some short scenarios for next NSW meeting

In the Jan 20 message from Crain asking for an NSW meeting he listed some topics of concern to him that he would like to see scenarios for to be sure the nsw would meet gunters initial expectations. Some of his suggestions show lack of common language about tools and things others are meaning ful. A split of writeup that CHI suggested and seems fine with me is that he would writeup 3a,3b,3d,3f,3g,3i as they are Frontend type things, EKM would deal with 3e 3k and any others of nls type and JBP would do 3c, 3h 3j which are protocoly. We should have drafts to read by next wed to go over and send them out as modified on thurs. Dick 1 some short scenarios for next NSW meeting

(J25184) 22-JAN-75 17:04;;;; Title: Author(s): Richard W. Watson/RWW; Distribution: /CHI([ACTION]) EKM([ACTION]) JBP([ACTION]) ; Sub-Collections: SRI-ARC; Clerk: RWW;

Our Dear Ms, Git 'em who lives in ARC's Help

'FOR YOUR AMUSEMENT' ...The database builder will get a laugh out of it too (Kirk?)

Our Dear Ms. Git 'em who lives in ARC's Help

Ms. Git 'em is one of our more entertaining personages in ARC's Help database, but she is hard to find. Moreover, one would not even know whe was there to be found; it takes a couple of steps. I found that an S in Message subsystem now gets me Send instead of Sort. To find out what that was, I did a CTRL-Q, and after selecting a couple of menu items # 3, I got a descripption of Send. And, lo, there was Ms. Git 'em (sans her punctuation, but, alas, searching for MSGITEM directly does not work, because she is not named. Next time you're in Help, try it, you'll like it...................P.S. This is not a complaint, merely a late night perceptual block. 1

Our Dear Ms, Git 'em who lives in ARC's Help

(J25185) 22-JAN-75 17:37;;;; Title: Author(s): Jeanne M, Beck/JMB; Distribution: /FEEDBACK([INFO-ONLY]) ; Sub-Collections: SRI-ARC FEEDBACK; Clerk: JMB;

SanJuan and Business cards go to COM

The files SanJuan and Cards (the business cards) were sent to ISI and DDSI has been alerted to pick them up in the morning. 1

SanJuan and Business cards go to COM

(J25186) 22-JAN-75 17:38;;;; Title: Author(s): Ann Weinberg/POOH; Distribution: /JOAN([ACTION] Please put it in DPCS notebook) NDM([INFO-ONLY]) IMM([INFO-ONLY]) ; Sub-Collections: SRI-ARC; Clerk: DVN;

New commands in user-subsystems

> The new version of NLS brings with it user-programs containing several new commands.
> The MODIFY user-subsystem contains "Insert Address" (US postal from IDENT)," Delete Leading (spaces)", and "Delete Names" in addition to it's previous commands.
> The MESSAGE user-subsystem has added to it the "Send Message" command (the old sendmes program) and "Reformat (citations in) STRUCTURE" (the old Jform3 program).
> The FORMAT user-subsystem has no new additions, but the command "Format File "has been changed to "Insert Format".
> The PUBLISH user-subsystem has a "Generate References" command (the old makeref user-program).
> See <documentation, help, userprograms: Blebbt> for a list of all approved user-programs and their documentation. 1

New commands in user-subsystems

(J25187) 22-JAN-75 18:56;;;; Title: Author(s): Kirk E. Kelley/KIRK;
Distribution: /SRI-ARC([INFO-ONLY]) &DIRT([INFO-ONLY]) ;
Sub-Collections: SRI-ARC DIRT; Clerk: KIRK;

insert left

i suspect that it would not take much more than one to two hours time of an NLS programmer to implement an INSERT LEFT CHARACTER command and it sure would be nice to have. (I understand the onliest thing stopping this from happening is getting agreement on the command syntax to be used. It seems a shame to let this quibble keep us from having such a nice new feature.) 1

insert left

(J25188) 23-JAN-75 09:30;;;; Title: Author(s): Kenneth E. (Ken) Victor/KEV; Distribution: /FEEDBACK([ACTION]) NPG([ACTION]) RWW([ACTION]) DCE([ACTION]) JCN([ACTION]) ; Sub-Collections: SRI-ARC FEEDBACK NPG; Clerk: KEV;

line printer output

since people seem to leave listings lying around on the output printer tables, and since this makes finding current listings sometimes difficult, i propose that we have jeff modify our printer program to time and date stamp the first page of all listings and that we have our operators through out all listings more than 3 days old, 1

line printer output

(J25189) 23-JAN-75 09:36;;;; Title: Author(s): Kenneth E. (Ken) Victor/KEV; Distribution: /SRI-ARC([ACTION]) ; Sub-Collections: SRI-ARC; Clerk: KEV;

line printer output

I think KEV's suggestion concerning line printer output 25189 deals with the symptom but not the source of the problem. The source of the problem is that although we have 24-hour, seven day a week operator service, line printer output distribution has slipped from it's daily schedule to a schedule that seems like once a week maybe. The solution to the source of the problem would be to follow the daily line printer output distribution schedule. This would eliminate the problem KEV addresses. 1

line printer output

(J25191) 23-JAN-75 16:37;;;; Title: Author(s): Kirk E. Kelley/KIRK; Distribution: /SRI-ARC([INFO-ONLY]) ; Sub-Collections: SRI-ARC; Clerk: KIRK;

test

test 1

test

(J25192) 23-JAN-75 18:27; Title: Author(s): Marcia Lynn Keeney/MLK; Distribution: /MLK; Sub-Collections: SRI-ARC; Clerk: MLK;

my two cents on kirk's two cents

with reference to kirk's journal complaint about operators not clearing the line printer tables, i'd like to mention that i perform this mundane little chore almost without fail every evening that i am here. however, when i started being operator, jeff mentioned that, while straightening up the printouts on the table was an operator duty, actual hand delivery to the offices was not mandatory. while some people may wish to take issue with this policy, i think it is beneath no one's dignity at arc to pick up files he or she has printed out. as i say, i don't really mind delivering topeople's offices, but i do think people at arc could take a bit more initiative and responsibility for their own work. 1

my two cents on kirk's two cents

(J25193) 23-JAN-75 18:52; Title: Author(s): Marcia Lynn Keeney/MLK; Distribution: /SRI-ARC; Sub-Collections: SRI-ARC; Clerk: MLK;

I Will Visit Washington, Would Like to See the XGP

I am going to be in the nation's capital Monday and Tuesday of next week. I wll be tied up all day Monday but have an appointment at 9:00 AM Tues with Connie Mc to talk about XGP and allied printer problems and possibilties. I would like a chance to watch the XGP being used. Can you help me be able to do that?...see you next week. 1

I Will Visit Washington, Would Like to See the XGP

(J25194) 23-JAN-75 19:40;;;; Title: Author(s): Dirk H. Van Nouhuys/DVN; Distribution: /JMB([ACTION]) JOAN([ACTION] dpcs notebok please) RLB2([INFO-ONLY]) RWW([INFO-ONLY]) EKM([INFO-ONLY]) ; Sub-Collections: SRI-ARC DPCS; Clerk: DVN;

NSW/NLS Questions

There is a new file (nsw-sources,nls-questions,) which contains a lot of questions concerning mostly the relationship between NLS and NSW. I think it would be a good idea to keep this as a working file for awhile. So please read it and feel free to add any comments, questions, or (someone please) answers. 1

NSW/NLS Questions

(J25195) 23-JAN-75 19:52;;;; Title: Author(s): David S. Maynard/DSM; Distribution: /RWW([INFO-ONLY]) EKM([INFO-ONLY]) CHI([INFO-ONLY]) JEW([INFO-ONLY]) JBP([INFO-ONLY]) KJM([INFO-ONLY]) KIRK([INFO-ONLY]) HGL([INFO-ONLY]) RLB2([INFO-ONLY]) ; Sub-Collections: SRI-ARC; Clerk: DSM;

SIGART NEWSLETTER Number 39 April 1973 1

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SIGART NEWSLETTER 1b

The SIGART Newsletter is a bimonthly publication of the Special Interest Group on Artificial Intelligence of the Association for Computing Machinery. The Newsletter reports on projects being conducted by the artificial intelligence research community and generally reviews current progress in the state-of-the-art. Correspondents report news from local SIGART Chapters and other AI Centers.

--- 1b1

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SIGART NEWSLETTER Number 39 April 1973

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 6 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), Advertisements (New Products or Classified Advertising), Puzzles, Poems, Cartoons, etc. Material may be reproduced from the Newsletter for non-commercial purposes with credit to the author and SIGART. 1b2

Anyone interested in acting as editor for a special issue of the Newsletter devoted to a particular topic in AI is invited to contact the Editor. Letters to the Editor will be considered as submitted for publication unless they contain a request to the contrary. Technical papers appearing in this issue are unrefereed working papers, and opinions expressed in contributions are to be construed as those of the individual author rather than the official position of SIGART, the ACM, or any organization with which the writer may be affiliated. 1b3

You are invited to join and participate actively. SIGART membership is open to members of the ACM upon payment of dues of $3.00 per year and to non-ACM members upon payment of dues of $5.00 per year. To indicate a change of address or if you wish to become a member of SIGART, please complete the form on the bottom of the last page of this issue. 1b4

Copy deadline for the June Issue: May 25th.

1b5

CHAIRMAN'S MESSAGE 2

There will be a SIGART meeting at the first National Computer Conference and Exposition this June and Saul Amarel will be the invited speaker. (See Editor's Entry for details.) 2a

Last February, I attended the Computer Science Conference in Columbus, Ohio and found it to be an interesting and successful conference. There were over 300 talks most of which reported on work in progress rather than finished results, and only the abstracts were published. Each was scheduled for a particular, 15 minute time slot, and amazingly enough, the session chairman held the speakers to their scheduled time. Thus, one could look at the abstracts to see which talks he wanted to hear and after attending a talk in one session, he could leave that session for a talk during the next time slot in another session. If there was nothing of interest during the next time slot, that period could be spent in the lobby talking to someone he had not seen for a few years. Hence, this format also improved personal communication, since people were constantly wandering in and out of the lobby. 2b

Refereeing abstracts is not as selective as refereeing complete papers. However, the number of high quality papers in which I was interested seemed to be the same at this conference as at the average conference which referees complete papers. One of the reasons for this was a relatively large number of experienced researchers, including a half dozen from the West Coast that I know personally, who took the time to come to Columbus to tell other people what they are currently doing. 2c

G.W.E. 3/26/73 2d

EDITOR'S ENTRY 3

1. SIGART MEETING AT THE NATIONAL COMPUTER CONFERENCE
-- 3a

There will be a SIGART meeting at the first National Computer Conference and Exposition in New York, tentatively scheduled for Wednesday, June 6th at 8:00 P.M. Prof. Saul Amarel, Chairman of the Department of Computer Science at Rutgers, will talk on "AI at Rutgers." Topics to be discussed include research on representations and modeling in problem solving, question answering, generation and interpretation of event sequences, as well as applications in medical decision-making and automatic programming. 3a1

2. IJCAI-73
-------- 3b

According to the conference Program Chairman, Dr. Nils Nilsson, "approximately 150 papers have been submitted for the third IJCAI. A preliminary look reveals that many are outstanding." More information will be forthcoming in future issues of the Newsletter. 3b1

3. ADDITIONAL SIGART NEWSLETTER REPORTERS 3c

Univ. of California at Berkeley	Michael H. Smith
GM Research Labs.	Arvid L. Martin
Information Sciences Institute at USC	Robert Hoffman 3c1

4. CHARGES FOR BACK ISSUES OF SIGART NEWSLETTER 3d

Liz Klein informs me that the charge for back issues of our newsletter is $.50, prepaid. (Since there is a $2.00 billing charge, prepayment is obviously more convenient.) Make checks payable to the ACM. Back issues are still available as listed in the December '72 Newsletter, p.29, and including the most recent issues (Dec. '72 and Feb. '73). Write to: 3d1

Ms. Liz Klein
ACM
1133 Avenue of the Americas
New York, New York 10036 3d1a

5. ARPA NET USED TO TRANSMIT NEWSLETTER MATERIAL 3e

For the first time in history, we did not need to retype an article solicited for the newsletter. The report by Mike Rychener on AI research at CMU, appearing on p. 17 of this issue, was obtained over the Net using the standard FTP protocol and edited on-line. We hope this precedent will be followed by many more in the future. 3e1

6. NSF PROJECT TO STUDY ROBOT HARDWARE 3f

The National Science Foundation has awarded SRI a contract to study and recommend moderately priced, general-purpose robot hardware for possible use by any university or organization interested in starting a research program in artificial intelligence. A few institutions such as MIT, Stanford University, and SRI have already invested many man-years in developing special-purpose hardware, and are continuing to do so. However, there are many other universitites engaged in research in computer science that simply cannot afford to commit a substantial engineering effort to the development of such hardware for their own AI research. 3f1

SRI is planning to put forth its recommendations in the form of a catalog of modular system components, which will hopefully satisfy the above need for the near future. Of course, as new system components become available, the catalog would have to be expanded and updated. 3f2

The SRI study consists of two parts: First, a questionnaire was sent to approximately 250 universities and research institutions throughout the world that might be interested in "robotic" equipment, such as television cameras, manipulator arms, and mobile vehicles. The purpose of the questionnaire was to try and establish functional characteristics and operational parameters deemed important at the present time. The second part of the study is to inquire from all known manufacturers the specifications of relevant hardware devices, such as visual and tactile sensors, manipulators, and other related devices. Tom Binford of the Stanford University Artificial Intelligence Laboratory has provided us with valuable information on sensors, which he has been studying for the past year. 3f3

Also in connection with this project, Victor Scheinman of Stanford University and Jerry Gleason of SRI have recently completed a two-week tour of AI-related hardware developments in Japan. (Jerry's report appears on p. 12 of this issue). Judging from the enormous level of activity by both Japanese universities and industry, as well as strong government endorsement through the PIPS Project, it is quite possible that the Japanese will outdistance us in the development of robot hardware in the next few years. Although there seems to be comparatively little attention being given to the more theoretical aspects of AI such as problem solving, theorem proving, etc. in Japan, perhaps the development of fairly sophisticated hardware will precipitate greater concern for this area of AI in the future. 3f4

7. THE LIGHTHILL REPORT 3g

It has recently come to my attention that our British colleagues are in the midst of a serious controversy about the future of artificial intelligence in Great Britain and its proper level of government support. To document this debate, see two recent articles appearing in the British Journal, THE NEW SCIENTIST (cf. p. 29 for abstracts). 3g1

As best as I can infer from these articles and other personal communications, the British Science Research Council commissioned Prof. Sir James Lighthill, an eminent physicist, to examine the future of AI research and formulate recommendations for future government funding. It appears that his report was so displeasing to workers in the field that the SRC has not yet made its contents public and only a few people have actually seen it in full. (It will allegedly be published late this Spring.) Needless to say, it could not have been a very positive report. 3g2

It is reputed that Sir James was invited by Prof. Donald Michie to visit the facilities at the School of Artificial Intelligence at Edinburgh University while he was preparing his report in order to learn what AI was all about first hand, but that he declined. Michie's article in the NEW SCIENTIST seems to be a direct public refutation of the contents of the Lighthill Report. The second article by Rex Malik provides a more detailed account of its contents with additional observations by Drs. Marvin Minsky and Terry Winograd of MIT and Dr. Bertram Raphael of SRI. We certainly hope that our British cousins will resolve this controversy in a satisfactory manner, so they can continue to produce the high quality AI research which they have demonstrated in the past. 3g3

8. PRINTER QUALITY
---------------- 3h

Finally, Rich and I wish to thank those who volunteered the services of their own line printers, in printing a more legible edition of the newsletter for publication. We apologize for the poor type-quality of the last issue and hope that this current issue is more adequate, having been printed with a mylar instead of cloth ribbon. 3h1

L.S.C. 3/28/73 3h2

IN MEMORIUM 4

1. TO THE FRIENDS OF JAIME CARBONELL by Ted Strollo, BBN 4a

As many of you know already, Jaime died suddenly and unexpectedly of a heart attack on February 2, 1973. He leaves his wife, Nelly, and 5 children: Jaime Jr., Dina, Miguel, Ana Maria, and Pablo, their ages ranging from 19 to 6 years old. 4a1

Nelly is most concerned about her financial ability to provide for the children's educations, and many of us want to help with that concern. To this end, we have contacted the Carbonell's family lawyer and arranged to set up a trust fund that will minimize any tax burden to the family. We hope you too may want to help. Please send checks made to "The Jaime R. Carbonell Memorial Trust" in care of the undersigned. 4a2

Dr. Theodore R. Strollo
Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, Massachusetts 02138 4a2a

2. W. ROSS ASHBY, FAMOUS CYBERNETICIST DIES by Gordon Pask (from the ASC Forum, Vol. V, No. 1, March 1973) 4b

Prof. Dr. Ross Ashby, gentleman, genius, and scholar, died at the age of 69 on November 15, 1972. He was, of course, a world authority on cybernetics and systems theory. He came down from Sidney, Sussex, Cambridge, and practiced medicine; served for many years as Research Director of Barnwood House and at the Burden Neurological Institute. Later he came to the United States, where he was Professor in the Department of Biophysics, at the University of Illinois from 1961 to 1971. On retirement he returned home to Great Britain and spent the last few years of his life as Professorial Fellow at the University of Wales. 4b1

AI FORUM 5

COMPUTATIONAL LOGIC - A DISSENTING VIEW by John Laski
Computing Center
University of Essex
Colchester, Essex. 5a

Now that Pat Hayes has joined us at Essex, I have stopped being lazy and looked more closely, though not technically very deeply, at computational logic, or as it's devotees call it, Automatic Theorem Proving. What I found has confirmed my earlier naive view. 5a1

I can best express this by paraphrasing my memory of Bar-Hillel's beginning to a lecture on language translation at IFIP in 1962. "After n million dollars of support, after m man-years of effort, after x Ph.D. theses, we must honestly admit that our goals (of fully automatic, high quality translation and of new and interesting proofs automatically generated for new and interesting theorems), though properly attractive as an area of scientific research that had a good chance of payoff when it began, must now be recognized as a chimera." 5a2

Bar-Hillel exaggerated then and I exaggerate now. I admire the intellectual contribution originated by Robinson in reformulating Predicate Logic in a manner amenable to computation and the mathematical ingenuity of many of his followers. 5a3

But I consider that the work of this school has reached a plateau or local maximum whose level is way below the then reasonable expectations of the earlier pioneers and is an order of magnitude below what we need for proofs of program correctness. And I don't see extra-hyper-para-super-modulation, or improvements in software or hardware technology making a blind bit of difference to the situation. 5a4

Those were the symptoms; now a dignosis of what I think is wrong. When we produce a program that we confidently allege solves the problem we set out to solve or embark on a plan of action that we believe will attain some desired goal, our confidence is based on natural informal reasoning. Moreover, we can convince our friends of the validity of our solutions; they accept the "reasonableness" of our reasoning. 5a5

What is more amazing is that our programs often do what we intended them to, and that our plans, too, yield us, usually, the gratifications we sought. Conversely, when we formalize this reasoning into applied predicate logic, proving the corresponding theorems is too difficult for current automatic theorem provers. This contrast is all the more striking at first sight because these programs are much faster and more reliable at producing proofs than I am; I am actually rather inaccurate at writing things down and consequently don't trust what I've written without constant rechecking. But, I can, and think I should, turn this last thought upside down to reach my diagnosis. 5a6

The formal deductive systems we are using are bad ones for constructing proofs that justify our informal reasoning. This is not surprising; we have taken them uncritically from the mathematical logicians who use them as objects of analysis, whereas we want to use them as objects of use. An object of study should be as parsimoniously specified as possible so that elaborate case analysis in proving its properties can be minimized; conversely, the richer the tools of arguments available, the easier it is to justify some (valid) proposition. 5a7

To use a programming analogy, the way we construct proofs is like writing programs in absolute hexadecimal. After diagnosis comes treatment. Robin Milner's LCF system is interesting, and not due to the fact that the logic with which he is working is due to Scott, rather than being classical, applied predicate logic. Scott is just as traditionally parsimonious in describing his system as the predicate logic systems in the literature. What is interesting about what Milner has done is that he has embedded Scott's logic within an interactive, proof-construction mechanism. The user constructs his proof either bottom-up by requesting that a rule of deduction be applied to already proved formulae or top-down by hypothesizing that a goal will finally be reached by some rule of deduction. The system automatically produces the consequent wffs that are, in the one case, now proved and, in the other, form new subgoals. In both cases -- and this is what I see as important -- the wffs that are produced are syntactically correct and do not require tedious textual checking. To continue the programming analogy, Milner allows us to construct our proofs in a macro-assembly language. 5a8

But treatment is not cure, and I have no cure. I believe, however, that the analogy I have drawn between program-contruction languages and proof-construction languages reaches further and provides a clue to the next step. Above macro-languages exist procedural languages which, over the last two decades we have tuned to express naturally the way we construct algorithms. We need to discover formal deductive systems in which we can naturally construct proofs. What semantic constructs this requires I don't yet know. Milner has a Simplify command which allows a dynamically changing set of simplifications to be, when appropriate, invoked as a class; he claims this to be very valuable and I also believe it to be a valuable beginning. Some of my collegues, following Winograd, want to see a proof not as static, but as a planned or contrived procedural construct; of this I am very sceptical. 5a9

I hope that this note will stimulate some response, either directly to me, or through the AI Forum. 5a10

MEMBERSHIP SERVICES by Wiley R. McKinzie
ACM Membership #1185214 (I think)
State University College of Arts and Science
Genesco, New York 5b

A copy of this letter is addressed to "Membership Services" of the ACM. A more appropriate title would have been "Membership Disservices." My dealings with you over the past year surely has aged me by five. I will not bother to outline the blunders you have made in the mailing of publications (I missed 6 last year), the handling of membership numbers (I've had three in one year), and the handling of membership dues (I paid for

SIGART membership and got SIGACT). I concede! I know when I am dealing with a GIIGO (i.e., Good Information In, Garbage Out). 5b1

