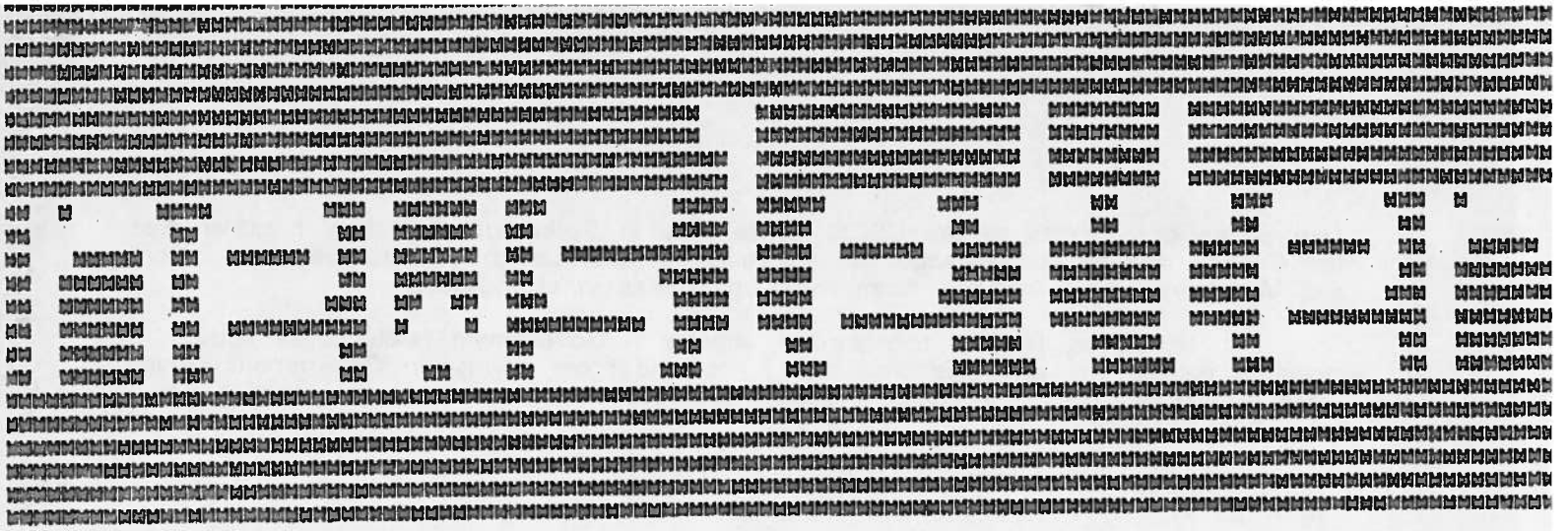

CSCSI/SCEIO CMCCS/ACCHO CIPPRS

Vol. 2, Number 1 February 1983

THE ENLIGHTENMENT OF THE BUREAUCRATS

Elsewhere in this document you will find a program for a workshop on Artificial Intelligence that was held in Ottawa in January 1983. This workshop was sponsored by the Science Council of Canada and undoubtedly represents a laudable effort of that illustrious body to finally recognize a very promising area of research. Unfortunately, I feel compelled to comment, mainly to ensure that their self-inflicted glory doesn't go too far to their heads.

There is substantial "artifical intelligence" or "cognitive science" research in Canada. Enough, in fact, to have a group of like minded individuals form an organization "Canadian Society for Computational Studies of Intelligence" in 1973. This society has produced newsletters, conferences and workshops and even hosted an international conference on artificial intelligence. Undoubtedly, some of the blame for the lack of publicity of the society belongs to its executive; however, some portion of that responsibility also has to lie with the research funding agencies.

AI research in Canada is and has been underfunded for some time now. The struggle to acquire enough funds to produce anything significant has been an uphill battle at the least. The current system of rewarding the achievers is really rather ridiculous. It is something akin to supporting an athlete once he has won a gold medal. In other words, don't help the promising athletes with their training expenses, because they might not be good enough, and furthermore might not spend the money wisely. By waiting until they have won the medal, you are assured that they are good. Well, you know, they are right because if anyone can produce significant results with the pittances that are doled out, they have to have ability. Unfortunately, there are many others who don't want to put up with the struggle and go elsewhere where the pastures are greener, i.e., dollars.

The science council is not the only government agency with their head in the sand; the Natural Sciences and Engineering Research Council is another agency which can be criticized for their practices. In the past, various members of their committess have stated their lack of enthusiasm for support of research in artificial intelligence. Furthermore, it is often not clear what their standards are, i.e., past publication of papers or innovative ideas.

Meanwhile, let's get back to the workshop. It seems to me that the workshop was a great idea, but rather sad when the one major organization devoted to the subject is left off the invitation list. Mind you, judging from the program, not too many members may have been interested in going, but surely they should have been given the opportunity.

In addition, judging from the rumours that I have heard about the costs of the workshop, the Science Council could have saved a lot of money by merely sending a

few dozen bureaucrats to the CSCSI conference in Saskatoon. But then, I gather that the Council doesn't acknowledge the existence of the part of Canada between Toronto and Vancouver, since nobody from that region was in attendance.

On reflection, I'm not too sure if anyone in Government really cares about research issues. The only response that I received from anyone in Government circles were in support of my editorial on Tell-a-Don, but were afraid to say so. Do you think they really care?

W. A. Davis
February 16, 1983

****

NEW PUBLICATION: R & D Newsletter on Robotics and Artificial Intelligence, published by Multitrol Corporation, 10 Planchet Road, Maple, Ontario, L0J 1E0.

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This newsletter is published by CSCSI/SCEIO, CMCCS/ACCHO, and CIPPRS at the University of Alberta, Department of Computing Science, Edmonton, Alberta, T6G 2H1.

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443-5011

February 8, 1983

Reference: Development of Intelligence Through Computer Support

In D.C. Snyder's absence, I am forwarding this letter.

The Market Development Department of IBM Canada Ltd. is currently considering an investigation involving the development of intelligence through the use of personal computers. Using existing viewpoints, we wish to devise a structure of intelligence and its components. With this structure as a base, we wish to examine the feasibility of adapting computer programs to aid the development of intelligence. Our assumption is that if one improves the component abilities of intelligence, one also improves intellectual capacity.

We are contacting various researchers throughout North America to determine what type of research is presently going on and who has objectives similar to ours. If we find others who share our interests, we will want to establish a dialogue aimed at fostering cooperation to achieve common goals.

In order to help us understand how your activities may relate to ours, we have designed several questions, attached, which we hope you will be willing to spend some time answering. These will allow us to understand your work and lines of reasoning, as well as to provide a basis for determining if future dialogue would be mutually beneficial. If possible, we would like you to return your response to us as soon as you can, along with any of your work, such as papers or presentations, which you feel might be relevant to the questions we have posed. When possible, please support your answers with current studies of intelligence, highlighting your interests and activities in this field, particularly if they incorporate the use of computers.

Thank you very much for your participation and assistance. When you respond, please let us know if you would like a copy of the summary of the responses we receive to this letter. We hope to hear from you soon.

Sincerely

J. H. Foster

J.H. Foster:ib
Co-op student for
D.C. Snyder
Manager, Enterprise Analysis
D. 776
Attachment

1. What are the components or abilities which form the basis of intelligent human behaviour? Can these be subdivided into different elements -- for example, verbal ability could be composed of the ability to speak, the ability to recognize printed words, the ability to understand verbal communication... What is the structure of intelligence, and is there a graphical means of diagramming this structure?

2. What are some of the most significant limitations which might prevent someone from utilizing these component abilities to the maximum potential, eg: a learning disability, limited opportunities in the individual's environment, short-term memory retention limitations of three to eight factors, a capability which is not developed to its potential or not yet performed automatically, d etc. They might be processing difficulties, resource shortages, environmental differences, and so on.

3. Are there any measurement devices or scales for determining the level of utilization of these abilities or the limitations that prevent one from employing them? Please list and describe them briefly.

4. Do you know of any software developments in the areas of measuring or developing intellectual abilities? If so, please describe them briefly.

5. What characteristics or parameters would be useful in positioning an individual along a continuum of these various component abilities?

6. Are there any exercises or activities which might be useful in moving the individual upwards along this continuum?

7. What is, or how could one determine, the value of advancing along this continuum? Are there any studies concerning the value of computers in education -- their contribution to one's ability to learn?

- - - - - - - - - - - - -

Editor's note: The above letter and questions were submitted by IBM for circulation to the membership.

Announcement from Paterson-Phipps International Inc.

Paterson-Phipps International Inc. announces its new high-tech product for 1983. The PP2100 software console is a new concept in programmer's workstations, greatly improving productivity. Studies indicate that coding time can be reduced by up to 50%. The system is economically priced and, including the cost of a micro-computer, a conservative cost-justification shows a payback within 10 months.

PPI is a unique company concerned with:

- Improving the human-computer interface to the point where single-button pushing will execute block functions.
- Making the Computer easy-to-use for business people who don't understand computers.
- Introducing friendly user-tools to the end-user's desk-top to command executive functions in computers.
- Bringing innovative functionality to the human-computer interface for expert professionals.
- Attacking the serving processes of data extraction and providing meaningful tasks for the creative knowledge worker.
- Serving the Computer Industry and the user needs in a dynamic, progressive way. Cheaper computers with faster processors and more memory are not the answer. Most users can't effectively use the hardware and software they have now, what use is more power?

The system includes a keyboard-like console with all the language syntax, keyboard and editor functions displayed, ready for use. Interfaces to any readily-available CP/M micro-computer to provide local storage and communications capability. The PPI software package loads onto the CP/M micro-computer and allows easy interfacing of the console. Using the combination of the PPI 2001 console package, software and a CP/M micro-computer, the experienced programmer can achieve the following benefits:

1. Automatically generate perfect language syntax at speeds up to twenty times those of keyboard typing.
2. Achieve a 50% increase in overall productivity for production programming.
3. Eliminate all the boring monotony of repeatedly typing language syntax.
4. Use an integrated full-screen scrolling editor designed specially for programmer's use with source code. Known as "FAST EDDIE" this editor is <u>not</u> a word-processing editor, but a "source code editor" with programmer's functions built in, such as 'Up-page', 'down page', 'Indent to col.7', 'skip', and includes a fast global FIND/REPLACE function.
5. Provide local storage for up to 50,000 lines of code.
6. Ideal for maintenance environment: All the source code can be managed in one place under the control of one person, such as chief programmer or source code librarian.

Telecommunications to host computers allows down-loading of existing programs from the host to a micro-computer. The programmer would then use the PP2100 system for edits, copying, redesign of sections, addition of new code, and transmitting the revised program back to the host computer for test compiles and debugging. Languages presently available: ANSI standard COBOL, FORTRAN, and UCSD PASCAL. Shortly, BASIC and ADA will be implemented.

