their cartoons.
- To Renato de Mori, Bill Havens, and the organizing and program committees for putting on the 1986 Montréal conference.
- To Richard Rosenberg, Fred Popowich, Nick Cercone, and the other organizers of the workshop on Theoretical Approaches to Natural Language Understanding.
- And to the outgoing executive, Gord McCalla (president), John Tsotsos (vice-president), Wayne Davis (treasurer), and Mike Bauer (secretary).

Looking ahead, one issue springs to mind. We have always had lofty expectations for AI, and recently some of those expectations have been converted into promises. Now AIers face the task of keeping those promises! The task affects us all in one way or another: through

additional types of research being pursued, the use of different criteria for judging quality of research, changes in funding mechanisms, hype surrounding some of the applications in industry, opportunities generated for consulting, and a much broader general interest in AI. Thankfully there is a lot of enthusiasm and optimism about AI, but occasionally it seems to be thought of as the "magic bullet" (cf. penicillin) that will immediately cure all the ills brought on by conventional software, as well as doing everything that can't currently be done!

Whether or not CSCSI/SCEIO as a society should try to do anything about that opinion, we its members should take every chance we get to demonstrate the absurdity of the "magic bullet" theory. If we don't, there'll be a lot of egg on our faces when we have to explain what AI is really all about.

I'm looking forward to my term as president of CSCSI/SCEIO. I and the rest of the executive are here to serve you. Help us do it.

□ □ □ □ □

Readers write

De nos lecteurs

Letters to  
the Editor

Lettres à  
l'éditeur

En français, s.v.p.

Prière de prendre un abonnement pour le *Canadian Artificial Intelligence* et *Computational Intelligence*. J'aimerais avoir une version française, si disponible.

Denis Boisclair  
Logiq  
Montréal

I am writing to you concerning *Canadian Artificial Intelligence*, the first copy of which I received recently as a new member of CSCSI/SCEIO.

I was very surprised to realize that the title of the magazine is in English only, given that it is the official publication of a Canadian learned society. The magazine does contain a French summary of its contents, as well as articles in French; it would seem only natural for it to have a bilingual title as well. I would like to suggest

that this be given consideration.

I look forward to future issues of this important magazine.

Philippe Duchastel  
Université Laval  
Québec

*A compter de ce numéro nous nous appelons également Intelligence artificielle au Canada (Computational Intelligence a toujours eu un nom en français, Intelligence informatique), et, grâce à nos traducteurs volontaires, notre sommaire en pages 3 and 4 est rédigé dans les deux langues. Nous continuerons de publier les articles dans la langue dans laquelle on nous les fait parvenir, ainsi qu'un résumé dans l'autre langue. Nous ne pourrions nous permettre dans un avenir rapproché l'effort supplémentaire de traduction, ni l'augmentation de frais d'impression et de poste, qui résulteraient d'un magazine entièrement bilingue et donc deux fois plus long. — l'éditeur*

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## New Editor Sought

CSCSI/SCEIO seeks applicants for the volunteer position of editor of *Canadian A.I. / I.A. au Canada*. People interested should contact the present editor for details.

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## Erratum

In the March issue, the name of Professor Randy Goebel was inadvertently omitted from the list of members of the program committee of the Sixth Canadian Artificial Intelligence Conference.

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## Deadline for the September issue is 15 August

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## Guidelines for electronic submissions

*Canadian A.I.* prefers submissions to be made by network mail when possible, to eliminate the need for retyping. However, please do not send text that has been through a document formatter; extra embedded spaces and hyphenated line breaks just have to be edited out again before typesetting. The best thing to send is plain typing or *troff* source (preferably with *-me* macros).



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*I. A. au Canada* en français?

### Plus d'argent pour le programme spatial canadien, 13

Le gouvernement canadien a annoncé qu'il investirait 476\$ millions en sus des 800\$ millions à dépenser au cours des quinze prochaines années pour le programme spatial canadien. Ceci accélérera la recherche en IA et en robotique.

### Le fond pour la technologie de pointe de l'Ontario, 13

Le nouveau budget ontarien, présenté le 23 avril, comprend un fond d'un milliard de dollars pour dix ans, pour la technologie de pointe. Les "champs stratégiques" couverts devraient probablement inclure l'IA et la robotique.

### Subventions du CRSNG: de bonnes et de mauvaises nouvelles, 13

Le gouvernement n'a pas approuvé les augmentations de dépenses prévues par le CRSNG. Par contre il a promis qu'il n'y aurait pas de coupures. Il a également annoncé un programme qui égalerait dollar pour dollar toute contribution du secteur privé.

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- Un groupe s'intéressant à l'IA voit le jour à Winnipeg.
- L'atelier sur l'acquisition de connaissances devant avoir lieu à Banff en novembre a reçu plus de 100 articles.
- Petro-Canada a donné 100,000\$ à l'institut canadien pour la recherche avancée, afin de soutenir la recherche en intelligence artificielle.
- La bourse Daniel Berlin est créée à l'université de Toronto.
- Le Dr. Arthur May succède à Gordon MacNabb comme président du CRSNG.
- Le gouvernement compte ouvrir "un centre de calibre international de fabrication industrielle" à la Science Place Canada de Winnipeg.

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La sixième conférence canadienne d'intelligence artificielle, qui eut lieu à l'Ecole Polytechnique de Montréal du 21 au 23 mai, fut la plus importante que la CSCSI/SCEIO eut organisé jusqu'à maintenant avec 375 personnes inscrites.

Le prix pour le meilleur article fut gagné par James Delgrande de l'université Simon Fraser. Une liste de tous les articles apparaît à la page 20. Les actes de la conférence peuvent être commandés.

L'assemblée annuelle de la CSCSI/SCEIO eut lieu durant la conférence. Sujets discutés:

La CSCSI/SCEIO compte maintenant plus de 800 membres, en comparaison à 250 il y a deux ans. Ce chiffre n'inclut pas les nombreux nouveaux membres inscrits pendant la conférence.

La prochaine conférence aura lieu à Edmonton en 1988. De plus, la société envisage de commanditer un atelier sur l'IA en éducation à Calgary en 1987.

La société a été approchée par deux maisons d'éditions au sujet de la distribution ou réédition des actes de conférences de la CSCSI/SCEIO.

Un résumé de la situation financière courante de la société fut présenté. Un rapport complet du trésorier apparaîtra dans le numéro de septembre de *I. A. au Canada*.

### Création du Laboratoire d'IA en Education à l'Université Laval (*Philippe Duchastel*), 22

En français.

### Recherche à Waterloo sur les systèmes intelligents d'information personnelle fondés sur la logique (*Randy Goebel*), 26

Le groupe de programmation logique et d'intelligence artificielle de l'université de Waterloo a reçu récemment une subvention thématique de 450,000\$ pour trois ans du CRSNG. On vise à construire une machine pour l'IA qui soit peu dispendieuse, puissante, et qui puisse raisonner. Le point de départ est le langage de programmation logique Prolog. L'essentiel du projet porte sur un système, appelé "le théoricien", qui peut assembler automatiquement des théories.

Le groupe développera un prototype du "théoricien", une version améliorée de Prolog qui lui est nécessaire, ainsi que plusieurs applications démontrant comment "le théoricien" englobe le raisonnement par défaut, les systèmes experts de diagnostic, et un modèle de l'utilisateur requis pour la communication efficace entre l'homme et la machine. Les applications comprennent

- un programme diagnostiquant les fautes dans un



système complexe,

- un système diagnostiquant les problèmes de lecture chez l'enfant, et
- une interface en langue naturelle pour ces systèmes de diagnostic.

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- *The Connection Machine* par W. Daniel Hillis, compte rendu par Bart Selman;
- *Models of the visual cortex* par David Rose and Vernon G. Dobson, compte rendu par John Tsotsos.
- Livres reçus.
- Résumés d'*Intelligence Informatique*, 2(1), février 1986, et 2(2), mai 1986, Numéro spécial sur l'IA en éducation.

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L'échéance pour le numéro de septembre est le 15 août.

## Intelligence Artificielle au Canada

## Canadian Artificial Intelligence

Fondée en 1974 en tant que *CSCSI/SCEIO Newsletter*

L'*Intelligence artificielle au Canada* est publiée trimestriellement par la CSCSI/SCEIO, et est offerte gratuitement aux membres de la société.

L'*Intelligence artificielle au Canada* encourage les contributions, en français ou en anglais, portant sur l'intelligence artificielle. Ceci comprend:

- Des articles d'intérêt général.
- Des descriptions de recherche courante et de cours.
- Des rapports de conférences récentes et d'ateliers.
- L'annonce d'activités à venir.
- Des requêtes d'articles.
- Des critiques de livres (ainsi que des livres à critiquer).
- L'annonce de nouvelles compagnies en IA et de leurs produits.
- Des opinions, des répliques, tout ce qui est polémique.
- Des résumés de publications récentes, de thèses et de rapports techniques.

Des trucs humoristiques ou artistiques, des bandes dessinées.

Des annonces (s'enquérir des frais).

Tout autre matériel touchant à l'IA.

Veillez expédier vos contributions, soit sur papier ou par courrier électronique, à l'éditeur dont l'adresse apparaît à la page précédente. Nous préférons le courrier électronique mais ce qui est ainsi envoyé ne devrait pas contenir d'espaces de justification ni de mots à trait d'union puisque ceux-ci doivent être supprimés avant la mise en page; un texte 'tel quel' est ce qu'il y a de mieux.

L'*Intelligence artificielle au Canada* apparaît en mars, juin, septembre et décembre. Le matériel pour un numéro doit nous parvenir le 15 du mois précédant sa parution.

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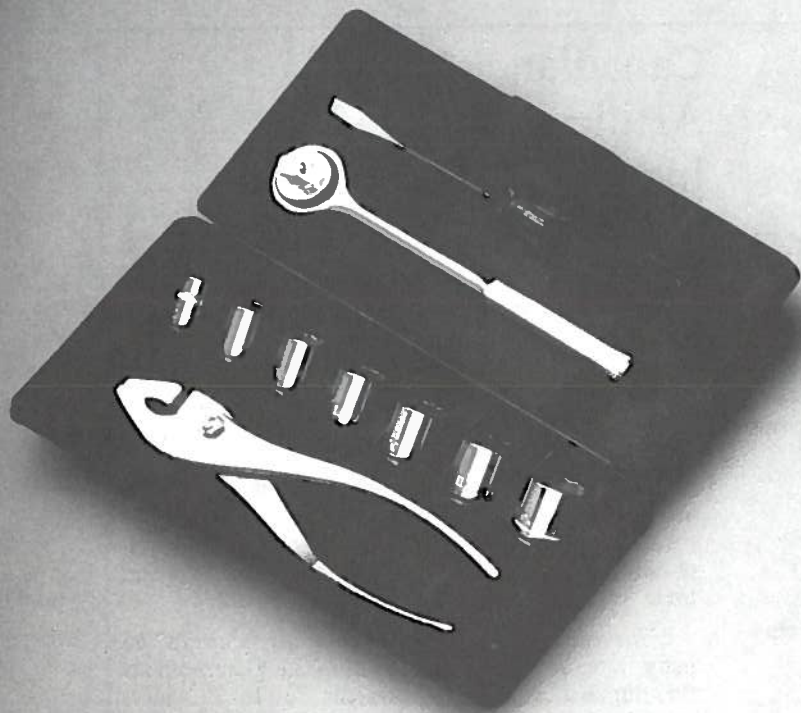
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- Hypothetical Scenario Generation
- Comparative Evaluation
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Inference Canada Inc., 5915 Airport Road, Suite 200, Mississauga,  
Ontario L4V 1T1. Contact Don Pepper at 416/671-8405.  
Ferranti Computer Systems Limited, Ty Coch Way, Cwmbran,  
Gwent NP44 7XX. Contact Barrie Avis at (06333) 71111.  
Nichimen Corporation, 11-1, Nihonbashi 3-Chome, Chuo-ku,  
Tokyo 103 Japan. Contact K. Kobayashi at (03) 277-5017*

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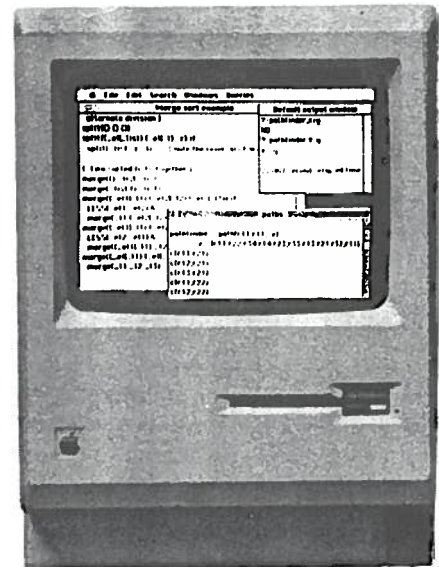
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## Expert system shell

### **apes**: An augmented prolog for expert systems

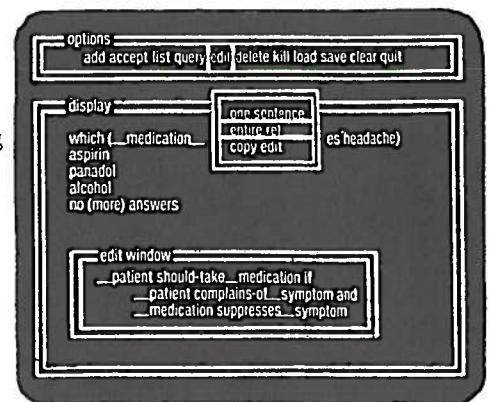
**apes** is an effective logic programming and Expert System construction tool which runs on LPA PROLOG. Features of PROLOG may be accessed from within **apes** for sophisticated programming. A simple Natural Language facility enhances the robustness of application. **apes** has been successfully applied in various AI projects in the world including Expert Systems in the domains of Geology, Law, Biochemistry, Medicine, and Engineering.



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LPA **micro**-PROLOG professional, **apes**, LPA **micro**-/**sigma**-PROLOG Reference manual, **apes** manual, introductory logic programming text book "micro-PROLOG: Programming in Logic", by Clark & McCabe; available for \$1072.64 + tax + shipping(\$20.00) for **micro**-PROLOG, \$3,718.48 + tax + shipping(\$20.00) for **sigma**-PROLOG versions.

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## AI News

### More Money to Canadian Space program

The boost it will give to AI and robotics in Canada was featured prominently in the recent Canadian government announcement that an extra \$476 million has been committed to the national space program. This is in addition to the \$800 million announced in March to be spent over the next 15 years.

About half of the total amount will be used for Canada's part in the proposed U.S. space station: the construction and operation of a "Mobile Servicing Centre" for the assembly and maintenance of the station. This will involve development in automation, robotics, and AI and expert systems, building on the earlier work on the CANADARM.

In addition, the Remote Sensing Program will receive \$77 million for continued development through the Department of Energy, Mines, and Resources.

Other aspects of the program include development of MSAT, billed as the world's first satellite system for mobile communications, and continuation of the Canadian astronaut program.

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### Ontario High-Tech Fund

A \$1 billion, 10-year technology fund is one of the key elements of the new Ontario provincial budget, announced on 23 April. The budget emphasized throughout the importance of technology in Ontario's future development.