Therefore, with regard to the current problem of multiple billings for SIGART membership, I reluctantly enclose a $3.00 check for the second payment of my SIGART dues in the hope that you don't lose it, enroll me in SIGCAPH (although I feel I belong there at this point) or spend it on more Renewal Notice Forms (I have enough now to paper the walls and ceiling). I am also enclosing a copy of my previous correspondence on this matter in the event someone there happens to read, and is interested. It is against my principles to submit when I'm being raped. However, SIGART does put out an interesting newsletter and for this reason alone I stand compromised. 5b2

Finally, I sound this alarm, although these sage words are surely written on the wind. 5b3

> "Layman, beware! Your cybernetic priests have feet of clay. They boast of their machines that will deliver up your wildest dreams, but their arts are feeble. They cannot even put their own house in order. Better place your fate in the hands of a shaman than such as these." 5b3a

[Ed. Note: I have personally consulted with ACM Headquarters on the case of Mr. McKinzie and have been assured that the problems referred to above have been satisfactorily resolved.] 5b4

KEEP UP THE GOOD WORK by Garry Carlson
Brigham Young University
Provo, Utah 5c

In the December issue of the SIGART Newsletter, which I received on February 12, you have some discussion on a possible dues increase. I think the answer to this problem is very simple: whatever it costs to keep SIGART going, including the Newsletter, is what should determine the dues. I think most of us receiving the Newsletter feel it one of the more significant publications that we get and are happy to pay whatever the costs are that are necessary to create and publish it. We realize that there is a large amount of donated labor by you and your secretaries and others, and that all is being done possible to keep the cost to a minimum. You have at least one member's vote for a raising of the dues to whatever is necessary to cover the costs. 5c1

Thanks for your good work. 5c2

ROBOT RESEARCH IN JAPAN by Jerry Gleason, SRI 6

1. INTRODUCTION 6a

As part of an international study sponsored by NSF to recommend hardware for artificial intelligence research, Victor Scheinman and I spent two weeks in Japan visiting universities, industrial research laboratories, and factories. We were impressed to find that a substantial effort is being devoted to image processing techniques and to the development of robots for industrial automation. The largest effort is an eight-year, 100 million dollar program sponsored by the Japanese Ministry of International Trade and Industry (MITI). This is a National research and development program under the over-all direction of Dr. Hiroji Nishino of the Electrotechnical Laboratory (ETL). The PIPS project (Pattern Information Processing System) has five major goals to be accomplished by 1978: (i) Recognition of 2000 printed characters (including Chinese Kanji characters), (ii) Recognition of pictures, (iii) Recognition of 3-D objects, (iv) Recognition of voice, and (v) Recognition of sentences. 6a1

2. ETL 6b

At the Electrotechnical Laboratory in Tokyo, under the direction of Dr. Kohei Sato, we saw five manipulators (one of which is shown in Figure 1), a demonstration of an image dissector/laser ranging system, and a small mobile robot which had a TV camera with a flexible fiber-optic light guide, a manipulator with 68 tactile sensors in its hand, and a mini-skirt around its perimeter equipped with an additional 16 tactile sensors. (The latter was developed by Dr. Hirochika Inove and Dr. Hideo Tsukuno.) The computer used by this laboratory was a 20K PDP-12. 6b1

3. HITACHI 6c

The HIVIP Mark I hand/eye system at the Hitachi Central Research Laboratory can assemble simple structures given appropriately shaped blocks and a three-view assembly drawing of the desired structure (see Figure 2). It is currently being modified to permit the introduction of tactile sensors on the fingers of the hand. 6c1

Dr. Masakuzu Ejiri and Dr. Tadamasa Hirai then demonstrated the HIVIP Mark III hand/eye system, a successor to the Mark I, which used a TV camera to determine the location and orientation of different blocks moving down a conveyor belt, acquire and track a moving block, and finally pick it up and place it in a standard position. They also showed us a soon-to-be-announced printed circuit board inspection system which displays cracks and other defects in red on a color TV monitor, while the boards are moving on a conveyor belt. 6c2

ETL-HAND 6c3

The ETL-HAND is a hydraulically-driven, multi-joint manipulator with six degrees of freedom (three modes of motion for both rotation and flexion respectively and finger tips with tactile sensors which detect contact with an object. The ETL-HAND has been designed with special attention paid to its driving mechanism and the entire shape of the system for a minimum number of motions. The finger tips are replaceable as necessary. 6c3a

Receiving signals from the sensors on the finger tips, the computer sends out action signals to define what steps the HAND should take to perform the task. 6c3b

4. MITSUBISHI 6d

At Mitsubishi Central Research Laboratory, Dr. Takayasu Ito demonstrated a minicomputer-controlled manipulator that used two TV Cameras: one provides an overview of a rotary conveyer table, and the other is mounted in the hand to provide visual feedback for arm positioning. The system "reads" the Kana Character on each of several blocks placed on a fixed table and stacks them on the moving table in the desired order. This system uses a PDP-8/I with 8K of core. The program, however, occupies only 5K of core, including the storage areas for the video image and reference tables for 20 different shapes and characters. A paper describing this system will be presented at the Third International Symposium on Industrial Robots on May 29-31 in Zurich, Switzerland. 6d1

Dr. Ito's group, which was formed two years ago, is interested in studying the mathematical theory of Computation, theoretical aspects of AI, theorm proving, and improvements of Planner for program writing. Dr. Ito has a 32K PDP-15/40, a 16K PDP-11/20, an 8K Super-Nova, a 16K Melcom 350-5F, and an 8K Melcom 70 (which is similar to a Super-Nova). All of these computers are inter-connected using the PDP-11's Uni-bus. An XDS Sigma 5 is going to be added to this system sometime this year! Mitsubishi also had on display an 80x80 electroluminescent (EL) panel TV, a 200x240 EL Computer display with 3 bits of grey levels, and a multi-color liquid crystal display. 6d2

5. WASEDA 6e

At Waseda University, Dr. Ichiro Kato had several arms and articulated hands with tactile sensors that were developed primarily for prosthetic applications. Dr. Kato has developed several "walking machines," the latest of which has two arms with hands and a dual TV system for eyes (see Figure 3). Drs. Atsuya Seko and Hiroshi Kobayashi have developed an experimental, parallel-image preprocessor which utilizes the dead-time characteristics of a channel plate multiplier. This device can be used to extract the boundary of high contrast objects, detect moving objects, and perform logic operations on images such as a+b, axb, etc. 6e1

6. OTHER LABORATORIES 6f

In addition to the above, we visited Toshiba Research Laboratory, which has a self-navigating, mobile robot for delivering and picking up packages and Kyoto University, where Dr. Toshiyuki Saki is doing research in automatic speech processing, pattern recognition, picture processing (including computer analysis and classification of photographs of human faces), and processing of natural language. We also visited Tokyo University, where Dr. Jin-ichi Nagumo is doing research on associative memory systems and Dr. Yasuhiro Doi is studying new techniques for real time processing of holographic images. At RiKen Information Science Laboratory, Dr. Takashi Soma is developing an ultra-high resolution CRT (16,000x16,000) for use both as a flying spot scanner and as a large-scale memory. Dr. Eiichi Goto (who is also on the faculty of the University of Tokyo) is developing a graphic system with halftone and area color capabilities based on a Data Disk 6500 display system. 6f1

RiKen has the largest computational facilities that we encountered with a FACOM 270-60, (a Dual cpu with a 256 Kw x 32 bits and 200x10^6 bytes of disk storage) and a FACOM 270-30 (65 Kw x 16 bits with a large graphics system). By the end of the year the 270-60 will be replaced with a FACOM 270-75, which is five times faster (and reputed to be the largest computer in Japan). 6f2

7. INDUSTRIAL FACILITIES 6g

We visited four manufacturing facilities: 6g1

(i) Aida Engineering, which manufactures one- and two-handed industrial robots for working with punch-presses, 6g2

(ii) Nikon, where we watched the assembly of the F-2 camera (which contains over 1000 parts!), 6g3

(iii) Honda Engineering Co., where the assembly of Honda cars is accomplished, and 6g4

(iv) Furukawa Electric Co., which is the 4th or 5th largest communications cable manufacturer in the world. Dr. Kazuhiko Masuda at Furukawa (and former International Fellow at SRI) has designed many systems to automate the assembly of a wide variety of cables. 6g5

8. CONCLUSION 6h

It seemed to us that the Japanese are working very diligently to acquire the technology to carry out advanced image processing and also to apply AI technology to industrial automation within the next few years. On the other hand we saw conparatively little interest in the major software and theoretical aspects of AI research. 6h1

AI RESEARCH AT CMU - A BRIEF SUMMARY by Mike Rychener
Computer Science Dept.
Carnegie-Mellon University 7

The most populous project at CMU is the speech recognition project headed by Professor Raj Reddy and Lee Erman. The current achievement is a voice-chess system incorporating several knowledge sources working in a hypothesize-and-test mode and interacting smoothly as a set of cooperating independent processes. This Hearsay system is reasonably successful in recognizing connected speech in the limited chess context, even though the chess-move grammar includes about five million possible utterances. It relies on a chess semantic specialist, the Tech program, on a grammar specialist, and on basic acoustic routines. Presently, re-analysis and reorganization of that effort is being undertaken, by Lee Erman, Victor Lesser, and Richard Fennell, with views towards implementation on the CMU C.mmp (multi-mini-processor) system. Bruce Lowerre and Richard Smith are analyzing the performance of Hearsay for multiple speakers on several other tasks: a Doctor task, voice news retrieval, and a desk calculator. 7a

More basic linguistic research, consisting of gathering and analyzing large amounts of connected speech, is also under way, in the form of single-person projects: Linda Shockey is studying the rules of relaxed speech; Janet Baker, time domain methods and their relationship to neurophysiological theories; Jim Baker, probabilistic representation of knowledge used in a speech understanding system; and Henry Goldberg, comparative evaluation of various parametric representations of speech. 7b

Two graduate students, Keith Price and Ron Ohlander, are working with Professor Reddy in computer vision: face recognition and detection and representation of motion in natural scenes. The work on SYNAPS (Symbolic Neuronal Analysis Programming System) was reported in the previous SIGART newsletter (No.38, p.9). 7c

Research in understanding and problem-solving forms the main focus of Professor Allen Newell's interest at the moment. This manifests itself in the form of understanding human problem-solving behavior (protocol analysis), in building an understanding system (MERLIN) to represent and reproduce this behavior, and in analyzing the behavior of such systems, expressed as production systems. PAS-II is a fairly large sophisticated LISP system for automatic protocol analysis, written by Don Waterman. It features multiple passes over a protocol transcription in English, carrying it successively through grammatical parse-trees, semantic elements, behavior graphs (the context of the protocol), and finally a production system simulation of the protocol. The program is highly interactive, allowing the human to take over where the program makes major or minor slips. 7d

Use of the system has been made outside the protocol analysis task area, since its components are sufficiently general to apply to general text-processing "inductive" tasks. Jim Moore is the mainstay of the MERLIN work, incorporating knowledge of processes and methods of AI into a semantic-net framework. Professor Newell's PS(G) has been used as a principle tool for expressing production systems, although almost every task has resulted in a different sort of implementation. 7e

Tom Moran has studied the simulation of a visualization task using a production system which relies solely on symbolic information (i.e., no visual memory as such), with a great deal of success. Stu Card is building a complex data structure (he calls it a knowledge bush) including a production system to represent an understanding of the area of cognitive learning experiments. Another project involves expressing AI programs as production systems in order to carry out an analysis of intelligence and knowledge in the program, a particular example of which is the current focus, the STUDENT program of Daniel Bobrow. 7f

By now I've mentioned five different production system applications in the environment, and there still seems to be a lot that we don't know about these as programming vehicles, in particular we're nowhere near the stage assumed by programs like PLANNER and QA4, which have taken the liberty of building into the system a set of assumptions which guide the user in solving his problems. In other words we're trying to isolate important design issues which will encapsulate the kinds of knowledge one has after writing many production systems, observing how the lack of control structure can make the task very difficult. 7g

In the area of chess, there are three efforts. Jim Gillogly is working on his Tech program as an example of performance analysis for AI programs, in particular heuristic search types. Hans Berliner, our resident chess Master, has worked up a chess tactics program which has attained a level of 65% success in "Win at Chess," a book of tactical problems. His program is successful in limiting tree search to about 400 nodes in a depth 10 search, utilizing the semantics of the chess position to guide the mode in which the program carries out its analysis. Chess also provides a bridge over the gap between perception and problem-solving, in the work led by Professor Herbert Simon. Through the efforts of Bill Chase and others, about 3000 chess patterns have been encoded into an EPAM-like net with the result that boards can be recognized perceptually at the level of Expert with respect to chess memory tasks. 7h

On other fronts, S. Ramani is working in a CAI area, generating fairly complex drill-type problems usable in beginning programming courses. Bill Mann has developed a semantic-net-based system for structuring external data in terms of known templates, in particular on tasks such as encodings for short-term-memory, and dis-assembly of machine-language insructions. Charles Hedrick is working on the design of a system which uses a semantic net to solve a class of problems including concept formation and sequence extrapolation, in other words general rule inducton. Our efforts in mechanical theorem-proving are being directed by Professor Donald Loveland, consisting of a fairly powerful theorem-prover by Mark Stickel which uses the linear format for resolution. This basically is oriented towards studying applications and experimenting with newly-discovered proof strategies. Professor Peter Andrews is extending work into mechanizing higher-order logic. 7i

THE HEURISTIC PROGRAMMING/HEURISTIC DENDRAL PROJECT by N. S. Shridharan
Computer Science Dept.
Stanford University 8

The Heuristic Programming Project at Stanford University is an interdisciplinary research effort. The problems of interest to this project include, besides the major effort in the Heuristic DENDRAL set of programs, determination of protein structures from X-ray crystallographic data, work in automatic programming and automatic debugging of programs, and studies on the representation problem. Some aspects of the Heuristic DENDRAL work are detailed below: 8a

The co-principal investigators for the project include Dr. Joshua Lederberg (Genetics), Dr. Edward Feigenbaum (Computer Science), and Dr. Carl Djerassi (Chemistry). Dr. Bruce Buchanan has been with the project from its conception. The interdisciplinary staff include several research associates, research assistants, programmers, and graduate students. The problem chosen to work on -- the application of artificial intelligence techniques to mass spectrometry -- is a rich and varied domain of interest to medicine, organic chemistry, and computer science. 8b

Interpretation of mass spectra requires the judicious application of a very large body of knowledge, whether it is done by a chemist or a computer. Our efforts have paid rich dividends in not only providing a handsome tool of utility to mass spectrometrists and in the systematization of knowledge and technique of mass spectral analysis, but also in helping to further the state of the art in artificial intelligence. The project remains committed to the idea that AI can benefit greatly by applications that do not merely demonstrate feasibility, but actually are of significant practical value. 8c

EXTENSION OF PERFORMANCE 8d

The performance programs developed in the past, for several subclasses of compounds, have been given a unified presentation in [1]. Since that time much effort has been put into extending the performance level of the program by 8d1

(i) the successful application for the first time to a problem of biological relevance, namely, the analysis of the high resolution mass spectra of estrogenic steroids. Of particular significance in the effort were, in addition to exceptional performance, the capability for analyzing spectra of mixtures of estrogens without prior separation. 8d2

(ii) the completion of the design and programming of a CYCLIC STRUCTURE GENERATOR. Whereas the original DENDRAL algorithm could only generate molecules that do not contain any cycles, the new generator can produce all molecules of a given chemical composition in a prospectively irredundant manner. This problem has defied solution for nearly 100 years and is considered significant in defining the scope and limits of all of chemistry. A substantial effort is now being mounted to flexibly constrain the generator with heuristics. 8d3

EXTENSION OF THE THEORY OF MASS SPECTROMETRY 8e

The task of theory formation in science (Meta-DENTRAL) was described in [2], and partial implementation was detailed in

[3]. Our objective is to explore the theory formation problem within the context of AI research. The difficulty of the problem is indicated by noting that (i) mass spectrometry has not been formalized to any great degree, (ii) existing theories are not systematic and quite incomplete, and (iii) progress is slow and difficult, even for the chemists. 8e1

The present program is at the level of being a very useful aid to the chemist in comprehending the great volume and richness of data that mass spectra contain. The two completed parts of the program are: 8e2

(i) Data Interpretation and Summary -- a heuristic search that transforms raw data (spectra and structures) into a representation amenable to rule-formation. 8e3

(ii) Rule-Formation -- a process of successive refinement with heuristic guidance that formulates the first-order rules of mass spectrometry. 8e4

The formation of sophisiticated rules and their subsequent unification lies in the future. The problem is interesting and nevertheless difficult. There are prolific instances where AI issues like the representation of data, representation of processes, and selection of paradigms are involved. The possibility of introducing a "model" to guide theory formation brings in several other key AI questions. 8e5

Copies of articles referenced above are available by writing to the: 8f

Heuristic Programming Project
Serra House
Computer Science Department
Stanford University
Stanford, California 94305 8f1

[1] Buchanan, B. G. and Lederberg, J. [1971] "The Heuristic DENDRAL Program for Explaining Empirical Data," Proc. IFIP Congress 71, Ljubljana, Yugoslavia. (Also AI Memo 141, Stanford AI Project, Stanford University.) 8g

[2] Buchanan, B. G., Feigenbaum, E. A., & Lederberg, J. [1971] "A Heuristic Programming Study of Theory Formation in Science," Proc. Second Int. Joint Conf. on Art. Int., Imperial College, London. (Also AI Memo 145, Stanford AI Project, Stanford University.) 8h

[3] Buchanan, B. G., Feigenbaum, E. A., & Sridharan, N. S. [1972]

"Heuristic Theory Formation: Data Interpretation and Rule Formation," Machine Intelligence 7, Edinburgh University Press. 8i

[4] Papers on the Cyclic Structure Generator are in various stages of preparation. 8j

CHESS 9

1. A META COMMENT ABOUT THE I.J. GOOD - SAM RASHEVSKY INTERCHANGE
by Hans J. Berliner
Former World Correspondence
Chess Champion 9a

Though I usually prefer to smile (benignly) when chess amateurs discuss computer problems, the discussion in the SIGART Newsletter of February 1973 was a little too much for me. 9a1

First of all, I would think that Mr. Good would know better than to challenge the judgment of Mr. Reshevsky when it comes to chess. I am sure Mr. Reshevsky would have the good sense not to get into a statistics debate with Mr. Good. 9a2

Secondly, such positions should be analyzed for the general public at a level commensurate with the play of the competitors in the game. To measure the outcome of a position by grandmaster standards when Class C players are involved, is ludicrous. It is done only in tournaments when a game cannot be finished and must be adjudicated, and I wince every time I am called upon to do that. 9a3

Thirdly, Mr. Fischer and Mr. Reshevsky should be informed that chess players of great reputation and ability are working on the chess programming problem. They may not want to include me, since their joint over the board score against me is 6 1/2 - 1/2. However, the credentials of Dr. M. M. Botvinnik of the Soviet Union are impeccable. Besides being probably the greatest player of all times (unless now eclipsed by Fischer) he has outstanding contributions credited to him in the field of electrical engineering. Further, I think all persons interested in chess programming ought to be informed that for any of today's chess programs, it would be impossible to encode 90% of what I know about chess. The problem is the usual semantic data base problem. 9a4

P.S. I like your new format of informal presentations along with the technical stuff very much. Please don't take this as a criticism of that. 9a5

2. LETTERS TO GEORGE KOLTANOWSKI

[Ed. Note: The following two letters were published in a recent issue of the San Francisco Chronicle in the Chess Column edited by George Koltanowski, a grand master and former world, blind-fold champion.] 9b

WISDOM V by Kerry K. Takew
Chicago, Illinois 9b1

I noted with interest an article in one of your recent columns concerning the 1972 ACM Computer Chess Tournament. I was disappointed that the author (and, perhaps, you yourself) shares the popular disdain for computer chess among professional players. Admittedly, the playing algorithms which have been profusely developed by programmers to date have not shown success proportional to the time devoted to them. 9b1a

Two of my collegues and I have therefore been working on chess projects of more limited goals, in order to provide a foundation for more advanced projects. In the process, we have been able to progress more rapidly than if we plunged directly into game-players, and have developed programs which I think are of immediate interest to human players. 9b1b

Our machine WISDOM V can solve any two-move problem easily. It is more than a match for any human problem solver. I am now in the process of extending the algorithm to three-movers, but will not speculate on its efficiency as yet. 9b1c

The computer can mean more to chess than most people realize. 9b1d

Recent Game By MAC HACK by Robert Uommi
Berkeley, California 9b2

Here is a game which three of us played in consultation last week, at the Stanford Artificial Intelligence Project. The sacrifice on move 11 is apparently unsound, but although White had us busted, it finally blundered in the end thus proving once again the superiority of Man over Machine. 9b2a

The program which we played, the Greenblatt Chess Program, is said to be the strongest in the world. It is presently about 1580 in strength (High C rating)... 9b2b

White: MAC HACK. 9b2c

Black: Cyril Grivet, Tony Marshall*, and Robert Uommi. 9b2d

FRENCH DEFENSE 9b2e

1.	P-K4	P-K3	17.	K-K2	QxPch
2.	P-Q4	P-Q4	18.	K-K1	N-R7
3.	PxP	PxP	19.	R-B2	Q-N8ch
4.	B-Q3	B-Q3	20.	B-B1	B-N5
5.	N-KB3	N-KB3	21.	Q-Q3	N-B6ch
6.	O-O	O-O	22.	RxN	BxR
7.	N-K5	P-B4	23.	N-R3	P-KR4
8.	P-QB3	N-B3	24.	K-Q2	P-R5
9.	NxN	PxN	25.	N-B2	P-R6
10.	B-K3	R-K1	26.	Q-B5(a)	Q-B7ch
11.	PxP	BxPch	27.	K-B1	QxBch
12.	KxB	N-N5ch	28.	N-K1	QxNch
13.	K-N1	RxB	29.	K-B2	Q-B7ch
14.	PxR	Q-R5	30.	K-B1	Q-B8ch
15.	R-B3	Q-R7ch	31.	K-Q2	Q-K7ch
16.	K-B1	Q-R8ch	32.	K-B1	Q-Q8 mate