Measurements of productivity show that a rate of 500 source lines per hour can be achieved (over a 2-3 hour period).

Paterson-Phipps International Inc. is a Canadian high-technology company specializing in the design and manufacture of products utilizing computers and communications technology.

For further information contact:
Paterson-Phipps International Inc.
450 Matheson Blvd. E.,
Mississauga, Ontario. L4Z 1R5
Telephone: (416) 273-5626

SIMON FRASER UNIVERSITY, BURNABY, B.C., CANADA V5A 1S6
DEPARTMENT OF COMPUTING SCIENCE; 291-4277

Dear Colleagues,

The Fifth National Conference of the CSCSI/SCEIO is tentatively scheduled to be held on May 18-20, 1984 in London, Ontario. Professor Ted Elcock has agreed to act as general chairman. Local arrangements will be handled by Dr. Mike Bauer. Dr. John Tsotsos will act as programme chairman.

Early this year the International Journal of Computers and Mathematics with Applications (Permagon Press) will publish a special issue on Computational Linguistics. The fifteen papers include eight written by Canadian AI researchers. In addition, the September 1983 issue of IEEE Computer will feature Artificial Intelligence by publishing a special issue on Knowledge Representation. Gordon McCalla and I are editing this issue, and Canadian AI will be featured.

The Science Council of Canada held a Workshop on Artificial Intelligence in Ottawa from January 19 to 21 1983. Participants in the workshops included Canadian AI researchers, consultants and businessmen (enclosure 1). It is apparent from the agenda (enclosure 2) that the Science Council was unaware of our ten-year-old National Organisation. Mr. Jorge Miedzinski, the Chairman of the workshop, graciously adjusted the agenda to permit me to make a few announcements concerning CSCSI/SCEIO activities. Alan Mackworth and Ray Reiter had circulated at the workshop a discussion paper entitled, "Towards a National Policy for Artificial Intelligence: Notes for a discussion of AI in Canada" (enclosure 3). I asked that this paper, either in its entirity or suitably abstracted, be published in the Proceedings of the Workshop.

It is entirely conceivable that the Science Council or some concerned Government agency will write a report to instigate or influence national policy towards Artificial Intelligence and/or Information Technology in Canada. Enclosure 4 is a summary of the United Kingdom's proposed national program for Advanced Information Technology as it concerns Intelligent Knowledge Based Systems (IKBS). Canadian AI research and

U.K. IKBS research are similar in that they have both been pursued almost exclusively by the academic community. Members of the CSCSI/SCEIO have a special opportunity and responsibility to contribute to the formulation of Canadian policy and programs.

The CSCSI/SCEIO executive has undertaken to poll the group membership concerning their research, the contents of the Mackworth/Reiter document and the implications of a National Policy for Artificial Intelligence. The results of the survey will be presented as a special issue of the next CSCSI/SCEIO Newsletter. This Newsletter will be sent to the Science Council. Since this special issue of the Newsletter should appear within two months, I ask you please to take a few minutes to complete the questionnaire (enclosure 5). Completed questionnaires should be returned to me by April 1, 1983.

Finally, I am including a questionnaire which Zenon Pylyshyn originally circulated last year to the Artificial Intelligence Community (enclosure 6). I thank you in advance for your suggestions and co-operation.

Sincerely,

Nick Cercone

Nick Cercone

8. ENCLOSURE 1

LIST OF PARTICIPANTS - A.I. Workshop

NAME	PROFESSIONAL AFFILIATION	ADDRESS	PHONE NO.
A.J. Cordell	Science Council	Ottawa	992-1151
William Coderre	NRC	Montreal Rd. Bldg. M-58	235-6118
Richard Kittredege	Université de Montréal	C.P. 6128, Montréal	343-7932
Ray Reiter	UBC	Computer Science	228-4142
Pierre Isabelle	IRSST/Québec	4405 Isabella #2, Montréal	733-2518
Marc Beauchamp	Novacap Investments	680 Sherbrooke W., Montréal	733-2518
F. David Peat		90 Fentiman Ave., Ottawa	235-3941
Ken Pulfer	NRC	Montreal Rd., Ottawa	993-1992
Nick Dawes	Systemhouse Ltd.	2827 Riverside Dr., Ottawa	526-0670
Donald Chisholm	NTL	33 City Center, Mississauga	275-0960
Judith Scott	Gandalf Technologies	33 John St., Manotick	692-2577
James Mackie	Mitel	350 Legget Dr., Kanata	592-2122
John Pugh	Carleton U., Comp. Sci.	Colonel By Dr.	231-3618
Wilf Lalonde	Carleton University	Computer Science	231-6301
Denzil Doyle	Doyletech	71 Tiffany Pl., Kanata	592-3158
Gilles Ouellet	Science Council	38, Le Roy, Touraine, P.Q.	561-3956
David McCart	SB Capital	85 Bildor St. E., Toronto	967-5439
Gwynneth Martin	Treasury Board	Pl. Bell Canada, Ottawa	992-1065
Nardin Ghahary	Hitech Canada	1390 Prince of Wales, Ottawa	226-7800
Robert Baser	Dept. of Communications	365 Laurier Ave. W.	996-4351
J. de Montigny	Convergent Technologies	220 Laurier Ave. W., S700	236-8611
Gerald Grant	Woods Gordon	T-D Centre, King St., Toronto	864-1212 (X 2519)
Zenon Pylyshyn	U. of Western Ontario	London, Ontario	679-2461
Douglas Skuce	U. Of Ottawa	Computer Science	231-5420
T. Pietrzykowski	Acadia University	Comp. Sci., Wolfville, N.S.	542-2201
M.G. Strobel	U. of Montreal	Dept. Psychology	343-5923
Renato de Mori	Concordia University	Computer Science	879-8070
Andy Tenne-SEns	Dept. of Communications	300 Slater St., Ottawa	995-4744
A. Davidson	Laventhol and Horwath	1600-120 Adelaide W., Toronto	862-7900
Nick Cercone	Simon Fraser U.	Computing Science, Burnaby	291-3791
Randy Goebel	U. of Waterloo	Waterloo, Ontario, N2L 3G1	885-1211 (X 3512)
Alan Mackworth	UBC	Computer Science	228-4893
John Tsotsos	U. of Toronto	Computer Science	978-3619
C.R. Perrault	U. of Toronto	Computer Science	978-8747
G.D. Sutton	Can. Enterprise Dev.	1103-155 Bay St., Toronto	366-7607
T. Kasvand	NRC	DEE, M-50, Ottawa	993-2003
E.W. Elcock	U. of Western Ontario	Computer Science	679-3567
John W. Ball	GEAC Computers	350 Steelcase W., Markham	475-0525
George Young	IT&C	235 Queen St., Ottawa	593-4481
David Burden	Convergent Technologies	220 Laurier W., Ottawa	236-8611
N. Otsu	Pattern Recognition, AI	ETL, JAPAN (c/o T. Kasvand)	993-2003
P. Mermelstein	Bell Northern Research	3 Pl. du Comm., Nun's Island	768-6691
Robert Steklasa	Financial Post	Ottawa	236-0895
N. Munro	Southam News	Ottawa	236-0491
K.E. Iverson	I.P. Sharp Associates	Toronto	364-5361

.../2

Tom Carey	U. of Guelph	Guelph	824-4120
Bourbeau Laurent	Translation Bureau	Ottawa	994-0412
Roger Kaye	Carleton University	Systems Engineering	231-2601
R.W. Shaw	Public Works Canada	Ottawa	998-8207
Marla Tenenbaum	Elliott & Page	Toronto	365-8331
John Collins	AES Data	Montreal	744-6711
Joseph Maksym	Defence Research Establishment Atlantic	Darmouth, N.S.	426-3100
Maurice L'Abbé	Science Council	Ottawa	992-9991
Judith Miller	Science Council	Ottawa	992-9901
Lewis Auerback	CRTC	Hull	997-6141
Alfred Stein	Continuum	Toronto	960-3289
Murdoch McKinnon	CAE Electronics Ltd.	Montreal	341-6780

ENCLOSURE 2

10

AGENDA
A WORKSHOP ON ARTIFICIAL INTELLIGENCE

Chateau Laurier, Ottawa — 19, 20 and 21 January 1983

Sponsored by
The Science Council of Canada
100 Metcalfe Street
Ottawa, Ontario K1P 5M1

Thursday, 20 January

Welcoming address, Dr. Stuart Smith, Chairman, Science Council of Canada
Introduction by Chairman of the Workshop, Mr. Jorge Miedzinski, Deputy Executive Director, Science Council of Canada

Artificial Intelligence: A Perspective, Professor Zenon Pylyshyn, Director, Centre for Cognitive Studies, University of Western Ontario

Knowledge Representation, Professor John Mylopoulis, Department of Computer Science, University of Toronto

Progress in Automatic Translation and Natural Language Processing, M. Pierre Isabelle and M. Laurent Bourbeau (TAUM)

Logic Programming, Professor Randy Goebel, Department of Computer Science, University of Waterloo

Computer Vision, Professor Alan Mackworth, Deparment of Computer Science, University of British Columbia

Question Answering Systems, Professor Ray Perrault, Department of Computer Science, University of Toronto

Expert Systems, Professor Douglas Skuce, Department of Computer Science, University of Ottawa

The Role of Government and Government Laboratories in Artificial Intelligence, Mr. Keith Glegg, Vice-President (Industry), National Research Council

Discussion: Directions for AI in Canada. What should be done and how to do it.

Friday, 21 January

Speech Recognition and Synthesis at Bell Northern Research Laboratories, Montreal, Dr. Maier Blostein and Dr. Mamalstein

AI Applied to Long Range Planning and Decision Making, Professor George Strobel, Department of Psychology, Universite de Montreal

AI and Office Automation, Professor Tom Carey, Department of Computer Science, University of Guelph

Discussion: Applications. How soon? How good?

Hardware for Artificial Intelligence, Professor Thomaz Petrokowski, Department of Computer Science, Acadia University, Wolfville, Nova Scota

The Role of Theory, Professor Raymond Reiter, Department of Computer Science, University of British Columbia

Artificial Intelligence: A National Priority?

A Canadian Fifth Generation System: Industry and Government involvement? Where will the Money Come From?

Closing Remarks, Mr. Jorge Miedzinski

****

ENCLOSURE 3

January 18, 1983

Towards a National Policy for Artificial Intelligence: Notes for a Discussion of AI in Canada

Alan Mackworth and Ray Reiter

Department of Computer Science
University of British Columbia
Vancouver, B.C. V6T 1W5

1 The Need for a Policy

1.1 AI will be a central component in future computing environments.

Supporting evidence:

(i) The Japanese 5th generation project.
(ii) US industrial AI research labs. (Fairchild, TI, Xerox, SRI, Schlumberger etc.)
(iii) US academic AI research labs. (MIT, Carnegie, Stanford etc.)