The fund consolidates provincial spending on technological research, and about half of the money allocated is "new". The fund will support "strategic fields", though details have not yet been worked out. Presumably, AI and robotics will be included.

Education in technology and science will also receive more government attention, apparently at the expense of the humanities. A special program to encourage women to enter fields of science and technology is planned.

Opposition leaders criticized the budget as merely recycled ideas from the past.

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### NSERC Research Funding: Good News, Bad News

The federal government has basically rejected the five-year plan proposed by the Natural Sciences and Engineering Research Council that would have seen a substantial increase in research funding by the Council.

However, NSERC was not treated as badly as it has been at times in the past. The government has promised it a base level of funding of \$311.6 million per annum for the next five years, equal to its 1984-85 budget. (There is no allowance for inflation.) The government also restored the 1985-86 budget to the same level, and gave a temporary increase to \$324 million for 1986-87.

A system of matching grants to NSERC was also announced. Starting in 1987-88, the government will contribute an extra dollar to NSERC for every dollar contributed privately, up to 6% of the Council's previous year budget. These contributions in each preceding year will be included in the matching base for the following year.

The announcement of increased funds for 1985-86 and 1986-87 came just too late to prevent cuts in this year's grants. The number of new grants was reduced by 10%, and grants that were renewed had their value cut by 4%. The new money will be used for equipment grants.

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### Interact R&D Starts AI Division

Interact Research and Development Corporation has an eight-year history of successfully developing and integrating software and hardware systems to meet the unique needs of its clients. During this time, divisions were established in numerical modelling, communications, marine science, software development and hardware development at laboratories in Victoria and Regina.

After considerable planning and preparation, Interact created a division of Artificial Intelligence in the spring of 1985. The Artificial Intelligence Division is currently oriented towards contract research on knowledge-based systems for clients in both the private and public sectors.

Basic and applied research is conducted by a multi-disciplinary team consisting of cognitive psychologists, computer scientists and engineers. At present the division is engaged in the

following research activities:

- Expert system applications.
- Expert system shell development.
- Knowledge representation.
- Automated knowledge acquisition.
- Application of machine learning to expert systems.
- Application of database techniques to expert systems.
- Parallel distributed processing.

The Artificial Intelligence Division is located at 4252 Commerce Circle, Victoria, B.C., V8Z 4M2; telephone 604-727-6641, telex 049-7309. For further information contact Drs B.A. Schaefer, B.J. Smith, or I.R. Morrison.

*Brian Schaefer  
Interact R&D Corp*

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## Art-Expert Inc

Art-Expert est une compagnie privée spécialisée dans le domaine de l'intelligence artificielle.

Ses projets actuels sont:

1. Système experts dans le domaine juridique Pour une institution financière canadienne. Art-Expert a terminé la première phase de développement de ce système. Au cours des prochains mois le système sera lancé en tant que produit de l'institution. Il est le premier de son genre au Canada, il tient compte de la langue française.
2. Outils intelligents de gestion de projet.
3. Structure de représentations des connaissances.
4. Outil de développement de système expert.

---

## Student Volunteers Needed for AAI-86

AAAI-86, the American National Conference on Artificial Intelligence, will be held 10-15 August 1986, in Philadelphia. Student volunteers are needed to help with local arrangements and staffing of the conference. To be eligible for a volunteer position, an individual must be an undergraduate or graduate student at a college or university.

Student volunteers receive free registration at AAI-86, as well as a copy of the conference proceedings and a "STAFF" T-shirt. Participating as a volunteer is a terrific way to meet students and researchers in AI and robotics from all over

the world.

Student volunteers help with stuffing of registration packets, creating and distributing conference direction signs, pre-registration and registration of attendees, staffing of science and engineering sessions, staffing of tutorials, and general organizational tasks. Twelve hours of time is officially required from each volunteer, but in the general spirit of the group, many give more than the official minimum.

Some volunteers are needed for a day two weeks before the conference. Some are needed for a day three days before the conference begins. The majority of volunteers will be needed from 10 to 15 August.

If you are interested in participating in the AAI-86 Student Volunteer Program, send your name, electronic and postal addresses, phone number, university of enrollment, and dates available to:

Linda Quarrie, Assoc. Engineer  
Martin Marietta Denver Aerospace  
PO Box 179, MS #0427  
Denver, CO 80201, U.S.A.  
NET: mmda@usc-isi.arpa, with "attn LJQ"  
in the subject header  
Phone: 303-977-4142, -1569, or 697-1834

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## News briefs

### AI in Winnipeg and Calgary

Local AI interest groups are forming in Winnipeg and Calgary. If interested, contact Tony DeLuca, Bldg BT12X Manitoba Telephone System PO Box 6666 Winnipeg, Man R3C 3V6

Alex Rotzang  
Canterra Energy  
PO Box 1051  
Calgary, Alta T2P 2K7  
Phone: 403-267-9111

### Banff Workshop Flooded

The workshop on knowledge acquisition to be held in Banff in November has received over 100 papers, involving about 200 authors and co-authors, in response to its call for papers. The workshop was originally intended to be limited to about 30 people. Brian Gaines, one of the organizers, said that the workshop would be increased in size a little, but many authors would be disappointed.

More details on the workshop may be found in its listing on page 41.

### Petro-Can Supports CIAR

Petro-Canada has made a substantial donation to the Canadian Institute for Advanced Research to support its research program in artificial intelligence. The money has been used to create the Petro-Canada Fellowship in artificial intelligence, to be held by Professor Hector Levesque of the University of Toronto for five years.

### Daniel Berlin Scholarship

The family and friends of Daniel Berlin have set up a scholarship in his memory at the University of Toronto. The award will be given annually to a third year undergraduate showing strong promise of a research career in computer science, with preference given to students in artificial intelligence.

Daniel Berlin was a student in AI at the University of Toronto and Stanford University. He died last year at the age of 28.

### New NSERC President

Dr Arthur May is the successor to Gordon MacNabb as President of the Natural Sciences and Engineering Research Council. Dr May took up

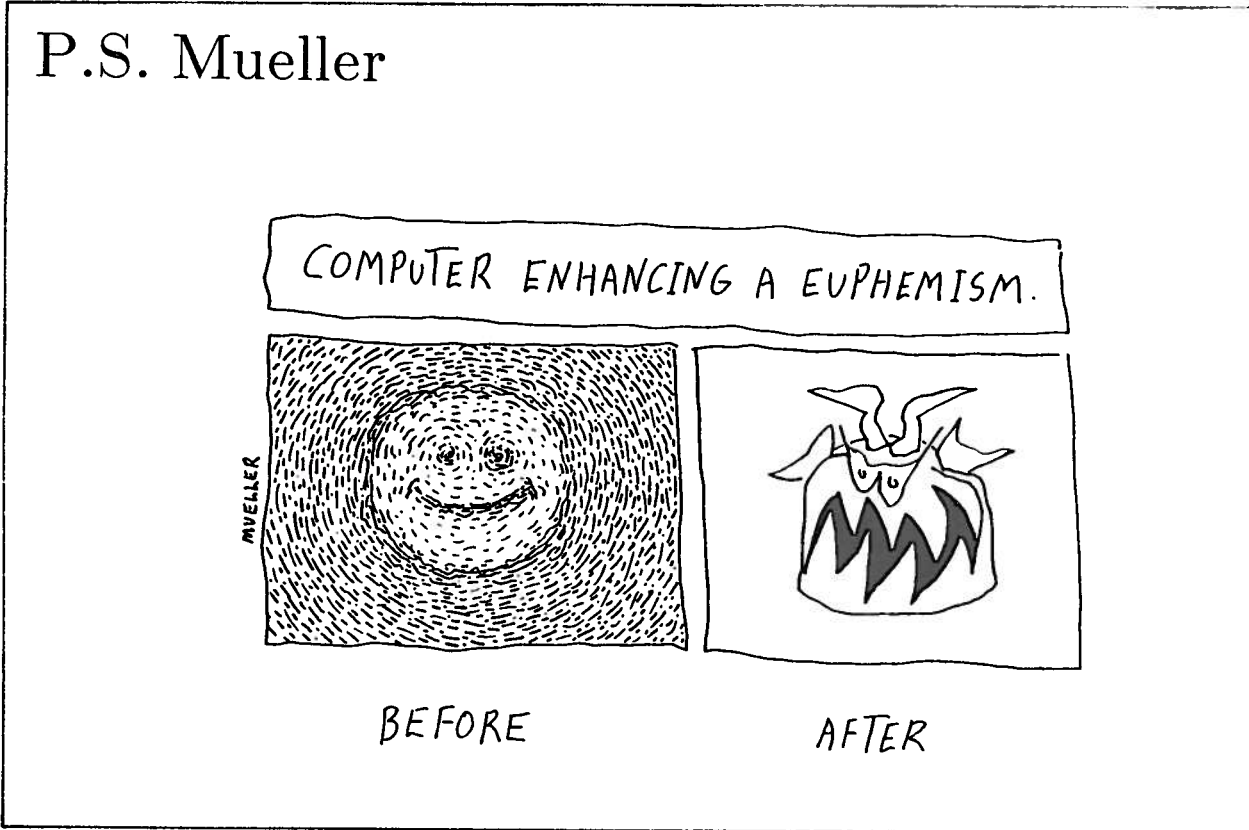
his position in April. Mr MacNabb had been President of NSERC since its creation in 1978. Under his presidency, which emphasized the pure research and the role of universities as a national source of skilled people, NSERC's research budget grew 150%, and several programs fostering industrial cooperation with universities were started.

### Science Place to be used

The government will establish a "world-class centre of excellence for manufacturing technology" in Science Place Canada, in Winnipeg. The centre, to be coordinated by the National Research Council, will seek tenants from industry, universities, and government authorities. The Manitoba Research Council has been invited to participate. The building, a project of the previous federal government, has been empty for some time.

### New Bindings

- Evangelos Milios*, from MIT to the University of Toronto.
- Richard Rosenberg*, from Dalhousie University to the University of British Columbia.
- Taro Shibahara*, from University of Toronto to Bell-Northern Research.



**It's 11 p.m.**  
**Do you know what  
your expert system  
just inferred?**

**Computer Professionals for  
Social Responsibility**

**Emploi disponible  
en France**

L'Université de Paris-Sud située à Orsay à 30 minutes de Paris offre plusieurs places de professeur associé et de maître de conférence associé (maître de conférence signifie maintenant "assistant professor"), à des informaticiens ayant présentement un poste hors de la France.

Un doctorat est nécessaire pour poser sa candidature sur un poste de professeur.

Le travail demandé est celui d'un enseignant en informatique (120 heures/an) et la durée de leur séjour doit être au moins de 6 mois.

L'enseignement se fait en français, ce qui n'exige pas un français parfait, mais simplement correct.

Si vous êtes intéressé(e)s à venir entre le 1er octobre 1986 et le 1er octobre 87, envoyez-moi d'urgence un curriculum et une lettre de candidature précisant le poste (professeur ou maître de conférence) sur lequel vous candidatez.

Je serais très content de soutenir toute candidature en Intelligence Artificielle de quelqu'un ayant un bon curriculum. Si, en plus, il/elle s'intéresse à "Machine Learning" (Apprentissage Symbolique Automatique dans mon français), ou à la démonstration automatique de théorèmes, ou à la synthèse de programmes, ou aux environnements Prolog, ou à l'inférence temporelle et incertaine, alors c'est l'enthousiasme!

Yves Kodratoff  
Directeur de recherche au CNRS  
LRI, Bat 490  
Université Paris Sud  
F - 91405 Orsay  
FRANCE

## AI Trivia Quiz

Answers on page 32.

1. Who coined the expression "artificial intelligence"? When and where?
2. Which has more CSCSI/SCEIO members — Prince Edward Island or Romania? British Columbia or Korea? Newfoundland or Philadelphia?
3. Which university has a separate department of artificial intelligence?
4. Which is older — CSCSI/SCEIO or the American Association for Artificial Intelligence?
5. Where would you find an abacus inside a brain?
6. Which Canadian machine translation system is the world's most successful?
7. What is the largest AI conference to have been held in Canada?
8. What was the first mobile robot to smash itself?
9. How many first issues of the CSCSI/SCEIO newsletter have there been? Who edited the first one?
10. Where was the first CSCSI/SCEIO National Conference held?
11. What Canadian AI researcher achieved fame and fortune by appearing on television with Johnny Carson? What song did he perform?
12. What was the name of the taxi driver in the system for route planning developed at the University of Toronto in the late 70's and later continued at the University of Saskatchewan?

*Thanks to Robin Cohen, Randy Goebel, Dick Kittredge, and Brian Nixon for suggesting some of the questions.*



## 1986 Canadian AI Conference at Montréal

The Sixth Canadian Artificial Intelligence Conference, held at Ecole Polytechnique de Montréal, 21 to 23 May, was the largest that CSCSI/SCEIO has yet held. With 375 people registered, it was twice as big as the 1984 conference in London, Ontario. Many of the registrants were not previously members of CSCSI/SCEIO.

The conference featured six invited lectures, 43 papers, a public lecture on problems of 'Star Wars', and a banquet. A conference proceedings was published, and is available by mail from CIPS for those who could not attend the conference; see page 21 for a table of contents, and an order form. The CSCSI/SCEIO annual business meeting was held during the conference; details appear below.

The award for the best paper at the conference was won by James Delgrande of Simon Fraser University for his paper "A propositional logic for natural kinds". Prof Delgrande received a prize of \$1000, and his paper will appear in the journal *Artificial Intelligence*, which sponsors the award.

Brian Smith, a Montreal native now working at Xerox Palo Alto Research Center, gave both an invited technical lecture on his research and also, in his capacity as president of Computer Professionals for Social Responsibility, a public lecture on the U.S. Strategic Defense Initiative. Dr Smith defended the thesis that the technical problems of 'Star Wars' cannot be divorced from its political aspects.



*James Delgrande, winner of the award for the best submitted paper*

The other five invited speakers also gave well-received talks, each of which introduced the session on their particular subfield of AI. They were:

- Elliot Soloway (Yale)
- Candy Sidner (Bolt, Beranek and Newman)
- Pat Hayes (Schlumberger)
- Takeo Kanade (Carnegie-Mellon)
- Mark Fox (Carnegie-Mellon)

The conference banquet was held at a restaurant in Vieux Montréal. (The food, alas, was not representative of the city.) CSCSI/SCEIO president Gord McCalla introduced the society's new president, Dick Peacocke, and related some anecdotes about CSCSI/SCEIO presidents. A





plaque was presented to Kathryn Finter, thanking her for designing the society's logo, which appears on the cover of *Canadian A.I.*, and the conference logo.