9b2e1

(a) This loses fast. With 9b2e1a

26. B-K2, Q-N7 27. N-K1 or
26. ... Q-B7 27. N-Q4 9b2e1a1

White can still get out of the mess. By the way a computer never resigns. It always plays on until "It's mate." 9b2e1b

*[Ed. Note: For reference, Tony is one of my frequent lunch-hour chess adversaries, and I know he has a "B" tournament rating.] 9b2f

CONFERENCES 10

1. IJCAI-73 DEMONSTRATIONS 10a

We would like to have live demonstrations of AI programs at the IJCAI next August. We plan to provide teletype access to a local PDP-10 as well as to remote computers as necessary via the ARPA Net. If you have an interesting program that can be demonstrated with the above facilities, please contact: 10a1

Dr. Jay Tenenbaum
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025 10a1a

2. 1973 IEEE SYSTEMS, MAN, AND CYBERNETICS CONFERENCE
November 5-7, Boston, Massachusetts. 10b

CALL FOR PAPERS 10b1

Papers are solicited on the broad range of desciplinary frontiers that comprise systems science and cybernetics including decision and utility theory, modeling and simulation, man-machine interaction, control theory, pattern recognition, social choice theory, game theory, adaptive and learning systems, etc. A major theme of the Conference will be the role of systems analysis in solving societal problems. Papers addressed to the application of systems analysis to the analysis, delivery, or planning of public services (transportation, medicine, justice, water resources, etc.) are especially appropriate. 10b2

Two types of papers are being solicited: (1) regular papers describing more complete work in some detail, and (2) short papers describing recent and perhaps preliminary work. Authors should submit five copies of the complete manuscript for the regular papers. Deadlines are April 1, 1973 for regular papers and June 1 for short papers. Send manuscripts or summaries to 10b3

Dr. Sheldon Baron
Bolt Beranek and Newman, Inc.
50 Moulton Street
Cambridge, Massachusetts 02138. 10b3a

Each regular paper will be reviewed for possible publication in the IEEE Transactions on Systems, Man, and Cybernetics. All papers accepted for presentation will be published in the Conference Proceedings. Copies of the Proceedings will be available to Conference participants at the time of the meeting and can also be ordered directly from IEEE Headquarters after the Conference. 10b4

3. 1973 SYMPOSIUM ON THE HIGH-LEVEL-LANGUAGE COMPUTER ARCHITECTURE
November 7 and 8; University of Maryland; College Park, Md.
Conference Chairman: Prof. Elliott I. Organik
Program Chairman: Prof. Yaohan Chu 10c

CALL FOR PAPERS 10c1

This Symposium is sponsored by the TCCA of the IEEE Computer Society, SIGPLAN, and SIGARCH. The objective is to identify and focus on a new kind of computer architecture whereby machines are designed to accept high-level languages and/or direct-users' languages. The topics of interest include, but are not limited to: 10c2

** Evaluation of current compilation and execution processes
** Architecture for high-level-language processors
** Architecture for high-level-language control processors
** High-level-language I/O architecture
** Evaluation of high-level-language architecture
** High-level machine languages
** User languages and user-directed architecture
** Semantic modeling of high-level languages
** Symbiosis of semantics and architecture
** Direct implementation of semantic models
** Impact of high-level-language computer systems 10c3

Tutorial as well as research papers are solicited. These should be limited to twenty, double-spaced, typed pages including charts, tables, and diagrams. These papers will be refereed. A Proceedings will be published and distributed during the registration at the Symposium. 10c4

There will be a special session for researchers to present five-minute research snapshots. Those who wish to include a one-page summary in the proceedings should submit this summary before the deadline. 10c5

Deadline for submitting a paper: June 30, 1973 10c5a

Deadline for submitting research snapshots to be included in the Proceedings: Sept. 15, 1973 10c5b

Notification of acceptance to the authors: August 15, 1973 10c5c

Submit papers to: 10c5d

Dr. Yaohan Chu
Computer Science Center
University of Maryland
College Park, Md. 20742 10c5d1

4. AISB SUMMER SCHOOL 10d

An AISB Summer School is to be held at St. Catherine's College, Oxford, England from July 16 to July 20, 1973. The plan is to bring together a fairly informal mix of four or five leading British researchers in artificial intelligence and about fifty other participants eager to learn from them. The program of instruction will be flexible and will focus on the topic "knowledge systems." Such basic questions will be asked as

"How we and intelligent machines do or can acquire, store, and use knowledge?" Participants can expect historical perspectives and detailed and varied insights into current research. Reading lists and notes will be circulated in advance of the meeting itself. 10d1

Accommodation will be provided in the College. The basic charge to each participant, including accomodation and all meals, will be about $75.00. It is likely, however, that a number of scholarships will be available for suitable participants. Anyone wishing to attend the School (whether or not a member of AISB) should write for further details to: 10d2

James Doran
AISB Summer School
SRC Atlas Computer Laboratory
Chilton, DIDCOT, Berkshire
OX11 OGY, England 10d2a

5. IFIP CONGRESS '74
August 5-10, 1974; Stockholm, Sweden
CALL FOR PAPERS 10e

This triennial meeting is sponsored by the International Federation for Information Processing (IFIP), which represents the information science interests of its 33 member countries throughout the world. Past congresses, which have been held in Paris, Munich, New York, Edinburgh, and Ljubljana, have been the major international media for the world-wide exchange of information among developers and users of information processing techniques and technology. 10e1

The Program for IFIP Congress 74 will span the broad field of information processing and will consist of three kinds of presentations: 10e2

Invited papers, consisting of one-hour surveys of broad fields, and half-hour presentations of recent advances in specific areas. 10e2a

Submitted papers, making up the major part of the program, reporting on original work in information processing. 10e2b

Panel discussions, exploring the present state of the art and current trends. 10e2c

Papers for the submitted-paper part of the program are solicited throughout the whole range of the information processing field. Papers dealing with new techniques or new theoretical advances are particularly looked for, but papers describing practical experiences with information processing systems will also be welcome. Papers should be strongly related to the design or use of computer systems. All submitted papers will be reviewed. 10e3

For more information write to: 10e4

Dr. Herbert Freeman
IFIP Congress '74
c/o AFIPS
210 Summit Avenue
Montvale, New Jersey 07645 10e4a

AI JOURNAL: SPECIAL ISSUE ON KNOWLEDGE 11

The journal ARTIFICIAL INTELLIGENCE hereby invites papers on the topic of Representation of Knowledge. The first issue of 1974 is intended to be a special issue, exclusively devoted to this topic. 11a

The issue will be concerned with such "knowledge" which is incorporated in human common sense and with such "representations" as are suitable for expressing that knowledge in a computer, and which are also suitable for semantic operations on that knowledge, such as learning, deduction, generalization, or other operations which are of interest and within the reach of computer programs. The "computer" may then be an existing or proposed hardware or hardware-software system. The primary emphasis is on knowledge about the physical world, which among humans is usually conveyed in natural language. 11b

In particular, papers addressing the following topics are within the intended scope of the issue: 11c

1. Principles for the design, criteria for adequacy, and methods for verifying adequacy of a proposed Representation of Knowledge (R of K); 11c1

2. Descriptions of specific systems for representation of knowledge; 11c2

3. Work in logic, linguistics, and/or psychology, if its relevance to the problem of R of K is carefully explained in artificial intelligence-oriented terms; 11c3

4. Experiments with, experience from, analyses of, and opinions about previously proposed systems for R of K; 11c4

5. Surveys and syntheses of previously proposed systems for R of K. 11c5

Papers addressing the following topics are not within the intended scope of the issue, and will normally be considered for conventional issues of the Journal: 11d

1. Representations for the study of "logical truth" rather than "knowledge"; 11d1

2. Methods of transformation between natural language or digitized pictures on one hand, and an R of K on the other; 11d2

3. Methods for performing or guiding search in a data base with a given R of K; 11d3

4. Methods for collecting knowledge in a given R of K (e.g., dealing with informants). 11d4

Complete manuscripts must be recieved by August 1, 1973. Manuscripts should be in English, and submitted with original and two copies conforming to the rules of the Journal. Each paper will be reviewed; acceptable papers will be returned to the author by October 15, 1973 for recommended modifications, and must then be resubmitted no later than December 1, 1973. Contributions can be sent to any member of the Committee for this issue: 11e

John McCarthy
Artificial Intelligence Project
Stanford University
Stanford, Calif. 94305
U.S.A. 11e1

Erik Sandewall
Datalogilaboratoriet
S-752 23 Uppsala
Sweden 11e2

Pat Winston
MIT Project Mac
545 Technology Square
Cambridge, Mass. 02139
U.S.A. 11e3

ABSTRACTS 12

MACHINE INTELLIGENCE IN THE CYCLE SHED * by Donald Michie
Prof. of Machine Intelligence
Univ. of Edinburgh 12a

In the shadow of the British Science Research Council's controversial Lighthill Report on the future of machine intelligence, the head of the biggest AI group in Britain argues that the cost of such research, with its anticipated pay-off for industry, is trivial compared with England's concorde-like commitment to nuclear physics. During the later 1970's, computing in its various forms is expected to become the world's third largest industry, with the software component predominating. 12a1

WHY BUILD ROBOTS + by Rex Malik
Freelance Computer Journalist 12b

Artificial intelligence researchers are being branded simply as robot builders. But the bulk of their work today concerns programming computers with strategies for solving a whole range of open-ended tasks. And the robot--really a computer peripheral--is merely their "talking workbench." 12b1

A PROGRAM WHICH PLAYS PARTNERSHIP DOMINOES _ by Michael H. Smith
Department of Electrical Engineering and Computer Sciences
University of California at Berkeley 12c

A learning program has been written in BASIC to play 4-player partnership dominoes. Because dominoes is a game of incomplete information, the program uses somewhat different principles of artficial intelligence from those used in programs for games of complete information, such as checkers, chess, and go. The program was constructed to use a "strategy signature table," which classifies board situations through the interactions of game parameters. Each entry in the table contains adaptively determined weights indicating the advisability of various strategies. Once chosen, a strategy then employes probability analysis and linear polynomial evaluation to chose a move. Our program wins approximately two-thirds of its games in tournament situations, and has defeated two champion players. 12c1

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* pp. 422-423, THE NEW SCIENTIST, Feb. 22, 1973.
\+ pp. 478-480, THE NEW SCIENTIST, March 1, 1973.
_ Mr. Smith, an undergraduate student in EECS at Berkeley, has just learned that this paper has won first place in the 1972-73 ACM Communications National Student Paper Competition (now renamed the George E. Forseyth Student Paper Competition). It will be presented at the Annual ACM Conference this August in Atlanta and will probably be published in the Communications at a later time. 12d

REPORT ON A WORKSHOP IN NEW TECHNIQUES IN COGNITIVE RESEARCHby A. Newell, H. A. Simon,

R, Hayes, and L, Gregg
Carnegie-Mellon University
January 1973 12e

A nine day Workshop on New Techniques in Cognitive Research was held at CMU in June 1972 under the sponsorship of the Mathematical Social Science Board. The workshop involved continuous on-line interaction with a set of theory-laden program systems (production systems, natural language understanding systems, simulation, automatic protocol analysis systems, and experimentation systems). A guide system (ZOG) was used to mediate the use of these systems. This paper is the final report on the Workshop to the MSSB. 12e1

BEYOND REF-ARF: TOWARD AN INTELLIGENT PROCESSOR FOR A NONDETERMINISTIC PROGRAMMING LANGUAGE by G.D. Gibbons,
Computer Science Dept.
Carnegie-Mellon University
January 10, 1973 12f

This document reports work on two heuristic problem solving systems, Ref2 and POPS. Both systems accept problems stated as programs in a nondeterministic programming language, and solve the problems by applying heuristic methods to find successful executions of the programs. Ref2 is patterned after Rich Fikes' system, REF-ARF, and contains the problem solving methods of REF-ARF, as well as additional methods based on an alternative representation for the problem context. Ref2 is also able to solve a class of integer programming problems. POPS is a revised and extended version of Ref2, obtained by the addition of goal directed methods based on concepts from GPS. 12f1

COMPUTER ANALYSIS OF NEURONAL STRUCTURE by D. R. Reddy, W. J. Davis,
R. B. Ohlander, and D. J. Bihary
Computer Science Dept.
Carnegie-Mellon University
March 1973 12g

This paper describes research to date on SYNAPS (Symbolic Neuronal Analysis Programming System), for the analysis of the geometry of single nerve cells and of neuronal networks. Images of dye-injected serial sections are digitized and analyzed to determine the profiles of dentritic branches crossing each section. These sectional profiles are used to reconstruct a three dimensional structure of the dentritic branches. A 3-D display program permits the researcher to look at the structure from different points of view. The eventual goal of this research is to assemble a 3-D model (the wiring diagram) of an architypical ganglion containing select, identified neurons and to correlate neuronal structure with neuronal function within such a system. 12g1

SEMANTIC MEMORY OF A PROBLEM SOLVER GENERATOR by Franco Sirovich
Computer Science Dept.
Carnegie-Mellon University
September 1972 12h

The paper is concerned with computer semantic memory, i.e., with the problem of representing general knowledge about a given world. The semantic memory issue is raised in the context of the problem of machine learning of heuristics, and the connection with the problem of machine representation of knowledge is emphasized. A brief overview is made of what is known about the mechanisms responsible for the observed human memory behavior. The guidelines for the implementation of a semantic memory are presented. The problem of knowledge representation is tackled in its general form, so that the proposed semantic memory may be of interest also in other fields, like natural language understanding, question answering, or theorem proving. 12h1

CAN EXPERT JUDGES, USING TRANSCRIPTS OF TELETYPED PSYCHIATRIC INTERVIEWS, DISTINGUISH HUMAN PARANOID PATIENTS FROM A COMPUTER SIMULATION OF PARANOID PROCESSES? by Kenneth Colby and Franklin Hilf
Stanford Artificial Intelligence Project MEMO AIM-182
December 1972 12i

Expert judges (psychiatrists and computer scientists) could not correctly distinguish a simulation model of paranoid processes from actual paranoid patients. Two interviews between a psychiatrist and an actual patient on the one hand and the computer model on the other are presented. 12i1

AN APPLICATION OF ARTIFICIAL INTELLIGENCE TO ORGANIC CHEMICAL SYNTHESIS by N. S. Shridharan
Ph. D. Thesis*
Computer Science Dept.
S.U.N.Y. at Stony Brook
August 1971 12j

Organic chemical synthesis is found to be a suitable problem for developing machine intelligence where the resulting system promises to be of genuine utility. The aim of the program is to take as input the name of a chemical compound and, utilizing its base of chemical data and chemical reactions, to specify a set of complete synthesis sequences and their evaluation of merit. 12j1

----------------- 12j2

* Available only through University Microfilms, Ann Arbor, Michigan. 12j2a

The program has successfully discovered multi-step syntheses for relatively complex organic structures without on-line guidance or intercession on the part of the chemist-user. The program is able to deal with a wide variety of functional and structural features. Information concerning organic synthesis reaction mechanisms is provided to the computer in a tabular-form reaction library containing, for each reaction, structural schema for the target and subgoal molecules and a set of tests, largely heuristic, to govern the choice of reaction. With its initial limited library of reactions, problem-solving heuristics, and subgoal evaluation functions, the program developed a conceptually correct synthesis for the complex polycyclic structure of a ketone derivative of twistane and several suggested syntheses for Vitamin A. 12j3

The computing effort is divided between the tasks of solution generation (the subject of the thesis) and solution evaluation. The present program uses a heuristic search procedure leading from the target molecule to terminal compounds (the Aldrich Chemical Catalog of commercially available compounds) to investigate partial reaction sequences and stores partial results in a tree structure. There are complex heuristics to prune the tree and to set strategies in developing the tree. Since the program is to specify more than one synthesis sequence, the techniques of tree development are interesting. The problem solving tree, reaction list, and the compound catalog are very large and require the use of auxiliary storage. 12j4

The program is written mostly in PL/1(F) applicable to an IBM 360/67, and program timings indicate that we have a fast and efficient practical system. 12j5

Inquiries may be sent to: 12j6

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Stony Brook, New York 11790 12j6b

References: 12j7

1. Gelernter, H., Sridharan, N. S., et al. "Computer Methods in Organic Synthesis" (accepted in) TOPICS IN CURRENT CHEMISTRY, Volume 37, Springer-Verlag, Berlin and New York. 12j7a

2. Sridharan, N. S., "Search Strategies for the Task of Organic Chemical Synthesis" (Submitted to IJCAI-73). 12j7b

INFANTS IN CHILDREN STORIES - TOWARD A MODEL OF NATURAL LANGUAGE COMPREHENSION by Garry S. Meyer
MS Thesis, MIT AI Lab Memo 265
August 1972 12k

How can we construct a program that will understand stories that children would normally understand? By "understand" we mean the ability to answer questions about that story. Here we are interested in the understanding of natural language in a very broad area. In particular, how does one understand stories about infants? We propose a system which answers such questions by relating the story to background real-world knowledge. We make use of the general model proposed by Eugene Charniak in his Ph.D. Thesis*. The model sets up expectations which can be used to help answer questions about the story. There is a set of routines called BASE routines that correspond to our "real-world knowledge" and routines that are "put in," called DEMONs, that correspond to contextual information. Context can help to assign a particular meaning to an ambiguous word, or pronoun. 12k1

The problem of formalizing our real-world knowledge to fit into the model is the primary problem here. I discuss a first-level attack on formalizing information about infants and then "baby bottles." The contrast between the two leads me to suggest that the same methods can not be used successfully for both inanimate and animate objects. Finally, I outline how a finite-state model of infant behavior can be used to understand infants in children's stories better. 12k2

A MODEL FOR ADAPTIVE PROBLEM SOLVING APPLIED TO NATURAL LANGUAGE ACQUISITION by Larry R. Harris, Ph.D. Thesis, TR 133
Computer Science Dept.
Cornell University (August 1972) 12l

Adaptive Problem Solving is the application of artificial intelligence learning techniques to practical problems. The approach taken in studying Adaptive Problem Solving is three-fold. First, to develop a model for Adaptive Problem Solving in order to specify the processes involved in computer learning, as well as the interaction between these processes. Second, theoretically well-founded, practical algorithms are developed for each of these learning processes. Third, as an application of this theory, the Natural Language Acquisition Problem is formulated in terms of the adaptive model. 12l1

The specification of algorithms to perform learning processes leads to the development of a Bandwidth Heuristic Search, an extension of heuristic search, that includes many practical considerations without forfeiting any theoretical capabilities. A modification of this algorithm, the Bandwidth Heuristic Search for MIN/MAX trees, is shown to be superior to the alpha-beta minimax process. 12l2

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* See SIGART Newsletter, p. 21, (Feb. 1973) for abstract. 12m

The model is applied to the Natural Language Acquisition Problem in order to force an encounter with several critical problems involved with computer learning. The Natural Language Acquisition Problem is the problem of providing a robot the adaptive mechanisms sufficient to learn to converse with a human teacher using natural language. The robot first learns the lexicon of the language by correlating the teacher's description of the robot's actions with the robot's internal description. Then the robot infers a grammar that reflects the structure of the teacher's sentences. At this point the robot can begin conversing using a natural language. The linguistic capability of the robot includes the ability to disambiguate lexical and structural ambiguities, and the ability to formulate full sentence replies. After several learning sessions the robot converses in English using nested dependent clauses. 12m1

This adaptive linguistic system successfully copes with many of the critical problems involved in computer learning and serves as an example of an adaptive program in which the learning, rather than yielding only minor improvements, provides the primary basis for successful performance. 12m2

THE ROLE OF THEOREM PROVING IN ARTIFICIAL INTELLIGENCE by H. G. M. Huber
U.S. NWL Technical Report No. 2864

Dahlgren, Virginia
November 1972 12n

This paper describes and evaluates theorem proving and its role in artificial intelligence in non-technical terms. It discusses the general principles underlying automatic theorem proving on the computer and considers the different strategies and techniques that are used for improving performance. It is shown by examples that theorem proving plays a central role in artificial intelligence. The application of theorem proving to automatic program writing is treated in detail. A candid evaluation of the situation will reveal that further research in specific directions is desirable and that certain other areas do not appear to be promising in the near future. 12n1

PROVING THEOREMS ABOUT LISP FUNCTIONS by Robert S. Boyer and J Strother Moore
Memo, 60
School of Artificial Intelligence
Edinburgh University 12o

We describe some simple heuristics combining evaluation and mathematical induction which we have implemented in a program that automatically proves a wide variety of theorems about recursive LISP functions. The method the program uses to generate induction formulas is described at length. The theorems proved by the program include that REVERSE is its own inverse and that a particular SORT program is correct. 12o1

REPRESENTATION OF KNOWLEDGE FOR VERY SIMPLE PAWN ENDINGS IN CHESS by S. T. Tan
School Of Artificial Intelligence
University of Edinburgh
MIP-R-98
November 1972 12p

For the purpose of studying how knowledge might be represented, organized, and used, we consider the example of single-pawn endings in chess and develop a program written in the POP-2 language to play these endings. Here, knowledge is represented as associations between predicates over board situations and action schemes, and organized to form a decision tree. To use knowledge to find a move in a given situation, the program retrieves the action scheme associated with the class of situations to which the given one belongs. Only very simple partial evaluation functions are used. 12p1

IN THE FOOTSTEPS OF THE AMOEBA - OR MULTI-PROCESSING WITHOUT TEARS by H. R. Townsend

Dept. of Machine Intelligence
University of Edinburgh 12q

The difficulty of analysing data from electroencephalogram recordings stems from the stochastic nature of the signals that we are able to record. A large amount of data must be processed in order to derive any useful quantitative estimates. The complex nature of this 'filtering' process makes it necessary to use digital computer techniques, while at the same time something at least approaching real-time processing is necessary to make E.E.G. analysis a practical proposition. 12q1

BEYOND OMNIPOTENT ROBOTS by Gary G. Hendrix
Department of Computer Sciences
University of Texas at Austin
Technical Report NL 14
March 1973 12r

A new methodology for the construction of world models is presented. The central feature of this methodology is a mechanism which makes possible the modeling of (1) simultaneous, interactive processes, (2) processes characterized by a continuum of gradual change, (3) involuntarily activated processes (such as the growing of grass), and (4) time as a continuous phenomenon. 12r1