1.2 Canada should not become an AI (and hence high technology) 3rd world nation.

Apart from the obvious shift in the economy from resource exploitation and manufacturing to knowledge-based industries, there are other reasons unique to Canada that dictate substantial, focussed support for AI. The most important of these are:

- The emphasis is on software not hardware. Software is increasingly dominating the cost of computer systems.
- AI development will help the resource industries tremendously through remote sensing and Prospector-like expert systems.
- Robotics and advanced automation require high-level reasoning, planning and vision systems.
- Our bilingual environment dictates work on language understanding and translation.

1.3 Canada has no privately funded AI research labs of any consequence. Its AI expertise is concentrated in academia, primarily in computer science departments. These departments are small, overwhelmed with undergraduate students and seriously underbudgeted. The US offers far better AI research environments which are increasingly drawing away some of our best AI researchers and graduate students. In particular, these students, on graduation,

tend to remain in the US where they are attracted by high paying industrial positions and attractive research environments. This trend will accelerate if nothing is done to encourage Canadians to remain or return here.

1.4 The current situation in Canada is a result of underfunding of Computer Science by NSERC and a neglect of AI by the Canadian academic Computer Science community. The three leading academic computer science environments in the US (Stanford, MIT and CMU) and many others (Rochester, Yale, Rutgers, Columbia, Amherst, Maryland, UC Irvine, UC San Diego, Texas, etc.) have each developed AI as a central area of competence. In Canada, only one or two departments have pursued that strategy. In the US, ARPA has provided massive support for AI, and NSF created the Intelligent Systems Program for AI and an Experimental Computer Science Program.

2 Background

2.1 Basic AI research in Canada is, and will remain for some time, centred in the universities.

2.2 Canada must remain abreast of current and future developments in the field. At least initially, this responsibility rests with its academic AI researchers.

2.3 The proper national and economic role for Canada's academic AI research community is to train future generations of AI professionals who are, in turn, applying their expertise in Canadian industrial, entrepreneurial, and academic settings.

2.4 There are already centres of excellence in specific areas of AI across the country. Their development should be encouraged and accelerated with common infrastructure support available over the new computer networks.

2.5 The application areas currently of most promise for the Canadian economy are:

(i) Office Automation and Databases
(ii) Robotics
(iii) Remote Sensing and Resource Management
(iv) Natural Language Translation and Interfaces
(v) Education
(vi) Medicine

There are existing Canadian research groups in each of these areas that must be strengthened. We emphasize, however, that in such a young field the science and engineering (theory and application) must develop together; for example, concentrating exclusively on "knowledge engineering" or expert systems for specific applications would be a short range sterile strategy.

We therefore believe that a national policy for AI is necessary and that it should focus on strengthening the academic research environment. This is where Canada's current expertise is concentrated. This is where future expertise will be trained.

3 Proposals

A national industrial strategy for Canada should recognize the central role of artificial intelligence and computer science. The Science Council's earlier reports on high technology have already changed the perceptions of policy makers and planners. A planning document for AI development would perform a similar function, suggesting roles for government, industry and academic groups. In particular, NSERC should take an activist position.

We propose that NSERC declare AI a high priority field. This should minimally entail:

3.1 Increased funding for research and graduate student support.

3.2 Provisions for partial release time from administration and undergraduate teaching duties for selected researchers, a common practise in US universities. This is especially important now in computer science departments where everyone is seriously overworked.

3.3 The addition of Artificial Intelligence to the set of areas funded under the Strategic Grants Programme.

3.4 The provision of state-of-the-art computing facilities for AI researchers. These are now cheaper and more powerful than previously but a capital investment of $50K-$150K per researcher is necessary (the level depends on the area of research). This should be recognized in the Strategic Grants program for AI. One or two of the existing AI centres should be funded for AI software development: to maintain, develop and import/export useful software tools. They should be supplied with the necessary infrastructure support to operate on a long-term basis.

4 Conclusion

The implementation of these proposals is essential for the creation of an environment that would encourage our ablest researchers to remain in Canada, and induce some of our expatriates to return. It will also allow researchers to focus on graduate education, strengthening graduate programs in AI, and therefore attracting graduate students to Canadian universities. Such students are then more likely to remain in Canada upon graduation. An important consequence of the existence of a body of experts representing a broad spectrum of AI is their

availability as independent consultants to industry, entrepreneurs and government policy makers.

We believe the cost/benefit ratio of the proposals made here to be among the highest that the government could achieve in any scientific or engineering field. The economic, social and intellectual benefits are greater than those of the classical sciences. The cost of not making this investment in the future would be enormous.

****

From ubc-visi!mack Mon Feb 21 17:26:06 1983
Subject: New group for AI in Canada
Newsgroups: can.general

The national society for artificial intelligence is known as the Canadian Society for Computational Studies of Intelligence/ Societe Canadienne des Etudes d'Intelligence par Ordinateur. In order to improve communication among its members, I propose to create a newsgroup for that purpose. It would serve as an electronic newsletter, bulletin board and soapbox. For example, the Science Council of Canada recently held a Workshop on AI and emphasis was placed on (among other things) the need for communication over networks such as this. One immediate purpose is to gather information over the network for a common position paper to be authored by the executive. Another purpose is to establish a database of researchers and projects in the discipline. Most articles for our newsletter which is joint with the CMCCS and CIPPRS are already machine readable when they are submitted to Wayne Davis.

Since can.cscsi is not too informative (and newsgroup titles should be) I suggest that can.ai be created for general discussion of ai issues and a subgroup can.ai.cscsi specifically for the society's affairs be established. That way you can unsubscribe to can.ai and avoid both of them. The current executive of the society have asked me to do this but in accordance with the etiquette of Usenet I'd like to get feedback from newsreaders on how they feel about the idea. Please mail your comments and votes (both yea and nay) to me or if you feel you want a wider audience submit a followup article.

Alan Mackworth

...!ubc-vision!mack

Enclosure 5

Questionnaire to survey AI research interests and opinions on a national AI policy

Respondent Name:_____

Address:_____

_____

_____

_____

1. Primary Artificial Intelligence Research Interest

1.1 Statement of Primary Artificial Intelligence Research Interest

Keywords to identify your primary AI research interest:

_____

_____

Objectives of research:

short term_____

_____

long term_____

_____

Please write a brief paragraph describing your primary AI research interest:

_____

_____

_____

_____

_____

_____

_____

_____

1.2 Facilities for pursuing Primary Research Interest

Facilities currently in use:

Facility	Use you make of it

Facilities which are not available and use which could be made of additional facility:

Facility	Use you could make of it

1.3 Applications of Primary Research Interest

Potential applications for results of primary research interest:

Applications of your primary research interest which you are investigating:

Applications of your primary research interest which you would like to investigate in the future:

Applications of your primary research interest which others are investigating:

1.4 Collaboration on Primary Research Interest

Please describe your collaborative partners by completing one box for each of three partners in the chart below. Exclude graduate students whom you supervise.

Types of Collaborator	Collaborator: First	Second	Third
individual faculty member within your department (describe partner's research specialisation)			
research group within your department (describe group's research orientation)			
individual faculty member within your university, in a different department (specify department)			
research group within your university, in a different department (specify group's research orientation)			
individual faculty member at another Canadian university (specify department)			
research group at another Canadian university (specify group's research orientation)			
individual faculty member at a foreign university (specify department)			
research group at a foreign University (specify group's research orientation)			
individual in some other public agency (specify agency)			
research group in some other public agency (specify agency)			
individual in private enterprise			
research group in private enterprise			

Please describe the division between yourself and your collaborators of responsibility in pursuit of your primary research interest.

Division of research responsibilities:

Yours:_____

_____

_____

First Collaborator's:_____

_____

_____

Second Collaborator's:_____

_____

_____

Third Collaborator's:_____

_____

_____

2. Secondary Artificial Intelligence Research Interest

2.1 Statement of Secondary Artificial Intelligence Research Interest

Keywords to identify your secondary AI research interest:

_____

_____

Objectives of research:

short term_____

_____

long term_____

_____

2.2 Facilities for pursuing Secondary Research Interest

Facilities currently in use:

Facility	Use you make of it
_____	_____
_____	_____
_____	_____
_____	_____

Facilities which are not available and use which could be made of additional facility:

Facility	Use you could make of it
_____	_____
_____	_____
_____	_____
_____	_____

2.3 Applications of Secondary Research Interest

Potential applications for results of secondary research interest:

_____

_____

Applications of your secondary research interest which you are investigating:

_____

_____

Applications of your secondary research interest which you would like to investigate in the future:

_____

_____

Applications of your secondary research interest which others are investigating:

_____

_____

2.4 Collaboration on Secondary Research Interest

Please describe your collaborative partners by completing one box for each of three partners in the chart below. Exclude graduate students whom you supervise.

Types of Collaborator	Collaborator: First	Second	Third
individual faculty member within your department (describe partner's research specialisation)			
research group within your department (describe group's research orientation)			
individual faculty member within your university, in a different department (specify department)			
research group within your university, in a different department (specify group's research orientation)			
individual faculty member at another Canadian university (specify department)			
research group at another Canadian university (specify group's research orientation)			
individual faculty member at a foreign university (specify department)			
research group at a foreign University (specify group's research orientation)			
individual in some other public agency (specify agency)			
research group in some other public agency (specify agency)			
individual in private enterprise			
research group in private enterprise			

Please describe the division between yourself and your collaborators of responsibility in pursuit of your secondary research interest.

Division of research responsibilities:

Yours:_____

_____

_____

First Collaborator's:_____

_____

_____

Second Collaborator's:_____

_____

_____

Third Collaborator's:_____

_____

_____

3. Future Artificial Intelligence Research Interest

3.1 Statement of Future Artificial Intelligence Research Interest

Keywords to identify the topic in AI that you would like to investigate:

_____

_____

Objectives of anticipated research:

short term_____

_____

long term_____

_____

3.2 Facilities necessary for pursuing Future Research Interest

Facilities currently in use:

Facility	Use you make of it
_____	_____
_____	_____
_____	_____
_____	_____

Facilities which are not available and use which could be made of additional facility:

Facility	Use you could make of it
_____	_____
_____	_____
_____	_____
_____	_____

3.3 Applications of Future Research Interest

Potential applications for results of future research interest:

_____

_____

Applications of your future interest which you would investigate:

_____

_____

3.4 Collaboration on Future Research Interest

Could you design a research project on your topic of interest that would permit collaboration? _____

Do individuals or groups exist who would be capable of and interested in collaboration:

at your University? _____
in Canada? _____
elsewhere? _____

4. Research pursued with Graduate Students under your supervision (Include students supervised during the last three years.)