Despite the occasional disorganization that happens at every conference, things went smoothly for the most part. Nadine Lasalle of the Centre de Recherche Informatique de Montréal did much of the coordination with conference chairman Renato De Mori of McGill



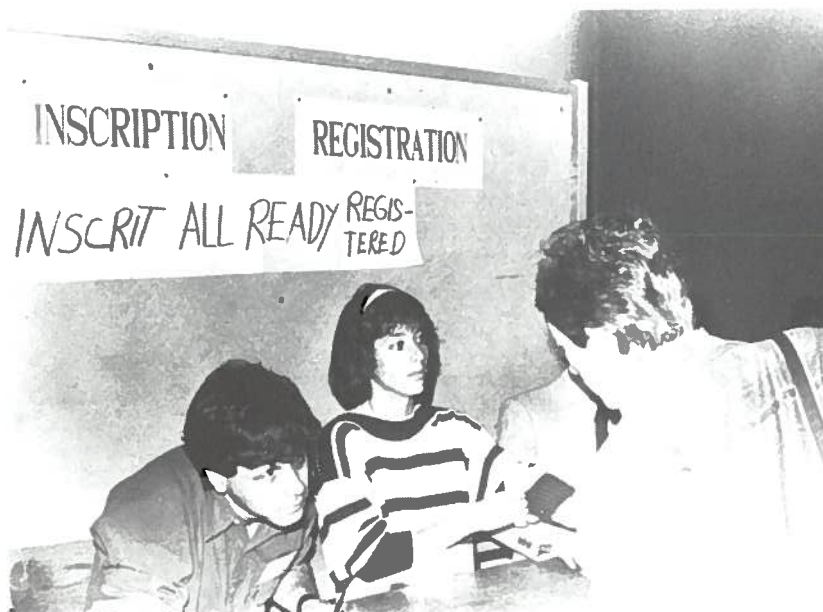
University. They were assisted by a team of local student volunteers.

The next CSCSI/SCEIO conference is planned for Edmonton in 1988.

### CSCSI/SCEIO Business Meeting

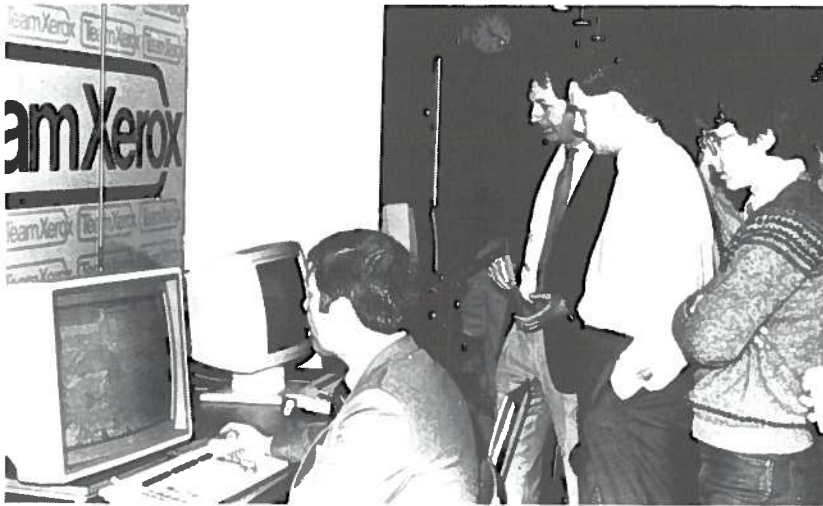
The annual business meeting of CSCSI/SCEIO was held at the Sixth Canadian AI Conference. Outgoing president Gord McCalla presided. Following are the matters discussed.

The society's membership continues to climb rapidly. There are now over 800 members, up from 250 two



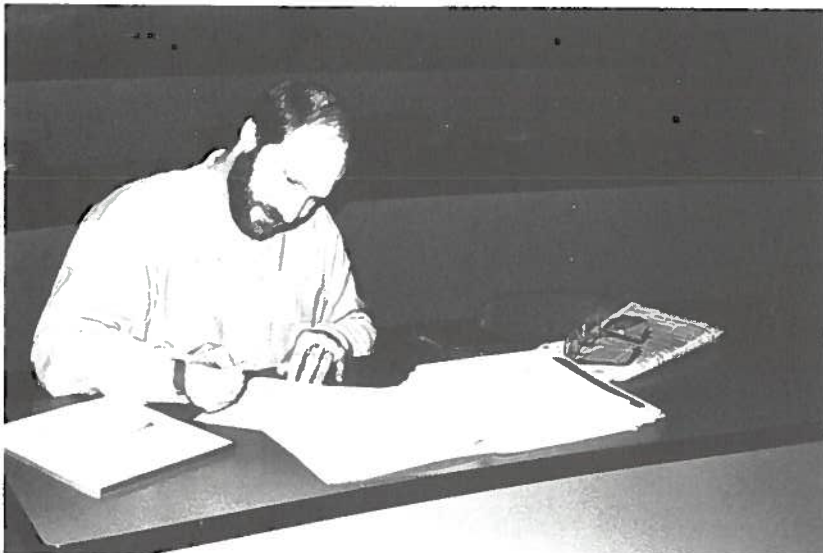
years ago. Conference attendees who paid at the non-member rate automatically became members; a count of how many new members this gave was not available.

There was discussion of the location of the next conference. The meeting voted to recommend to the executive that it be held in Edmonton in 1988, and that conference officials be appointed. In addition, the society may sponsor a workshop in 1987. Ernie Chang of the



Alberta Research Council will investigate the possibility of a workshop in Calgary on AI in education.

The society has been approached by two publishers concerning distribution or republication of CSCSI/SCEIO conference proceedings. The meeting voted to authorize Graeme Hirst, in consultation with the new president and treasurer, to investigate further, and see if a deal can be made, advantageous to the society, for non-Canadian distribution rights.



An outline of the society's current finances was presented. The conference is expected to show an adequate surplus to subsidize other society activities and publications. A full treasurer's report will appear in the September issue of *Canadian A. I.*

Local interest groups in AI are starting in Winnipeg and other cities, and some have expressed interest in a formal affiliation with CSCSI/SCEIO. The executive will look into the matter.



## Proceedings of the Conference

Following are the contents of the proceedings of the 1986 Canadian AI conference. Copies may be ordered from CIPS for \$30 plus postage (\$5 in Canada, \$7 outside Canada). Use the form opposite, or on the inside back cover. Copies of the 1980 and 1982 proceedings are also available for \$25 each; 1984 is out of print.

### Actes de la conférence

Le contenu des actes de la conférence canadienne d'IA 1986 est reproduit ci-dessous. Pour obtenir une copie, envoyez 30\$ plus les frais de poste (5\$ au Canada, 7\$ à l'extérieur) à la CIPS. Utilisez le formulaire à la page suivante ou à l'intérieur de la couverture arrière. Des copies des actes de 1980 et 1982 sont aussi disponibles pour 25\$ chacune; 1984 est épuisé.

### Apprentissage / Learning

- "Why Kids Should Learn to Program" *Elliot Soloway (Yale University)*
- "Generative Structure in Enumerative Learning Systems" *Robert C. Holte (Brunel University, England) and R. Michael Warton (York University)*
- "Detecting Analogous Learning" *Ken Wellsch and Marlene Jones (University of Waterloo)*
- "GUMS: A General User Modeling System" *Tim Finin (University of Pennsylvania) and David Drager (Arity Corporation)*

### Raisonnement formel / Formal reasoning

- "An Efficient Tableau-Based Theorem Prover" *Franz Oppacher and Ed Suen (Carleton University)*
- "Domain Circumscription Revisited" *David Etherington (University of British Columbia) and Robert Mercer (University of Western Ontario)*
- "Two Types of Quantifier Scoping" *Sven O. Hurum and Lenhart Schubert (University of Alberta)*
- "A Propositional Logic for Natural Kinds" *James Delgrande (Simon Fraser University)*
- "Fagin and Halpern on Logical Omnisciences: A Critique with an Alternative" *Robert F. Hadley (Simon Fraser University)*

### Compréhension des langages naturels / Natural language understanding

- "Representing Contextual Dependencies in Discourse" *Tomek Strzalkowski (Simon Fraser University)*
- "A Domain-Independent Natural Language Database Interface" *Yawar Ali, Raymond Aubin, and Barry Hall (Bell-Northern Research)*
- "Natural Language Report Synthesis: An Application to Marine Weather Forecasts" *R. Kittredge and A.*

*Polguère (Université de Montréal), and E. Goldberg (Environment Canada)*

- "What's in an Answer: A Theoretical Perspective on Deductive Questioning Answering" *Lenhart Schubert, L. Watanabe (University of Alberta)*
- "A New Implementation for Generalized Phrase Structure Grammar" *Philip Harrison and Michael Maxwell (Boeing Artificial Intelligence Center)*
- "TRACK: Toward a Robust Natural Language Interface" *Sandra Carberry (University of Delaware)*

### Programmation logique / Logic programming

- "Representation of Negative and Incomplete Information in Prolog" *Kwok Hung Chan (University of Western Ontario)*
- "On the Logic of Representing Dependencies by Graphs" *Judea Pearl (University of California) Azaria Paz (Technion, Israel Institute of Technology)*
- "A Proposal of Modal Logic Programming (Extended Abstract)" *Seiki Akama (Fujitsu Ltd., Japan)*
- "Classical Equality and Prolog" *E.W. Elcock and P. Hoddinott (University of Western Ontario)*

### Reconnaissance et perception / Recognition and perception

- "Diagnosis of Non-Syntactic Programming Errors in the SCENT Advisor" *Gordon McCalla, Richard B. Bunt, Janelle J. Harms (University of Saskatchewan)*
- "Using Relative Velocity Information to Constrain the Motion Correspondence Problem: Psychophysical Data and a Computational Model" *Michael Dawson and Zenon Pylyshyn (University of Western Ontario)*
- "Device Representation Using Instantiation Rules and Structural Templates" *Mingruey R. Taie, Sargur N. Srihari, James Geller, and Stuart C. Shapiro (State University of New York at Buffalo)*
- "Machine Translation Between Chinese and English" *Wanying Jin (University of Texas at Austin)*
- "Inter-Word Constraints in Visual Word Recognition" *Jonathan J. Hull (State University of New York at Buffalo)*

### Vision

- "Sensitivity to Corners in Flow Patterns" *Norah K. Link and Steve Zucker (McGill University)*
- "Stable Surface Estimation" *Peter T. Sander and Steve Zucker (McGill University)*
- "Measuring Motion in Dynamic Images: A Clustering Approach" *Amit Bandopadhyay and R. Dutta (University of Rochester)*
- "Determining the 3-D Motion of a Rigid Surface Patch Without Correspondence, Under Perspective Projection" *John Aloimonos and Isidore Rigoutsos (University of Rochester)*
- "Active Navigation" *Amit Bandopadhyay, Barun Chandra and Dana H. Ballard (University of Rochester)*
- "Combining Visual and Tactile Perception for Robotics" *J.C. Rodger and Roger A. Browse (Queen's University)*



## Systèmes experts / Expert systems

- "Observation on the Role of Constraints in Problem Solving" *Mark Fox (Carnegie-Mellon University)*
- "Rule Interaction in Expert System Knowledge Bases" *Stan Raatz (University of Pennsylvania) and George Drastal (Rutgers University)*
- "Towards User Specific Explanations from Expert Systems" *Peter van Beek and Robin Cohen (University of Waterloo)*
- "DIALECT: An Expert Assistant for Information Retrieval" *Jean-Claude Bassano (Université de Paris-Sud)*
- "Subdivision of Knowledge for Igneous Rock Identification" *Brian W. Otis (M.I.T. Lincoln Lab) and Eugene Freuder (University of New Hampshire)*

## Représentation des connaissances / Knowledge representation

- "A Hybrid, Decidable, Logic-Based Knowledge Representation System" *Peter Patel-Schneider (Schlumberger Palo Alto Research)*
- "The Generalized-Concept Formalism: A Frames and Logic Based Representation Model" *Mira Balaban (State University of New York at Albany)*
- "Knowledge modules vs Knowledge-bases: A Structure for Representing the Granularity of Real-World Knowledge" *Diego Lo Giudice and Piero Scaruffi (Olivetti Artificial Intelligence Center, Italy)*

- "Reasoning in a Hierarchy of Deontic Defaults / Raisonnement dans une Hiérarchie de Faits de Base Déontiques" *Frank M. Brown (University of Kansas)*
- "Belief Revision in SNePS" *João P. Martins (Instituto Superior Tecnico, Portugal) Stuart C. Shapiro (State University of New York at Buffalo)*

## Applications

- "GENIAL: Un Générateur d'Interface en Langue Naturelle" *Bertrand Pelletier et Jean Vaucher (Université de Montréal)*
- "Towards a Domain-Independent Method of Comparing Search Algorithm Run-Times" *H.W. Davis, R.B. Pollack, and D.J. Golden (Wright State University)*
- "Properties of Greedily Optimized Ordering Problems" *Rina Dechter and Avi Dechter (University of California, Los Angeles)*
- "Mechanisms in ISFI: A Technical Overview (Short Form)" *Gary A. Cleveland (The MITRE Corp.)*
- "Un Système Formel de Caractérisation de l'Evolution des Connaissances" *Eugène Chouraqui (Centre National de la Recherche Scientifique, France)*
- "Une Expérience de l'Ingenierie de la Connaissance: CODIAPSY Développé avec HAMEX" *Michel Maury, A.-M. Massotte, Henri Betaille, J.-C. Penochet, et Michelle Nègre (CRIM et GRIP, Montpellier, France)*

Conference  
Proceedings  
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To / A: CIPS, 243 College Street (5th floor), Toronto, Ont M5T 2Y1

Please send me the CSCSI/SCEIO conference proceedings indicated. (Prices: \$30 for 1986; \$25 for 1980 and 1982; please add \$5 for postage in Canada, \$7 outside Canada. The 1984 proceedings are out of print.)

Veuillez m'envoyer les actes des conférences de la CSCSI/SCEIO indiquées. (Prix: 30\$ pour 1986; 25\$ pour 1980 et 1982; veuillez ajouter 5\$ pour les frais de poste à l'intérieur du Canada, 7\$ à l'extérieur du Canada. Les actes de 1984 sont épuisés.)

( ) Montréal, 1986. ( ) Saskatoon, 1982. ( ) Victoria, 1980.

Name / Nom .....

Mailing Address / Adresse postale .....

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# Création du Laboratoire d'IA en Education à l'Université Laval

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Laboratoire d'Intelligence Artificielle en Education  
1466 Pavillon De Koninck  
Université Laval  
Québec G1K 7P4  
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## Introduction

Le Laboratoire d'Intelligence Artificielle en Education (LIAE) est un laboratoire créé en janvier 1986 à la Faculté des Sciences de l'Education de l'Université Laval pour promouvoir la recherche en intelligence artificielle appliquée à l'éducation. Ce domaine comprend l'enseignement intelligemment assisté par ordinateur (EIAO) et les systèmes experts reliés à l'éducation.

Le LIAE est constitué des éléments suivants:

- Un groupe de professeurs et d'étudiants gradués actifs en IA appliquée à l'éducation.
- Un cadre physique où sont disponibles des ressources informatiques telles des appareils, des logiciels et une documentation spécialisée.
- Une série "Documents de Recherche".
- Des liaisons avec d'autres groupes de recherche oeuvrant en intelligence artificielle.
- Des activités de développement: cours gradués, projets de recherche, recontres.

En somme, le LIAE est un environnement structurel pour encadrer et promouvoir la recherche dans ce domaine d'application. Il demeure néanmoins une structure informelle au sein de l'université.

## Programmation scientifique du Laboratoire

Le LIAE a comme mission globale de développer une expertise québécoise et canadienne dans l'application de systèmes intelligents en éducation.