A HIERARCHY-DRIVEN ROBOT PLANNER WHICH GENERATES ITS OWN PROCEDURES by L. Siklossy and J. Dreussi
Department of Computer Sciences
University of Texas at Austin
TR-10
February 1973 12s

LAWALY is a LISP program which solves robot planning problems. Given an axiomatic description of its capabilities in some world, it generates its own procedures to embody these capabilities. It then executes these procedures to solve specific tasks in the world. Hierarchies of subtasks guide the search for a solution. In sufficiently large worlds, LAWALY has routinely solved tasks requiring several hundred steps without needing to learn from previous tasks. The times to solution usually grow about linearly with the number of steps in the solution. LAWALY is extensively compared to another robot planner based on a theorem prover. 12s1

PROVING THE IMPOSSIBLE IS IMPOSSIBLE IS POSSIBLE, WITH APPLICATIONS TO ROBOT WORLDS by L. Siklossy and J. Roach
The Department of Computer Sciences
University of Texas at Austin

TR-11
February 1973 12t

A novel technique, called hereditary partitions, is introduced. It permits the rigorous proof that, in a given axiomatization, certain states can never be reached. The technique is implemented in a computer program, DISPROVER, and is applied to robot worlds. DISPROVER cooperates with a path-finding program when the latter encounters difficulties. 12t1

GOLEM: GENERATOR OF OBSERVATIONAL LAWS FROM EXPERIMENTS AND MODELS
by Alois Glanc
Department of Computer Science
Queens College
of the City University of New York 12u

This paper describes a design and evaluation of an interactive computer system, called GOLEM, for generation and verification of laws (hypotheses) valid on the basis of given experimental data and/or mathematical models. In the buidling of GOLEM methods of mathematical logic (predicate calculus and theorem provers), statistics, and Methodology of Science with heuristic techniques have been combined. 12u1

A variant of the applied monadic predicate calculus is used for the description (input) of experiments (data sets) and for the expression (output) of laws and hypotheses valid on the basis of the given data sets. The monadic predicate calculus is embedded into an applied second-order predicate calculus with methodological relations, e.g., the causality relation, the correlation relation, etc. The methodological relations form the basis of a query language. GOLEM's basic task is to generate all or some of the formulas which satisfy given methodological relations. 12u2

GOLEM can be useful in such areas as: theory formation (e.g., in biology, medicine, or sociology), experimental design, hypothesis formation, or as a component in a robot control program. GOLEM is tested on the problems of finding logical relations between concepts (properties) of 'large' mathematical models and 'discovering' axiomatic systems describing these models. 12u3

AI ON TV 13

1. Martin Cardin's novel CYBORG* has now been made into a TV pilot film (by Universal) for a possible series on ABC-TV next Fall. Aired on March 7th and entitled "The Six Million Dollar Man" with Lee Majors as Lt. Col. Steve Austin and Martin Balsom as

Dr. Rudy Wells, the film was an excellent and faithful recreation of the original novel. As you may recall, the story concerns a test pilot mutilated in the crash of an experimental NASA plane -- and then turned into a superman by means of incredibly powerful artificial limbs and advanced sensors. Locations included Edwards Air Force Base, and appropriate credit was given at the end to the UCLA Prosthetics Laboratory for their technical assistance. 13a

2. "Genesis II," shown on CBS on March 23rd, is also a pilot for a possible series next Fall. The year is 2133; the world as we know it has long been destroyed by nuclear holocaust. The technologically-based civilization of our own time, dating from before The Great Conflict, has all but disappeared. Moreover, the ecology has become revitalized. Distributed around the globe now are fragments of ancient human culture, wild hordes of savages, and autocratic police states. 13b

Dylan Hunt (played by Alex Cord) is a handsome NASA scientist from our own generation, who was frozen in a suspended animation experiment in 1979 and awakens 154 years later to find that a rock slide has trapped him all this time in an underground laboratory deep under the Carlsbad Caverns. He quickly becomes a pawn in a power struggle between two civilizations vying for access to his immense technical knowledge. 13b1

The Tyranians are a race of mutants-- stronger, more intelligent, and disdainful of humans, whom they believe are crippled by emotions. They live under an Ancient Roman-Empire-style dictatorship, located near Phoenix, Arizona, where human slaves are controlled by (supersonic) "pleasure sticks." 13b2

Their rivals are a group called PAX, composed of strange, but true human, people in unisex garb and whose patron saint is St. Sigmund (Freud). PAX controls the only advanced system of transportation left--the massive, underground "Subshuttle" whose transcontinental trains whiz down tunnels bored by nuclear power at incredible supersonic speeds. 13b3

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* Now reprinted in paperback by Werner Publications ($1.25). Cf. review in the Oct. '72 SIGART Newsletter, No. 36, p. 45. 13b4

Before the film ends our hero must contend with a giant savage, a slave uprising, two kidnappings, a nuclear explosion, and a magnificently beautiful mutant renaissance woman (her mother was true human, and the only evidence of her mutation is a double navel!) galloping on horseback, long hair and full cape blowing in the wind. I'm sure that you can instantly perceive the endless possibilities for blending the distant past with the remote future. Although this particular movie did not explicitly involve computers, I'm sure that its creator, Gene Roddenberry ("Star Trek"), is sure to include them in future installments, if it ever reaches our screens next fall. 13b5

If you would like to add your voice in helping to make these pilots into full series, I would suggest that you write to ABC and/or CBS-TV in New York. Every little bit helps. 13b6

ADVERTISEMENT 14

PROPOSAL FOR AN ARTIFICIALLY INTELLIGENT COMPUTER SCHEDULER by Joseph Sharp
General Electric Co. 14a

Why not make scheduling decisions by sophisticated methods? More specifically, why not apply the look-ahead techniques, which improve the quality of node evaluation by tree-searching, to the scheduling decisions used in a time-sharing system? The scheduling problem is formulated as a game against nature. Statistics about the past behavior of each job are used to forecast the most probable consequence of a decision; the next decision is made; and then the cycle is repeated. The improvement contributed by the next level of look-ahead is eventually cancelled by the increasing number of forecast errors. 14a1

In addition to a more powerful use of the present algorithm, this procedure permits the use of two conflicting objectives. An urgency-oriented algorithm may be used to select admissable decisions, while resource utilization may be improved by selecting the terminal node with the best overlap of resource consumption. 14a2

The main evidence in favor of this proposal so far is the significant improvement which James Slagle has obtained by applying a similar approach to sequential pattern recognition, as reported in the February 1971 Communications of the ACM. 14a3

Anyone, perhaps a student, who wishes to pursue this topic should contact 14a4

Joseph Sharp
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518-346-8771, ext. 6346 or 6476. 14a4a

-- 14b

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SIGART NEWSLETTER 1b

The SIGART Newsletter is a bimonthly publication of the Special Interest Group on Artificial Intelligence of the Association for Computing Machinery. The Newsletter reports on projects being conducted by the artificial intelligence research community and generally reviews current progress in the state-of-the-art. Correspondents report news from local SIGART Chapters and other AI Centers.

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 6 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), Advertisements (New Products or Classified Advertising), Puzzles, Poems, Cartoons, etc, Material may be reproduced from the Newsletter for non-commercial purposes with credit to the author and SIGART, 1b2

Anyone interested in acting as editor for a special issue of the Newsletter devoted to a particular topic in AI is invited to contact the Editor, Letters to the Editor will be considered as submitted for publication unless they contain a request to the contrary. Technical papers appearing in this issue are unrefereed working papers, and opinions expressed in contributions are to be construed as those of the individual author rather than the official position of SIGART, the ACM, or any organization with which the writer may be affiliated, 1b3

You are invited to join and participate actively, SIGART membership is open to members of the ACM upon payment of dues of $3.00 per year and to non-ACM members upon payment of dues of $5.00 per year. To indicate a change of address or if you wish to become a member of SIGART, please complete the form on the bottom of the last page of this issue. 1b4

Copy deadline for the October Issue: September 21st. 1b5

CHAIRMAN'S MESSAGE 2

In the last issue George Ernst thanked all of the officers of SIGART for the excellent job they have done. I know of no better way of starting my term then by adding my thanks to these same people and to add George to the list for the fine job he has done in tying all the activities together. 2a

During my term, I would like to accomplish three goals: 2b

1. Help continue the steady expansion of the benefits of SIGART to the members by encouraging more participation in and contributions to our newsletter and the sessions and symposia we sponsor. 2b1

2. Increase our contacts with other disciplines and with practical applications of AI. 2b2

3. Use SIGART as a forum for examining the field of AI. 2b3

Let me expand on the last point. Recently, AI has come under critical review, most notably by Sir James Lighthill in a report to the Science Research Council in Britain (see the SCIENCE article reprinted in this issue, pp. 6-8 for a short summary). Such criticism gives us an excellent opportunity (though perhaps for the wrong reasons) to step back from our day-to-day activities and evaluate the accomplishments of AI and consider its goals. 2c

I hope to expand on each of these themes in following issues. 2d

R.M.B. 7/24/73 2e

EDITOR'S ENTRY 3

1. CONGRATULATIONS TO PROF. ALLEN NEWELL 3a

A remarkable coincidence has just been called to my attention: the immediate past Chairman, George Ernst, the current Chairman, Bob Balzer, and the current Editors of the Newsletter, Rich Fikes and yours truly, were all at one time (seven or eight years ago) simultaneously students of Prof. Newell at Carnegie-Mellon. Even though we have all subsequently moved to other areas of the country, I am sure that I speak for all of us when I say that his inspired teaching continues to influence our approach to AI even today. 3a1

2. CARNEGIE TO SIMULATE HUMAN PROBLEM SOLVING 3b

I have recently been informed that John R. Hayes and Herbert A. Simon of the Psychology Department at Carnegie-Mellon University have been awarded a $56K NSF grant to test and refine a tentative model of how the human mind takes a problem that it has never encountered before and puts it into a form that it can recognize and deal with. The ultimate goal of the project is to develop a computer program that can simulate this process, so that a computer can understand and define a problem directly from written instructions. The end result will be "a program that will tell itself what the problem is, rather than having to be told." Dr. Hayes has been an Associate Professor of Psychology at CMU since 1965. He was published extensively on the topics of cognitive development and problem solving. Dr. Simon has been at CMU since 1949, serving as the Richard King Mellon Professor of Computer Science and Psychology since 1966. 3b1

3. BBC DEBATE 3c

Last July 4th in London, Sir George Porter moderated a controversial panel discussion on the subject "The General Purpose Robot is a Mirage." The program, one of a series of six, was run in conjunction with The Royal Institution for the BBC. Participants included Sir James Lighthill, Prof. Donald Michie of Edinburgh, Prof. Richard Gregory of Bristol University and our own Prof. John McCarthy, representing U.S. AI. The program will probably be screened on August 20th and will last about one hour. We hope that Nils Nilsson will be able to obtain a video tape for showing at IJCAI-73. 3c1

4. MORE ON THE LIGHTHILL REPORT 3d

Although I had originally planned to use this space to make an editorial statement about the adverse impact of the "General Survey of Artificial Intelligence" by Sir James Lighthill,* commissioned by the British Science Research Council, on the field of AI generally and especially on our British counterparts, I find that the subject has by now been extensively treated in other sources. The July, 1973 article in SCIENCE reported by Allen L. Hammond, has been reprinted on pp. 6-8 of this issue for the benefit of those who may have missed it. I especially recommend an article by Pat Hayes (now at Essex University) in the current issue of the AISB European

Newsletter,** since it covers virtually all of the criticisms I planned to make and more. Firbush News 3 has reprinted the complete text of the Lighthill Report and contains a useful comment on the Report by Prof. Bernard Meltzer.*** 3d1

Prof. Flowers, Chairman of the SRC, says in his preface to the Report that "the Council would welcome readers' comments on the importance of artificial intelligence research, and the extent of the support the Council should plan to give to it." If you feel you would like to make your opinions regarding the Report and related matters known the SRC, we would be happy to receive them first, so that the U.S. AI community could have an opportunity to formulate a joint response to Prof. Flowers. 3d2

L.S.C. 7/26/73 3d2a

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* As mentioned in the preceding issue, copies of the report including followup comments by Profs. N. S. Sutherland, R. M. Needham, H. C. Longhet-Higgins, and D. Michie may be obtained by writing to the Public Relations Unit; Science Research Council; State House; High Holborn; London WCIR 4TA, England. 3d4

** Pat Hayes, "Some Comments on Sir James Lighthill's Report on Artificial Intelligence," AISB European Newsletter, ed by A. Bundy and M. Liardet, pp. 36-54, Issue 19, July 1973. 3d5

*** B. Meltzer, "Comments on the Lighthill Report: Extracts from a Letter," Firbush News 3, pp. 44-46, March 1973. 3d6

ARTIFICIAL INTELLIGENCE:
A FASCINATION WITH ROBOTS OR A SERIOUS INTELLECTUAL ENDEAVOR? by
Allen L. Hammond
SCIENCE Magazine
June 29, 1973 4

In early 1972 Sir James Lighthill of Cambridge University undertook to survey the field of Artificial Intelligence (AI) for the Science Research Council of Britain. His report was sufficiently controversial that the Council held up its release for over a year until last month, when a somewhat sanitized version was published (along with comments from several other scientists) in an AI newsletter edited at the University of Edinburgh. Ironically enough, funding for AI research at Edinburgh, heretofore the largest center in Britain, was also cut back last month--in part due to the criticisms leveled by the Lighthill report against AI research in general and against the Edinburgh project in particular. 4a

The report questions whether artificial intelligence is a coherent field of research or whether it is really two diverging kinds of investigations linked in a makeshift way by a fascination with robots. The report is cautiously optimistic about the future of research on particular aspects of AI (automation and computer studies of neurobiological functions), but downgrades work on robots as having, at best, discouraging prospects. 4b

Researchers in artificial intelligence, for their part, have been quick to criticize the report as betraying a lack of understanding as to what the field is all about. They dispute not only the report's assessment of prospects in AI but also the division of what they see as a coherent field into artificial and misleading categories. 4c

The ABC's of artificial intelligence, as Lighthill styled them, amount to 4d

(A) Advanced automation, including pattern recognition, speech recognition, and automation of industrial processes; the emphasis, according to Lighthill, is on practical problems and on efforts oriented toward new hardware. 4d1

(B) Building robots, including coordination of eye and hand functions, use of natural languages for communicating with computers, automated analysis of visual scenes or environments, and problem solving techniques; Lighthill describes this category of research as forming an imperfect bridge between the practical area of advanced automation and the more basic research of category C. 4d2

(C) Computer-based research on the central nervous system, including associative recall, functioning of the cerebellum, psycholinguistic studies, and other theoretical (modeling) investigations related to neurobiology and psychology. 4d3

It is particularly the work on robots that Lighthill sees as having little future in itself and as being of marginal value to other areas of AI. He goes even further, suggesting that those who work on robots may be fulfilling "pseudomaternal" urges or catering to popular interest. Researchers on AI are understandably irked at these slurs on their motivations and, more substantively, do not see the rationale for Lighthill's ABC's. They believe that his description is limited and arbitrary, that it includes some subjects such as neurobiology which have little to do with AI, and that it excludes others central to the field. As one U.S. scientist put it, neither artificial intelligence nor neurophysiology is advanced enough to have anything to contribute to the other discipline. 4e

Lighthill is a well-known scientist respected for his work in applied mathematics and hydrodynamics, and his criticisms, as one observer described them, "do not have the religious character" of earlier attacks on AI. But he is admittedly an outsider to AI research and he qualifies his report as a "highly personal view." It is thus not impossible that his report, based on a 2-month survey, does misconstrue the field and that his view of its prospects is, as AI researchers claim, seriously misguided. 4f

Lighthill's main criticism boils down to the claim that work on robots is not an intellectually important endeavor. Those working on artificial intelligence reply that robots are not their primary goal, but merely research tools. Marvin Minsky, of the Massachusetts Institute of Technology, believes that research on AI is important because it is really research on theories of intelligence, and that work with robots, with computer vision machines, and with other similar devices--whatever their practical applications--aids the unraveling of ideas about possible "intellectual mechanisms." Even the process of developing these devices and the computer programs that control them is leading, in his view, to deep insights into the nature of learning. 4g

John McCarthy of Stanford puts it somewhat differently--nobody knows any mechanism that can carry out the coordination of vision and manipulation, that can distinguish objects against a background, and that can perform a number of tasks as effectively as humans and animals routinely do. Investigation of these mechanisms, he believes, is a valid intellectual goal. And it is not a trivial problem, in his view, to try to formalize a description of the intellectual structure of the world. 4h

Researchers on AI do not claim to have made much progress in understanding the details of specifically human thought processes, but they do believe that they have made a start on discovering how intelligence might work. They point to a new interest among cognitive psychologists in the vocabulary for discussing thought processes and in a variety of simple cognitive phenomena developed by AI researchers. More concrete, if preliminary, results include a computer-directed hand-eye machine developed at Stanford which can assemble a simple pump from parts randomly placed on a table. Researchers at Bolt Beranek and Newman Inc. in Boston have developed a natural language question-answering program which, when combined with a data bank of information on moon rocks (as a demonstration), proved so irresistible and accessible to geophysicists that they soon forgot it was the program, not the data base, that was being demonstrated. In contrast to earlier presuppositions that the use of computer languages to describe cognitive phenomena would result in oversimplification, there is growing recognition that work on artificial intelligence has provided a lot of new ideas. 4i

Even granting that AI is an intellectually important area for research, it is fair to ask whether the field is using its resources wisely. The Lighthill report suggests that, in the United States especially, little attention has been given to this question, in part because there has been a relatively assured source of funding. As is true for computer science in general, research on AI is predominantly supported by the Defense Advanced Research Projects Agency (ARPA), which provides about $4.5 million a year. Another $1.5 million comes from the National Science Foundation (NSF). The bulk of the ARPA money goes for work on robots and natural language programming at a few large centers, while smaller, more widespread research projects on pattern recognition, pattern processing, and automation make up the core of the NSF funding. There has been no overall evaluation of the field for some years, researchers admit, and there are substantial disagreements as to which of several lines of research will prove most fruitful. But while conceding the need for some reexamination, what concerns many AI researchers is that the Lighthill report will be used as ammunition by budget-conscious administrators looking for reasons to eliminate funding entirely. They report that ARPA is getting nervous about supporting basic research, and also point to a lack of U.S. research on automated manufacturing techniques comparable to the $115 million effort launched by Japan in 1971. 4j

The term artificial intelligence was initially chosen by Minsky and McCarthy so that they and their colleagues could work on the nature of problem-solving processes without competition from psychologists. The field has outlived the excess optimism that characterized its early years, although it continues to be judged, unfairly many believe, in the light of promises made during that period. Even ardent proponents of AI admit that it still does not have any well-agreed-upon theoretical basis. Nonetheless, they are optimistic. Work on natural language programming alone, one admittedly partisan research administrator told SCIENCE, will greatly affect how people interact with computers. "We are looking," he said, "at a science in its infancy which will have an enormous impact." But as the Lighthill report makes clear, that impact is not yet obvious to everyone. 4k

SRC THREATENS BRITISH ROBOT RESEARCH by Alan Cane
Science Correspondent
The London Times
June 1, 1973 5

University Research in constructing "thinking robots" which mimic human activities, a field in which Britain is an acknowledged world leader, is threatened by a controversial new report from the Science Research Council. 5a

The report, entitled Artificial Intelligence, is a personal review by Sir James Lighthill, Lucasian Professor of Applied Mathematics at Cambridge University, but also contains criticisms and comments by other scientists. 5b

It is seen as a further threat to the survival of the only team of University scientists in Britain which builds robots. 5c

The future of the team, led by Professor Donald Michie, head of the Department of Machine Intelligence at Edinburgh University, has already been prejudiced by the failure of the SRC--which has financed Professor Michie's work since 1963--to renew his chief source of support. 5d

Only funds from the Continent are keeping the team together. It is living "from hand to mouth" according to Professor Michie, and if more support is not forthcoming by the end of the year, the team will break up and its best members will be lost to British science. 5e

"Artificial Intelligence" is described by the SRC as a paper symposium. In an introduction, Sir Brian Flowers, SRC Chairman, explains: "It did not appear to me to be possible to assemble a dispassionate body of experts to review the field as is our usual practice. I therefore asked Sir James Lighthill FRS, to make a personal review of the subject." 5f

Sir James's review suggests that artificial intelligence as a field of research--it includes the construction of machines to replace humans in difficult or dangerous circumstances and basic research in the theory of thought and intelligence--has failed to live up to expectations, but that building robots has proved especially valueless. 5g

He wonders whether robot buiders are driven by an urge to give the public the kind of science-fiction devices that create attention, and wonders whether male robot builders are compensating for their inability to give birth by creating mechanical children. 5h

American scientists, who undoubtedly lead the world in artificial intelligence research, regard the Lighthill comments and the threat to Edinburgh's survival as a direct attack on the integrity and quality of research in robotics. A letter signed by 11 eminent American artificial intelligence scientists, has been sent to Sir Brian Flowers declaring their admiration for the Edinburgh team. 5i

It reads: "In our opinion the Edinburgh work is well up in the main wave of progress in this field and should be regarded as technicaaly comparable with the leading U.S. projects both in level of attainment and in style of approach." 5j

The experts are also disconcerted by their belief that Professor Lighthill gave the wrong advice that led to Britain losing the initiative in fusion research, an area of great importance for energy supply in which Britain held an early lead. 5k

Dr. Michie said this week that he was maintaining a "useful and cordial dialogue with the SRC", and was examining the possibility of giving his robotics work an industrial slant. He was engaged in discussions with Professor W. B. Heginbotham, Head of the Department of Production Engineering at Nottingham University, where a good industrial robotics group is already at work. 5l

He hoped that the SRC would eventually accept the recommendations of its Computing Science Review Panel which almost a year before the Lighthill Report was published recommended that about L500,000 should be given to machine intelligence and at least one new major center established. 5m

Artificial intelligence groups are in existence at Edinburgh, Essex University, and Sussex University, but only Edinburgh, with 50 staff and half as many technicians, is big enough to take on the large American groups. 5n