Year Degree completed	Degree conferred	Research topic	Student employment upon graduation and country of employment

5. Participation in the Infrastructure of Canadian Artificial Intelligence

5.1 For how many years have you been pursuing AI research in Canada? (Exclude your graduate degree research.) _____

What proportion of your research career has been spent:

abroad?_____ in industry?_____ at universities?_____

in your own business?_____

Of what professional associations are you a member?

_____

_____

Which were the most professionally satisfying conferences, workshops, or seminars you attended over the past 3 years?

_____

5.2 Please describe any communication networks which you use, including:

size of network _____

types of users _____

what you use the net for _____

Please describe any communication network which you would like to see in place, including:

size of network _____

types of users _____

what you would use the net for _____

_____

If a national AI network (including a database and library service) was established, what services could it provide that would help you with your research?

_____

_____

5.3 Please describe one collaborative research program which you would like to pursue at a National AI research laboratory?

_____

_____

_____

5.4 Please describe any changes to the Canadian AI research infrastructure that you think would facilitate collaborative and individual research.

_____

_____

_____

_____

5.5 Would support for your research be better at another AI site in industry, government, or the academic community?

_____

5.6 What contributions can the CSCSI/SCEIO make to the formulation of a national AI policy?

_____

5.7 Would you favor more research support to Computing Science in general with explicit recognition of AI or would you favor support directly to AI?

_____

_____

_____

6. Reactions to the Mackworth/Reiter document

Please add your comments on:

1 The need for a national policy for Artificial Intelligence

_____

_____

_____

_____

_____

_____

2 The current state of AI research in Canada

_____

_____

_____

_____

_____

_____

3 Proposals on the place of AI in a national industrial strategy and how to achieve it

4 Conclusions about the benefits which would accrue from a national AI policy

ENCLOSURE 6

Questionnaire on AI, Human Factors, and Cognitive Science applied to Computer Users and Office Automation

Name: _____
Address: _____
_____
_____
_____
_____

I. Artificial Intelligence

1. Does any of the research and/or applications work carried out by you or your laboratory/company fall under the general heading of Artificial Intelligence.

My Own Work	Company/Lab Work
____yes ____no	____yes ____no
	If yes, who else is involved in a professional capacity? _____ _____ _____
	_____ number of other people involved in the projects (e.g. grad students, research assistants -- if more room needed, write on back of this sheet).

2. If you answered "yes" above, summarize projects in one sentence descriptions and indicate sponsorship, and whether any of the projects are of an applied nature. Please enclose reprints, abstracts, references, and any other pointers to further details.

_____
_____
_____
_____
_____
_____
_____
_____
_____

II. Human Factors, Software Psychology, Applied Cognitive Science

3. Does any of the work carried out by you and/or your laboratory/company involve the study of human-machine or human software interactions.

My Own Work

____yes ____no

Company/Lab Work

____yes ____no

If yes, how many are involved in a professional capacity? ____ Names:

_____
_____
_____

4. If you answered "yes" above, summarize projects in one sentence descriptions, indicate sponsorship, etc as in #2 above.

_____

_____

_____

_____

III. Office Automation, Computer Assisted Training, etc.

5. Does any of the work carried out by you and/or your laboratory/company involve the study of Office Automation (broadly conceived) or computer tools for education and training?

My Own Work

____yes ____no

Company/Lab Work

____yes ____no

If yes, how many are involved in a professional capacity? ____ Names:

_____
_____
_____

6. If you answered "yes" above, summarize projects in one sentence descriptions, indicate sponsorship, etc as in #2 above.

_____

_____

_____

_____

McGill University

Electrical Engineering Department

Computer Vision and Graphics Laboratory

RESEARCH PROJECTS: COMPUTER VISION

Cooperative and Competitive Computation in Vision Systems

This continuing algorithmic research has primarily been centered around the study of networks of cooperating and competing computational processes. These processes, called relaxation labeling processes, are particularly useful in reducing local ambiguities which arise during the processing of visual information. For example, when an original intensity array (i.e. picture) is interpreted into a low level, symbolic vocabulary, local feature detectors do not respond only to the selected pattern feature; they also respond to various noise configurations. The relaxation labeling processes reduce these kinds of local ambiguities by making use of constraint or compatibility relationships between pairs of neighbouring response interpretations (or labels). They work in a parallel and iterative manner, thus allowing local certainties to exert a more global influence.

Formally, relaxation labeling is a class of computational processes that manipulate labels on graphs. The underlying graph structure denotes both the picture parts or abstract objects to be labeled and the neighbour relations over these projects. If the relaxation process operates discretely, then it discards labels that are inconsistant with the label sets attached to neighbouring nodes. If it operates continuously, then it updates a measure of certainty attached to each label. The initial certainties are obtained, e.g., on the basis of the feature detector responses.

A theory of continuous relaxation founded on a definition of consistency in labelings that was motivated by discrete relaxation, has been developed in two directions. The first direction led to an explicit functional that could be maximized to guide the search for consistent labelings from inconsistent ones. The functional is similar to others that have recently been suggested from results in optimization theory. It only exists under restricted circumstances, however, and is mainly used to derive a new relaxation operator that is valid under these restrictions. The second direction, based on variational calculus, provides the real core of the theory. The problem of finding consistent labelings is shown to be equivalent to solving a variational inequality. A procedure for accomplishing this is derived which is very similar to the above restricted relaxation operator. Surprisingly, this new relaxation operator can be approximated, under certain conditions, by the more standard ones. The circumstances under which the original operator functioned well are similar to these conditions, which suggests practical confidence in the new theory, and leads us to conjecture that the successful applications of the standard operators are explainable by the current theory. Most recent work is centered on additional convergence properties of this new operator, on its relationships to established theories of (partial) differential equations, and on its extension to multiple-level systems.

Robert Hummel (Courant Institute, NYU), Steven Zucker

Optimal Interpretation of Local Operator Responses

The feature detection process is often composed of two essentially different stages. The first of these is the convolution of a local operator, such as an elongated "line detector", over an image. The second stage is an evaluation, or interpretation, of the response of this operator. If it were possible to build perfectly accurate feature operators, then the above process would be trivial. One could, for example, evaluate a line operator at several orientations around a point, and then simply take the maximal response as a certain indication of the presence of a line (with a given orientation) at that point. The response of real line operators is ambiguous, however, and requires a more serious interpretation effort.

There are two premises underlying our interpretation system. The first is that the interpretation should be an optimal one, so that, e.g., it could be computed by a relaxation network. The second is the sense in which it should be optimal. It is an explication of the (contextual) constraints that should exist between operator responses. The general idea is illustrated by the following example.

Consider the problem of interpreting a binary image of thin curves into local oriented segments. (This is really the line finding problem alluded to above as it could arise, e.g. in the interpretation of the zero-crossings of a differential operator.) A local line operator evaluated over such an image would give a particular response characteristic, say as a function of the underlying segment's orientation. Given that there was a unique, straight segment with no noise, it would be maximal when they were oriented identically, and would drop off as one was rotated. Such expected response characteristics could be measured or computed for more general situations as well. It is these expected responses that are the basis for our constraints: the interpretation system should find the line most likely to give the response characteristics observed for the image under analysis. Or, in other words, the answer is the line pattern L for those that would be expected, given L. While this could be done for operator responses of one size, the constraints to which it gives rise are weak ones. Much stronger constraints arise when operators of different size are considered simultaneously. The larger ones then restrict the context within which the smaller ones are to be interpreted.

Pierre Parent and Steven Zucker

Texture Discrimination Using Multiple Image Representations

The co-occurrence based approach to texture discrimination can be viewed as one of finding summary statistical representations for the information in textural patterns. Functions of these statistics then provide the feature vectors for standard pattern classifiers. In an empirical study we found that, for certain classes of patterns, features of intensity and edge co-occurrences, taken together, were more powerful (for discrimination) than features of either one individually. And, in other studies, we found that more "abstract" edge features could pollute the classificiation process. The reason for this, we believe, is based on the amount of texture structure captured by the texture representation. The purpose of this project is to determine useful measures of texture structure, so that they can be applied to real discrimination tasks. The particular task domain under study is remotely-sensed SAR imagery.

Pierre Lamoureux, Kamal Kant, Steven Zucker

A Rule-Based Low Level Image Segmentation System

A low level image segmentation process has been designed and implemented as a production system. General knowledge about low level properties of an image is fomulated into condition-action rules and stores in a long term memory (LTM). The input image data, the segmentation data, and at the end of processing, the output are stored in a short term memory (STM). A number of low level processes employ the rules to segment the image into uniform regions separated by connected lines. In addition to regions and lines, which are maintained separately during the analysis, a third data entry is used to direct the attention of the system to the more interesting and worthwhile areas in the image. These focus of attention areas correspond to regions or groups of regions and lines and can be large smooth areas, textured areas or areas bounded by long connected lines. The low level processes match the rules in the LTM against the image data in the STM and whenever a rule fires it triggers a low level action to perform an operation on the image data. These include merging and splitting regions, detecting lines, detecting textured areas, and connecting line segments. The processing strategy is defined by a set of control rules that are also stored in the LTM.

These include meta-rules that embody knowledge about the other rules in the system,

and are used to test different rule selection strategies. In addition, focus of attention rules determine various data selection strategies by determining the regions, lines, and areas to match the knowledge rules on. A dynamic mechanism that employs a fuzzy decision-making paradigm is used for setting both strategies. This process is based on a number of performance parameters that are designed to measure the quality of the segmentation at any point in time. Various experiments are being conducted to test and improve the low level knowledge and control model.

A. Nazif, M. D. Levine

3D Dynamic Scene Interpretation

The aim of scene analysis is to be able to recover the three-dimensional structure underlying its two-dimensional projected view. As a first step in this process, it is necessary to be able to represent 3D shape and extract this information from a 2D image. Much work has been done in the recovery of shape information from monocular depth cues such as shading, contour, and texture. There has also been considerable investigation of shape representation in Computer Vision as well as the Graphics and CAD/CAM fields.

Our research is concerned with dynamic scene analysis. Therefore we are interested in representations of shape that are intrinsic to the object, support a notion of coarse-fine description, and admit to incremental refinement. Our model takes as its input local estimation of surface orientation obtained through shading and contour cues. At each successive frame, new information is integrated into the model, and the description refined further. Ultimately, after a sequence of views, the description is sufficiently precise for higher level interpretation.

We intend to apply this research in two areas: robotics applications where the camera is in motion about an object, and in biomedical analysis of cells undergoing motion in 3D. At present, preliminary investigations have been concluded on the surface estimation problem. Our present efforts are directed towards an appropriate model for shape.