Son action est orientée vers le développement de prototypes expérimentaux de tels systèmes. Cette action permet:

- d'explorer l'application de l'IA à l'enseignement;
- d'illustrer les possibilités en ce domaine;
- d'approfondir les possibilités de l'IA qui y sont sous-jacentes;
- de clarifier les aspects théoriques qui y sont impliqués en tant qu'entreprise scientifique.

Le champ d'étude du LIAE est le secteur éducatif: l'on vise à développer des applications pédagogiques. Ce terme est cependant pris dans un sens large: il inclut aussi bien des programmes proprement didactiques, des environnements d'exploration favorisant l'apprentissage par découverte, et des jeux éducatifs, que des systèmes experts reliés à la gestion et au développement de systèmes d'enseignement. De plus, il s'applique à l'éducation formelle, à la formation spécialisée, et à l'autodidaxie.

Sa programmation est centrée sur le développement de prototypes, plutôt que d'être orientée vers des analyses théoriques, quoique cette dernière perspective est nécessairement impliquée dans tout développement qui se veut être à la pointe de la recherche scientifique en IA.

La programmation du LIAE est structurée en terme de projets de développement. A l'heure actuelle, deux projets sont inscrits à son programme:

- GEO: système interactif pour enseigner et apprendre la géographie;
- PLAN: système de planification pédagogique assistée par ordinateur.

D'autres projets s'ajouteront à sa programmation au fil de son développement.

Plusieurs étudiants gradués explorent présentement la possibilité de structurer un projet en EIAO dans le cadre de leur mémoire ou thèse. L'application de l'EIAO dans le contexte d'un enseignement par vidéodisque retient en particulier l'attention de plusieurs.

## Le projet GEO

Le projet GEO a pour objectif l'élaboration d'un système intelligent pouvant enseigner et apprendre des faits géographiques. GEO sera un système conversationnel à initiative partagée: il pourra répondre aux questions d'un étudiant et lui en poser à son tour, cela afin d'accroître sa propre base de connaissances.

Les principales composantes de GEO seront:

- une base de connaissances sous forme de réseau sémantique;
- une interface en langage naturel;
- un module conversationnel pour gérer le dialogue;
- un module d'acquisition de nouvelles connaissances;
- un module de vérification des connaissances.

Les principales thématiques de l'IA qui sont explorées dans ce projet sont le langage naturel et le dialogue, l'acquisition de connaissances (apprentissage-machine), et les STI (systèmes tutoriels intelligents).

Statut du projet (1.4.86): Le prototype actuel construit sa base de connaissances et peut répondre à quelques questions encore étroites. L'interaction s'effectue en langage de programmation. La prochaine étape sera le développement d'une interface en langage naturel restreint. Par la suite viendront le développement des modules conversationnel, tuteur, et d'acquisition de connaissances.

Le projet GEO est sous la direction du professeur P. Duchastel.

## Le projet PLAN

Le projet PLAN a pour objectif le développement d'un système-expert en planification pédagogique. PLAN sera un système qui assistera le concepteur de cours ou de programmes de formation dans ses tâches d'analyse et de conception.

Ces tâches comprennent:

- l'analyse des besoins de formation;
- l'analyse des contenus à enseigner (connaissances, habiletés et attitudes);
- la spécification des objectifs d'apprentissage;
- le choix de méthodes et de média d'enseignement;
- la construction d'éléments d'évaluation des connaissances;
- la conduite de la mise à l'essai et de l'amélioration du cours ou de la formation.

## English summary

*The Laboratory for AI in Education  
at Laval University*

The Laboratory for AI in Education (LIAE) is an informal structure created in January 1986 at the Faculty of Education of Laval University to promote research on the application of AI to education. This domain of study comprises computer-aided teaching and expert systems for education.

The LIAE consists of a group of professors and graduate students involved in AI applied to education. It has access to hardware as well as specialized software and documentation, and publishes technical notices. Its main activities include offering graduate courses and developing experimental prototypes of systems for computer-aided education. There are presently two active projects:

- GEO: an interactive system for the teaching of geography.
- PLAN: an expert system to aid in planning the different aspects involved in the teaching of a course.

La principale thématique explorée dans ce projet est l'applicabilité d'un système-expert à ces tâches de planification pédagogique.

Le projet PLAN fait partie d'un projet plus vaste qui vise à explorer l'application de logiciels variés à la planification pédagogique.

Statut du projet (1.4.86): Le prototype actuel contient un ensemble de règles relatives au choix de méthodes d'enseignement. Les travaux en cours portent sur le raffinement de cet ensemble de règles, afin que PLAN puisse offrir une expertise plus précise.

Le projet PLAN est sous la direction du professeur R. Brien. □



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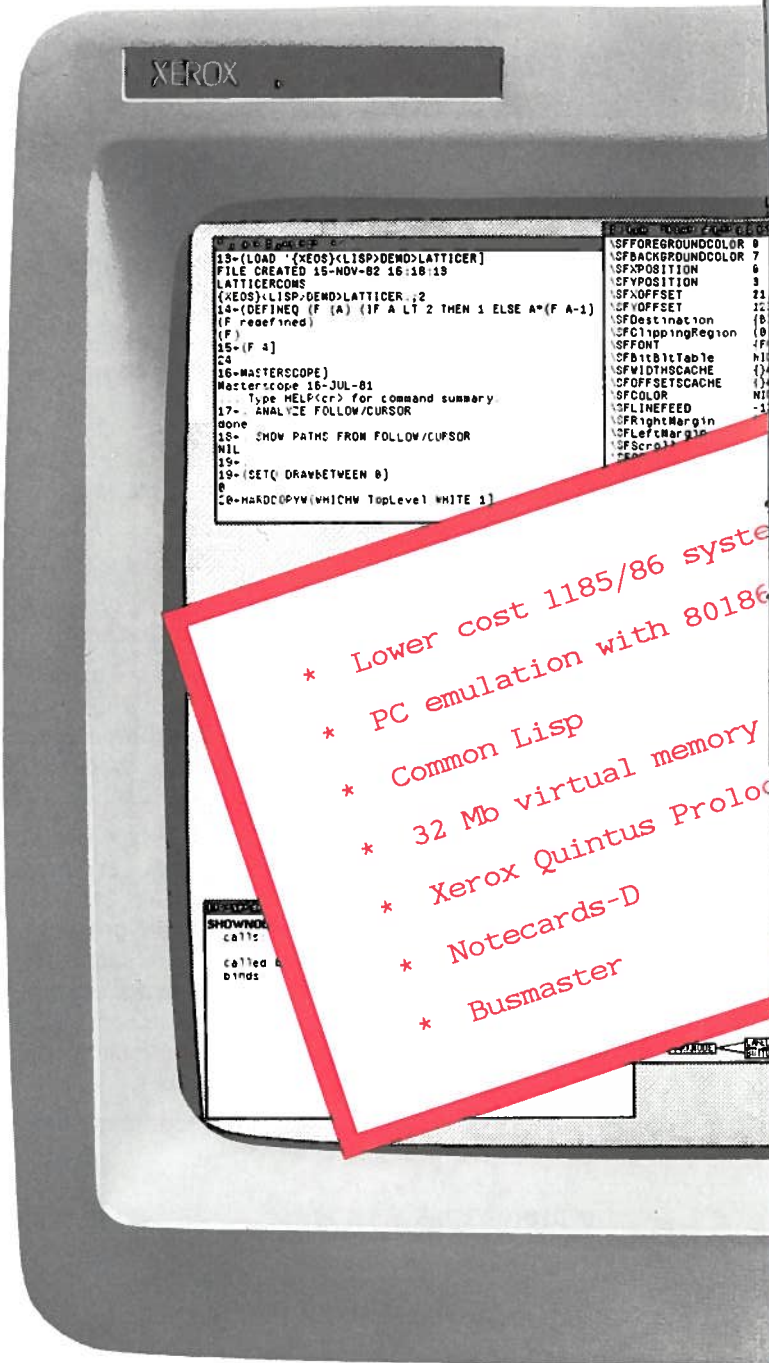
## Power Tools for Programmers

### 1. Display Editor and Inspector

The display-based structure editor allows the interactive editing of programs and other list data. Structure-based editing exploits the form of an object, emphasizes the meaning of its parts, and thus reduces errors. The data inspector extends the philosophy to both system and user data types, allowing easy inspection and modification of any object in the system.

### 2. Programmer's Assistant

The Programmer's Assistant provides an intelligent assistant and bookkeeper that frees the programmer from much mundane detail. The Programmer's Assistant includes an error analysis capability and also monitors and records all user inputs. For example, a history is kept of the commands typed, their side-effects, and the results. Thus, one can request that a previous command or sequence of commands be repeated, modified and then repeated, or even undone (which undoes all the changes it may have caused). Also



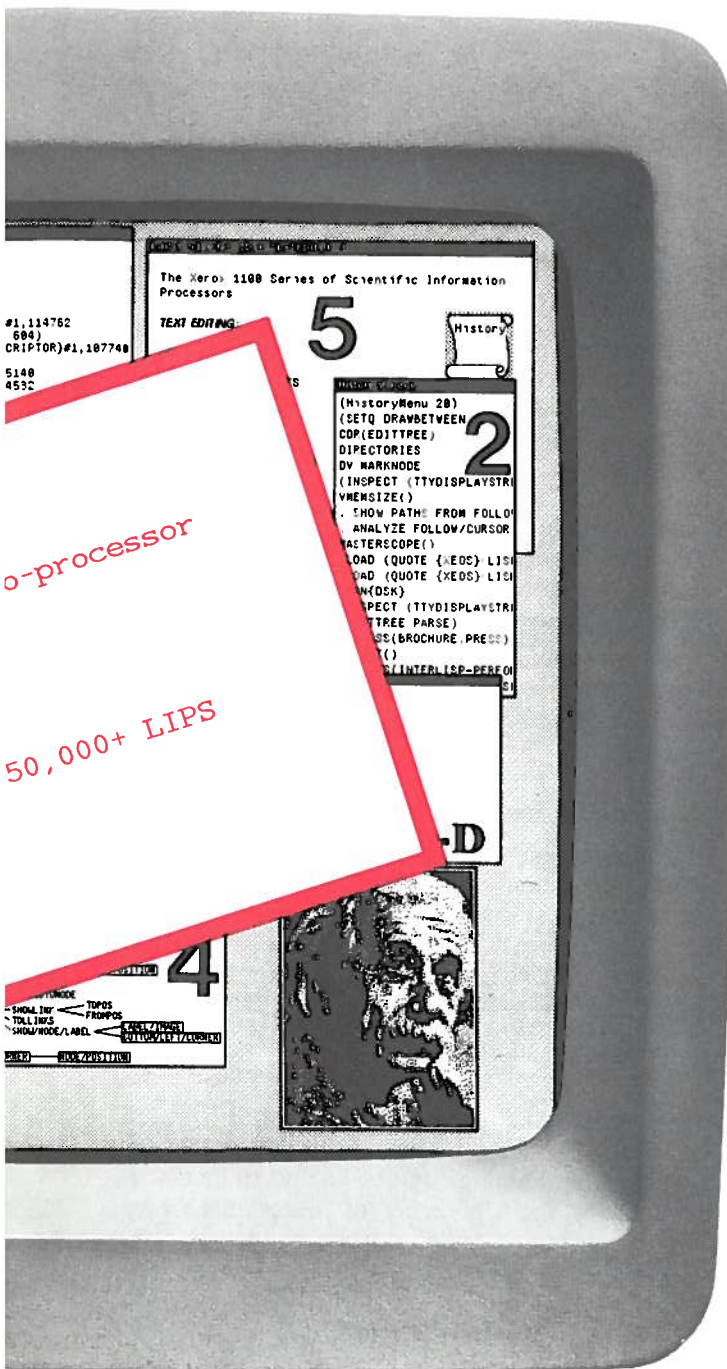
provided is a spelling corrector that automatically corrects spelling mistakes using information from the local context. To simplify file management for the programmer, Interlisp-D automatically keeps track of where in the file system each object is stored and which ones have been modified. In response to a simple request, the system can therefore save the user's state, updating all changed files automatically. The Programmer's Assistant provides a programming environment which cooperates in the development of programs allowing the user to concentrate on higher level design issues.

### 3. Debugging Tools

Debugging tools allow the user to break and trace



# XEROX



the program's structure and assist in the process of making modifications automatically. Because Masterscope is interfaced with the file package and editor, it re-analyzes a program whenever it is modified. Information about program calling structure, variable and data structure usage, and side effects can be graphically displayed and used to provide a map or browser for the system. The same information can be used to make systematic changes automatically. Further, Interlisp-D's measurement tools can be used to analyze the behavior of a system after it has been developed to pinpoint those areas that may need improvement.

## 5. A Professional Workstation

A high bandwidth user interface is provided by combining the mouse and the high resolution display. The mouse permits the user to specify and manipulate positions or regions on the screen. The interactive display facilities include complete raster graphic functions as well as a display management system supporting multiple overlapping windows, menu driven selection of operations, and a wide range of built-in graphical abstractions. Functions are also provided to display text in multiple fonts, manipulate raster images, and draw spline curves. The large format, high resolution display and the sophisticated multiple window system allow concurrent sessions, close-up views, and simultaneous displays of multiple representations of complex data. It is easy to create windows with text, graphics, or both and to make them scroll, update and interact in useful ways with the end user.

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arbitrary functions, and examine the state of the machine at any desired level of detail. Not only can the state of a suspended computation be displayed and perused graphically, but it can be manually unwound to a specified point, the offending program edited, and execution resumed, all without loss of state. Also included is the capability of specifying complex, user-defined intervention conditions, such as allowing breaks only when a given function is called from another given function. These debugging tools allow bugs to be tracked down quickly and easily.

## 4. Program Analysis

The Masterscope facility can analyze a user's program and use that information to answer questions, display

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## Research at Waterloo on Logic-Mediated, Knowledge-Based Personal Information Systems

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Maarten van Emden, Randy Goebel,  
and members of the Logic Programming  
and AI Group  
Department of Computer Science  
University of Waterloo  
Waterloo, Ont N2L 3G1

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The Logic Programming and Artificial Intelligence Group at the University of Waterloo has recently been awarded a Natural Sciences and Engineering Research Council Strategic Grant for \$450,000 over three years. The principal investigator is Maarten van Emden, with Romas Aleliunas, Robin Cohen, Randy Goebel, Marlene Jones, and David Poole.

Our goal is an inexpensive, powerful AI machine that reasons with logic. The research is directed towards the ultimate emergence of an inexpensive personal computer capable of the functions suggested by current research in artificial intelligence: to execute and to support the development of a wide variety of practical, knowledge-based, problem-solving systems, and to communicate with a non-computer specialist in a simplified form of natural language.

Presently, isolated demonstrations and theories exist which seem promising but are as yet untested in practical situations. There remains the challenge of integrating all of these ideas into an easily usable, inexpensive machine. The power we seek will not come from amalgamating large sets of *ad hoc* complex systems and relying strictly on the past trend of processors and memories becoming smaller and less expensive: a *conceptual* breakthrough is needed as well. This breakthrough can only come from the application of unifying and simplifying design principles.