THE EDINBURGH VERSATILE LAYOUT AND ASSEMBLY PROGRAM by A. Patricia Ambler
Department of Machine Intelligence
University of Edinburgh 6

A computer-controlled versatile layout and assembly system has recently been programmed at the School of Artificial Intelligence, University of Edinburgh. The equipment used, locally known as Freddy, consists of a moveable table, a mechanical hand suspended over the table and two fixed TV cameras, all connected via an 8K Honeywell 316 to a timeshared 128K ICL 4130 running POP-2 programs. The hand is fixed above the table but can be raised and lowered, and rotated about a vertical axis. It has two palms, with force sensors, which are parallel to each other, and can be tilted about a horizontal axis, and moved together and apart. There is an obliquely mounted, wide-angle TV camera which is used to scan the table, and a vertically mounted one which is used to examine in detail smaller areas of the table (See Figure 1). 6a

The layout and assembly program enables one to tip a boxful of toy parts into a heap on the table (Figure 4), and to leave the robot, unattended, to sort out the parts, choose those which are needed to make a particular toy, lay them out neatly on the table, and then assemble them into a completed toy. It takes about 1 1/2 hours per toy. In order to do this the robot has to be taught (a) how to recognize individual parts, and how to handle them and (b) how to assemble the toy. These two teaching processes both take 2-3 hours of interactive time. The heap smashing and layout program is able to deal with things going wrong. Sometimes a part is dropped when it is being moved, and sometimes an even worse than usual TV picture leads to the non-recognition of an object. The robot is able to recover. However, the assembly part of the system is not able to recover from unforeseen events. 6b

Finding Objects on the Table 6c

The table top is searched with the oblique camera. Objects on it are seen as white blobs on a black background. The robot works out their location on the table, using some arbitrary figure for their height. Objects seen in subsequent pictures are put into correspondence with the map so formed using not only their absolute positions, but also their relative positions. To do this, a graph matching program is used. This program is also used in object recognition when matching segments and holes. 6c1

Object Description and Recognition 6d

An object lying by itself on the table will be in one of several possible mechanically stable states. The robot is taught, by example, the appearance, under the vertical camera, of the object in each of these stable states. The learned description is hierarchical, and includes, at the region level, details of the white blob on the black background of the table; at the hole level, the number and shape of any holes; at the outline level, the number, shape, and relations between curved and straight-line segments that have been fitted to the outline of the blob (Figure 6). 6d1

Having learned a visual description of an object lying on the table, the robot is shown how to handle it when it is in such a position. Freddy is shown, by example, how to grasp the object, how to turn it over into a standard stable state, and where to lay it on the table ready for assembly. 6d2

Recognition of an object involves matching the hierarchical description of the object as seen under the vertical camera (the actual description), with the learned description (the model description). Once it has been recognized as an object in a particular stable state, the robot will be able to work out how to pick it up and how to lay it out. 6d3

Heap Smashing 6e

If an object seen under the vertical camera is not recognized then it is treated as a heap, and the hands are used to break up the heap. The robot does not try to recognize individual objects in a heap, but tries to lift something out so that it can be put down on a clear part of the table and examined without interference. When breaking a heap, Freddy first tries to see a protrusion which can be grasped by the palms. If he can't find one, then he tries a blind grab at the heap, and if this fails to get anything, then he sweeps his hands through the heap to spread it over the table, and then tries to pick something up again. Objects which have not been recognized because of a poor TV picture will be treated as heaps and picked up and put down again and re-examined, so that they have a good chance of being properly recognized. 6e1

Assembly 6f

The assembly part of the program works blind, using only hand sensing. It is written interactively at instruction time using some basic moving and sensing operations and two higher-level ones. The higher-level operations are: constrained move--i.e., move in some particular direction until some opposing force is felt, while at the same time keeping in contact with the surface; and hole fitting--i.e., use a spiral pattern search to fit some protrusion into a hole. 6f1

The assembly of a toy car from a kit consisting of four wheels, two axles and a car body usually takes about 1/2 hour. A workbench is used, fixed to a corner of the table. It has a "vice" for holding wheels while axles are being fitted, and a wall to hold the car against while the second wheels are being fitted onto the axis (Figure 5). 6f2

A paper describing the system is to be presented at IJCAI-73 (Ambler, Barrow, Brown, Burstall, and Popplestone, "A Versatile, Computer-Controlled, Assembly System"). Two films have been made--one showing the robot sorting out and assembling a toy car, and the other showing the robot sorting a mixed heap of car and ship parts, and then assembling both the car and the ship. 6g

REPORT ON THE SIGART MEETING AT THE NCC by Ranan Banerji
Case Western Reserve University
Cleveland, Ohio 7

SIGART met on June 6, during the National Computer conference as announced. This reporter met a number of people the next day who were disappointed to miss it, and said they did not know about it. Perhaps the SIG meetings should have been somewhat better publicized by the NCC Committee itself. Need we punish so severely those members who do not read their newsletters or those sympathizers who are not members? 7a

That's all for the comment. The business part of the meeting consisted mostly of Chairman George Ernst introducing the new chairman, Robert Balzer. There was some discussion of the ACM and SIGART finances. The Chairman answered some questions regarding the mechanism of selection of officers of SIG's under ACM bylaws. 7b

The highlight of the evening was Saul Amarel's talk on present AI activities at Rutgers University. What follows is this reporter's recollection and understanding of what he said. 7c

The three areas of work that he discussed at some length were: 7d

1. A work on automated individualized teaching, where the students' specific shortcomings are analyzed and attended to. As a major example of the analysis of errors, he quoted their work on the guessing of grammar modification. The work differs from those of Solomonoff, Gold, Fu and others in the major respect that the program is not made to guess at grammar about which no information is known except for the example sentence. Instead, it is known that the sentences come from a grammar which is similar in many respects to a given known grammar. Computer-aided teaching of programming has been a major vehicle of this research. 7d1

2. A model of a belief system and its use in automatic interpretation of social interactions. This involves explaining motives and goals of people by analysis of how they interact. Such analysis is based on assumptions of a person's belief system about the world, which includes a model of belief systems of other people--among them a model of the initial person's belief system. Some of the interesting problems involve modes of changing belief systems under interaction. The problem of interpreting sequences of actions on the basis of beliefs about rules of action is approached by the same method of 'parsing', which is used in (1) to analyze deviation from normal linguistic behavior. Indeed the same parser is used in both cases. 7d2

3. Computer aids to medical consultation. The most extensive and successful work done along these lines has been on Glucoma. A whole book on the interactions of cause and effect in the

prognosis of Glucoma is now available as a computer data base. The system can suggest additional tests for the establishment of diagnosis and has done so in real-life cases. After establishing a plausible diagnosis, the system also formulates recommendations for treatment. At present, the main data base is in the form of a causal network whose nodes are physiological states. A more elaborate process control model--which underlies the phenomena in the causal network model--is being studied. The interesting AI problems are how to best use the models at two levels of resolution in diagnostic and treatment decisions; how to abstract useful information from the high-resolution model into the low-resolution model; and how to form, update, and validate (part of) the models. 7d3

As usual, the meeting lasted late into the night and continued informally in a coffee shop into the early hours of the morning. Your reporter established two non-technical facts while he was there: 7e

1. The Rutgers mailing list is very informal at this moment--so the place needs a reporter very badly.* 7e1

2. The work at Rutgers is so interdisciplinary that Dr. Amarel and his colleagues have had to expend a lot of effort and planning in order to open communication channels between the various disciplines. Therefore, they have some useful hints to give about the sociological, political, and economic techniques involved. 7e2

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*[Ed. Note: Prof. Bertram Bruce has recently agreed to act as a Newsletter reporter from Rutgers.] 7e3

EFFICIENT UTILIZATION OF ALGORITHMS THROUGH HEURISTIC LEARNING by
Tamio Shimizu
Department of Electrical Engineering
Polytechnic School
University of Sao Paulo, Brazil 8

1. Introduction 8a

In the study of problem solving methods, problems have been classified into two broad categories: 8a1

Structured Problems - for which it is possible to formulate one or more algorithms to find a solution of the problem. 8a1a

Ill-Structured Problems - in which, finding a solution is only possible through the application of a set of general rules and strategies. 8a1b

Both Newell [1] and Minsky [2] have analyzed the nature of general problem solving methods and the resolution steps for such problems. They suggested many rules and strategies for general problem solving, such as hill-climbing, recognition, learning, heuristic search, planning, and induction. These techniques have been applied by artificial intelligence workers in the solution or simulation of various types of ill-structured problems (game-playing, pattern-recognition, theorem-proving, question-answering, etc.). In particular, a program named GPS [3] has been considered to be one of the most general and suitable for solving a large variety of problems, once they have been represented in an appropriate form. 8a2

In this work, a more efficient approach for solving structured problems is suggested. Because, in practical cases, existing algorithms for many types of problems may be more or less efficient due to a variety of factors (truncating-errors, rate of convergence, number of sub-functions, and so on). Another difficulty is the case of multidimensional problems, for which new problem-solving techniques must frequently be formulated [4,5]. 8a3

Thus, it is reasonable to expect that better results could be obtained for structured problems if a strategy were applied for automatic selection of algorithms through a heuristic learning approach. There is, of course, a trade-off problem to be solved. 8a4

This approach is based on the concept of learning by the creation of a table of connections between strategies (different algorithms) and stimulus features, as used by Newell et al in GPS and later by Huesman [6]. 8a5

2. Summary of Problems Being Testing 8b

Through the following problems, the strategies and some stimulus features used in the table of connection are presented. 8b1

(a) Global Optimization Problems 8b2

These are examples of ill-structured problems discussed by Newell [1]. 8b2a

Strategies used: 8b2b

Zeutendyck Method
Random Sampling
Stratified Random Sampling
Bayes Decision Algorithms used by Shimizu and Hill [7,8]. 8b2b1

Stimulus features: 8b2c

Time consumed or number of feasible solutions generated. 8b2c1

Depth in solution (Initial, Intermediate, or Final phase of the searching process). 8b2c2

Variance of the mean value. 8b2c3

Some test problems (Rosen and Suzuki [9], Fletcher-Powell [10]) have been successfully solved. Presently, problems with more then ten variables are being tested. 8b2d

(b) Numerical Solution of Ordinary Differential Equations 8b3

Strategies used; 8b3a

Runge-Kutta's Methods
Predictor - Corrector Methods
Polynominal - Extrapolation 8b3a1

Stimulus Features: 8b3b

Truncation - Errors
Stepsize
Depth in Solution
Number of points used to generate the next point in the curve. 8b3b1

A recent comparative study of methods due to Fox [11] may suggest better ideas for the choice of strategies and stimulus. The same scheme could be used for numerical integration, matrix inversion, and eigenvalue problems for ill-conditioned matrices. 8b3c

(c) Use of Variance Reducing Techniques in Simulation and Monte-Carlo Problems. 8b4

These are several variance reducing techniques used for the improvement of simulation and Monte Carlo Methods (Hammersley and Handscomb [12]). However, the performance of such techniques depends on the type and condition of the simulated problem. Thus, an automatic selection schema for such techniques would be desirable. 8b4a

The problems tested are: simulation of the Traveling-Salesman Problem, multiple integration, and matrix inversion by the Monte Carlo Method. 8b4b

Strategies: 8b4c

Stratified Sampling
Importance Sampling
Antithetic Variates
Regression Analysis 8b4c1

Stimulus Features: 8b4d

Variance of the Mean Value
Depth in Solution
Time Consumed 8b4d1

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PROGRESS REPORT FROM CASE WESTERN RESERVE UNIVERSITY by Ranan B. Banerji 9

The work last year continued along the three areas of pattern recognition, theorem proving, and theory of problem solving. I believe that the new work on Theorem Proving is best described in terms of one of the abstracts referenced below. The work on pattern recognition has continued along the lines of "simulation for evaluating the effectiveness of generalization." Theoretical and experimental results are being collected on how large a sample size one needs during the training phase to ensure good generalization. The answer seems to be, "a huge lot, unless there are very few significant parameters or (almost equivalently) there is strong clustering of the classes." 9a

The work on theory of problem solving has progressed sufficiently to allow some case studies in automatic heuristic discovery. We have been very pleasantly surprised to find that a uniform set of heuristics have been useful in discovering good differences for a diversity of problems, leading to considerable search reductions. The initial results are being written up as a report. 9b

This summer "yours truly" is away to Schenectady, where he and some colleagues at General Electric are trying to develop a syntactic recognition method for fixed-font characters. The purpose is to reduce time and bandwidth for facsimile transmission. 9c

The abstracts for papers and reports that have come out recently are included in the Abstracts section beginning on p. 46. 9d

PAJARO DUNES WORKSHOP ON AUTOMATIC PROBLEM SOLVING by Nils J. Nilsson
Stanford Research Institute 10

1. Introduction 10a

Stanford Research Institute recently organized an informal workshop on Automatic Problem Solving, under the sponsorship of the Information Systems Branch of the Office of Naval Research (Contract No. N00014-73-C-0245). The workshop took place at Pajaro Dunes, California on May 14-16, 1973. In this report we shall present a brief summary of the workshop proceedings. 10a1

Participants in the workshop included: Bruce Anderson, Cordell Green, and Arthur Thomas from Stanford University; Robert Balzer from Information Sciences Institute, University of Southern California; Harry Barrow, Robert Boyer, Robert Kowalski, and Donald Michie from University of Edinburgh; Ted Elcock from University of Western Ontario; Richard Fikes, Peter Hart, Nils Nilsson, Bert Raphael, Earl Sacerdoti, and Richard Waldinger from Stanford Research Institute; Michael Foster from the Royal Radar Establishment; Gordon Goldstein from the Office of Naval Research; Carl Hewitt and Gerald Sussman from Massachusetts Institute of Technology; and Jeff Rulifson from Xerox Palo Alto Research Center. 10a2

2. Summary of Talks 10b

The following summary gives a few paragraphs outlining the substance of each talk and some of the discussion topics. 10b1

Proving Theorems about LISP Functions--Robert Boyer 10b2

This talk was based on recent work by R. Boyer and J Moore. A paper of the same title will be presented at IJCAI-73 in August at Stanford. The authors' abstract to this paper is as follows: 10b2a

We describe some simple heuristics combining evaluation and mathematical induction which we have implemented in a program that automatically proves a wide variety of theorems about recursive LISP functions. The method the program uses to generate induction formulas is described at length. The theorems proved by the program include that REVERSE is its own inverse and that a particular SORT program is correct. APPENDIX B contains a list of the theorems proved by the program. 10b2a1

QLISP--Earl Sacerdoti 10b3

QLISP is an extension of LISP that incorporates many features of the QA4 language including pattern matching, associative retrieval of expressions, pattern-directed function invocation, backtracking, and demons. A version is now available at SRI. Future versions will make use of the Bobrow-Wegbreit control structure to implement "processes." QLISP allows easy mixing of conventional LISP and QA4-like programs and, in addition, gives the user the full power of the editing and assistance features of BBN-LISP (now called INTERLISP). Sacerdoti's presentation raised the issue of whether it is better to design completely a new language with all of the desired features well-integrated in a consistent fashion or to follow the QLISP approach of adding new features to an existing language, thus complicating the syntax. Most participants felt that there have been so many years of effort put into BBN LISP, that it would be unwise to try to build a brand new language with QA4-like features. 10b3a

New AI Language Features for Robot Planning and Automatic Programming--Richard Waldinger 10b4

Waldinger discussed some proposed features that would be desirable additions to new AI languages. One is the "world-splitting" feature. Here a context is split into two contexts differing only in that there is a different assertion or goal in each. Waldinger distinguishes between an AND split and an OR split. In an AND split, the goal in each of the two contexts must both be established; in an OR split, only one of the goals need be established. Such a feature builds right into the language the capability of setting up AND/OR search trees. If accompanied by a feature that enables the programs to run in the different contexts as processes, then the supervision of search is also automatic. There are, of course, the usual problems of communication between contexts. 10b4a

Waldinger also discussed the desirability of having an automatic "protect" mechanism for maintaining the truth of goals already established during attempts to establish others. 10b4b

Predicate Calculus Programming--Robert Kowalski 10b5

The author's advance abstract of this talk follows: 10b5a

The interpretation of predicate calculus as a programming language is a recent development made possible by two advances in the field of automatic theorem-proving. The first is the advent of more efficient theorem-proving systems, such as SL-resolution. The second is a new appreciation for the dependence of problem-solving efficiency upon the form of the axiomatic representation of the problem. This observation, stated in terms of the programming language interpretation of predicate calculus, is just a statement of the familiar fact that different programs for solving the same problem can be equivalent in meaning but very different in computational efficiency. 10b5a1

The programming language interpretation of predicate calculus involves regarding an axiomatization of a problem domain as a program for solving problems within that domain. The theorem to be proved represents the input associated with a given problem. The theorem-prover acts as an interpreter, running the program for a given input. Proving that the theorem is implied by the axioms amounts to computing a solution for the problem represented by the theorem. That theorem-provers can be used for computation has been observed before, notably by Cordell Green. What is new is our thesis that, when well-written predicate calculus programs are run by an efficient theorem-prover, then the resulting search for a solution is done in a manner similar to, or more intelligent than, that which would be done by a more conventional programming language interpreter. 10b5a2

Kowalski also showed some examples of the isomorphism between the predicate calculus and programming paradigms. These ideas are discussed fully in a forthcoming memo to be entitled "Predicate Logic as a Programming Language." 10b5b

Discussion centered mainly around the question "Is AI semantics or pragmatics?" Some in the audience felt that the real content of AI is pragmatics, namely information about what to do next, how many solutions to find, and the like. Kowalski acknowledged the importance of pragmatics but was unwilling to say that it exhausted the subject matter of AI. Since Kowalski's formalism ignores pramatics, he is unable to give any instructions in the language about the order in which things are to be done. This lack was felt to be fatal by the pragmatics-is-all school. Nevertheless, Kowalski's formalization has an aesthetic appeal, and we should remember that yesterday's pragmatics is today's semantics is tomorrow's syntax. 10b5c

Actor Formalisms--Carl Hewitt 10b6

From the people who brought us PLANNER, we now have ACTORS. Hewitt's goal is to establish a programming formalism in which programs can be written that both run and use existing technology and, in addition, are extendable. Thus he wants strong modularity. 10b6a

Each module is an ACTOR. It is a piece of code that runs and is to be regarded as a black-box. Its insides cannot be tampered with. It is not easy for people to understand exactly what is going on with ACTORS. ACTORS do not call programs or return to other programs as in conventional formalisms; instead they pass messages. Hewitt showed how the ACTOR formalism can be used to do all the conventional things one wants a formalism to be able to do such as iteration, and he gave some examples of ACTOR-based programs. 10b6b

There was not enough time for Hewitt to describe ACTORS sufficiently for us all to understand them, and it was agreed to hear more of this later in the program, which we did. The ACTOR formalism is discussed in more detail in a paper to be presented at IJCAI-73 entitled "A Universal modular ACTOR Formalism for Artificial Intelligence," by Carl Hewitt, et al. 10b6c

Freddy Assembles a Car--Harry Barrow 10b7

As part of his presentation, Barrow showed a film in which the Edinburgh robot system, FREDDY, assembled a toy car starting with a heap of parts. The system consists of a gripper arm, a television camera, and a platform that is movable under the arm and camera. The system is described in a paper to be presented at IJCAI-73 entitled "A Versatile Computer--Controlled Assembly System," by A. Ambler, et al (see pp. 11-14). 10b7a

The AI Situation
Britain--Donald Michie
U.S.A.--Bert Raphael
Canada--Ted Elcock 10b8

Michie reported on the study by Sir James Lighthill that was commissioned by the Science Research Council to appraise AI research (see pp. 5-10). Lighthill's report is a criticism generally of the attempt to make a separate science of AI, and specifically, of attempts to build robots. The report can be faulted on several grounds, but it has led apparently to the cessation of SRC funding of the robot work being done under Michie's leadership at Edinburgh. Michie discussed the probable consequences of the Lighthill report on AI research in Britain. 10b8a

Raphael described briefly the current ARPA attitude that AI research should be conducted according to soundly developed management plans. 10b8b

Elcock is attempting to get an AI Council together in Canada and will soon send a report to SIGART describing a recent Canadian AI workshop. 10b8c

Automatic Programing--Robert Balzer 10b9

As a first step toward automatic programming, Balzer has implemented a system called the Programmer's Interface. It is an interface between the BBN programming environment and other languages, such as EL/1. Whenever an evaluation is to be done, it is done in the user language. The system uses the ARPA Network to get routines evaluated at centers having the language in which the routine is written. The system now works with PL/1, EL/1, and COBOL. 10b9a

Balzer described a dozen or so features that he thought would be useful and currently implementable in a software production facility. These include: programmer's interface, perturbation detectors, interface specifiers, structured objects (like ACTORS), machine exercizers (to simulate a machine), code testers (path analysis programs), scaffolding (for testing unwritten code), and documentation aspects. Useful program verification and man-machine code generation facilities would probably not be available until somewhat later. 10b9b

Balzer's approach toward automatic programming seems to be to anchor in current technology one end of a spectrum of features and then to proceed gradually along this continuum toward more exotic facilities. 10b9c

HACKER--Gerald Sussman 10b10

HACKER is a program, written in CONNIVER, that automatically generates debugged code to perform robot tasks in the MIT BLOCKS world. Starting with a library of documented routines (that can initially be as large or as small as you please), HACKER uses various sorts of programming knowledge--including the documentation contained in the routines--to construct a program to perform a task. In constructing the program, HACKER tries for the simple kill first using a "maybe-this-will-work" approach. Tentative programs are then tested, and if bugs occur (typically they will), more detailed programming knowledge is used to find the reason for the bug and to eliminate it. 10b10a

HACKER really is an attempt to simulate how a programmer (specifically Sussman) programs. It is thoroughly described in a forthcoming MIT dissertation by Sussman. 10b10b

Modelling, Question-Answering and Route Finding in a Robot World--Richard Fikes 10b11

Fikes discussed some new retrieval routines he has added to QA4. These allow deduction processes to be called to attempt to prove statements not explicitly found in the QA4 data base. Such routines will be quite useful in question-answering systems. 10b11a