F. Ferrie, M. D. Levine

Scene Interpretation for a Visual Prosthesis

Optical information necessary for navigation in the everyday world is unavailable to the blind. An effective prosthetic aid permitting safe and efficient mobility has long been needed. In the quest for attaining this goal, the objective of the research in this area is to design a computer vision system to serve as a viable substitute for the lost sense of vision. The desired abilities of such a vision system in the analysis of the natural environment encountered by a pedestrian include the identification of objects with appropriate interpretation, the determination of the absolute distance of an object relative to the pedestrian, and the capacity to discern static and moving objects. Scene interpretation of this nature is dynamic, data-directed and knowledge-based. The development of such a computer vision system is presently under study.

W. Hong, M. D. Levine

Picture Processing in Man and Machine

A comprehensive literature study is being carried out to isolate those models of human vision which could be incorporated into a computer vision system. Only so-called low level computational processes are under investigation at this time. A book on picture processing in man and machine is in preparation.

M. D. Levine

RESEARCH PROJECTS: BIOMEDICAL IMAGE PROCESSING

The Automatic Classification of Lymphocyte Subsets by Means of 2D-Locomotory Patterns and Pseudopod Kinetics

Lymphocytes are known to play a major role in host defense mechanisms. To understand this role, the movement of cells and the factors which affect their motion have to be studied. To achieve this objective, a rule-based biomedical image processing system has been developed, capable of analyzing the structural change in the shape of moving cells from sequences of pictures. The system provides a quantification and symbolic description of the cell's geometry, thereby characterizing the changes in shape of the cell membrane.

We are extending the rule-based analysis system, in order to characterize the psueodpod kinetics of T cell subgroups. Using time-lapse photography, these kinetics will be examined for random locomotion, and positive and negative chemotaxis. The rules which will be able to classify the three subgroups of lymphocytes according to their dynamic morphological behaviour. The existence of such a classification must be investigated and perhaps compared with data which is solely based on previous functional experiments. The existing rule-based system will be reprogrammed to make it more efficient to use for these experiments.

A. R. Dill, M. D. Levine, P. Noble, Y. Youssef

A System for Tracking and Quantifying White Blood Cell Movement

A software package was designed to facilitate the tracking and quantification of the dynamics of blood cell motion. This was achieved analytically, using a Markov Chain model which characterizes the global directional movement of a group of cells. The accomplishment of the project is the quantification of the directional probabilities of a group of cells for both a four and a five state probability vector distribution. The program is written for the Faculty of Dentistry HP85 computer system which incorporates a bit pad, graphics plotter and disc drive. Communications software has been written for the VAX 11/780 computer in the Computer Vision and Graphics Laboratory.

Additions are being made to the program to allow data to be stored upon completion of one cell track for single cell tracking or one frame for multi-cell tracking, and the operation restarted at a later time. A similar software package is being written to allow the cell shape to be specified by inputting points along the cell's contour rather than a single point at the cell's center.

M. D. Levine, P. Noble, Y. Youssef S. Abu-Hakima, N. Rao, G. W. McCartney

Study of the Geometry of Circulating Platelets

Blood platelets appear to play a central role in homeostatis, the particular mechanism by which the vascular system is protected from death due to bleeding after injury. Platelet shape change is usually considered to be the first event for the participation of platelets in homeostatis and thrombosis. The purpose of this research is to develop a system for automated analysis of the geometry of circulating platelets.

At present, very little quantitative study of platelet geometry has occurred, due to the difficulty of tracking the morphology as the platelet undergoes motion in 3D. The underlying computer vision problem is that of estimating the complete 3D shape of the platelet from a sequence of 2D views. We consider the problem as having three distinct components:

1. local surface estimation (i.e. the shape of a projected view),
2. extraction of independent measurements (elimination of overlap between views), and
3. the estimation of global shape based on measures over the image sequence.

The desired output from the system will be a classification of individual cells into shape classes based on geometrical features. The major research effort is in the development of a suitable model, of 3D shape which incorporates a notion of coarse fine approximation, representation based on intrinsic properties of the surface, and a means of incremental refinement. This representation will allow considerable morphological detail to be included in the model.

F. Ferrie, M. Frojmovic (Dept. of Physiology), M. D. Levine

3D Tracking of Cell Locomotion and Shape

The study of cell movement, particularly of white blood cells, is of great interest to the biomedical community. In the past, these observations of cell dynamics have been carried out in two dimensions. This provides a restricted picture of the cell's pseudopod kinetics. The goal of this project is to study and characterize the behavior of white blood cells in three dimensions. The research is divided into two components. The first involves the actual construction of the cell model. The second deals with the determination of the descriptions of the morphology and locomotory paths of the cell. The first component is presently under study and it involves three stages. In the first stage, the 3D data is obtained. The second stage deals with segmentation and boundary detection of several sections of the cell. The third stage involves matching the sections and constructing a three-dimensional computer model of the cell. It is proposed to prepare a movie of the reconstructed cell motion.

M. D. Levine, B. Kimia, P. Noble

Spatial Pattern in Section of Human Muscle

One feature of certain types of abnormal human muscle is the presence of large clusters of fibres of the same type. Such 'type grouping' in a sample of muscle biopsy is important because it indicates a history of damage to the nerves supplying the individual muscle fibres. It is required to measure the degree of fibre type grouping in a given section of muscle biopsy. The 'distance' between two fibres is defined as the minimum number of fibre-fibre boundaries in any path between them. Informally, a section of muscle biopsy may be said to show 'type grouping' if fibres which are 'close' are more likely to be of the same type than two fibres chosen at random.

In this project we are developing methods for assessing fibre type grouping statistically. A second-order representation is used, and a chi-square statistic provides the measure. Preliminary experimental results show that the measure discriminates strongly between grouped and non-grouped fibres.

Keith Paton, Steven Zucker, Sophie Terzopoulos

Analysis and Display of Three-dimensional CAT imagery

Tomography has created the potential for non-invasive three-dimensional imagery, especially in medical diagnosis. Analysis techniques must be developed that take explicit advantage of the 3-D characteristics of these images. This project is aimed at two general problems: (i) the location of surfaces in 3-D images, somewhat analogously to the way that "edges" are located in 2-D images; (ii) the interpretation (and matching) of these surfaces into internal anatomical models; and (iii) the rendering of these surfaces into smooth, shaded graphical displays using computer graphics techniques and equipment. We are concentrating on images of the spine and the head.

Peter Sander, Nora Link, Steven Zucker

Dynamic Computer Assisted Tomography

In computer assisted tomography (CAT) the cross-sectional image of the patient is computed from radiation data of X-ray or radionuclides. An underlying assumption in existing methods is that the tissues and organs in the cross section are essentially stationary during data collection which may take from about 1 second to over 60 seconds in the commercially available scanners at present. This assumption is violated particularly in imaging relatively fast moving objects such as the heart, and consequently the resulting images are severely blurred. Further, there is increasing interest in clinical research and practice to use CAT to investigate the dynamic functions of organs, metabolism and transport phenomena. This project is concerned generally with the problems of imaging moving objects from their projections.

Our current emphasis is on imaging the beating heart. In our approach the projections for each viewing angle, measured at various times, are used to compute an optimal set of projections at any specified time for all viewing angles, and the computed data set is then used to compute the data set. We have demonstrated by computer simulation studies that it can produce clear images from "blurred data" and significantly reduces the scanning speed requirement.

H. C. Lee, H. Ibisoglu

RESEARCH PROJECTS: COMPUTER GRAPHICS

A Parallel Microprocessor System for Real Time Computer Animation

The general objective of this research is the application of paralelled microprocessor units for rendering and animating color TV raster images in real time. The configuration and evaluation of a modular multiprocessor system is a recent development offering greatly improved bandwidth per dollar but requiring significant new research in software. Continued evolution toward cheaper hardware systems precipitates new challenges such as increasing the size of the data bases of models, their additional complexities when special lighting and texture effects are included to incorporate more "realism", and finally the human perceptual aspects associated with these animated displays. An additional long term goal for this system of parallel microprocessor units involves real time image analysis applications with the addition of a TV camera and frame grabber hardware in place of the color display monitor. Currently the hardware construction and debugging of a prototype color display system GRADS - Graphic Real Time Animation Display System - is underway. The notable feature of this system is its ability to support real time animation of computer generated images using the raster scanned television monitor for obtaining full color ranges in the images. Since the task of animating a raster color image exceeds the memory bandwidth of a single computer, a superior architecture was adopted using multiple data busses and supporting the concurrent operation of parallelled processor units. The system uses a video frame buffer which is read out continuously to a television display system while offering random picture access to the microprocessors. The design is modular so that the number of parallelled microprocessors as well as the number of lanes used in the video frame can be expanded to suit the requirements of a particular problem. The display system can operate in two resolutions: 256 x 256 or 512 x 512, and is programmable using a command register to support the increasing display capabilities as the number of installed memory planes is increased from one to a maximum of fifteen. The display system hardware involves five functional sub-assemblies: the microprocessor units, the graphics controller, the frame buffer memory, the television sequencer, and the interface to the host computer. Additional details and operating characteristics of the overall graphics system appear in thee individual project summaries given below.

A. S. Malowany

The GRADS Graphic Controller

This project involves the design and evaluation of the graphics controller system. Its main functions are the arbitration of the Microbus to the parallelled microprocessors and of the video bus to the video frame memory, as well as the execution of DMA block transfers. In order to minimize the number of words and the computational overhead associated with the block transfers, four instruction formats are supported: point, solid color, shaded color, and readback modes. Video memory color contents may be overwritten or additively mixed using an opaque/transparent mode selection.

G. Carayannis, A. S. Malowany

A Microprogrammable Microprocessor Module

The project involves the design and evaluation of a micro-computer module based on the 2900 bit-slice microprocessor. A 20 bit word size is designed for directly addressing the image in 512 x 512 resolution. The microcoding memory contains 1K words of 40 bit RAM which can be dynamically overlayed from the host computer system to support graphic instructions. The local memory of 4K words of 20 bits supports the graphics programs as well as double buffers for the output data destined to the video frame. Three ports allow this local memory to be serviced by the host computer interface, the graphics controller, and the 2900 ALU. Interrupt capabilities are included.

P. Shahriari, A. S. Malowany

Microcoding the 2900 Microprocessor Module

This project involves developing microcode software for operating the 2900 Microprocessor Module in the GRADS system. The main objectives are the realization of high level graphic primitives such as point, line, and polygon. In addition the real-time operating system requirements associated with the management of input/output buffers and interrupts are supported. The software is being developed using GPMA - General Purpose MacroAssembler. For testing, the M2900 SIMULATOR program, written in FORTRAN, is used. A 2900 microcode trace facility is also available (described below).

D. Chau, A. S. Malowany

A Microcoding Trace Facility for the 2900 Microprocessor

This software package is designed to permit testing of microcoding on the 2900 prototype microprocessor. It runs on the Z80 8 bit host computer microprocessor system using parallel I/O interface cards, a CRT console, and a floppy disc. The program's functions include the initial loading and verification of microcoding and graphics programs from Cromemco's CDOS floppy disc files. Typical debugging functions include displaying the 2900 register contents, microcode breakpointing, microcode disassembly, single or multiple instruction executions, and optional hardcopy printouts. The tracing output can be interactively selected by the user and is automatically formatted. The package inclues a multitasking operating system for the Z80 microprocessor system allowing the user to execute other programs concurrently during the tracing.