The group's proposal is to develop one such principle: to extend the current notion of logic programming. Our starting point is the logic programming language Prolog, which combines the features of a general problem-solving system, a

programming language, and the relational data model in one simple, powerful and practical system. The focal point of the project is our Theorist system which, like logic programming, is based on mathematical logic, but is not restricted to a single fixed theory. Instead, Theorist is capable of automatic formation of theories in a way that is made effective by suitable constraints.

We will develop a prototype of Theorist, an improved version of Prolog to support it, and several applications demonstrating how Theorist unifies default reasoning, expert systems for diagnosis, and the modelling of users required in advanced man-machine communication.

In the past few years, our group, the Logic Programming and Artificial Intelligence Group (LPAIG), has conducted broadly based research and development on knowledge-based, logic-mediated information processing. Among other projects, we have:

- Designed and implemented DLOG, a logic-based knowledge representation language.
- Designed and implemented two full-featured implementations of the Prolog language for logic programming. (One is about to be distributed by the University of Waterloo's Computer Systems Group. An earlier implementation has about 20 installations in Canada, the U.S., and Europe, distributed by Intralogic Corp. of Waterloo, Ontario.)
- Designed Theorist, a system extending the logic programming and rule-based reasoning paradigm to include a theory-formation mechanism applicable to expert systems for diagnosis, to learning, and to modelling of users in man-machine interaction. A continuation of this forms the centrepiece of the new project.
- Designed and implemented an expert system for diagnosing children's reading disabilities. This system pre-dates Theorist, but is a candidate for improved reimplementing using Theorist.
- Designed and implemented a new computer architecture ("D-machine") especially suited

for executing programs in Prolog.

- Designed and implemented Concurrent Prolog.

## Our goals

As mentioned above, the focal point of the new project is Theorist. The project will:

- Implement a prototype for Theorist, a system extending the rule-based expert-system paradigm to include revision of rule sets, with application to default reasoning, diagnosis, and user modelling. The version of Theorist earlier implemented is no more than a test of the system design: it serves as a test for the presence of fundamental design errors. It will be a usable system, allowing us to implement a number of typical applications (see below). We expect to make this prototype available to our industrial contacts.
- Implement a prototype of a new Prolog system suitable for supporting the above. One urgent reason for a new implementation is the unsatisfactory state of the "meta" built-in predicates. These are awkward for building systems such as Theorist. The current set of built-in predicates discourages from adding to them: they are already too complex. Reimplementation will include redesigning the entire set on the basis of Bowen and Kowalski's concept of amalgamating metalanguage with object language. This will yield both the required improvements in power and simplicity.
- Write, as an example of an application of Theorist, a program for diagnosing malfunctions in a complex system. We plan to collaborate with firms to supply the application-specific expertise.
- Write, as an example of an application of Theorist, a system diagnosing children's reading disabilities. This application is chosen to capitalize on the experience gained by LPAIG (Jones) in building an earlier version of such a system.
- Write, as an example of an application of Theorist, a natural-language interface to the diagnosis systems mentioned above. This application is selected to capitalize on the experience of LPAIG (Cohen) in computer analysis of natural-language dialogue.

In the course of the project, we expect to graduate at least 25 MSc and PhD students expert in the technology.

## The role of Theorist

The "rules-and-inference" paradigm has captured many of the practical aspects of how a human pursues a single strand of deductions when all rules are fixed beforehand. Our Theorist work exemplifies a new paradigm, capturing the process by which humans generate and explore different ideas or conjectures in a way that leads efficiently to a decision to either explore further, to give up, or to take some action. A simple form of learning is a property of this wider paradigm.

The Theorist paradigm for the exploitation of knowledge is quite different from the usual one. Rather than just making deductions from what is known, as all rule-based expert systems do now, it can propose theories built out of elementary hypotheses. It uses these theories to guide further questioning and interaction leading to more refined versions. The LPAIG has already built a simple prototype. The first full implementation is in progress, with completion expected during this summer.

Theorist provides a unified approach to three seemingly unconnected tasks: default reasoning, diagnosis, and modelling of human-machine communication.

**Default reasoning** formalizes an important component of human deductive reasoning, namely, the use of generalized knowledge that is refined when more information is obtained. For example, we usually assume that birds fly, and use this hypothesis to assume that Tweety, the bird, flies, unless circumstances dictate the opposite, say, in the case where Tweety is a penguin. Raymond Reiter of the University of Toronto has shown that the inability to perform this kind of reasoning is not inherent in the use of logic (as is sometimes claimed), but only in certain naive applications of it. Theorist provides a logical model of default reasoning that is, in addition, particularly well suited to producing diagnoses and to developing adaptive (*i.e.*, learning) expert systems.

**Diagnosis**, whether of malfunctions of complex equipment or of dysfunctions of human bodies, can be viewed as the incremental improvement of the best model consistent with the observed symptoms and prior knowledge of the system's function and state. Theorist performs these incremental improvements on the basis of answers to questions suggested by the information already gathered.

**Modelling human-machine communication** requires building up a consistent theory of what a human is talking about. The actual stream of words and signs, however it is used or abused



grammatically, functions only to provide hints as to what the content of the communication is. Theorist is capable of building a theory as to what the meaning of a stream of information may be, to test it by engaging in dialogue, and to revise it on the basis of the responses.

### A Theorist example

The following shows a simplified example of the use of Theorist. Theorist uses several sets of knowledge. The first is the set of basic facts known to be true. There is also a set of admissible hypotheses which may be used as building blocks for complex explanations. For our toy example, the set of basic facts is the following (using a naive translation of predicate calculus to English).

```
if patient has tennis elbow
  then patient has aching elbow;
if patient has dishpan hands
  then patient has aching hands;
if patient has arthritis
  then all joints of patient ache;
elbow is a joint;
hands is a joint;
knee is a joint;
if patient has tennis elbow
  then patient plays tennis;
```

The set of possible hypotheses which we are prepared to accept as part of an explanation are these:

```
patient has tennis elbow;
patient has dishpan hands;
patient has arthritis;
patient has meningitis;
```

We assume that the observable symptoms are that some part is aching, or that the patient plays tennis. This information can be revealed by answers to questions asked of the user. For example, suppose the user asks the system to diagnose:

```
patient has aching hands
and patient has aching elbow
```

By using a general deduction system, the system generates the following two possible explaining theories:

- 1) patient has arthritis;
- 2) patient has dishpan hands  
and patient has tennis elbow.

For each in turn, Theorist asks relevant questions that may help reject an explanation. This can be accomplished through application of the deduction machinery to try to prove that the theories are inconsistent. For example, suppose that we

consider the theory that the patient has arthritis. Theorist will ask

Does the patient have an aching knee?

It asks this because this theory predicts that the patient has an aching knee. If the answer is "no," then arthritis is ruled out. This corresponds to empirically checking a scientific theory by allowing it to make predictions, and then modifying the theory if the facts do not correspond with the predictions.

Supposing the user answers "no," this new knowledge is then added to the set of facts (patient does not have aching knee). This only leaves the second theory as a possible consistent explanation of the observations. This second theory predicts that the patient plays tennis. Consequently Theorist asks

Does the patient play tennis?

If the answer is "yes" then that is our concluding theory. However, if the user answers "no," then this theory too can be ruled out, and no explanation is possible within this system. The occurrence of this latter event indicates that more knowledge needs to be added.

### What's new about Theorist?

This approach should be contrasted with the traditional rule-based diagnosis systems, as exemplified by the well-known Mycin system (Buchanan). Theorist has a number of advantages over Mycin:

1. There is a fundamentally different way in which knowledge is represented. Instead of going from effects (symptoms) to causes (diseases), with associated "certainty factors," we go from causes to effects. That is, we can use a *causal model*, allowing us to avoid the need to fiddle arbitrary certainty factors.
2. Even in this example, we can see that there is more structure to the diagnoses than just certainty factors for the hypotheses, as would be returned by Mycin. The second theory contains a conjunction of hypotheses which are competing with the first theory as an explanation of the observations.
3. Within the same formalism we have the use of default knowledge which gives us the ability to handle general rules possibly having exceptions.
4. This system allows us to learn, by building up a theory about the patient, using the same mechanism to build a model of the user for dialogue understanding. It also allows us to learn about new diagnoses when we can't find a

solution with our current knowledge.

5. "Heuristics" are factored from the reasoning process. Heuristics are used to guide the search for a solution.

### Representation of knowledge

In the new project, the Theorist prototype will be used in at least two distinct diagnosis tasks, to demonstrate its practical feasibility, and to provide feedback on its redesign. Concurrently, a new representation system and user-oriented natural language explanation facility will be developed for integration with the Theorist prototype. The explanation component will exploit Theorist's capability for maintaining user models to provide a level of explanation appropriate to the user. The representation system will attempt to provide a simple knowledge-description language that will aid the Theorist user in constructing application knowledge bases.

The departure point for the improved representation language is the DLOG system, designed and implemented by Goebel. It is a representation system based on the Horn clause subset of first order predicate calculus as implemented in Prolog. The general methodology on which DLOG is based suggests that representation systems must address the issue of knowledge acquisition as well as knowledge retrieval and use. For example, DLOG integrity constraints provide a weak form of non-monotonic reasoning based on Prolog's negation-as-failure. This feature aids acquisition by testing new facts for consistency with a certain class of integrity constraints.

Our existing experience gained in designing, implementing and applying DLOG to an application domain will provide a foundation for developing a new representation system that can fully exploit the new reasoning paradigm implemented in Theorist.

### Applications in Theorist

Jones's system for diagnosing children's reading disabilities provides a practical test of Theorist's feasibility. Jones's system has been previously implemented, and so can provide feedback by being re-designed and re-implemented in Theorist. The essence of the diagnosis system focuses on the requirement for some method of maintaining a model of the child being diagnosed. This is provided by the Theorist reasoning paradigm.

Jones's overall project is not only aimed at re-developing the logical foundation of her program using Theorist, but to demonstrate the feasibility of her system in field studies. This

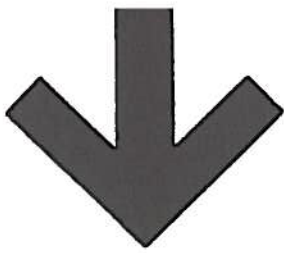
feedback will ensure that Theorist, and the representation and natural-language features integrated with it, are directed to the solution of practical problems encountered in developing intelligent diagnosis systems.

The structure underlying natural-language dialogue is the topic of Cohen's current research. Her interests are in developing computational models for the analysis and generation of discourse. In particular, her focus is on "user-directed" methods, where the goals, beliefs and plans of the user are incorporated into a model of discourse.

The development of a user-directed natural language explanation model will focus on using Theorist to maintain consistent user models for directing natural language dialogue with the user. The practical use of such a model will be demonstrated by integrating the model within a diagnosis expert system constructed in Theorist. The user models maintained by Theorist will provide the pragmatic information needed to guide intelligent discourse with users.

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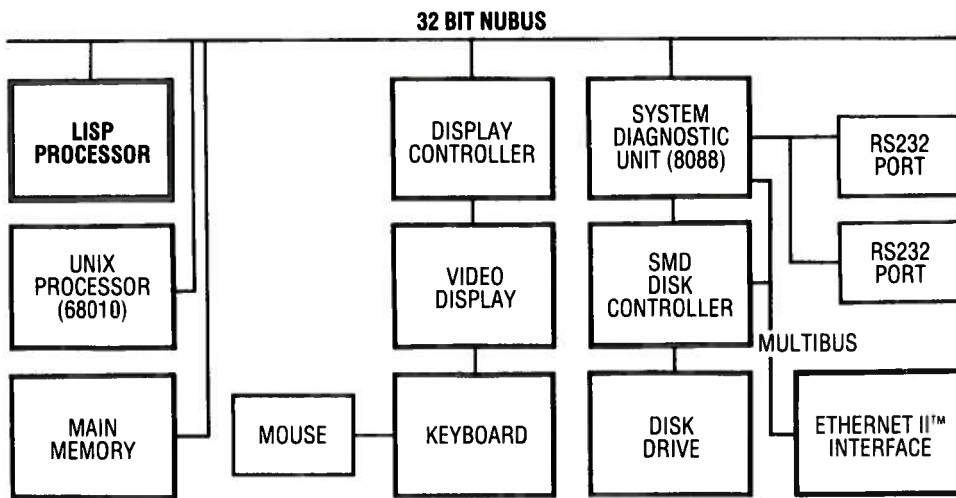
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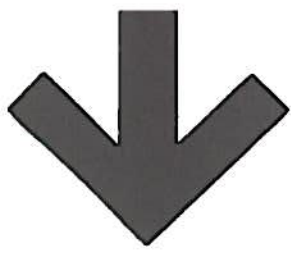
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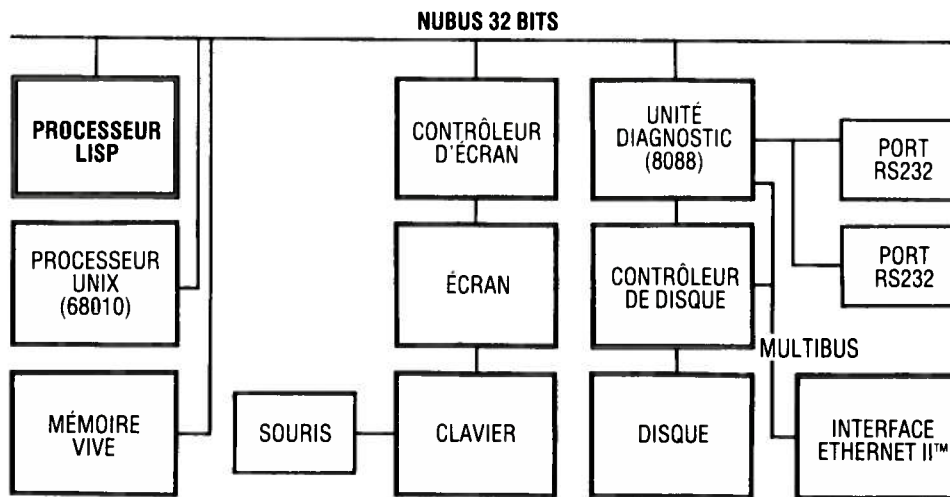


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## Mises à jour du répertoire de programmes en IA offerts par les universités canadiennes

*Note de l'éditeur:* Ce qui suit est une nouvelle entrée au catalogue publié dans le numéro de décembre 1985 de la *I. A. au Canada*.

□ □ □ □ □

### Université du Québec à Hull

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*Marek B. Zaremba:* Robotique, vision artificielle.

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Deux machines VAX-11/750 sur VMS et sur ULTRIX-32. Prolog, plusieurs logiciels pour graphisme et simulation. Terminaux graphiques.

#### Renseignements

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#### Notes

Un dossier pour l'ouverture du Baccalauréat en Informatique—Intelligence Artificielle a été soumis et nous attendons à ce qu'un programme commence dans un avenir très rapproché.

Le projet de recherche actuel concerne la simulation et la commande de bras de robot dans l'environnement peu structuré.

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## Updates to Directory of Canadian AI Businesses

*Editor's note:* The full directory is published annually, in the September issue of *Canadian A. I.* Updates are published as they are received.

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Contact: Don Pepper

Sells and supports automated reasoning tools. Canadian representative of Inference Corporation.