A hierarchical modelling scheme was also described. As applied to a robot world, the hierarchy contains several levels of detail of various locations in the robot world. Fikes then described a special route-finding package for robot navigation to be used in conjunction with the hiearchical model 10b11b

Automatic Programming Research at Stanford--C. Cordell Green 10b12

In the absence of Jack Buchanan (formerly a student at Stanford), Green described the problem-solving system constructed by Buchanan and David Luckham. An abstract of the talk Buchanan was to have given follows: 10b12a

The objectives of this research project have been to develop methods and to implement a system for automatic generation of programs. The problems of writing programs for robot control, symbol manipulation, and simple numerical computations have been studied and some elementary programs generated. A particular formalism, i.e., a Semantic Frame, has been developed to define the programming environment and permit the statement of a program. A Semantic Frame includes a particular representation of the world in the form of axioms, a set of fully instantiated literals, and rules for manipulating the state of the world. Rules may define atomic operators (i.e., operator rules), iterative processes (i.e., iterative rules), or situations defined as equivalent to the achievement of a set of goals (i.e, definitional rules). A Semantic Frame may be translated into a particular set of programs used in a sub-goaling system which involves backtracking from the goal to be achieved to the initial state. The system is interactive, i.e., responds to some simple advice and allows incremental and "stepwise" program development. The output program or solution will transform the initial state into one in which the desired goal is true. The program constructs used are procedure calls, assignments, "while" loops, and conditional statements. Some elements of the underlying logical theory for such a system will be described; the basic problem solving algorithm will be shown to be correct; and methods for implementing the various system features will be discussed. 10b12a1

Green also discussed some of the approaches being taken toward automatic programming by him and by his students at Stanford. Of particular interest is a study in how to generate a program from a trace of its execution. 10b12b

ABSTRIPS--Earl Sacerdoti 10b13

A problem domain may be represented as a hierarchy of abstraction spaces, in which successively finer levels of detail are introduced. The problem solver ABSTRIPS, a modification of STRIPS, can define an abstraction space hierarchy from the STRIPS representation of a problem domain and can use the hierarchy in solving problems. 10b13a

The ABSTRIPS program is the subject of a paper presented at IJCAI-73 entitled "Planning in a Hierarchy of Abstraction Spaces," by E. Sacerdoti (see p. 49). 10b13b

Hierarchical Planing and Execution--Nils Nilsson 10b14

Nilsson described a program for hierarchical robot plan generation and execution. The system is further described in a note entitled "A Hierarchical Robot Planning and Execution System," by Nils J. Nilsson, Stanford Research Institute Artificial Intelligence Center, Technical Note 76, April, 1973 (see p. 49). 10b14a

Harry Barrow mentioned that some similar work was being performed at Edinburgh by a student, Philip Hayes. Hayes' work concerns the hierarchy of planning and execution performed by a travel agent in arranging trips. 10b14b

The discussion then focused on a sample planning and execution task used in a Stanford University seminar in AI languages. Some controversy ensued over whether these kinds of problems could be studied adequately with robot simulations or, instead, required robot (particularly vision) hardware. 10b14c

"Small Talk"--J.F. Rulifson 10b15

"Small Talk" is a programming language being developed by Alan Kay and Jeff Rulifson at Xerox Palo Alto Research Center for use in teaching children about computing. It shares several ideas with the ACTOR formalism, and Rulifson spent most of his time talking about the similarities and differences between ACTORS and "Small Talk." 10b15a

Robotic Equipment--Nils Nilsson 10b16

Nilsson briefly reviewed the preliminary conclusions of an SRI study on robotic equipment. These are contained in an interim report being written for the National Science Foundation entitled "Study of Equipment Needs for Artificial Intelligence Research," by N. J. Nilsson, et al. (See p. 45) 10b16a

3. CONCLUSIONS 10c

At the end of the workshop, it was the general consensus that such informal get-togethers provide an extremely valuable means for learning about and discussing each other's work. At this workshop, many of us were surprised to see that so many problem-solving issues are now being discussed as issues of AI language design. Since this trend of incorporating problem-solving strategies directly into AI languages will probably continue, we concluded that any future workshop on automatic problem-solving ought to include, as this one did, specifically recent work in AI languages. 10c1

Most of the participants agreed that much the same group should meet again for another workshop next year. Donald Michie suggested that perhaps the next one could again be in Scotland, possibly immediately preceeding or following IFIP-74. 10c2

CHESS 11

FOURTH UNITED STATES COMPUTER CHESS CHAMPIONSHIP
from
ACM-73 NEWS RELEASE 11a

A record field of between twelve and sixteen teams will participate in the Fourth United States Computer Chess Championship. The tournament will be held as a Special Event at the ACM's Annual Conference in Atlanta, Georgia. The first two rounds of play will be held on Sunday, August 26, the third round on the evening of August 27, and the final round on the evening of August 28. 11a1

Returning to defend their title is the team of Larry Atkin, Keith Gorlen, and David Slate. Their program has won the previous three tournaments without the loss of a game. Their program, called Chess 4.0, uses a CDC 6400 on the Northwestern University campus. Also entered are programs written by Jim Gillogly (PDP-10), George Arnold and Monty Newborn (Data General Supernova), Dennis Cooper and Ed Kozdrowicki (UNIVAC 1108), Ken Thompson (PDP-11/45), and Al Zobrist, Fred Carlson, and Charles Kalme (IBM 370/155). Many of the programs were developed at America's leading universities; included are Georgia Tech., MIT, Carnegie-Mellon, USC, U. Cal-Berkeley, Dartmouth, Texas A&M, and Columbia. 11a2

David Levy, an international Chess Master from England, will serve as tournament director. A panel discussion, moderated by Ben Mittman, is also scheduled during the ACM's conference. The tournament is being sponsored in part by Control Data Corporation, International Business Machine Corporation, Sperry-UNIVAC, and National Data Industries. 11a3

Tournament Participants 11a4

RESEARCH PROGRESS REPORT IN COMPUTER CHESS* by Richard J. Cichelli
901 Whittier Drive
Allentown, Pennsylvania 18103 11b

This working paper describes a developing brute-force middle-game chess program. New concepts are clarified and comparisons with existing programs are made. The mechanisms described are sufficient to enable information collected during search to be used for dynamic search ordering and dynamic forward pruning. The suggested mechanisms replace the static plausible move generators in existing programs. 11b1

Background 11b2

Brute force chess programs are characterized by their large game tree searches and simple evaluation functions. In addition, little of their computational time is spent in computations involving chess specific knowledge. James Gillogly's TECH [1] is an example of such a program. TECH searches as many as 500,000 end nodes, uses only material for evaluation, and spends less than 5% of its time applying chess specific knowledge. 11b2a

More sophisticated programs such as CHESS 3.6 (the currently reigning world champion) and the Greenblatt program manage to search effectively by using highly developed plausible move generators. These routines embody much of the chess program's chess knowledge; at each depth, at move listing time, they order and forward prune the legal move list. A good ordering increases the probability of alpha-beta cutoffs; forward pruning further limits the game tree size and hopefully keeps it manageable while still including the analysis tree (i.e., the tree a Grandmaster would search in the same position). The Zobrist [2], CHESS 3.6 (Slate) [3], and Greenblatt [4] programs have game trees with fewer than 20,000 end nodes. 11b2b

Dr. Zobrist's program is an attempt to produce the ultimate plausible move generator by giving much chess knowledge to the program. Alternatively, my approach is to gather information during search and to use this position-specific data to guide further search. 11b2c

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*[Ed. Note: Mr. Cichelli has indicated that he welcomes responses (questions, rebuttals, etc.) on this paper from interested readers. 11b2e

Overview 11b3

The brute force chess program I am currently developing uses two types of information to order searchable plies and to forward prune. Refutation data is global to the tree and DEPTH-minus-two data is local to move pairs (1 move = two plies). 11b3a

Refutation Data 11b4

Given a ply "A" such that making "A" leads to a non-terminal position, then some ply "B" is the best reply to "A". In short, B refutes A. Should a ply A' which is similar to A (i.e., same piece, same square-to) be made subsequently in the game tree then should B' exist, it will probably be a good ply to try first. To implement this and its logical extension, best (and possibly, second best) refuters against moving the piece of A and moving to the square-to of A, simply requires an array indexed by side, piece, and square-to containing the refutation piece, square-to, and its value (i.e., the backup value B got when refuting A). 11b4a

Refutation data is continuously updated with superior refuters encountered during search. Since A - B pairs are not considered in the context of a particular game tree node but span the entire search tree, refutation data collection is said to be global to the tree. 11b4b

DEPTH-Minus-Two Data 11b5

If one visualizes a depth first game tree being grown down and from the left, then backup values pass up and to the right. Thus, for nodes at depths greater than three, there are plies in lists at DEPTH-2 which are similar (i.e., same piece and square-to) to plies at the current DEPTH. Each ply at the current DEPTH will lead to a node which will receive a backup value and will probably receive this value before the node for the similar ply at DEPTH-2 is reached and evaluated. Plies which do well at DEPTH+2 should be searched earlier at DEPTH, and those which do poorly at DEPTH+2 may not need to be searched at all at DEPTH. Significantly, previously accumulated DEPTH-2 data can be used in a preliminary ordering of plies at DEPTH. The following diagrams illustrate the two types of game tree information gathering. 11b5a

To implement this DEPTH-minus-two heuristic, the program needs to maintain, at each depth, a list of plies with storage with each ply for three backup value data elements (a total, count, and average). After listing the plies at DEPTH, a seaach of the DEPTH-2 plies is made and back pointers are set for similar plies. Preordering can be accomplished by setting initial counts of 1 and setting the total and average equal to the previous average at DEPTH-2.* 11b5b

By listing the opponent's moves at DEPTH 0 and making "no move", the program can provide storage for DEPTH-2 values for DEPTH=2. Searching the ply lists is speeded by listing plies, by piece, in the same order at each move, as implemented in Bell's algorithm [5]. 11b5c

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*After the initialization of move values with DEPTH-2 data, refutation ordering data can be applied to those refuters of the previous move by adding N times the refutation value to the total, increasing the count by N, and calculating the new average. (I have used the values 3,2,1,2,1 for N when applying refutation values to the best refuter, best and second best against moved piece, and best and second best against moved square-to). 11b5d

Forward Pruning 11b6

since one can expect more than 80% of the plies at any two successive moves to be the same, plies at DEPTH will have counts about 11b6a

With a width of 7, one would expect a count of nearly 300. The contention here is that the average, generated for high counts, approaches the backup value of that ply's successor node, i.e., predicts the backup value. 11b6b

Within this information framework a ply selector would function by referencing the ply list at current DEPTH and picking the best unsearched ply (by its average) and passing it to the MAKEMOVE routine if there existed some ply in the ply list whose count was below the threshold for the current DEPTH and/or whose average was not worse by some factor than the DEPTH's current alpha-beta value. Note: a feedback mechanism is hereby created, for heavy pruning at some DEPTH will result in lower counts at predecessor DEPTHs and thus broaden search at predecessor levels. 11b6c

I am experimenting with broad, shallow searches (3 ply to capture-promote-check quiessence) to initialize the refutation and ply 0 and 1 values followed by a much deeper, narrower search. The evaluation function is material (Pawn = 100) and mobility (1 for each legal ply). 11b6d

Implementation 11b7

My program is approximately 1500 short lines of PASCAL code [6] and performs nearly all of the functions described above. It also includes an extensive user interface. So far, it has been a part-time four week effort and will probably be ready for actual games in two more weeks. Batteries of searching strategies are being compared; this is easily accomplished because the SELECTMOVE routines are parameters to the SEARCH routine. 11b7a

With the PASCAL assignment checking feature negated and ply records packed for optimal use of storage, the program [including the 5K (octal) PASCAL operating system] will probably run in less than 25K (octal) 60 bit words on the CDC 6400. 11b7b

Conclusion 11b8

The mechanisms described here present methods for using information gathered during search to dynamically order and prune plies in a depth-first game tree. Though the example problem space is chess, the concepts and methods are not in any way chess dependent. I suspect, however, that the methods may not be applicable to games like GO (too large a potential search space) or Kalah (too large a change between plies). 11b8a

REFERENCES 11b9

[1] Gillogly, James J., "The Technology Chess Program," Carnegie-Mellon University, Department of Computer Science, 1971. 11b9a

[2] Zobrist, Albert L. and Frederic R. Carlson, Jr., "An Advice-Taking Chess Computer," SCIENTIFIC AMERICAN, June, 1973 11b9b

[3] Slate, David J., Larry Atkin, and Keith Gorlen, CHESS 3.6, Vogelback Computing Center, Northwestern University. 11b9c

[4]Greenblatt, R.D., D. Eastlake, and S. Crocker, "The Greenblatt Chess Program," Proc. AFIPS 1967 FJCC. 11b9d

[5] Bell, A.G., "How to Program a Computer to Play Legal Chess," The Computer Journal, May, 1970. 11b9e

[6] Wirth, Niklaus, "The Programming Language Pascal (Revised Report)," University of Colorado Computing Center, 1972. 11b9f

RECENT PAPERS ON CHESS 11c

SKILL IN CHESS by Herbert A. Simon and William G. Chase
Psychology Department, Carnegie-Mellon University
Pittsburgh, Pennsylvania
In AMERICAN SCIENTIST, Vol. 61, No. 4, pp. 394-403
July-August 1973 11c1

Experiments with chess-playing tasks and computer simulation of skilled performance throw light on some human perceptual and memory processes. 11c1a

COKO: THE COOPER-KOZ CHESS PROGRAM by Edward W. Kozdrowicki
University of California at Davis
and
Dennis W. Cooper
Bell Telephone Laboratories
Whippany, New Jersey
Communications of the ACM, Vol. 16, No. 7, pp. 411-427
July 1973 11c2

COKO III is a chess player written entirely in Fortran. On the IBM 360-65, COKO III plays a minimal chess game at the rate of .2 sec cpu time per move, with a level close to lower chess club play. A selective tree searching procedure controlled by tactical chess logistics allows a deployment of multiple minimal game calculations to achieve some optimal move selection. The tree searching algorithms are the heart of COKO's effectiveness, yet they are conceptualy simple. In addition, an interesting phenomenon called a tree searching catastrophe has plagued COKO's entire development just as it troubles a human player. Standard exponential growth is curbed to a large extent by the definition and trimming of the Fischer set. A clear distinction between tree pruning and selective tree searching is also made. Representation of the chess environment is described along with a strategical preanalysis procedure that maps the Lasker regions. Specific chess algorithms are described which could be used as a command structure by anyone desiring to do some chess program experimentation. A comparison is made of some mysterious actions of human players and COKO III. 11c2a

CONFERENCES 12

ACM SYMPOSIUM ON PRINCIPLES OF PROGRAMMING LANGUAGES
Copley Plaza Hotel October 1-3, 1973
Boston, Massachusetts 12a

The following papers will be presented at the conference: 12a1

Mechanical Parser Generation for Ambiguous Grammars
Alfred V. Aho and Stven C. Johnson, Bell Laboratories, and Jeffrey D. Ullman, Princeton University 12a1a

Strict Deterministic Vs. LR(0) Parsing
Matthew M. Geller and Michael A. Harrison, University of California, Berkeley 12a1b

Labeled Precedence Parsing
Mario Schkolnick, Carnegie-Mellon University 12a1c

Top Down Operator Precedence
Vaughn Pratt, Massachusetts Institute of Technology 12a1d

Practical Syntactic Error Recovery in Compilers
Susan L. Graham and Steven P. Rhodes, University of California, Berkeley 12a1e

Analysis of a Simple Algorithm for Global Flow Problems
Matthew S. Hecht and Jeffrey D. Ullman, Princeton University 12a1t

Transitions in Extendable Arrays
Arnold L. Rosenberg, IBM T.J. Watson Research Center 12a1u

Large Scale File Processing - POGOL
Gloria J. Lambert, National Security Agency 12a1v

On the Decision Problems of Program Schemas with Commutative and Invertible Functions
Ashok K. Chandra, Stanford University 12a1w

For further information contact: 12a2

Professor Michael J. Fischer
MIT Project MAC
545 Technology Square
Cambridge, Massachusetts 02139
617-253-5880 12a2a

SEVENTH HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES
and a special subconference on COMPUTER NETS
University of Hawaii January 8-10, 1974
Department of Electrical Engineering
and Department of Information and Computer Sciences
Honolulu, Hawaii 12b

This is the seventh in a series of conferences devoted to advances in information and system sciences. The conference will broadly encompass the following areas: Information Sciences, Computer Sciences, Communication Theory, Control Theory, and System Theory. A special subconference, "Computer Nets," will have sessions on Computer Nets, Satellite Communications, and Computer-Communication. The objective of the subconference is to communicate present practices, new techniques, and future problems. A major feature of the subconference will be to lay the groundwork for a Pacific Education Computer Network. 12b1

Papers are invited in these and related areas. The summaries of all accepted papers will be published in the CONFERENCE PROCEEDINGS. This will not preclude publication of the full length paper in another scientific journal. Authors are encouraged to present preliminary results of their research since the conference is intended to have some of the aspects of a closed workshop. 12b2

INSTRUCTIONS FOR AUTHORS: Three copies of a one page, single-spaced abstract must be submitted by SEPTEMBER 1, 1973. Authors will be notified of acceptance before October 15, 1973. Instructions for the preparation of accepted paper summaries for the PROCEEDINGS will then be sent to each author. The length of each summary will be limited to three pages, including figures. Please mail all abstracts to: 12b3

HICSS-7
Department of Electrical Engineering
University of Hawaii
2540 Dole Street
Holmes Hall, Room 488
Honolulu, Hawaii 96822 12b3a

EMPLOYMENT REGISTER Computer Science Conference
Detroit Hilton February 12-14, 1974
Detroit, Michigan 12c

The success of the first Computer Science Employment Register held in 1973 demonstrated the desirability and need for continuation of this service for computer scientists. Accordingly, it will be conducted again at the Detroit Computer Science Conference. The purpose of the Register is to bring employers and prospective employees together to aid in the employment process. It achieves this purpose by providing enough data about the open position, on the one hand, and the applicant, on the other, to determine the desirability for follow up. 12c1

The following policies and procedures will be in effect: 12c2

Two listings will be available at the conference: (a) prospective employees, and (b) employer openings (an employer may have more than one listing). 12c2a

Both prospective employees and employers must file their registration on official forms. These forms may be obtained from and completed forms should be returned to: 12c2b

Orrin E. Taulbee
Department of Computer Science
University of Pittsburgh
Pittsburgh, Pennsylvania 15260 12c2b1

Employers should request one form for each type of position available (only one form is needed in the case of several identical positions). Employers may use this opportunity to list summer positions. Forms must be typewritten since they will be reproduced exactly as submitted. Photocopies will not be accepted. 12c2c

Closing date for acceptance of forms is February 1, 1974. The inclusion of a late listing cannot be guaranteed. 12c2d

Charges: 12c3

Prospective Employee 12c3a

(a) Student: No charge (must be certified as student at time of filing by Department Chairman). 12c3a1

(b) Non-student: $5.00 12c3a2

(c) Anonymous listing: $5.00 additional charge. 12c3a3

Employer: $15.00 per form submitted. 12c3b

A check for the appropriate amount (payable to Computer Science Employment Register) must be sent with the completed form. 12c3c

Multiple copies of employer and prospective employee listings will be available at the conference for review. A message desk will be operated at the conference by Employment Register Staff to facilitate making contacts. Actual arrangements for interviews will be the responsibility of the employer and prospective employee. 12c4

Information on the availability of complete copies of employer and prospective employee listings after the conference may be obtained by writing to the above address. 12c5

CONFERENCE STAFF CANNOT ASSUME RESPONSIBILITY FOR THE ACCURACY, COMPLETENESS, TIMELINESS, OR GOOD FAITH SHOWN IN THE PROSPECTIVE EMPLOYEE OR EMPLOYER LISTINGS. 12c6

NATIONAL CONFERENCE ON THE USE OF ON-LINE COMPUTERS IN PSYCHOLOGY
Third Annual Meeting
St. Louis, Missouri October 31, 1973 12d

The National Conference on the Use of On-Line Computers in Psychology provides a forum for the exchange of information on all aspects of on-line computer applications in psychology. Sessions are intended to provide an opportunity for experienced users to exchange information on various aspects of on-line computing. In addition, tutorial sessions will be presented to potential users of such systems. 12d1

A one-day meeting of the National Conference will be held at St. Louis University, St. Louis, Missouri, on October 31, 1973, the day before the start of the annual meeting of the Psychonomic Society. The meetings will run from 8:30 a.m. to 11:00 p.m. Equipment manufacturers will exhibit and demonstrate their products throughout the day-long meeting. 12d2

The program will consist of: (a) three invited addresses on topics of general interest; (b) contributed papers; (c) contributed and invited symposia; and (d) any other functions proposed and organized by individuals, e.g. work shops, special interest groups, etc. 12d3

For further information on the conference, contact: 12d3a

Peter G. Polson
2690 Heidelberg Drive
Boulder, Colorado 80303 12d3a1

MICRO--THE SIXTH ANNUAL WORKSHOP ON MICROPROGRAMING
Louise H. Jones, Program Chairman
University of Maryland Conference Center September 24-25, 1973
College Park, Maryland 12e

Micro 6, the Sixth Annual Workshop on Microprogramming sponsored by the ACM Special Interest Group on Microprogramming (SIGMICRO), will be held at the University of Maryland Conference Center, College Park, Maryland on Monday and Tuesday, September 24 and 25, 1973. The Program Committee has received a number of good papers, and expects that Micro 6 will be one of the best workshops ever. There will be participants from France, Germany, and Italy as well as from various parts of the United States. 12e1

The general structure of the conference is as follows: Early Monday morning, Earl Reigel of Burroughs will give a tutorial session on what microprogramming is all about. This will be followed by a formal paper session chaired by Louise Jones of the University of Delaware. In the afternoon there will be two workshop sessions on the applications of microprogramming (chaired by Gary Kratz of IBM) and, concurrently with these, a session on architecture chaired by Bill Lidinsky of Argonne and one on graphics chaired by Andy van Dam of Brown University. The conference banquet (and social hour!) will be held Monday evening; Bill McKeeman of the University of California at Santa Cruz will keynote the conference with a talk on "Mechanizing Bankers' Morality". On Tuesday, the first morning session will be on microprogramming languages (chaired by Ron Brody of Burroughs); this will be followed by a session organized by Y.