A. Mignot, A. S. Malowany

An 8086 Microprocessor Module

The project involves the design and evaluation of a 16 bit microprocessor module for supporting 256 x 256 resolution displays. The local memory has been expanded to

128K bytes using 16K dynamic RAM's. Three access ports are maintained just as in the 2900 microprocessor version. Interrupt capabilities are supported. A ROM monitor and a serial interface for a terminal are included to permit stand-alone operation when desired.

R. Ampudia, A. S. Malowany

Programming the 8086 Microprocessor for GRADS

This project involves developing software associated with operating an Intel 8086 microprocessor as one of the paralleled modules in GRADS. The main objectives are the realization of high level graphic primitives and operating system services previously described for the 2900 microprocessor. These are currently being developed in 8086 assembler using cross assembler and debugging facilities of a CP/M system provided with dual CPUS (8085/8088). The 16 bit word size can efficiently support 256 x 256 resolution displays in single precision arithmetic. High level languages will be available.

R. Haag, A. S. Malowany

A Z8000 Microprocessor Module

This design of the GRADS microprocessor module uses the Zilog Z8000 16 bit microprocessor and is provided with 32K of program/stack memory and 32K of data segment memory. The memories are multiported to support DMA transactions to the HCI and graphics controler as in the other module versions. Interrupt capabilities are supported. A ROM monitor and a serial interface for a terminal are included to permit stand-alone operation when desired.

R. Robert, A. S. Malowany

Programming the Z8000 Module for GRADS

This project parallels the implementations previously described for the 2900 and 8086. It is curently being implemented directly in machine code and debugging is performed using a Z2800 CPU card which is compatible with the S100 bus.

N. Kashef, A. S. Malowany

The Host Computer Interface

This module is responsible for efficiently linking up the S100, Unibus, and the paralleled microprocessor computers in GRADS. It realizes a DMA facility, linking all computer memories. Packing and unpacking facilities accommodate the 8, 16, 20 or 40 bit word sizes. Any computer in the GRADS system may request the DMA machine and command transfers between any of the memories once the arbitration has granted its use. The HCI also supports the interrupt system and the Status/Contrtol registers of the microprocessor network. These are used to co-ordinate the operation of the GRADS system.

R. Pancholy, A. S. Malowany

An Operating System for Animating Color Displays

This project involves the design of the operating system requirements for GRADS. Here a host computer system supervises the execution of high level graphic instructions being executed on an array of parallelled microprocessor modules, feeding a color display system based on a frame buffer. The applications involve real-time animation of computer generated images.

N. Partovi, K. Sung, A. S. Malowany

Computer Generated Animations on the GRADS System

The objective is the real-time execution of computer generated images using the GRADS system. Three-dimensional models for aircraft simulator daylight visual systems are envisaged.

G. Carayannis, S. Chong, A. S. Malowany

Three-Dimensional Display of Osteoclasts

Osteoclasts are the cells that metabolize bone. They are under (partial) control of the body's hormonal system, certain disorders of which cause them to proliferate in their function. The result is a dramatic change in their shape. This project is aimed at building 3-dimensional shaded graphics displays of these cells, both in the normal and in the enlarged states, so that physiologists can more accurately assess their shape changes. This is the first attemp to view the 3-D structure of these cells.

M. Kay (Montreal General Hospital), Yvan Leclerc, Steven Zucker

RESEARCH PROJECTS: HUMAN PERCEPTION AND PSYCHOPHYSICS

Orientation Selection and Grouping Evidence for Type I and Type II Processes

Oriented entities are a fundamental construct of early vision, and we consider the oriented structures that can explicitly arise from collections of dots; i.e., dot grouping. Psychophysical demonstrations suggest that there are two types of such grouping processes, separated according to several accuracy, or specificity, requirements. The first of these, Type I groupings, are very accurate with regard to spatial specificity. They usually result in smooth, one-dimensional contours with singularities in curvature and endpoints. The second of these. Type II groupings, are much coarser in their spatial specificity. They result in smooth "flow" patterns, with no endpoints and much less orientation change (or curvature) resolution.

The point of this project is to study the what, why, and how questions associated with these two types of grouping: what is being constructed (abstractly, a vector field of orientations); why it is being constructed (to enable surface inferences from monocular cues); and how it could be constructed (in a way that is not inconsistent with basic neurophysiological constraints). The final result is a computational (relaxation) model that essentially uses lateral inhibition among orientation selective operators to satisfy a given optimization criterion. But since this model is essentially syntactic in its operation, criteria must exist that delimit when its results could be valid. One criterion is formulated as a size/density constraint that functions conjointly with the existence of orientation structure.

S. Zucker

Quantification of the Gestalt Laws of Organization

Early visual information processing involves an essential decomposition of the visual array into local pieces. Such decompositions underly our edge-finding processes, for example, and create the subsequent necessity for recomposition, or grouping. Such grouping processes were studied qualitatively by the Gestalt psychologists fifty years ago; we are now repeating many of those explorations within an experimental paradigm that leads to quantitative data. The stimuli consist largely of dot and line patterns, and the data are empirical estimates of the affinity, or compatability, between tokens in these patterns.

Peter Sander, Kent Stevens (MIT), Steven Zucker

Curvature Sensitivities in Type II Patterns

Random dot Moire patterns (RDMP's) provide a convenient class of type II patterns for psychophysical experimentation. This project is aimed at quantifying the human observer's ability to discriminate between sinusoidal and triangular RDMP's, since this is one of the criteria that distinguish between Type I and Type II patterns. Preliminary results suggest that the visual system is most sensitive to sinusoids whose (local) radius of curvature is about 0.3 degrees of visual angle.

Steven Zucker, Pierre Lamoureux

Points and Endpoints: When do Dotted Lines Behave as if they were Solid Lines?

The size/density constraint in grouping suggests that there is a range over which dense dotted lines resemble solid lines in their behavioural and psychophysical effects. This project is aimed at checking this hypothesis, using subjective effects that are apparent in line-like patterns. Two are being used. The first is emergence of subjective contours when endpoints are smoothly aligned, and the second is the "sun illusion" or the regional brightness difference that results when line endpoints delimit a smooth region. Indications are that, when the dot density is on the same order as the dot diameters, say 3-4 times it, dotted lines cause the same effects as solid lines. When the density is decreased below this cutoff, the effects rapidly change. Furthermore, the changes are not due to local contrast changes, because they are no-replicable when contrast is explicitly varied.

Steven Zucker, Sheldon Davis

RESEARCH PROJECTS: FAULT-TOLERANT COMPUTING

Test Output Compression and Verification

In the recent past, built-in-testing (BIT) and design-for-testability (TFT) have become the keywords in the quest to solve the LSI/VLSI testing problem. The basic philosophy consists of the following two steps:

1. Apply all possible input vectors of interest by using a simple device such as a linear-feedback shift-register. This avoids the complex problem of test generation.
2. Compress the resulting output data into a very small, say 16-bit signature. This avoids the far more complex problem of storing and verifying large volumes of output data generated by the exhaustive testing performed in the first step.

However, due to the yet incomprehensible behavior of physical defects in LSI/VLSI chips, the output compression step leads to uncertainties in predicting the fault coverage poential of the above mentioned philosophy. In this project, our aim is to modify conventional output compression schemes in a fashion which will help provide formal bounds on their fault coverage capability.

The signature of an output data stream (is a good record of the original stream) if there are relatively very few streams which when compressed result in the same signature. We refer to such signatures as truly-representative-signatures (TRS). For a data stream which produces a non-TRS, we have developed a method which at the time of compression modifies the stream so that the resulting signature is a TRS. This method uses additional space on a chip which runs in the range of 10%-20% of the circuit-under-test. Various modifications and improvements of this concept are being worked out.

V. K. Agarwal

Test Set Generation for Non-Stuck-at Faults

An important class of failures in MOS logic comprises shorts and opens which cannot be modeled as classical stuck-at-faults. It has also been observed that various stuck-at faults in the equivalent logic circuit of a MOS realization cannot be accounted for by any physical failures at all. These observations strongly indicate the need to generate test sets for MOS logic which have more relevance to actual physical failures than can be incorporated by the classical generation procedures. The problem of test generation being NP-complete, new test sets must be generated using some heuristics to avoid exponential time complexity. We have been able to use the path sensitization concept to detect shorts and opens in NMOS logic at the transistor level. The average complexity of our test generation procedure is linear in the number of transistors. Attempts are now being made to integrate this work with classical stuck-at-test generation-process so that existing simulators may be used for non-stuck-at faults as well.

P. Lamoureux, V. K. Agarwal

Data Flow Anomaly Detection and Location

The occurence of a data flow anomaly is often an indication of the existence of a programming error. The detection of such anomalies can be used for detecting errors, and to upgrade software quality. We have introduced a new, efficient algorithm capable of detecting the anomalous data flow patterns in a program represented by a graph. The algorithm based on a static analysis scans the paths entering and leaving each node of the graph to reveal anomalous data action combinations. An algorithm implementing this type of approach was proposed by Fosdick and Osterwell. Our approach not only corrects an error in the previous algorithm, it also provides time and space improvements over that algorithm.

The location of data flow anomalies is a far more complex problem. To avoid the search on all possible paths, our approach uses a divide-and-conquer philosophy in which the detection algorithm is repeatedly applied on decreasingly smaller parts of a program until an anomaly is located. Current work in this project is directed towards solving some inherent problems associated with the static approach.

D. Newton, R. Trueur, V. K. Agarwal

RESEARCH PROJECTS: ROBOTICS

A Facility for Robotics Research

The objective of this research is to develop an intelligent industrial robotics system for the inspection and repair of hybrid circuits. The system will be able to "see" the circuits, decide on whether or not defects are present, and select and pick up the proper tool to perform any necessary repairs. The facilities in the robotics Laboratory will consist of three functional modules: A Robotics Module, a Vision Module and a Computing Module. The Robotics Module uses a PUMA manipulator arm and a controlling processor. The Vision Module, the eye of the intelligent robot, consists of solid state television cameras, an electronic microscope and a Vision Processor. The Computing Module incorporates the VAX-11/780 computer available in the Computer Vision and Graphics Laboratory. All three modules are connected together to form a local area network.