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Contact: Jean-Claude Zabbal

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## Answers to Trivia Quiz on page 16

1. John McCarthy, to describe the subject matter of the 1956 Dartmouth Conference, now generally taken as the starting point of AI as a field (Pamela McCorduck, *Machines Who Think*, Freeman, 1979, page 96).
2. Romania, British Columbia, and Philadelphia.
3. The University of Edinburgh.
4. CSCSI/SCEIO is older, by about seven years.
5. On the cover of *SIGART Newsletter*, published by the ACM Special Interest Group on Artificial Intelligence.
6. TAUM-METEO, developed at Université de Montréal, translates weather forecasts from French to English without post-editing. It has been running for Environment Canada for the last eight years, with a throughput of about 8,000,000 words a year.
7. The 1981 International Joint Conference on Artificial Intelligence, in Vancouver, was attended by about 1,000 people. At the time, it was the largest AI conference ever.
8. Shakey, at the then Stanford Research Institute.
9. There have been three first issues. The first was in 1974, as *CSCSI/SCEIO Newsletter*, edited by Ray Reiter. The numbering restarted in 1980, when two other CIPS subgroups, the Canadian Man-Computer Communication Society and the Canadian Image Processing and Pattern Recognition Society, joined in the newsletter. In 1984, when the present magazine format (for CSCSI/SCEIO alone) began, numbering was again restarted.
10. Vancouver, August 1976. (Old timers might answer London, Ontario, May 1983, or Ottawa, May, 1975. Those were workshops.)
11. Randy Goebel, now CSCSI/SCEIO treasurer, sang "Intergalactic Laxative" for Johnny Carson.
12. Elmer.



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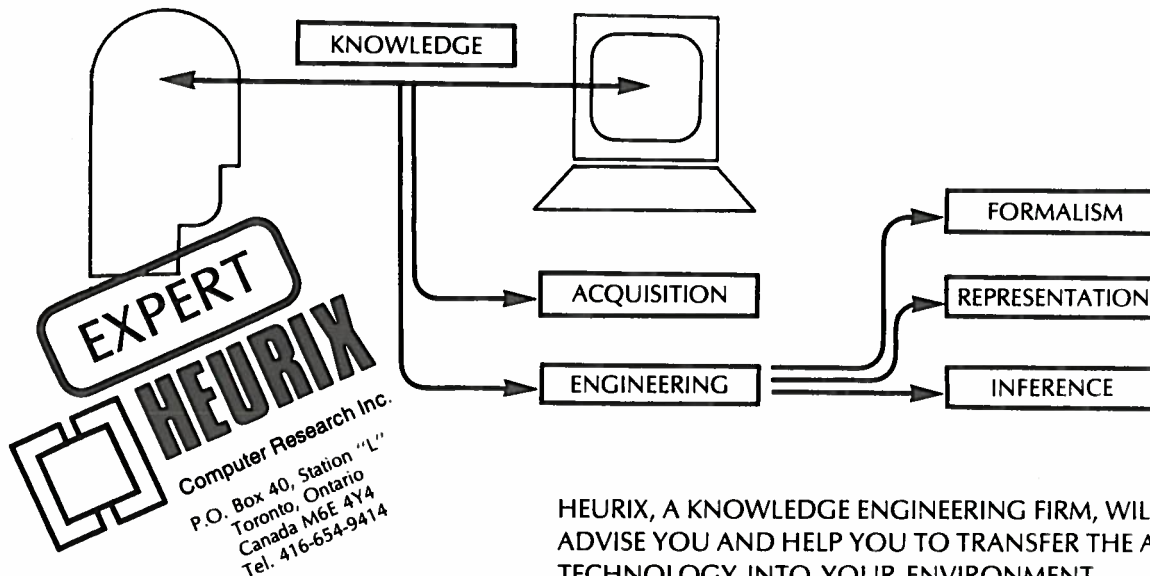
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## Book Reviews and Publishing News

### **Artificial intelligence: The very idea**

*John Haugeland*

[Dept Philosophy, University of Pittsburgh]

Cambridge, MA: The MIT Press / Bradford

1985, 287 pp.

ISBN 0-262-08153-9, \$US14.95

*Reviewed by*

*Alison Gopnik*

*University of Toronto*

To those of us outside the field, contemporary philosophy often seems to be obsessed with technical problems of conceptual analysis, which seem irrelevant to the concerns of scientists. John Haugeland shows us how a good philosopher can introduce us to the essential conceptual advances of other sciences and can illuminate our understanding of our own scientific work.

*Artificial Intelligence* manages to do two difficult, and even dangerous, things, and to do them both extremely well. First, it is an admirable introduction to artificial intelligence. I can't imagine a better book to give to philosophers or psychologists or even introductory computer science students who want to know what AI is all about. Haugeland's discussion of what it means for something to be an automatic formal system and his introduction to computer architecture are both models of clarity and precision.

But Haugeland's book also introduces professional computer scientists to the philosophical issues that are raised by the very idea of artificial intelligence. Computer scientists tend to be impatient with the philosophical objections to the idea that computers can mimic or even possess human abilities. This impatience is aggravated by the intemperate and a priori claims that have been advanced on both sides of the philosophical debate. People tend to say either that computers must (eventually) be able to think or that computers can't possibly think. Haugeland correctly argues that this is an empirical rather than conceptual question. We just have to wait and see. This stance enables him to present the arguments on both sides in a remarkably clear-sighted and even-tempered way.

Haugeland focuses on the semantic problem, the problem of how formal symbol systems can be interpreted, and, in particular, how such systems can be thought of as referring to the real world. He suggests that this is the central conceptual problem for theories of artificial intelligence. He also discusses some of the limitations of actual AI programs, particularly their use of micro-worlds. In the final chapter, he focuses on some of the other features of human minds that seem to resist simulation by machines, such as emotion and imagery. His discussion of these issues is interesting, but I wish he had paid more attention to human abilities, such as the ability to learn or perceive, that are more directly relevant to the question of intelligence. A system that couldn't fall in love and had no imagination might still be intelligence (we've all met humans like that). A system, like most existing AI systems, that couldn't learn or perceive, would be dumb by anybody's standards.

The book has all the standard philosophical virtues of clarity and subtlety, but it also has other philosophical virtues that are in short supply in other sciences, particularly a sense of history and a sense of humour. There is a wonderful chapter on the history of artificial intelligence and the writing is usually witty and often downright funny. The book's final virtue is even rarer — it's packed with appropriate and interesting illustrations. □

*Alison Gopnik is the director of the Cognitive Science program at Scarborough College, University of Toronto.*

### **The Connection Machine**

*W. Daniel Hillis*

(The MIT Press Series in Artificial Intelligence)

(An ACM Distinguished Dissertation)

Cambridge, MA: The MIT Press, 1985,

xiii + 190 pp., ISBN 0-262-08157 (cloth); \$US22.50

*Reviewed by*

*Bart Selman*

*University of Toronto*

The Connection Machine represents a new area in computer architectures; the machine links

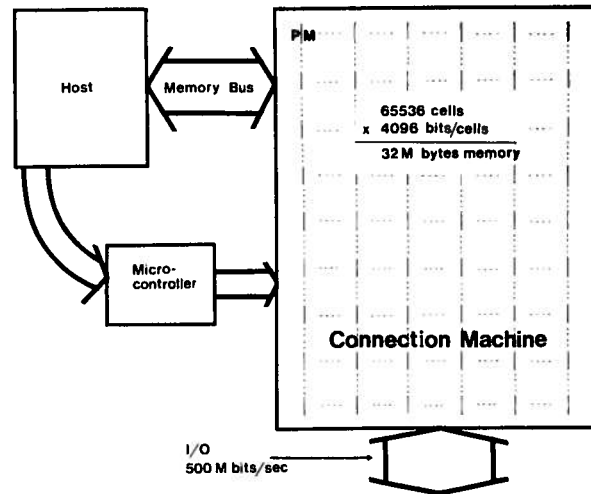
together a large number of relatively simple processors each with its own small memory. This book describes the design considerations, the programming language, and a prototype of the Connection Machine. Hillis also discusses some examples of algorithms that can be executed very efficiently on the machine, and, in the final chapter, how this architecture might shape the theory of computation of the future.

In the introduction, Hillis points out that the main motivation behind the design of the Connection Machine is to create a computer which can process information much more rapidly than conventional computer architectures. He argues that this is a minimal requirement for making a machine that will be able to perform the functions of the human mind. In the Connection Machine, the information processing power is achieved through a very high degree of parallel processing.

Hillis discusses in detail many of the issues involved in the design of the Connection Machine, for example, how much memory each processor should get, how many processors, and how the processors should communicate. These design considerations lead to the development of a prototype called CM-1, which is currently being constructed by Thinking Machines Corporation, Cambridge, Massachusetts. The CM-1 contains 64K simple processors, each with its own 4K memory. Each processor can talk to any other processor over a packet-switched network based on a 12-dimensional hyper-cube. This very general communication network, which led to the name 'Connection Machine' (each processor is virtually connected to every other processor), is the most difficult technical problem in the design of the machine; it represents most of its cost, dissipates most of the power, contains most of the wiring, and also leads to most of the performance limitations. The cost of a CM-1 is in the order of that of a large mainframe computer. The hardware of the machine is described in very basic terms, so no advanced background in hardware design is necessary.

CM-1 runs an extended version of Common Lisp, called CmLisp. All concurrent operations in CmLisp involve a simple data structure called *xector*, which is basically a set of elements with unique indices. Certain operations on these xectors can be performed very efficiently on the Connection Machine — for example the search for a particular value in a xector takes constant time.

The raw performance data of the CM-1 are quite impressive. For example, the machine has a peak instruction rate (32-bit additions) of about



*The CM-1 prototype Connection Machine.*

1000 MIPS (millions of instructions per second). However, there is not much discussion on to what extent this raw power can efficiently be used in actual algorithms; only a few relatively straightforward algorithms that are well-suited for parallel processing are described. Among the potential application areas of the machine Hillis mentions are early visual processing and connectionism.

In the final chapter of the book the reader is treated to some more philosophical issues concerning the Connection Machine and the theory of computation. The chapter has the intriguing title: "New Computer Architectures and Their Relationship to Physics, or Why Computer Science is no Good". Here Hillis touches on many interesting issues concerning the theory of computation, its possible future, and its relation to physics. The discussion of these issues is kept relatively short, possibly to avoid unnecessary speculation. I will limit myself here to describing just one of these issues.

Hillis suggests that we should, at some point, incorporate into our computational models some of the qualities of physical laws that make them so powerful and elegant, like locality, symmetry, and invariance of scale. And as a matter of fact, it might well be that architectures like that of the Connection Machine will 'enforce' these properties in our computational models. For example,

in parallel algorithms it is advantageous to choose a topology such that the only necessary communication is between nearby processors, so that messages only have to travel over short distances.

In conclusion, I would like to highly recommend this book; it is very clearly written, and, according to Marvin Minsky, it describes what history may judge to be the second stage in the evolution of digital computers!

Note that the book itself is typeset using one of those traditional, Von Neumann computers, which may explain some spelling mistakes, and an incorrect formula. □

*Bart Selman is a PhD candidate in the Department of Computer Science, University of Toronto. His MSc research concerned connectionist approaches to natural language understanding.*

### **Models of the Visual Cortex**

*David Rose and Vernon G. Dobson, editors  
[Dept Psychology, University of Surrey and  
Dept Psychology, Brunel University]*

Chichester: John Wiley and Sons, 1985  
xxii + 586 pp; ISBN 0-471-90697-2; \$<sup>CDN</sup>127.50

*Reviewed by  
John Tsotsos  
University of Toronto*

This book is a pleasure to read and to review. The editors are to be commended on a serious attempt to collect into one volume papers by most of the researchers in the world studying the striate cortex. There are 57 papers in all, and my major complaint about them is that they are, alas, too short. Each could have easily been much longer if more detail were included, and were permitted within the space constraints.

Perhaps the best parts of this book are not the research papers on specific issues of visual perception, but rather the several papers on history of research in the area, research methodology, and model building in general. I have worried quite a bit about research methodology in AI, and it was certainly pleasing to see that the neurosciences have the same worries. My favourite paper in this volume is written by Nicholas Maxwell of the History and Philosophy of Science Department of London's University College, titled "Methodological Problems of Neuroscience". Several important points are made, perhaps obvious to all of us, but in the light of current research in the field well worth stressing. Maxwell claims that

any branch of inquiry, in order to be rational, must at the very least obey the following rules:

1. Articulate, and seek to improve the articulation

of, the basic problem(s) to be solved.

2. Propose and critically examine possible solutions.

3. Where necessary, break the basic problem up into a number of . . . simpler . . . problems, in an attempt to work gradually towards a solution to the basic problem to be solved.

4. Interconnect attempts to solve basic and specialized problems, so that basic problem-solving may guide and be guided by specialized problem-solving.

He then proceeds to criticize not only the neurosciences, but artificial intelligence as a discipline as well. I will not detail his argument here, but will only add that he concludes that even the name AI is wrong, and that the discipline should be called 'artificial life', 'artificial control', or 'artificial goal pursuing'. Suffice it to say that he does not have a very high opinion of any of the brain sciences, including AI, as they are currently practised. Basically, they all use only rule 3 from above and fail to apply rule 4.

Two other very good papers are by the editors themselves, and these papers close off the book. They discuss methodological solutions for neurosciences, and propose a set of desiderata, while the second paper explains an application to the visual cortex of an explicit procedure for model building.

I highly recommend this book for any serious student of the visual sciences. It provides an excellent snapshot of the state of the art, as well as insights into research methodology. □

*John Tsotsos is co-director of the Research in Biological and Computational Vision Group in the Department of Computer Science, University of Toronto.*

## **Books received**

### **Expert systems 1986:**

#### **An Assessment of Technology and Applications**

*Terri C. Walker and Richard K. Miller*

SEAI Technical Publications (PO Box 590,

Madison, GA 30650, U.S.A.), 1986

ISBN 0-89671-074-2, paperback, 369 pp, \$<sup>US</sup>325.00

"Over 475 expert systems are described, representing virtually every known commercial, in-house, and research expert system developed in the U.S. and internationally," claims the publisher's announcement, and they may well be right. They have more expert systems catalogued than you would have ever thought existed yet, and they don't stop at the U.S. border. The systems are classified in 24 domains, and in each the authors summarize the current technology, the current systems and research, and the future outlook. If you want to know what expert systems have been written for, say, electrical utilities and nuclear facilities, publishing, or weather forecasting, this is the book to look in. There is also a



chapter on the basics of expert systems, and a review of 40 shells.

### The MPROLOG Primer

Richard Young, Gordon Graham,  
and Rizwan Kheraj

Toronto: Logicware Inc, 1986, \$CDN69.50 (\$US49.95)  
xiv+486 pp. and two diskettes.  
No ISBN; order from the publisher,  
1000 Finch Avenue West, Suite 600,  
Toronto, Ont. M3J 2V5

A textbook and software package for teaching the MPROLOG dialect of Prolog. Contains the book *A Primer for Logic Programming* (by Young), and software called MTUTOR (by Graham and Rizwan) giving nine on-line tutorials. Available for IBM PCs, VAX VMS and Unix 4.2 BSD, Tektronix 4404, Integrated Systems, Apollo, and Sun.