S. Wu of NRL on microprogram-controlled signal processors and, concurrently, a session on microprogramming in computer science education. Tuesday afternoon will be devoted to a panel discussion, on "The Future of Microprogramming", Stu Tucker of IBM is in charge of this session. 12e2

Preprints of the papers presented at the workshop are currently being prepared and will be mailed to all advance registrants early in September. The preprints will include three types of papers: formal papers (30 minutes formal presentations), regular session papers (15-20 minutes, including questions), and brief reports (5 minutes). There should be ample opportunity to ask questions in all of the workshop sessions. The program committee hopes that preprints will provide the basis for much fruitful discussion. 12e3

In addition to the above program of technical papers there will be a tutorial session "Introduction to Microprogramming" presented by Dick Merwin to be given on Sunday evening from 8 to 9:30 p.m. This session, which will only be offered if there is sufficient interest, is planned for those attending a Microprogramming Workshop for the first time (over half the attendees at the Fifth Workshop were in this category) and is intended to help them appreciate the technical sessions described above. It will cover the basic fundamentals. 12e4

For additional information on the conference, contact: 12e5

Dr. Richard E. Merwin
SAFEGUARD System Office
1300 Wilson Blvd.
Arlington, Virginia 22209
202-694-5281 12e5a

ABSTRACTS 13

ROBOTIC EQUIPMENT by Nils J. Nilsson
Artificial Intelligence Center
Stanford Research Institute 13a

This report describes interim results of a project to specify special equipment for research in Artificial Intelligence. After surveying several potential users it was decided that there was a need for standardized equipment for robot research. Such equipment includes a vision subsystem, an arm subsystem, and a mobile cart subsystem. Some users desire a robot consisting of all three subsystems, while others need lesser combinations. Taking into account these user needs, and equipment cost and availability considerations, we recommend a list of modular components that in total comprises a complete mobile robot system. Alternatively, subsets of the component list can be used to suit particular user needs. The recommended systems include a small minicomputer to be used for arm trajectory, vehicle navigation, and interfacing with the user's main computer. Use of the minicomputer provides needed research flexibility in that control algorithms can be easily revised and additional user sensor and effector equipment can be easily added. 13a1

The complete vehicle/arm/vision robot system will be controlled from the user's main computer over a radio link to the on-board minicomputer. The robot will be able to operate in an office or laboratory environment, and will be powered by rechargeable storage batteries. Television pictures from the vehicle will be sent back to the main computer over a video-bandwidth radio link. Cost estimates for both the prototype equipment and future copies are given. 13a2

SOME RESULTS CONCERNING THE SITUATION CALCULUS* by Olga Stepankova
Institute for Computation Techniques
Czech Technical University
and
Ivan M. Havel
Institute for Information Theory and Automation
Czechoslovak Academy of Sciences
Prague, Czechoslovakia 13b

In the present paper we introduce the concept of an image space as a basis for a formal logical counterpart to state-space problem solving. This concept is motivated by the ideas used in STRIPS. Our main result is the establishment of mutual correspondence between solutions of problems formalized in the image space and formal proofs of certain formulas in the situation calculus. The result suggests a possibility of using all the advantages of one approach in the other, and conversely. We treat the problem in considerable generality assuming solutions in the form of branching programs and not only linear ones. We also suggest how a solution of the frame problem, similar to that of Hayes, can be incorporated into the image space. 13b1

* Proceedings of the Symposium "Mathematical Foundations of Computer Science," The High Tatras, Czechoslovakia, September 1973. 13b2

A DEFINITION-DRIVEN THEOREM PROVER by George W. Ernst
Report No. 1124
Department of Computer and Information Sciences

Case Western Reserve University
Cleveland, Ohio 13c

This paper describes a theorem prover, running on a PDP-10-TENEX system, that can prove some theorems whose statements involve a relatively large number of definitions. Such theorems require special methods because (1) their statements have a large number of clauses, and (2) their proofs are quite long, although straightforward. 13c1

A theorem is proven by first subdividing it into "simple" subgoals and then using a standard resolution theorem prover to prove the subgoals. The first part of this process involves the substitutiion of definitions for defined quantities and the use of logical simplifications. This process, which is more similar to a natural deduction system than a resolution system, is shown to be complete when restricted to first-order logic. However, the theorem prover can deal with some interesting higher-order theorems as is shown by an example. 13c2

A CLASS OF BINARY RELATIONS: APPLICATIONS TO TWO-DIMENSIONAL ARRANGEMENTS by R. B. Banerji
Proceedings of the 1973 Princeton Conference
on Information Science and Systems 13d

Minsky once suggested a method for describing two-dimensional arrangements of figures by a tree-structure. The method was actively investigated, and it was found that the method loses some information. Certain modifications to the method have been suggested since, and it has been found that for a restricted class of arrangements, the modified method does not lose informaton. The restrictions have been discussed in terms of a formal theory of a class of binary relations. 13d1

STRATEGY CONSTRUCTION USING HOMOMORPHISMS BETWEEN GAMES by R. B. Banerji and G. W. Ernst
ARTIFICIAL INTELLIGENCE, 3, 223 (1972) 13e

One reason for changing the representation of a game is to make it similar to a previously-solved game. As a definition of similarity, people have proposed homomorphism-like structures. Two such structures are discussed in this paper and it is proven that they "preserve" winning strategies. They are incomparable in their strength and areas of applicability, i.e, neither of them is a special case of the other. 13e1

The games to which these homomorphisms have been applied are positional games and decomposable games. The reason for concentrating on these two classes is that powerful methods for playing these games are known. For motivation, these methods are briefly described in the paper. The two homomorphisms discussed in this paper effectively extend the methods for playing positional and decomposable games to a much larger class of games. For several specific games which are neither positional nor decomposable, it is shown how they can be played as though they were positional or decomposable by using the homomorphisms. 13e2

A METHOD FOR THE EASY STORAGE OF DISCRIMINANT POLYNOMIALS by R. B. Banerji
Proceedings of the 1973 National Computer Conference 13f

It has been illustrated how the use of the theory of finite fields enables one to express any polynomial as an integral power of a given polynomial in some polynomial field. When the polynomials to be stored have many variables (as in the case with usual discriminant polynominals in pattern recognition), this necessitates the storage of certain auxiliary polynomials--one for each variable involved and of a degree one more than the largest power to which the variable is raised. A rough estimate is given of the memory saved and the computation involved. 13f1

LIMITATIONS IN PATTERN RECOGNITION AND PROBLEM SOLVING by R. B. Banerji and G. W. Ernst
Proceedings of the 1972 ACM Conference 13g

This paper discusses the "standard" techniques used by problem solving and pattern recognition programs. It is pointed out that evaluation functions (often called discriminant functions) lie at the heart of these programs. Simplicity appears to be an important property of evaluation functions because those that are both relatively accurate and efficient, are in some sense simple. In addition, simple evaluation functions are easier to learn because there are fewer parameters to estimate. The real difficulty is that no general method exists which extracts a good set of features for a particular problem. Even if this were possible, one is still faced with the task of combining these features to obtain the "answer." In the case of pattern recognition this combination takes the form of connectives such as arithmetic operations and Boolean operations. However, in the case of problem solving, things are much more complicated since features are at the bottom of a search procedure which looks at many different problem states. This presents the difficulty of making good use of such a large volume of information. 13g1

PLANNING IN A HIERARCHY OF ABSTRACTION SPACES by Earl D. Sacerdoti

Artificial Intelligence Center
Technical Note 78
Stanford Research Institute 13h

A problem domain can be represented as a hierarchy of abstraction spaces in which successively finer levels of detail are introduced. The problem solver ABSTRIPS, a modification of STRIPS, can define an abstraction space hierarchy from the STRIPS representation of a problem domain, and it can utilize the hierarchy in solving problems. Examples of the system's performance are presented that demonstrate the significant increases in problem-solving power that this approach provides. Then some further implications of the hierarchical planning approach are explored. 13h1

This paper will be presented at the 1973 IJCAI. 13h2

A HIERARCHICAL ROBOT PLANNING AND EXECUTION SYSTEM by Nils J. Nilsson
Artificial Intelligence Center
Technical Note 76
Stanford Research Institute 13i

This report describes a robot control program consisting of a hierarchically organized plan generation and execution system. The program is written in QA4 and makes use of several features of that language. The usually sharp distinction between robot plan generation and execution is intentionally blurred in this system in that planning and execution phases occur intermixed at various levels of the hierarchy. The system currently exists as a running program that clearly illustrates the concepts involved; major additions and refinements would be necessary if the system were to be used to control an actual robot device. 13i1

A PARSER FOR A SPEECH UNDERSTANDING SYSTEM by William H. Paxton and Ann E. Robinson
Artificial Intelligence Center
Technical Note 79
Stanford Research Institute 13j

This paper describes a parsing system specifically designed for spoken rather than written input. The parser is part of a project in progress at Stanford Research Institute to develop a computer system for understanding speech. The approach described uses as much heuristic knowledge as possible in order to minimize the demands on acoustic analysis. 13j1

This paper will be presented at the 1973 IJCAI. 13j2

AUTOMATED LANGUAGE PROCESSING by Donald E. Walker
Artificial Intelligence Center
Technical Note 77
Stanford Research Institute 13k

This paper reviews a substantial amount of the literature on automated language processing written or published during the years 1971 and 1972. The major emphasis of the review is on computational linguistics; research is considered under the following headings: linguistics and computational linguistics; parsing and question answering; semantics, logic, and representation; psycholinguistics, sociolinguistics, and performance; speech understanding; mathematical models. Also discussed are studies in text processing that involve augmentation systems, document analysis, document retrieval, dictionaries and lexicons, and automatic and machine-aided translation of languages. The reference list contains 325 citations. 13k1

The paper was prepared for inclusion in Volume 8 of the Annual Review of Information Science and Technology, edited by Carlos A. Cuadra, which is to be published by the American Society for Information Science in October 1973. 13k2

SPEECH UNDERSTANDING THROUGH SYNTACTIC AND SEMANTIC ANALYSIS by Donald E. Walker
Artificial Intelligence Center
Technical Note 80
Stanford Research Institute 13l

Stanford Research Institute is participating in a major program of research on the analysis of continuous speech by computer. The goal is the development of a speech understanding system capable of engaging a human operator in a natural conversation about a specific problem domain. The approach being taken is distinctive in the extent to which it depends on syntactic and semantic processing to guide the acoustic analysis. This paper provides a description of the first version of the system, emphasizng the kinds of information that need to be added for effective results. 13l1

This paper will be presented at the 1973 IJCAI. 13l2

SEMANTIC ANALYSIS OF ENGLISH TEXT BY COMPUTER by Anne-Louise Guichard Radimsky
Ph.D. Thesis
Department of Electrical Engineering and Computer Sciences
University of California at Berkeley
20 May 1973 13m

The purpose of this research is to develop an adequate representation for the semantic analysis of simple English sentences such as are found in a grade school text book. The approach is based on a semantic theory of language developed by W. L. Chafe. The SPEC system, a computer program embodying this approach and written in SNOBOL IV, calls on both syntax and semantics for the parsing of sentences. The sentences are taken from an actual text used in elementary school entitled "Mathematics Enrichment." This source provides an unbiased set of sample sentences. For each sentence a "semantic structure" is created. This structure could then be used inside a Question-Answering System, dealing with simple mathematical facts at the level of such an elementary mathematics text book. Much attention has been paid to concentrating contextual information into a small number of tables, thereby facilitating the possible conversion of the system to another universe of discourse. 13m1

Chapter 1 compares this system with previous work done in the same area. The semantic structures are described at length in Chapter 2 and in Appendices A through D. The following three chapters present the process of analysis of the input and the construction of these structures. Possible extensions and further developments of the present system will be found in Chapter 6. 13m2

A HOLE IN GOAL TREES: SOME GUIDANCE FROM RESOLUTION THEORY by D. W. Loveland and M. E. Stickel 13n

The representation power of goal-subgoal trees and the adequacy of this form of problem reduction is considered. A number of inadequacies in the classical form are illustrated, and two versions of a syntactic procedure incorporating extensions are given. Although the form of the corrections are suggested from resolution theory results, and the value of this connection emphasized, the paper discusses the goal tree format and its extensions on an informal level. 13n1

MOTIVATION SYSTEM FOR A ROBOT by Jack Koplowitz and David Noton
Department of Electrical Engineering
University of Colorado
Boulder, Colorado 13o

A motivation system for a robot consists of a set of general goals and prohibitions which guide the robot's actions. The necessity of a motivation system presents itself when the robot has a complex task structure and hence must interact with the real world. A linear polynomial is suggested as a means of evaluating choices based on these motivations. Procedures to adjust the polynomial are given. An example is offered to illustrate that reasonable and consistent decisions can be made in situations of moderate complexity. 13o1

This paper appeared in the IEEE Transactions on Systems, Man, and Cybernetics, Vol. SMC-3, No. 4, pp. 425-428, July 1973. 13o2

INTRODUCTION TO ENT 2210 AND ENT DATABASE 2201 by David B. Benson
CS-73-006 Computer Science Report
Department of Computer Science
Washington State University
Pullman, Washington 13p

ENT is an IBM 360 program for writing natural language question-answering programs and other artificial intelligence uses. It is an extensible programming language system with base capabilities oriented toward symbolic processes. In the proper environment, a virtual machine or large storage-configured computer, it is interactive. 13p1

This report combines the following documentary uses: an introduction to the capabilities of ENT version 2200 using the ENT Database 2201, an instructional guide to this version of ENT. However, this report does not include the internal documentation necessary to make corrections, changes, or additions to the program. Nor does it include the documentation necessary to install ENT at a computer center. 13p2

Send requests to: 13p3

Kathleen Edwards, Librarian
Johnson Hall, C-119
Washington State University
Pullman, Washington 99163 13p3a

A FRENCH LANGUAGE REPRESENTATION IN FIRST ORDER PREDICATE-CALCULUS IN ORDER TO CONVERSE WITH A COMPUTER by Robert Pasero
Thesis
3rd cycle
Groupe d'Intelligence Artificielle
U.E.R. de Luminy, France 13q

The framework of this research is the realization of a question-answering system in natural language. This system is based on automatic theorem-proving. In the programming language we use, PROLOG, each statement is a first-order predicate-calculus formula and, so, the execution of a program consists of proving a theorem. This language affords one the ability to program: 13q1

- a "translator" which translates a tree representation of a text, and questions about it, called "syntaxic structure", into a set of simple logic formula, which allow an easy retrieval of the information contained in this text; 13q1a

- a "deductor" which infers from the previous logical formula and produces the answers to the various questions. 13q1b

Following a semantic analysis of the French language, we can bring out some general mechanisms which afford the ability to axiomatize the translation of a text into a set of simple statements. This translation is essentiaaly based on the meaning of the quantifiers which precede the noun phrases and on the way the sentences are embedded. 13q2

AUTOMATIC NOVEL WRITING: A STATUS REPORT by Sheldon Klein, J.F. Aeschlimann, D.F. Balsiger, S.L. Converse, C. Court, M. Foster, R. Lao, J.D. Oakley, and J. Smith
Technical Report No. 186, July 1973
Computer Sciences Department & Linguistics Department
University of Wisconsin
Madison, Wisconsin 13r

Programmed in FORTRAN V on a Univac 1108, the system generates 2100 word murder mystery stories, complete with semantic deep structure, in less than 19 seconds. The techniques draw upon the state of the art in linguistics, compiler theory, and micro-simulation. The plot and detailed development of events in the narrative are generated by a micro-simulation model written in a specially created, compiler-driven simulation language. The rules of a simulation model are stochastic (with controllable degrees of randomness) and govern the behavior of individual characters and events in the modelled universe of the story. This universe is represented in the form of a semantic deep structure encoded in the form of a network--a directed graph with labelled edges, where the nodes are semantic objects, and where the labelled edges are relations uniting those objects. The simulation model rules implement changing events in the story by altering the semantic network. Compiler or translator-like production rules are used to generate English narrative discourse from the semantic deep structure network (the output might be in any language). The flow of the narrative is derived from reports on the changing state of the modelled universe as affected by the simulation rules. 13r1

Nodes of the semantic network may be atoms, classes, or complex predicates that represent entire subportions of the network. Atom nodes and relations are linked to expression lists that may contain lexical stems or roots that are available for insertion into trees during the generation process. (Low level transformations convert the roots into appropriately inflected or derived forms. High-level transformations mark the tree for application of the low-level ones.) These expression lists may also contain semantic network expressions consisting of objects and relations which may themselves be linked to expression lists, thereby providing the generator with recursive expository power. An atom node may also function as a complex predicate node with status that may vary during a simulation. 13r2

Class nodes may refer to lists of object nodes, and the complex-predicate nodes can be linked to pointers to sub-portions of the network that includes themselves, allowing them to be recursively self-referential. (This would permit generation of sentences such as "I know that I know that - <sentence>"). 13r3

We are also testing a natural-language meta-compiling capability--the use of the semantic network to generate productions in the simulation language itself that may themselves be compiled as new rules during the flow of the simulation. Such a feature will permit one character to transmit new rules of behavior to another character through conversation, or permit a character to develop new behavior patterns as a function of his experiences during the course of a simulation. This feature, combined with the complex-predicate nodes helps to give the system the logical power of at least the 2nd-order predicate calculus. 13r4

Theoretical motivations include an interest in modelling generative-semantic linguistic theories, including case grammar and presuppositional formulations. The dynamic time dimension added to the semantic deep structure by the simulation makes it possible to formulate more powerful versions of such theories than now exist. 13r5

RECENT NOVELS reviewed by Dewayne Hendricks
Mental Health Research Institute
The University of Michigan 14

In case you haven't read it yet, may I call your attention to Robert Heinlein's new book TIME ENOUGH FOR LOVE. I think SIGART Newsletter readers would like to know about it, since it has a novel treatment of intelligent machines which is similar to that of Heinlein's previous book, THE MOON IS A HARSH MISTRESS. The computer this time is called Minerva and what happens to it by the end of the tale, is much more interesting, I think, then what happened to HAL. The publisher is Putnam. 14a

Another book of note is David Gerrod's, WHEN HARLIE WAS ONE, which deals with another intelligent machine and how it learns to assert itself in man's world. The plot again presents an interesting slant on just what a machine will require to act in an "intelligent" fashion, and what men will have to do to learn to live with their creation. It is available in paperback. 14b

INTERESTING FILMS TO ARRIVE IN 1974 15

Note that the future is not being neglected. John Boorman is writing and directing "Zardoz," starring Sean Connery, about the planet Vortex where eternal life turns out to be a mixed blessing, while "Westworld" will explore a Disneyland for adults controlled by robots. 15a

SIGART NEWSLETTER Number 41 August 1973

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SIGART NEWSLETTER Number 43 December 1973 1

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SIGART NEWSLETTER 1b

The SIGART Newsletter is a bimonthly publication of the Special Interest Group on Artificial Intelligence of the Association for Computing Machinery. The Newsletter reports on projects being conducted by the artificial intelligence research community and generally reviews current progress in the state-of-the-art. Correspondents report news from local SIGART Chapters and other AI Centers.
-- 1b1

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SIGART NEWSLETTER Number 43 December 1973

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 6 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), Advertisements (New Products or Classified Advertising), Puzzles, Poems, Cartoons, etc. Material may be reproduced from the Newsletter for non-commercial purposes with credit to the author and SIGART. 1b2

Anyone interested in acting as editor for a special issue of the Newsletter devoted to a particular topic in AI is invited to contact the Editor. Letters to the Editor will be considered as submitted for publication unless they contain a request to the contrary. Technical papers appearing in this issue are unrefereed working papers, and opinions expressed in contributions are to be construed as those of the individual author rather than the official position of SIGART, the ACM, or any organization with which the writer may be affiliated. 1b3

You are invited to join and participate actively. SIGART membership is open to members of the ACM upon payment of dues of $3.00 per year and to non-ACM members upon payment of dues of $5.00 per year. To indicate a change of address or if you wish to become a member of SIGART, please complete the form on the bottom of the last page of this issue. 1b4

Copy deadline for the February Issue: January 25th. 1b5

CHAIRMAN'S MESSAGE 2

This is the traditional time of year to wish everyone a Happy

Holiday Season and a Prosperous New Year. It is also a time for reflection; for stepping back from our day-by-day activities to examine our accomplishments and failures and goals. Throughout the year, the press of immediate needs screens out longer term issues. For this reason, the break in our daily schedule at this Holiday Season is an important opportunity to evaluate ourselves and our efforts this past year. 2a

I know of no greater wish than for you to find, in addition to health and happiness, that you've grown in capability, responsibility, and in service, and that you've addressed important issues without getting lost in the immediate details. The failure to see and heed the larger picture is usually a major limitation on our ability to grow and advance. 2b

Organizations, much like individuals, are largely preoccupied with immediate problems. It is therefore most appropriate that SIGART is currently undergoing such self evaluation (through last issue's questionnaire) of its goals, directions, and accomplishments. The increasing importance of AI techniques in applications and other disciplines gives us many opportunities, both as individuals and as an organization, to grow in new directions. I hope the New Year finds each of us willing and able to accept these challenges. 2c

R.M.B. 11/20/73 2d

EDITOR'S ENTRY 3

1. Foerster Public Lecture at Berkeley: "Computers and the Mind" 3a

The Foerster Memorial Lectureship Series (on the Immortality of the Soul) was innaugurated at the University of California in 1928. Since that time, except for a brief lapse between 1965 and 1968, this series has played host to such distinguished theologians as Rev. Fulton J. Sheen, Bishop James A. Pike, and Dr. Paul J. Tillich (Harvard Divinity School). However, other noted lecturers such as Aldous Huxley (Writer), Loren C. Eiseley (anthropologist), and Sir John C. Eccles (well-known neurobiologist from SUNY at Buffalo) have contributed to the series. 3a1