G. Carayannis, D. Chau, M. D. Levine, S. W. Zucker

A Visual Inspection System for Hybrid Circuits

The design of a rule-based system for the inspection of hybrid circuits during different stages of manufacturing is proposed. The tasks to be performed include the

visual inspection of the substrate, conductors, dielectric layers, resistivities, and overglaze layers, as well as the verification of the presence and position of discrete components. In order to make the system efficient, different algorithms are proposed for each particular inspection problem. For example, in some cases it is efficient to use the existing model of a particular part of the circuit in order to perform the inspection, whereas in other cases it is more effective to have symbolic descriptions of the probable defects. The approach is to design as a general inspection system which will be able to handle different kinds of circuits as well as hybrids, by expanding the data base and the number of rules.

C. J. Eskenazi, M. D. Levine

Automated Inspection of Solder Welds in Hybrid Circuits

Part of the problem of inspecting hybrid circuits includes the inspection of solder welds. Our aim is to provide a system that automatically performs this task. If it is found that a solder weld is bad, e.g. incorrect shape, poor wetting, cold joint, not enough solder on the joint, cracks, etc., the circuit would be handed over to a robot so that repairs could be effected. Inspection of a solder weld relies on the theory that a correct weld will have a different specular surface as compared to that of a bad one. A structured light approach is presently under consideration for solving this vision problem.

M. D. Levine, P. Merrill

Intelligent Robot Control

A central issue in robotics involves the design of an appropriate control hierarchy, particularly when the robot has access to visual feedback. The robotics research currently being undertaken by this laboratory will consider the issue of enabling a robot manipulator to perform simple repair operations on hybrid electronic circuits. One of the objectives of this research will be to devise a system which is capable of receiving a high level request [such as (REMOVE ITEM CIRCUIT-BOARD)] and outputting an appropriate sequence of low level robot commands which will allow the robot to carry out the desired task. In formulating the sequence of low level commands, attention will have to be directed in general to the context of the request and specifically to visual feedback as the request is carried out.

D. Chau, J. Lloyd, M. D. Levine

BOOKS AND CHAPTERS

Abraham, J. and V. K. Agarwal, Digital System Testing, in D. K. Pradhan (ed.), Recent Advances in Fault-Tolerant Computing, Prentice-Hall, to appear.

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Zucker, S.W., Cooperation and Visual Information Processing, in J. C. Simon and R. Haralick (eds.), Digital Image Processing, D. Reidel Publ. Co., Dordrecht, Holland, 1981.

McGILL REPORTS

(Some copies of reports are available. Write to: Att. Fran Lew, Admin. Secy.)

1. Abu-Hakima, S. Rao, N., Noble, P. B., Levine, M.D., A Software Package for

Tracing Cell Migration, TR-82-4.

2. Agarwal, V. K., Multiple Fault Detection in Programmable Logic Arrays, TR-79-4R.

3. Agrawal, D. P., and Agarwal, V. K., On-Line Fault Detection and Correction in Microprocessor Systems, TR-79-5R.

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5. Agarwal, V. K., Fung, A. S., Multiple Fault Coverage Predictions, TR-80-3R

6. Agarwal, V. K., Cerny, E., Store and Generate Built-in-Testing Approach, TR-81-2.

7. Carayannis, G., Structure Techniques for Computer Vision, TR-82-11.

8. Ferrie, F., Levine, M. D. and Zucker, S. W., Cell Tracking: A Modeling and Minimization Approach, TR-80-4R.

9. Haralick, R., Mohammed, J., and Zucker, S. W., Compatibilities and the Fixed Points of Arithmetic Relaxation Processes, TR-79-16R.

10. Hubschman, H. and Zucker, S. W., Frame to Frame Coherence and the Hidden Surface Computation: Constraints for a Convex World, TR-80-12.

11. Hummel, R. A., and Zucker, S. W., On the Foundations of Relaxation Labeling Processes, TR-80-7R.

12. Jachner, J., Agarwal, V.K., Data Flow Anomaly Detection, TR-81-12.

13. Knoll, A., A Real-Time System for Tracking and Quantifying Blood Cell Motion, TR-79-12R.

14. Leclerc, Y., Zucker, S., and Leclerc, D., A Browsing Approach to Documenting Documentation, TR-81-1.

15. Levine, M. D., A Knowledge-based Computer Vision System, TR-77-3R.

16. Levine, M. D., Ferrie, F., Cell Tracking by Inference. TR-81-11R.

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22. Levine, M. D., Zucker, S.W., An Annotated Bibliography on the Application of Computer Vision to Electronics Inspection, TR-81-5.

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25. Moshtagh, V., AMD 2900 Microcomputer Cross Assembler, M. Eng. Report.

26. Nazif, A., A Survey of Color, Boundary Information, and Texture as Features for Low-Level Image Processing, TR-78-7R

27. Pedanult, E., Zucker, S. W., and Muresan, L., On the Independence Assumption Underlying Subjective Bayesian Updating, TR-79-15R.

28. Rosenberg, D., Levine, M. D., and Zucker, S .W., Using Heuristic Occlusion Cues to Compute Relative Depth Relationships, TR-79-3.

29. Shaheen, S. I., An Implementation of a Relational Database and An Algebraic Sublanguage for Computer Vision System, TR-78-12R.

30. Terzopoulos, D., and Zucker, S. W., Detection of Osteogenesis Imperfecta by Automated Texture Analysis, TR-80-8R.

31. Zucker, S. W., Leclerc, Y. G., and Mohammed, J. L., Continuous Relaxation and Local Maxima Selection: Conditions for Equivalence, TR-78-15R.

32. Zucker, S. W., and Hummel, R. A., An Optimal 3-dimensional Edge Operator, TR-79-10R.

33. Zucker, S. W., and Terzopoulos, D., Finding Structure in Co-Occurrence Matrices for Texture Analysis, TR-79-13R.

34. Zucker, S. W., Motion and the Mueller-Lyer Illusion, TR-80-2R.

35. Zucker, S. W., Labeling Lines and Links: An Experiment in Cooperative Computation, TR-80-3R.

36. Zucker, S. W., and Cavanagh, P., Constructive Texture Perception: Orientation Anisotropies in Discrimination, TR-80-9R.

37. Zucker, S. W., Kant, K., Multiple Level Representations for Texture Discrimination, TR-81-3.

38. Zucker, S. W., Computer Vision and Human Perception: An essay on the Discovery of Constraints, TR-81-10.

THESES

1. Abaszadeh-Partovi, N., The Design of an Operating System for a Real-Time Color Animation System, M. Eng. Thesis, 1981.

2. Carayannis, G. A Color Display System for Real Time Animation, M.Eng. Thesis, 1981.

3. Ferrie, F. P., Experiments in Tracking the Morphologies of Proliferating Cell Cultures by Automatic Picture Processing, M. Eng. Thesis, 1980.

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8. Leung, C. H., Dynamic Computed Tomography through Interpolation in the Time Domain, M. Eng., Thesis, 1981.

9. Luk, S.-F., A Sub-Template Matching Algorithm for the Recognition of Nerve Fibres in a Section of a Nerve Trunk, M. Eng. Thesis, 1978.

10. Mignot, A., Un Logiciel de Developpement et 'Exploitation de Microcide Pour le Systeme Graphique d'Animation en Temps Reel, GRADS, M. Eng. Thesis, 1981.

11. Mohamed, J., A Feasible-Direction Operation for Relaxation Labeling Processes, M. Eng., 1981.

12. Rosenberg, D., Monocular Depth Perception for a Computer Vision System, M. Eng., 1981.

13. Shaheen, S. I., Image Segmentation and Interpretation Using a Knowledge Database, Ph.D. Thesis, 1979.

14. Terzopoulos, D., Applying Co-occurrence Matrices to Texture Classification, M. Eng. Thesis, 1980.

15. Ting, D., Intermediate Level Processing for a Computer Vision System, M. Eng. Thesis, 1979.

16. Youssef, Y. M., An Automatic Picture Processing Method for Tracking and Quantifying the Dynamics of Blood Cell Movement, M. Eng. Thesis, June, 1977.

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GRAPHICS INTERFACE '83 - PRELIMINARY PROGRAM
9 -13 May 1983 - Westin Hotel, Edmonton, Alberta

GRAPHICS INTERFACE '83 is *the* Canadian Computer Graphics Conference and is directed not only towards those already working with computer graphics, but also decision makers in government, industry, and business who are potential users of graphics hardware/software technology. The conference is sponsored by: The Canadian Man-Computer Communications Society, The Canadian Information Processing Society, the National Computer Graphics Association of Canada, the Canadian Society for the Computational Study of Intelligence, and the Canadian Image Processing and Pattern Recognition Society.

GRAPHICS INTERFACE '83 will feature tutorials, technical papers, a major equipment exhibition, and a graphics film festival.

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TUTORIALS

INTRODUCTION TO COMPUTER GRAPHICS
8:30 to 17:00 - Monday 9 May and Tuesday 10 May Location: University of Alberta
Speakers: Marceli Wein, Peter Tanner and Brian Barsky

This tutorial will present a broad introduction to computer graphics. It will discuss vector and raster systems, input devices, hard copy devices, interactive techniques, human factors, the organization and context of graphics packages, and the theoretical background of visible surface processing. Such applications as animation, CAD/CAM and mapping will be described briefly. In addition, a discussion of current and future developments in computer graphics, and an overview of the technical sessions at the conference will be presented.

RASTER GRAPHICS
8:30 to 17:00 - Monday 9 May and Tuesday 10 May Location: University of Alberta
Speakers: Alain Fournier and John Amanatides

This tutorial will discuss: Introduction, definitions, and applications of raster graphics; raster graphics hardware; raster display techniques for graphics primitives; techniques for shaded colored objects; raster programming systems and interaction techniques; research frontiers; case studies of commercially available systems.

INTRODUCTION TO COMPUTER-AIDED DESIGN
8:30 to 17:00 - Monday 9 May and Tuesday 10 May Location: University of Alberta
Speakers: Bertram Herzog et al.

This tutorial deals with computer-aided design/drafting, CADD, and emphasizes commercially available products. Computer-aided engineering, CAE, and computer-aided manufacturing, CAM, will also be covered to some extent. The course consists of lectures given by about a dozen experts, and augmented with moderated panels for audience participation and interaction. Topics to be covered include: an introduction to the general principles and characteristics of commercial systems; general structure of a CAD system; uses of CAD systems; interconnection of different CAD systems; engineering analysis that can be performed on parts defined by CAD systems and solid modelling and surface definitions.