### Introduction to expert systems

Peter Jackson

[Department of Artificial Intelligence,  
University of Edinburgh]

(International computer science series)  
Workingham, England: Addison-Wesley, 1986  
ix+246 pp, ISBN 0-201-14223-6; \$CDN32.50

A nicely written textbook on expert systems, suitable for an upper-level or graduate course, or individual study.

### Teleoperation and robotics:

Applications and technology  
(Robot technology, volume 3B)

Jean Vertut and Philippe Coiffet

Englewood Cliffs, NJ: Prentice-Hall Inc and  
Toronto: Prentice-Hall Canada Inc, 1986, 256 pp.  
ISBN 0-13-782202-2; \$US42.95

[Translated from French. Original edition published  
1985 by Hermes Publishing.]

Robots with arms.

### Legged robots that balance

Marc H Raibert

[Carnegie-Mellon University]

(The MIT Press series in artificial intelligence)  
Cambridge, MA: The MIT Press, 1986, xiii+233 pp.  
ISBN 0-262-18117-7 (cloth), \$US30.00

Robots with legs.

## New AI Journals

*AI Expert* is billed as "the first commercial magazine about artificial intelligence" and "the magazine of the artificial intelligence community". This seems to imply that *Canadian A.I.* and

AAAI's *The AI Magazine* are not magazines of the AI community — even though, unlike mere "commercial" magazines, they are available only with membership in a professional AI society! Perhaps the AI community that the publishers are referring to is the community of artificial intelligences, robots, and the like.

The magazine will be published monthly. Subscriptions cost \$US33 in Canada (\$27 in the U.S.).

*AI Expert*

2443 Fillmore Street, Suite 500  
San Francisco, CA 94115, U.S.A.

*The International Journal for Artificial Intelligence in Engineering* is a quarterly academic-style journal published by Computational Mechanics, a British publisher. The editors are Dr K.J. MacCallum (University of Strathclyde) and Dr D. Sriram (MIT). Subscriptions are \$US130. The publisher's North American address is:

Computational Mechanics Inc  
400 West Cummings Park, Suite 6200  
Woburn, MA 01801, U.S.A.

Hemisphere Publishing Corp has announced a new AI journal specializing in applications. It is called *Applied Artificial Intelligence*, and is edited by an individual too shy to include his or her name in the announcement. The first issue appeared in January 1986. For more information, contact the publisher:

Hemisphere Publishing Corp  
79 Madison Avenue  
New York, NY 10016, U.S.A.

## Abstracts of papers in *Computational Intelligence / Intelligence informatique*

[Note: Production of *Computational Intelligence / Intelligence informatique* is getting back on schedule. Issue 1(3-4) was mailed in March. Issues 2(1) and 2(2) are now in production.]

## Issue 2(1), February 1986

### Expression of Syntactic and Semantic Features in Logic-Based Grammars

Patrick Saint-Dizier

(Institut de recherche en informatique  
et systèmes aléatoires)

In this paper we introduce and motivate a formalism to represent syntactic and semantic features in logic-based grammars. We also introduce technical devices to express relations between features and inheritance mechanisms. This leads us to propose some extensions to the basic unification mechanism of Prolog.

Finally, we consider the problem of long-distance dependency relations between constituents in Gapping Grammar rules from the point of view of morphosyntactic features that may change depending on the position occupied by the "moved" constituents. What we propose is not a new linguistic theory about features, but rather a formalism and a set of tools that we think to be useful to grammar writers to describe features and their relations in grammar rules.

### **Natural Language Understanding and Theories of Natural Language Semantics**

*Per-Kristian Halvorsen*  
(*Xerox Palo Alto Research Center*)

In these short remarks, I examine the connection between Montague grammar, one of the most influential theories of natural language semantics during the past decade, and natural language understanding, one of the most recalcitrant problems in AI and computational linguistics for more than the last decade. When we view Montague grammar in light of the requirements of a theory natural language understanding, new traits become prominent, and highly touted advantages of the approach become less significant. What emerges is a new set of criteria to apply to theories of natural language understanding. Once one has this measuring stick in hand, it is impossible to withstand the temptation of also applying it to the emerging contender to Montague grammar as a semantic theory, namely situation semantics.

### **Unrestricted Gapping Grammars**

*Fred Popowich*  
(*University of Edinburgh*)

Since Colmerauer's introduction of metamorphosis grammars (MGs), with their associated type *O*-like grammar rules, there has been a desire to allow more general rule formats in logic grammars. Gap symbols were added to the MG rule by Pereria, resulting in extraposition grammars (XGs). Gaps, which are referenced by gap symbols, are sequences of zero or more unspecified symbols which may be present anywhere in a sentence or in a sentential form. However, XGs imposed restrictions on the position of gap symbols and on the contents of gaps. With the introduction of gapping grammars (GGs) by Dahl, these restrictions were removed, but the rule was still required to possess a nonterminal symbol as the first symbol on the left-hand side. This restriction is removed with the introduction of unrestricted gapping grammars. FIGG, a Flexible Implementation of Gapping Grammars, possesses a bottom-up parser which can process a large subset of unrestricted GGs for describing phenomena of natural languages such as free word order, and partially free word or constituent order. It can also be used as a programming language to implement natural language systems which are based on grammars (or metagrammars) that use the gap concept, such as Gazdar's generalized phrase structure grammars.

### **Toward a Computational Interpretation of Situation Semantics**

*Yves Lesperance*  
(*University of Toronto*)

Situation semantics proposes novel and attractive treatments for several problem areas of natural language semantics, such as efficiency (context sensitivity) and propositional attitude reports. Its focus on the information carried by utterances makes the approach very promising for accounting for pragmatic phenomena. However, situation semantics seems to oppose several basic assumptions underlying current approaches to natural language processing and the design of intelligent systems in general. It claims that efficiency undermines the standard notions of logical form, entailment, and proof theory, and objects to the view that mental processes necessarily involve internal representations. The paper attempts to clarify these issues and discusses the impact of situation semantics' criticisms for natural language processing, knowledge representation, and reasoning. We claim that the representational approach is the only practical one for the design of large intelligent systems, but argue that the representations used should be efficient in order to account for the systems embedding in its environment. We conclude by stating some constraints that a computational interpretation of situation semantics should obey and discussing remaining problems.

## **Issue 2(2), May 1986, Special Issue on AI Approaches to Education**

### **The Role of Native Grammars in Correcting Errors in Second Language Learning**

*Ethel Schuster*  
(*University of Pennsylvania*)

This paper describes, P, a system that has been implemented to tutor non-native speakers in English. This system differs from many tutoring systems by employing an explicit grammar of its user's native language. This grammar enables VP<sup>2</sup> to customize its responses by addressing problems due to interference of the native language. The system focuses on the acquisition of English verb-particle and verb-prepositional phrase constructions. Its correction strategy is based upon comparison of the native language grammar with an English grammar. VP<sup>2</sup> is a modular system: its grammar of a user's native language can be easily replaced by a grammar of another language. The problems and solutions presented in this paper are related to the more general question of how modelling previous knowledge facilitates instruction in a new skill.

## **COACH: A Tutor Based on Active Schemas**

*Donald R. Gentner  
(University of California, San Diego)*

The COACH system, a computer simulation of a human tutor, was constructed with the goal of obtaining a better understanding of how a tutor interprets the student's behavior, diagnoses difficulties, and gives advice. COACH gives advice to a student who is learning a simple computer programming language. Its intelligence is based on a hierarchy of active schemas that represent the tutor's general concepts, and on more specific information represented in a semantic network. The coordination of conceptually-guided and data-driven processing enables COACH to interpret student behavior, recognize errors, and give advice to the student.

## **Formative Evaluation in the Development and Validation of Expert Systems in Education**

*Alan M. Hofmeister  
(Utah State University)*

Researchers developing and validating educational products often expect the same field-test activities to provide information on product improvement and product effectiveness. For effective and economical use of resources, these two goals, product improvement and product validation, must be stressed at different times and with different tools and strategies. This article identifies the difference in procedures and outcome between formative and summative evaluation practices, and relates these practices to the development and validation of expert systems in education.

## **The Design of the SCENT Automated Advisor**

*Gordon McCalla, Richard Bunt, and  
Janelle Harms  
(University of Saskatchewan)*

The SCENT (Student Computing Environment) project is concerned with building an intelligent tutoring system to help students debug their Lisp programs. The major thrust of current SCENT investigations is into the design of the SCENT advisor which is meant to provide debugging assistance to novice students. Six conceptual levels constitute the advisor. At the lowest level is the "raw data", consisting of the students (possibly buggy) program. This can be interpreted by a "program behaviour" level which can produce traces, cross-reference charts, etc., from the student's program. These traces, etc., can be analyzed by "observers" for interesting patterns. At the next level are "strategy judges" and "diagnosticians" which determine which strategy the student has used in his or her program and bugs in this strategy. A "task expert" provides task-specific input into the process of analyzing the student's solution, and a "student knowledge component" provides student-specific input into this process. Information from the six levels interacts in a variety of ways and control is similarly heterarchical. This necessitates a blackboard-style scheme to coordinate information dissemination and

control flow.

## **A Programming Language for Learning Environments**

*J.I. Glasgow, L.J. Hendren, and  
M.A. Jenkins  
(Queen's University)*

Most of the recent research on programming languages for education has been centered around the language Logo. In this paper we introduce another candidate language for learning environments, Nial, the nested interactive array language.

Nial is a general-purpose programming language based on a formal theory of mathematics called array theory. This paper introduces Nial as a language for learning programming and developing and using computer-aided instruction tools. A comparison with Logo is provided to evaluate these two languages in terms of their strengths and weaknesses as programming environments for novice programmers. We also demonstrate that a programming environment can be both simple to learn at the novice level and extendible to a powerful and sophisticated language.

## **Student Modelling by an Expert System in an Intelligent Tutoring System**

*Odile Palies, Michel Caillot,  
Evelyne Cauzinille-Marmeche,  
Jean-Louis Lauriere, and Jacques Mathieu  
(Université Paris VII)*

ELECTRE is a project to build an intelligent tutoring system for teaching basic electricity. This paper describes a student modelling based on the student's cognitive processes. This model includes for each student, his or her domain knowledge and the specific heuristics as well. Moreover, it uses meta-knowledge of problem solving. This model is simulated by a knowledge base which controls the solving processes by meta-rules. A case study is presented.

### *Subscription information*

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## Recent AI Technical Reports

*Editor's note:* Recent Canadian AI technical reports are listed in this department. Abstracts will be included as space permits, with preference being given to theses.

□ □ □ □ □

### National Research Council

The following report may be obtained from:

Editorial Office, Room 301  
Division of Electrical Engineering  
National Research Council of Canada  
Ottawa, Ontario K1A 0R8

#### **WITNESS: A System For Object Recognition Using Range Images**

*C. Archibald and M. Rioux*

ERB-986

NRCC No. 25588

In English / en anglais

The development of new data acquisition devices demands new methods of data interpretation. This paper describes a new device capable of acquiring accurate range images in real time, and details methods which have been developed to use this range data in a robotics environment. A new approach to object recognition for a robotics environment is presented. Two-dimensional models enriched with three-dimensional information are constructed automatically from a range image. These "view models" are used to recognize objects by matching them to models subsequently constructed from similar images. A segmentation method for extraction of planar surfaces from range images has been developed. View models are constructed as augmented surface adjacency graphs. Heuristic model matching methods are presented. Results indicate that object recognition in a constrained domain and environment can be achieved at nearly a 100% success rate using single view range images.

La mise au point de nouveaux dispositifs d'acquisition de données nécessite l'utilisation de nouvelles méthodes d'interprétation des données. La présente communication décrit un nouveau dispositif permettant l'acquisition en temps réel d'images de distance précises et explique les méthodes qui ont été mises au point pour l'utilisation de ces données de distance par des robots. On présente une nouvelle approche pour la reconnaissance des objets par des robots. Des

modèles bidimensionnels enrichis d'éléments tridimensionnels sont construits automatiquement à partir d'une image de distance. On utilise ces "modèles de vision" pour reconnaître des objets en les appareillant à des modèles construits ultérieurement à partir d'images similaires. On a mis au point une méthode de segmentation pour l'extraction de surfaces planes à partir d'images de distance. Les modèles de vision sont construits sous forme de graphiques de contiguïté de surfaces augmentés. On présente des méthodes heuristiques d'appariement de modèles. Les résultats montrent que la reconnaissance des objets dans un domaine et un environnement restreints peut être réalisée avec un taux de réussite de presque 100% lorsqu'on utilise les images de distance suivant une seule orientation.

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## University of Toronto

Requests for any of the following publications should be addressed to:

Joanne Mager  
Department of Computer Science  
University of Toronto  
Toronto, Ont., CANADA M5S 1A4

### *Language and reasoning*

#### **The representation of ambiguity in opaque constructs**

*Brenda Fawcett*

CSRI TR-178 (MSc thesis)

A knowledge of intensions, which are used to designate concepts of objects, is important for natural language processing systems. Certain linguistic phrases can refer either to the concept of an entity or to the entity itself. To properly understand a phrase and to prevent invalid inferences from being drawn, the system must determine the type of reference being asserted. We identify a set of "opaque" constructs and suggest that a common mechanism be developed to handle them. Our approach is intensional in that it maintains a distinction between extensional and intensional reference, yet it does not adhere rigidly to the strict, logical definition of intension.

To account for the ambiguities of opaque contexts, noun phrases are translated into *descriptors*. It must be made explicit to whom the descriptor is ascribed and whether its referent is non-specific or specific. Similarly, sentential constituents should be treated as *propositions* and evaluated relative to conjectured *states of affairs*. As a testbed for these ideas we define a Montague-style meaning representation and implement the syntactic and semantic components of a moderate-size NLP system in a logic programming environment.

One must also consider how to disambiguate and interpret such a representation with respect to a knowledge base. Much contextual and world knowledge is required. We attempt to characterize what facilities are necessary for an accurate semantic interpretation, considering what is and is not available in current knowledge representation systems.

#### **The detection and interpretation of ambiguities of intension and description**

*Brenda Fawcett and Graeme Hirst*

*Proceedings of the 24th Annual Meeting, Association for Computational Linguistics, 1986*

A digest of the previous item.

#### **A theory of diagnosis from first principles**

*Raymond Reiter*

TR 187/86

Suppose we are given a description of a system, together with an observation of the system's behaviour which conflicts with the way the system is meant to behave. The diagnostic problem is to determine those components of the system which, when assumed to be functioning abnormally, will explain the discrepancy between the observed and correct system behaviour.

We propose a general theory for this problem. The theory requires only that the system be described in a suitable logic. Moreover, there are many such suitable logics, e.g., first order, temporal, dynamic, etc. As a result, the theory accommodates diagnostic reasoning in a wide variety of practical settings, including digital and analogue circuits, medicine, and database updates. The theory leads to an algorithm for computing all diagnoses, and to various results concerning principles of measurement for discriminating among competing diagnoses. Finally, the theory reveals close connections between diagnostic reasoning and non-monotonic reasoning.