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OFFICIAL OPENING 19:30 to 20:00 - Tuesday 10 May 1983 Room: Manitoba

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CONFERENCE

RASTER GRAPHICS
8:30 - 12:30 - Wednesday 11 May 1983 Room: Alberta
Chairman: Alain Fournier and Wayne Davis

08:30 A GRAPHICS FRONT-END FOR THE DESIGN OF GRAPHICS FIRMWARE
Larry D. Finkel, Bell Laboratories

09:00 A LOW COST IMAGE COMPRESSION TEST BED SYSTEM
T. Baleshta et al., Dept. of Communications

09:30 A FAST SCAN CONVERSION ALGORITHM
E. L. Fiume et al., University of Toronto

10:00 COFFEE

10:30 AN ALGORITHM FOR GENERATING ANTI-ALIASED POLYGONS IN 3-D
Guangnan Ni and Peter Tanner, NRC Ottawa

11:00 DESIGN AND ANALYSIS OF A PARALLEL RAY TRACING COMPUTER
J. G. Cleary et al., University of Calgary

11:30 INTERACTIVE SYSTEMS TO CREATE PRECISION GRAPHIC PRIMITIVES
G.E. McMaster and W. D. Hoskins, Brandon University

12:00 AN INTERACTIVE THREE-DIMENSIONAL GRAPHICS EDITOR
N. Magnenat-Thalmann et al., Ecole des Hautes Etudes

OFFICE AUTOMATION AND TELIDON
08:30 - 12:30 - Wednesday 11 May 1983 Room: Yukon
Chairman: Bill Armstrong and Brien Maguire

08:30 OFFICE AUTOMATION IN THE LANGUAGES OF THE WORLD - INVITED
Brian R. Gaines, CADRE Information Trans. Syst.

09:30 ACTIVE MESSAGING IN THE OFFICE: A LAMP UNTO MY FEET
Paul S. Licker, University of Calgary

10:00 COFFEE

10:30 TRANSCODING BETWEEN THE VDI AND TELIDON STANDARDS
Hannah Newman & B. Cohen, Dept. of Communications

11:00 USIPS: A TELIDON PICTURE CREATION STATION
E. Neufeld & Paul Sorenson, Univ. of Saskatchewan

11:30 NAPLPS IMPLEMENTATION: HARDWARE AND SOFTWARE ISSUES
Leo Lax, Norpak Ltd.

12:00 MEASURING TEXT-GRAPHIC ACTIVITY
Fred Lakin, Palo Alto Veterans Admin. Med. Centre

ROBOTICS
13:00 - 15:30 - Wednesday 11 May 1983 Room: Yukon
Chairman: Neil Stewart and Martin Levine

13:00 VISION FOR ROBOTS AND VISUAL INSPECTION
Tony Kasvand, National Research Council

13:30 ROBOTIC VISION AND GRAPHICAL DISPLAY BASED ON THE IBM PC
M. Feeley and N. F. Stewart, Universite de Montreal

14:00 VEGA: A GEOMETRIC MODELLING SYSTEM
R. F. Woodbury and G. J. Glass, Carnegie-Mellon Univ.

14:30 ROBOTIC ANIMATION - INVITED
Stuart Ketch, McDonald Douglas Automation Co.

APPLICATIONS
13:30 - 16:30 - Wednesday 11 May 1983 Room: Alberta
Chairman: Fred Peet

13:30 Invited talk
to be announced

14:30 COMPUTER VISUAL INSPECTION OF LIQUID CRYSTAL DISPLAYS
S. J. Dickinson et al., University of Waterloo

15:00 COFFEE

15:30 INTERACTIVE DESIGN OF WOVEN TEXTILES
J.A. Hoskins & M.W. King, University of Manitoba

16:00 INTERACTIVE CREATION OF CHINESE CHARACTERS
D. Ward, et al., University of Alberta

GRAPHICS PROGRAMMING
16:00 to 17:30 - Wednesday 11 May 1983 Room: Yukon
Chairman: Peter Tanner

16:00 HIGH-LEVEL LANGUAGE FOR AN INTERACTIVE GRAPHICS WORK STATION
R. W. Heuft and A. Schmidt, University of Alberta

16:30 ADVANCED CONCEPTS FOR HIGH-LEVEL GRAPHICS LANGUAGES
Gunter Schrack, University of British Columbia

17:00 A PROGRAMMING LANGUAGE: PROGRAPH
T. Pietrzykowski et al, Acadia University

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ANNUAL GENERAL MEETING - CMCCS
17:00 to 18:00 - Wednesday 11 May 1983 Room: Alberta
Chairman: Wayne Davis

FILM SHOW
19:00 to 22:00 - Wednesday 11 May 1983 Room: Alberta and B.C.
Chairman: Catherine Richards

19:00 FINAL PROGRAM TO BE AVAILABLE AT THE CONFERENCE

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COMPUTER CARTOGRAPHY
08:30 to 12:30 - Thursday 12 May 1983 Room: Alberta Chairman: Jean-Claude Muller

08:30 MATCHING AND INTERSECTION OF RANDOM CURVES - INVITED
Tom Poiker, Simon Fraser University

9:30 THREE DIMENSIONAL DISPLAY OF OBJECTS FROM PLANAR CONTOURS
J. Larry Paul, University of British Columbia

10:00 COFFEE

10:30 KNOWLEDGE REQUIREMENT OF A DIGITAL CARTOGRAPHER - INVITED
A. Ray Boyle, University of Saskatchewan

11:30 COMPUTER-ASSISTED MAPPING FOR CENSUS COLLECTION
Joel Z. Yan, Statistics Canada

12:00 VISUAL FIDELITY CRITERIA IN A 3D HOMOGENEOUS COLOR SPACE
B. J. Kurz, University of New Brunswick

MAN-COMPUTER INTERACTION
08:30 to 12:30 - Thursday 12 May 1983 Room: Yukon
Chairman: David Hill and Renee Elio

08:30 MENULAY - AN AUTOMATIC PROGRAM GENERATION MODULE
Bill Buxton et al., University of Toronto

09:00 COLOUR SELECTION, SWATH, AND MEMORY FOR PAINT SYSTEMS
Peter P. Tanner et al., National Research Council

09:30 VISIBILITY IN THE STAR USER INTERFACE - INVITED
David C. Smith, XEROX PARC

10:30 COFFEE

11:00 PERSONALIZABLE DIRECTORIES: AUTOMATIC USER MODELLING
Ian Witten & S. Greenberg, University of Calgary

11:30 CONTINUOUS HAND-GESTURE DRIVEN INPUT
Bill Buxton et al., University of Toronto

12:00 REACHING THE COLOR BLIND WITH COMPUTER GRAPHICS
Daniel S. Raker, Design & Systems Research Inc.

ANIMATION
13:30 to 17:00 - Thursday 12 May 1983 Room: Alberta
Chairman: Marceli Wein and Martin Tuori

13:30 COMPUTER ANIMATION AT LUCASFILM - INVITED
William T. Reeves, Lucasfilm

14:30 COMPUTER ASSISTED FILMMAKING: A REVIEW
Tom Calvert, Simon Fraser University

15:00 COFFEE

15:30 ACTOR AND CAMERA DATA TYPES IN COMPUTER ANIMATION
Daniel Thalmann, Universite de Montreal

16:00 DYNAMIC GRAPHICS AND THE LOW BANDWIDTH COMMUNICATION BARRIER
John Amanatides, University of Toronto

16:30 A STRUCTURED MOTION SPECIFICATION IN 3D COMPUTER ANIMATION
Philippe Bergeron, Universite de Montreal

GEOMETRIC MODELING
13:30 to 17:00 - Thursday 12 May 1983 Room: Yukon
Chairman: Gunter Schrack

13:30 CONTROLLING THE SHAPE OF PARAMETRIC SPLINE CURVES
Brian Barsky & John Beatty, UC Berkeley

14:00 A LANGUAGE FOR 3-D MODEL INTERACTIONS
David Makris, IBM, Poughkeepsie

14:30 A RESEARCH PERSPECTIVE ON SOLID MODELING - INVITED
R.B. Tilove, General Motors Reseach Laboratory

15:30 COFFEE

16:00 PROGRAMMING SOLID MODELING SYSTEMS
G. J. Glass, Carnegie-Mellon University

16:30 LOCATING, DELETING AND REPLACING PATTERNS IN GRAPHICS
D. Thalmann, et al, Universite de Montreal

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CONFERENCE BANQUET

19:00 to 21:00 - Thursday 12 May 1983 Room: Alberta and B.C.
Chairman: to be determined

19:00 DETAILS TO BE ANNOUNCED

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CAD/CAM
08:30 to 12:00 - Friday 13 May 1983 Room: Alberta
Chairman: David Bonham

08:30 EXPERIENCES WITH A GRAPHICAL DATA BASE SYSTEM
Mark Green, McMaster University

09:00 NEW REQUIREMENTS FOR USER INTERACTION WITH CAD/CAM DATABASES
F. Vernadat, National Research Council

09:30 CAD/CAM AT MITEL - INVITED
M. Caughey, Mitel Corp.

10:30 COFFEE

11:00 USE OF META OPERATIONS IN TAILORING DRAWING SYSTEMS
Clive K. Liu, Carnegie-Mellon University

11:30 BENEFITS FOLLOWING THE ACQUISITION OF A CAD SYSTEM
Lynn Sveinson, Nova, An Alberta Corporation

SPEECH ANALYSIS AND SYNTHESIS
08:30 to 10:00 - Friday 13 May 1983 Room: Yukon
Chairman: Ching Suen and R.C. Snell

08:30 AUTOMATIC SPEECH GENERATION AND UNDERSTANDING - INVITED
R. De Mori, Concordia University

09:30 THE FUTURE OF SPEECH PROCESSING
A. L. Bridges, VeXP Research/Systems Ltd.

ARTIFICIAL INTELLIGENCE IN CANADA
10:30 to 12:00 - Friday 13 May 1983 Room: Yukon
Speakers: Nick Cercone and Gordon McCalla

IMAGE PROCESSING
13:00 to 15:30 - Friday 13 May 1983 Room: Alberta
Chairman: Murray Press

13:00 RECOVERING THE MEANING OF DIAGRAMS AND SKETCHES - INVITED
Alan Mackworth, University of British Columbia

14:00 COMPUTER RECOGNITION OF HANDPRINTED CHARACTERS
Y. Mong and Ching Suen, Concordia University

14:30 ACQUISITION, EDITING AND ANALYSIS OF MICROSCOPE DATA
Fred Peet & T. S. Sahota, PFRC, Victoria

15:00 ENHANCEMENTS TO THE PROGRESSIVE TRANSMISSION MODEL
S. E. Walker & F. S. Hill, U. Mass. (Amherst)

RESOURCE APPLICATIONS
13:30 to 15:00 - Friday 13 May 1983 Room: Yukon
Chairman: Ted Barnicoat

13:30 GRAPHICS MAPPING SYSTEMS: PAST, PRESENT AND FUTURE
Harry Walters, Alberta Natural Resources

14:00 GEOGRAPHIC APPLICATIONS FOR SATELLITE DATA - INVITED
George Nagy, University of Nebraska

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ANNUAL GENERAL MEETING - CSCSI
15:30 to 16:00 - Friday 13 May 1983 Room: Yukon
Chairman: Nick Cercone

CLOSING PARTY 16:30 to 18:30 - Friday 13 May 1983 Room: t.b.d.

For registration information, contact:

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