### *Research in Biological and Computational Vision*

#### **Some problems with correspondence**

*Michael Jenkin and Paul A. Kolars*

Technical Report RBCV-TR-86-10,  
April 1986

The notion of correspondence underlies many current theories of human and machine visual information processing. Algorithms for both the *correspondence process* and solutions to the *correspondence problem* have appeared regularly in the computer vision literature. Algorithms for stereopsis (Barnard and Thompson 1980; Marr and Poggio 1977; Mayhew and Frisby 1980) and for tracking objects through time (Dreschler and Nagel 1981; Jain and Sethi 1984; Moravec 1977; Ullman 1979; Webb 1981) have been presented which assume that token matching of separated or successive views is the underlying visual process. This paper will address the notion of token matching as a primitive operation in vision. We will argue that correspondence seems ill suited to the task of accounting for how an object is positioned in time or space, and that some other mechanism may provide a more apt account.

#### **Aspects of saccadic eye-movements towards or away from photopic, mesopic, or scotopic stimuli**

*Hansarj Doma and Peter E. Hallett*

Technical Report RBCV-TR-86-11,  
April 1986

Various aspects of saccadic eye-movements are correlated with luminance range for a small lit stimulus that steps 10 degrees horizontally in darkness. The correlations depend on whether the subject's task is to look



towards or away from the stimulus after it steps, *i.e.*, the 'normal task', which foveates the retinal image, and the 'anti task' which peripheralizes it. (1) At photopic stimulus luminances, the anti task is executed in some ways in a less visual manner than the normal task. Latencies are longer, angular errors of correctly directed responses are larger, correction saccades do not require visual feedback of angular error, and direction mistakes are more frequent. (2) The transition from rod to cone latencies coincides with the peripheral rod-cone transition. The corresponding transition in the anti task is protracted, latency changing little in mesopic range up to 0.7-1.0 log unit above the rod-cone transition. Anti task direction errors are particularly common in this luminance range. (3) At scotopic luminances, the differences between the normal and anti tasks are diminished, largely because the normal task is more severely affected. The implications are that a mixture of rod and cone signals hinder the anti task, while pure rod signals are sub-optimal for both tasks.

**Aspects of the design of the visual pathways of mouse and rat**

*Helena M. E. Hallett and Peter E. Hallett*

Technical Report RBCV-TR-86-12  
March 1986

Photoreceptors and neurons at various levels to cortex have been counted in mouse and rat. The ratios of neuron numbers (rat/mouse) are similar to the ratio retinal areas or the squared ratio of eye sizes; so to a first approximation the two species have scaled eyes, equal photoreceptor spacings (in  $\mu\text{m}$ ), and numerically scaled visual pathways. The design seems straightforward: high visual acuity should be reached at low luminances with a close approach to noise-limited performance; spatial encoding across the visual field is plausibly just or almost adequate in the Nyquist sense at the cone and geniculate levels. Some aliased broadband noise may be introduced at these levels but its effects are probably slight. Hyperacuity is excluded on one model of the cortex, though not on another. Overall, there is structural and computational economy, or even *parsimony*, at all neural levels.

□ □ □ □ □

**University of Waterloo**

The following reports may be obtained by writing to:

Pat Bennett  
Department of Computer Science  
University of Waterloo  
Waterloo, Ont CANADA N2L 3G1.

**Using definite clauses and integrity constraints as the basis for a theory-formation approach to diagnostic reasoning**

*Randy Goebel, K. Furukawa, and David Poole*

Research Report CS-85-50  
[to appear in *Proceedings of the International*

*Logic Programming Conference, 1986]*

If one desires that an automatic theory formation program detect inconsistency in a set of hypotheses, the Horn clause logic of Prolog is unsuitable as no contradiction is derivable. Full first-order logic provides a suitably expressive alternative, but then requires a full first order theorem prover as the basic theory construction mechanism. Here we present an alternative for augmenting definite clauses with the power to express potentially inconsistent scientific theories. The alternative is based on a partitioning of definite clauses into two categories: ordinary assertions, and integrity constraints. This classification provides the basis for a simple theory formation program. We here describe such a theory formation system based on Prolog, and show how it provides an interesting reformulation of rule-based diagnosis systems like MYCIN.

**Gracefully adding negation and disjunction to Prolog**

*David Poole and Randy Goebel*

Research Report CS-85-51  
[to appear in *Proceedings of the International Logic Programming Conference, 1986]*

We show how one can add negation and disjunction to Prolog, with the property that there is no overhead in run time if we do not use the negation, and we only pay for the negation when we actually use it. The extension is based on Loveland's MESON proof procedure, which requires that a negative ancestor search and availability of contrapositive forms of formulae be added to Prolog. We identify a property of literals that can be statically determined, in order to avoid using the full generality of the MESON proof procedure when not required.

**Theorist: A logical reasoning system for defaults and diagnosis**

*David Poole, Randy Goebel, and Romas Aleliunas*

Research Report CS-86-06  
[to appear in *Knowledge Representation*,  
Nick Cercone and Gordon McCalla (editors),  
Springer-Verlag]

We provide an introduction to Theorist, a logic programming system that uses a uniform deductive reasoning mechanism to construct explanations of observations in terms of facts and hypotheses. Observations, facts, and possible hypotheses are each sets of logical formulas that represent, respectively, at set of observations on a partial domain, a set of facts for which the domain is a model, and a set of tentative hypotheses which may be required to provide a consistent explanation of the observations.

Theorist has been designed to reason in a fashion similar to how we reason with and construct scientific theories. Rather than monotonically deduce theorems from a fixed logical theory, Theorist distinguishes facts from hypotheses and attempts to use deduction to construct consistent theories for which the observations are logical consequences. A prototype, implemented

in Prolog, demonstrates how diagnosis, default reasoning, and a kind of learning can all be based on the Theorist framework.

**A logic data model for the machine representation of knowledge**

*Randy Goebel*

Research Report CS-86-07  
[PhD dissertation,  
Department of Computer Science,  
University of British Columbia, November 1985]

DLOG is a logic-based data model developed to show how logic programming can combine contributions of database management and AI. The DLOG data model is based on a logical formulation that is a superset of the relation data model, and uses Bowen and Kowalski's notion of an amalgamated meta- and object-language to describe the relationship between data model objects. The DLOG specification includes a language syntax, a proof (or query evaluation) procedure, a description of the language's semantics, and a specification of the relationships between assertions, queries, and application databases.

DLOG's basic data description language is the Horn clause subset of first-order logic, together with embedded descriptive terms and non-Horn integrity constraints. The embedded terms are motivated by AI representation language ideas, specifically, the descriptive terms of the KRL language. A similar facility based on logical descriptions is provided in DLOG. The DLOG language permits the use of definite and indefinite descriptions of individuals and sets in both queries and assertions.

**The design and implementation of DLOG, a Prolog-based knowledge representation system**

*Randy Goebel*

*New Generation Computing*, 3(1985), 385-401

**Default reasoning and diagnosis as theory formation**

*David Poole*

Research Report CS-86-08

We present a simple model-theoretic semantics for both defaults and diagnosis. The semantics is based on normal first-order model theory; instead of changing the logic, we propose to change the way in which the logic is used. Rather than deriving the consequences of our knowledge (finding what logically follows), we build falsifiable "scientific" theories which explain some set of observations. By using a predefined set of possible hypotheses which can be defaults or possible malfunctions or diseases, this idea subsumes the intuition behind Reiter's default logic and characterises model-based diagnosis. A prototype implementation, called Theorist, executes all of the examples given.

**Tutorial diagnoses of subtraction errors**

*Ross Bryant*

Research Report CS-86-09  
[M. Math Essay]

The Buggy system (Brown and Burton) for diagnosing student errors in subtraction is reviewed. It is argued that more direct, precise and comprehensive diagnosis could be performed by an interactive automated tutor which is capable of monitoring detailed solutions input by the student on the screen. A design for such a tutor, including other tutorial functions, is proposed. The educational issues involved in the design are discussed, in particular the role of a system-maintained student model. The design issues are extended to a consideration of more complicated arithmetic skills and some non-mathematical domains.

**Summarizing natural language database responses**

*J.K. Kalita, Marlene Jones, and Gordon McCalla*

[to appear in *Computational Linguistics*]

In a human dialogue it is usually considered inappropriate if one conversant monopolizes the conversation. Similarly, it can be inappropriate for a natural language database interface to respond with a lengthy list of data. A non-enumerative "summary" response is less verbose and often avoids misleading the user where an extensional response might.

In this paper we investigate the problem of generating such discourse-oriented concise responses. We present details of the design and implementation of a system which produces summary responses to queries of a relational database. The system employs a set of heuristics which work in conjunction with a knowledge base to discover underlying regularities that form the basis of summary responses. The system is largely domain-independent, and hence can be ported relatively easily from one database to another. It also has a number of shortcomings which are discussed thoroughly and which form the basis for a number of suggested research directions.

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*Editor's note:* Because of the volume received, some abstracts have had to be held over until the next issue.

## Forthcoming Conferences, and Calls for Papers

### Canadian conferences

#### **Workshop on Knowledge Acquisition for Knowledge-Based Systems**

3-7 November 1986

Banff, Alberta

The bottleneck in the process of building knowledge-based systems is usually acquiring the appropriate problem-solving knowledge. The objective of this workshop is to assemble theoreticians and practitioners of AI who recognize the need for developing systems that assist the knowledge acquisition process.

To encourage vigorous interaction and exchange of ideas the workshop will be kept small — about 30 participants. There will be individual presentations and ample time for technical discussions. An attempt will be made to define the state of the art and future research needs.

The workshop will look at all aspects of knowledge acquisition for knowledge-based systems, including:

- Transfer of expertise: systems which interview experts to obtain and structure knowledge.
- Transfer of expertise: manual knowledge engineering interviewing methods and techniques.
- Induction of knowledge from examples.
- Knowledge acquisition methodology.

For more information:

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University of Calgary  
2500 University Dr. NW  
Calgary, Alberta, CANADA T2N 1N4  
Phone: 403-220-6015

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#### **Advances in lexicology**

6-7 November 1986

Waterloo, Ontario

The Second Annual Conference of the University of Waterloo Centre for the New Oxford English Dictionary invites papers presenting original research on theoretical and applied aspects of lexicology. The Centre is interested in research on large-text files and, in particular, in the common concerns of those who are

studying lexical knowledge bases. Typical but not exclusive topics include:

- Syntactic and Semantic Analysis
- Natural Language Processing
- Computational Linguistics
- Knowledge Bases
- Computational Lexicology

All submissions will be fully refereed by the program committee. Authors should send seven copies of a detailed abstract (5 to 10 pages, double-spaced) by 15 June 1986 to the program committee chairman:

Dr. Gaston Gonnet  
UW Centre for the New OED  
University of Waterloo  
Waterloo, Ont., CANADA N2L 3G1  
CSNET: ghgonnet@waterloo  
BITNET: gonnet@watdcs

The abstract must provide sufficient detail to allow the program committee to assess the merits of the paper. Authors will be notified of acceptance or rejection by 15 August 1986. A working draft of the paper, not to exceed 15 pages, for inclusion in the conference proceedings will be due by 30 September 1986. Conference proceedings will be available at the conference. It is anticipated that most of these papers will be reports on continuing research and that many of them will appear, in more complete form, in scholarly journals. Subject to the availability of funding, financial assistance will be provided to speakers.

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### U. S. Conferences

#### **AAAI-86**

#### **AAAI National Conference on Artificial Intelligence**

11-15 August 1986

Philadelphia

With the introduction of sessions devoted to engineering practice, this year's NCAI technical program has accepted 67 papers for presentation in the engineering track and 119 papers in the science track with over 15 panels and invited talks scattered throughout the week. The science sessions, which were originally scheduled for the Wyndham Franklin Plaza Hotel, have been moved to the Philadelphia Civic Center; however, the dates of the Science Sessions remain the same — 11 and 12 August. The Engineering Sessions remain at the Philadelphia Civic Center on August 14 and 15.

This year's tutorial program has 23 tutorials which include advanced topics such as qualitative reasoning and uncertainty management. The tutorials also have been moved to the Wyndham Franklin Plaza.

The exhibit program has increased in size to include approximately 100 software and hardware vendors and publishers. This year, AAAI has set a precedent by offering complimentary booth space to academic and non-profit institutions to demonstrate



their different AI research projects to the conference attendees.

Registration by mail closes on 11 July. The Conference brochure, containing information on the program, registration, housing, transportation, and social occasions can be obtained by contacting:

AAAI-86  
445 Burgess Drive  
Menlo Park, CA 94025-3496, U.S.A  
Phone: 415-328-3123 or 321-1118  
NET: AAAI-Office@sumex-aim.arpa

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**TINLAP3**  
**Third [sic] workshop on**  
**Theoretical Issues in**  
**Natural Language Processing**

*7- 9 January 1987*

Las Cruces, New Mexico

TINLAP3, supported by the Association for Computational Linguistics, will follow the format of its predecessors at MIT (1975), Champaign-Urbana (1978), and Halifax (1985): panels of distinguished figures in computational linguistics, AI, and related disciplines will discuss the major topics at issue. Preliminary registration information:

Yorick Wilks  
Box 3CRL  
New Mexico State University  
Las Cruces, NM 88001, U.S.A.  
CSNET: az@nmsu

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**International Symposium on**  
**Methodologies for**  
**Intelligent Systems**

*23- 25 October 1986*

Knoxville, Tennessee

The goal of the symposium is to encourage exchange between theoreticians and practitioners in AI. For more information:

ISMIS '86  
Computer Science Department  
8 Ayres Hall  
University of Tennessee  
Knoxville, TN 37996-1301, U.S.A.

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**Outside North America**

**Intelligent Autonomous Systems**

*8- 10 December 1986*

Amsterdam

The aim of the conference is to bring together scien-

tists interested in sensor-driven robotics, working in such disciplines as mechanical engineering, signal processing, sensory control, computer architecture, VLSI design, AI, and mathematics. The conference language will be English. For more information:

Secretariat  
International Congress on Intelligent  
Autonomous Systems  
PO Box 27583  
3003 MB Rotterdam  
THE NETHERLANDS

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**First International Conference on**  
**Economics and**  
**Artificial Intelligence**

*2- 4 September 1986*

Aix-en-Provence, France

In English and French, with simultaneous translation.  
For more information:

AFCET  
156, bd Pereire  
75017 Paris  
FRANCE

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**First International Conference on**  
**Artificial Intelligence and**  
**its Impacts in Biology and Medicine**

*29 September to 2 October 1986*

Montpellier, France

In English. For more information:

IA Biomed 86  
Centre de Recherche en Informatique de Montpellier  
c/o Professor Michel Chein  
860, rue de Saint Priest  
34100 Montpellier Cedex  
FRANCE

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**Computational Linguistics**  
**in Canada**

For a directory of computational linguistics in Canada, people and companies active in research, development, or services in computational linguistics and machine translation in Canada are requested to write to:

Graeme Hirst  
Department of Computer Science  
University of Toronto  
Toronto, Ont M5S 1A4

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 Montréal, 1986.  Saskatoon, 1982.  Victoria, 1980.

Total enclosed: \$..... Cdn. / U.S. (Payment may be made in U.S. dollars at the current rate of exchange.)

Name .....

Mailing Address .....

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\*If an issue you request is out of print, a photocopy will be provided. Issue #3 (March 1985) includes the supplement *Towards a Canadian Fifth Generation Research Plan*.

† *Computational Intelligence* subscriptions are filled by its publisher, the National Research Council of Canada. CIPS only certifies your eligibility for the discount and forwards your order.

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