In an attempt to update the series, the 1973 lecture on October 25th was a debate on "Computers and the Mind" held at Zellerbach Playhouse on the Berkeley campus. Participants included Professors Seymour Papert (AI Laboratory at MIT), Hillary Putnam (Philosophy Department, Harvard), and Donald M. MacKay [pronounced MacEye] (Professor of Communication at the University of Keele, Staffordshire, England). 3a2

The format called for three one-hour presentations, one by each participant, followed by a general discussion (unfortunately, the audience was never included). Starting at 3:00 PM and with approximately 2 1/2 hours scheduled for dinner (the speakers were sequestered by one of the deans to a private dinner party), things didn't finish up until after 10:00 PM, and this was quite a long time for such an enthusiastic audience to absorb one-way communication. Nevertheless, the talks (and later interaction) were well worth the audience's effort. 3a3

In the first lecture, subtitled "The Simplicity of Mind" or "Talking about Talking about Artificial Intelligence", Prof. Papert called for a new epistemological approach to AI <*N1> to replace the old inadequate approach of trying to find a single powerful deductive procedure with sufficient generality to account for human intelligence. He gave numerous examples such as bicycle riding, catching a baseball, and elementary scene analysis to illustrate the apparent simplicity of what might be imagined to be extraordinarily complex feats. He then cited Herbert Simon's hypothesis <*N2> that the observed complexity of human behavior may reside largely in the complexity of man's environment rather than in his intelligence per se. 3a4

In talking further about the "artificiality" of human intelligence, he asked us to consider two skilled chess players, both of equal caliber, but one who acquired his talent through a careful and lengthy reading of chess books, while the other had only played a half-dozen games in his whole life. At first blush it may seem that the well-read player has capitalized on his rather pedestrian direct "knowledge" of the game, while the brilliant newcomer relied solely on native "intelligence". Yet how can we characterize the new-comer's "knowledge" of game-playing strategy and tactics in general? Could this not also be regarded as an exercise of knowledge too, but of a different sort? 3a5

Papert then suggested that AI is akin to the field of lexicography of several hundred years ago, before dictionaries were written down. In both cases a great deal of common sense knowledge has yet to be encoded in a form that one can deal with. Until we tried to write computer programs to operate in the real world, we never needed to "understand the ordinary." Papert also presented a metaphor between AI and aeronautics, suggesting that just as studying the structure of feathers is not the way to learn how birds fly, so studying neurons in order to learn how people think is a limited preoccupation. 3a6

In conclusion from among the numerous other models that have been proposed, Papert urged the audience to regard as the best model of the human mind, a complex network of interacting computer programs. 3a7

In the second presentation, Prof. Putnam generally supported Prof. Papert, giving examples from number theory (Wilson's Theorem), Newton's contribution to Kepler's Laws (concerning the elliptical orbits of planets around the sun), and the explanation of why a square peg won't fit through a round hole (from a modern physics point of view). However, he found it difficult to believe that general-purpose intelligence could result from the accumulation of a large number of sub-programs, each of which had a severely restricted solution space. He argued that prehistoric man, whose brain evolved millions of years ago in an environment with no hint of the sort of complexity that characterizes modern civilization, nevertheless in principle has the capability to be educated (by sending him to a university or whatever) in order to deal successfully with today's world. He suggested that it is this "capacity to know" that is involved in intelligence and not a linking of innumerable, restricted subroutines in a network under a "big switch." He concluded by appealing to automata theory to point out that the distinction between "brain stuff" and "soul stuff" is really irrelevant for psychology. 3a8

Prof. MacKay, a Christian theologian as well as a computer scientist, was quite interested in the structure of personal self-awareness or consciousness in men and machines (what he referred to as the "I story") and stated that it is still an open question as to whether machines could be programmed to have an "I story." He then observed that it should be as easy for God (since he made us) to achieve immortality of the human soul (as he already demonstrated by resurrecting Jesus Christ and reembodying his soul) as it is for a human programmer to run his programs on a different machine. This led to the conclusion that all mechanistically-based science, including AI, is in no way incompatible with theistic beliefs, arguments by uninformed theologians notwithstanding. To the contrary, it is quite congenial, and Prof. MacKay distinctly encouraged research in AI, which was quite refreshing. 3a9

During the joint discussion period which followed, Prof. Papert made a number of incisive observations (the two other participants occasionally had difficulty in getting him to relinquish the microphone) including, "just as the history of programming languages has been an attempt to make programs as remote as possible from the digital character of machine hardware, human children strive through learning to escape from their own biological heritage." 3a10

In the closing minutes a debate emerged between MacKay and Papert on the extent to which (rational) humans might feel that their dignity was lessened by the advent of highly intelligent machines. MacKay argued that even if Papert were an intelligent android (humanoid automaton) instead of a human being, his own self-esteem would in no way be threatened. Papert never really had time to bring his argument to its natural conclusion, but he wondered how society as a whole might respond to such a development. 3a11

NOTES 3a12

<N1> Papert's use of this term in AI is somewhat different, although similar in spirit, to the use John McCarthy has made of it over the years to distinguish the "engineering" or "heuristic" component of AI from the part concerned with causal reasoning or the relation between "knowledge" and "belief." 3a12a

<N2> H. A. Simon, THE SCIENCES OF THE ARTIFICIAL, (MIT Press, 1969), p. 25. 3a12b

<N3> He clearly was interested in including non-digital as well as digital machines in his notion. 3a12c

2. AI at the IEEE SMC Meeting in Boston 3b

Dr. Amand Mundra (Mitre Corporation, McLean, Virginia) and I recently served as co-chairmen of a session on Artificial Intelligence at the IEEE Systems, Man, and Cybernetics Society 1973 International Conference held in Boston, Massachusetts, November 5-7, 1973. The following papers were presented: 3b1

(1) "Problem Generation and Solution" by J. M. Perry and Elliot B. Koffman, University of Connecticut at Storrs. 3b1a

(2) "A Computer Controlled Rotating-Belt Hand for Orienting Objects" by John R. Birk, University of Rhode Island at Kingston. 3b1b

(3) "Theory Formation by Machine: A General Framework of the Golem System" by Alois Glanc, The City University of New York in Flushing. 3b1c

(4) "An Artificial Intelligence Approach to Automatic Speech Recognition" by Steven E. Levinson, University of Rhode Island at Kingston. 3b1d

(5) "The Four Faces of HAL" by Howard A. Peelle and Edward M. Riseman, University of Massachusetts at Amherst. 3b1e

(6) "An Augmented Active Image Transmission System for Visual Man-Machine Interaction" by Harold Alsberg of JPL and California Institute of Technology, Pasadena, California. 3b1f

Other papers in the Proceedings of the Conference relevant to AI but not presented in this session, are as follows: 3b2

(1) "Man and Computer Construction Techniques for the Generation of Crosswood Puzzles" by Lawrence J. Mazlack, University of Guelph, Ontario, Canada. 3b2a

(2) "A Structure of Memory in Concept Formation" by T. M. Khalil, University of Florida at Gainsville and Vladimir Lovitsky, Kharkow Institute of Radioelectronics, U.S.S.R. 3b2b

(3) "A Method of Concept Formation Based on Functional Decomposstion" by Edwin Towster, University of Iowa in Iowa City. 3b2c

Copies of the Proceedings may be obtained by writing to Mr. David Downing, Publicatons Chairman, Boston University, Boston, Massachusetts. 3b3

One of the highlights of the entire conference was the concluding session, a five-hour commemorative symposium celebrating the 25th anniversary of the publication of Norbert Wiener's book "Cybernetics: Control and Communication in the Animal and Machine." Chaired by Prof. B. Chandrasekharan of Ohio State, the session drew on a number of eminent speakers, most of whom knew Norbert Weiner personally and were able to relate first-hand anecdotes concerning Wiener's personal ideosyncrasies as well as take an objective view of what transpired during this quarter century regarding the promises of cybernetics, which ones have been satisfied and which were not. The list of distinguished speakers included: Michael Arbib (University of Massachusetts), Hans Bremermann (University of California at Berkeley), Collin Cherry (Imperial College, London), Michael Watanabe (University of Hawaii), Karl Deusch (Harvard University), Rudolf Kalman (University of Florida), and Marvin Minsky (MIT). 3b4

I'm not sure whether it was a side effect of Prof. Minsky being the concluding speaker or whether those present were truly more interested in discussing AI than pure cybernetics, but when the floor was opened up to the general audience, the vast majority of the questions pertained to AI and were directed to Prof.

Minsky, who as usual did an admirable job of representing the field. 3b5

3. On-Line SIGART Membership Directory 3c

You may recall a promise we made some time ago <*N1> to provide a directory of our 1831 members, giving up-to-date names and addresses, as an additional feature of the On-Line Newsletter. Although it wasn't easy <*N2>, we are pleased to report that our SIGART membership file now exists, and can be accessed over the ARPA Network at SRI-ARC on our directory 'SIGART' under the file 'MEMBERS'. However, we should say that it is indexed in a somewhat unusual way--by geographical location rather than alphabetically by name <*N3>. An interesting consequence of this indexing, however, is that one can browse near by his own name and discover other members of SIGART that are physically near by. We hope that you will find this additional capability useful. 3c1

NOTES 3c2

<N1> Advantage No. (5), Item 2, p. 4, SIGART Newsletter, No. 36, October 1972. 3c2a

<N2> After six months of negotiation and delay, due partially to a change over by the ACM to the IEEE computer system (for billing purposes), I stopped off at ACM Headquarters in New York City on my way back from the East Coast and picked up a computer tape of our membership. We then experienced just about every sort of tape incompatibility imaginable (9 track -> 7 track; 1600 -> 800 bpi density; BDC -> ASCII; etc.) before we succeeded in getting it on our own PDP-10. Clearly, it will be trivial if we ever need to do this again. Incidentally, the folks back at the New York Headquarters are a great bunch of people and don't deserve the vituperation normally heaped on them by those few irate members whose billing account goes astray or whose journals get lost in the mails. 3c2b

<N3> The file is actually listed alphabetically by State, and within each State in order of increasing zip code. 3c2c

4. LISP for IBM 360 3d

The University of Michigan has recently developed a new version of LISP for the 360 now running under the Michigan Terminal System. The major goals were efficiency, compatibility with other LISP systems (MIT, BBN, Carnegie, etc.), and powerful I/O and error recovery procedures. The interpreter is written in

360 assembly language and is now available. The compiler is under development. For a user's manual or other documentation contact: 3d1

Bruce Wilcox
Mental Health Research Institute
Ann Arbor, Michigan 3d1a

5. New SIGART Newsletter Reporters 3e

(1) At MIT, Ms. Andee Rubin replaces Dr. Eugene Charniak.
(2) At Stanford, University Horace Enea replaces Ms. Peggy Karp. 3e1

6. Questionnaires 3f

Please don't forget to send in your October-Issue Questionnaire. As of this date, they are starting to pour in. We hope to have a preliminary summary of the results by the next issue. 3f1

7. Holiday Greetings 3g

Rich Fikes and I would like to join with Bob Balzer in wishing you and yours a safe and happy holiday season. 3g1

L.S.C. 11/29/73 3h

INTERLISP by Warren Teitelman
Xerox Research Center
Palo Alto, California 4

INTERLISP (INTERactive LISP) is a LISP system currently implemented on the DEC PDP-10 under the BBN TENEX time sharing system<*R1>. INTERLISP is designed to provide the user access to the large virtual memory allowed by TENEX, with a relatively small penalty in speed (using special paging techniques described in <*R2>). Additional data types have been added, including strings, arrays, and hash association tables (hash links). The system includes a compatible compiler and interpreter. Machine code can be intermixed with INTERLISP expressions via the assemble directive of the compiler. The compiler also contains a facility for "block compilation" which allows a group of functions to be compiled as a unit, suppressing internal names. Each successive level of computation, from interpreted through compiled, to block-compiled provides greater speed at a cost of debugging ease. 4a

INTERLISP has been designed to be a good on-line interactive system. Some of the features provided include elaborate debugging facilities with tracing and conditional breakpoints, and a sophisticated LISP-oriented editor within the system. Utilization of uniform error processing through user accessible routines has allowed the implementation of "DWIM," a DO-What-I-Mean facility, which automatically corrects many types of errors without losing the context of computation. The CLISP facility extends the LISP syntax by enabling ALGOL-like infix operators such as +, -, *, /, =, _, AND, OR, etc., as well as IF-THEN-ELSE statements and FOR-WHILE-DO statements. CLISP expressions are automatically converted to equivalent LISP forms when they are first encountered. CLISP also includes list construction operators, a LISP oriented pattern match compiler, and facilities for record declarations. 4b

A novel and useful facility of the INTERLISP system is the programmer's assistant which functions as the interface between the user and the system, and monitors and records all user inputs. The user can instruct the programmer's assistant to repeat a particular operation or sequence of operations, with possible modifications, or to UNDO the effects of specified operations. The goal of the programmer's assistant, DWIM, CLISP, etc. is to provide a programming environment which will "cooperate" with the user in the development of his programs, and free him to concentrate more fully on the conceptual difficulties and creative aspects of the problem he is trying to solve. 4c

INTERLISP is the successor to BBN LISP<*R3>, a system developed first at Bolt Beranek and Newman for the SDS 940, and subsequently for the DEC PDP-10. System development and maintenance is continuing at Xerox Palo Alto Research Center and Bolt Beranek and Newman; implementations for other machines are in progress at the University of California, San Diego (for the Burroughs 6700), at the University of Uppsala, Sweden, (for the IBM 370 series), and at Xerox PARC, for the Data General Nova. 4d

A users group has been formed for INTERLISP consisting of all people on the official mailing list maintained by the executive committee (see below). The purpose of the users group is to promote communication among the users, help maintain a standard basic system, and make available other documented packages such as FLIP, a complete format directed list processing system <*R4>, TRANSOR, a subsystem which aids in converting programs written in other LISP dialects (e.g., LISP 1.5, Standard LISP) to INTERLISP, and INTERSCOPE, a question-answering system whose data base is the user's programs. 4e

Documentation for INTERLISP is available from Warren Teitelman. A new version of INTERLISP will soon be released that implements the general control-structure scheme described in <*R5>, thereby enabling and encouraging use of backtracking, coroutines, and other types of multiple environments. 4f

INTERLISP Executive Committee: 4g

Alice K. Hartley Bolt Beranek and Newman
50 Moulton Street
Cambridge, Mass. 02138 4g1

Warren Teitelman Xerox Palo Alto Research Center
3180 Porter Drive
Palo Alto, Calif. 94304 4g2

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<R2> Bobrow, D. G., and Murphy, D. L., "The Structure of a LISP System Using Two Level Storage," Communications of the ACM, Vol.15, No.3, March 1967. 4h2

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<R4>Teitelman, W., FLIP, A Format Directed List Processor in LISP, BBN Report, 1967. 4h4

<R5> Bobrow, D. G. and Raphael, B., "New Programming Languages for AI Research," given by D. G. Bobrow at IJCAI-73, August 1973, Stanford University, Xerox PARC Report No. CSL-73-2, August 1973. 4h5

EUROPEAN AISB SUMMER SCHOOL ON KNOWLEDGE SYSTEMS by Keith Oatley
Laboratory of Experimental Psychology
University of Sussex, England 5

A most successful meeting was held by the Study Group on Artificial Intelligence and Simulation of Behavior at Oxford University this summer. It took the form of a number of Britain's more distinguished workers in AI, Dr. M. B. Clowes, Mr. P. Hayes, Professor H. C. Longuet-Higgins, Mr. A. Mackworth, and Professor D. Michie each giving a series of lectures and leading discussions on the problems of how human and artificial intelligence organize and use knowledge. 5a

The School was limited in numbers to 50 participants, many of them lecturers and research leaders in departments of psychology and computer science. Perhaps the limitation was unfortunate because the very much larger number of applicants meant that many people had to be turned down. However the response did also indicate a very substantial and growing interest in AI in Britain, which the AISB group is now serving. 5b

A good deal of effort in AI at the moment is devoted to problems which people find very easy, but which computationally are very difficult - in particular perception and language. Some of the principles that have emerged from this work indicate the extremely rich and detailed knowledge of the world and of specific problems that need to be embodied in a machine to perform even the simplest linguistic or perceptual tasks in any plausible fashion. Indeed, artificial intelligence work on vision indicates in a striking way the real intelligence of human vision. This was brought out in the lectures of Alan Mackworth of the University of Sussex in which he traced the development of work on scene analysis, the task of forming descriptions of the objects and 3-dimensional structure of a scene by interpreting a 2-dimensional digitized photograph. 5c

It turns out that to do this task successfully there must be embodied in the program not only some understanding of the three-dimensional geometry of the world, but of the kinds of entities it might expect to encounter. It must have knowledge of what two-dimensional appearances result from translations and rotations of various 3-dimensional entities (be they whole objects as in Robert's program, corners as in Clowes's, or surfaces as in Mackworth's), it must know about viewpoint, perspective, lighting, and physical processes such as occlusion and support. Typically successful scene analysis programs have mobilized a varity of these specialized types of knowledge to make interpretations of the grey-scale patterns they were given. Typically also the knowledge in question has needed to be flexibly available at a number of different levels of the program. 5d

Thus rather than simply being able to categorize patterns in the picture, scene analysis needs to bring to the task a great deal of understanding about the universe it is dealing with. The same kind of conclusion follows from question answering programs, such as the widely-known one by Winograd. Much of the present excitement of Artificial Intelligence (and its importance for related disciplines) is due to the real progress being made with the problems of organizing and using knowledge in perceptual and question answering systems which although artificial, we can now say with a straight face, are also beginning to be intelligent. 5e

Winograd's program was based on Hewitt's computing language

PLANNER. This language was motivated partly by the idea of embedding specific knowledge about tasks in procedures which could be called easily from many parts of the program. Pat Hayes of the University of Essex spoke about the important recent developments in programming languages of this kind. 5f

Some of the directions of artificial intelligence are becoming very clear: on the one hand it constitutes a theoretical vehicle for psychology. On the other it opens new vistas of computation in the engineering sense which are quite different, and altogether more challenging than the number-crunching and stock-control applications which dominate much of current computational practice. 5g

GROUP D'INTELLIGENCE ARTIFICIELLE - UNIVERSITE D'AIX-MARSEILLE 6

There are about ten people in the group, most of whom are teaching in the Mathematics and Computer Science Departments. These are the projects which are currently being worked on: 6a

- the programming language PROLOG and its interpretor, based on a mechanical theorem-provng approach. 6a1

- a question-answering system in French with automatic inference (all written in PROLOG). 6a2

- a heuristic theorem prover (also written in PROLOG). 6a3

- the development of basic software for a small TI600 computer made by the French Company, Telemecanique. 6a4

CHESS 7

RESPONSE TO SIMON AND CHASE <*R1> 7a

Prof. Gordon W. Gribble (Department of Chemistry: Dartmouth College; Hanover, New Hampshire) has written a letter entitled "Chess Prodigies" published in the November-December 1973 issue of AMERICAN SCIENTIST (pp. 644-646) in which the author seeks to discredit the Simon-Chase premise that "no one has reached grandmaster level with less than about a decade's intense preoccupation with the game," by citing the examples of Sam Reshevsky and Jose Capablanca. 7a1

He also takes issue with the "chunking" of familiar patterns in short term memory by citing the counter example of the astonishing performance of blindfold masters like Najdorf and Koltanowski. Simon and Chase successfully refute these objections, however, in an accompanying letter (pp. 446-447). 7a2

<R1> SIGART Newsletter, No. 41, August 1973, p.37. 7a3

FOURTH U.S. COMPUTER CHESS CHAMPIONSHIP 7b

The 2nd-Place Playoff for the 4th U.S. Computer Chess Championship at ACM '73 has now been completed. The standings are as follows: 7b1

	Points	
1. TECH II		7b1a
PDP-10, Alan Baisley, MIT	2	7b1a1
2. CHAOS		7b1b
Univac 1108, I. Ruben et al, Sperry-Rand	1	7b1b1
3. OSTRICH		7b1c
Data General Supernova, George Arnold and Monty Newborn, Columbia University	0	7b1c1

Following the three games from the playoff are the six games from the first round of the tournament. We will publish games from rounds 2 and 3 in subsequent issues. 7b2

READER COMMENTARY ON THE CICHELLI HEURISTICS by Richard Cichelli
901 Whittier Drive
Allentown, Pennsylvania 18103 7c

Alex Bell (July 20,1973) on implementing some of my suggested changes to his two move mate solver: "I've got the 'refutation man' working in PL/1 on the IBM 360/195 and that alone seems to give improvements equal to the ones you describe. E.g., 'Bell Figure 1' has dropped from 7 seconds to about 2 seconds and three move mates are averaging about 1 minute." 7c1

James Gillogly (July 3, 1973): "The Killer heuristic is the same as your refutations, but applied locally rather than globally. One would expect this to give even better results than a global application because of the closer similarity of starting positions; but in TECH the improvement is not statistically significant in most cases..." 7c2

I quote from my letter of August 20 to Alex, and my reply to Jim was similar in content. 7c3

"Refutation and killer heuristics are, in my view, static ordering devices designed to find cheaply, likely moves which will generate alpha-beta cutoffs. Both you and Jim Gillogly have contributed to my thinking, which I here clarify. 7c4

There appear to be two conflicting goals in these heuristics which I call specificity and applicability. Given that we wish to associate some move, set of moves, or value with some pattern, then specificity measures how accurately the pattern is recognized and applicability measures the number of times the heuristic returns a recommended action. Obviously, the more specific the heuristic the more accurate its recommendation and the lower its applicability. We can thus see the following progression in decreasing specificity of chess patterns. 7c5

Actual position -> move -> square-to -> man-moved -> unspecified 7c6

Gillogly's use of Al Zobrist's exclusing ORing on move bit patterns lets him recognize identical positions (by hashing-error less than .01%) in the game tree and assign the previous back-up value with no further search. (Note: the ORing method solves your equivalent positions by differing paths problem.) Jim's few accurate hits don't pay for his overhead. 7c7

Move, square-to, and man-moved are the three levels of specificity my "refutation heuristic" uses. I make associations with moves, not simply movers, hoping that lack of specificity would be compensated for with limiting applicability. The intuitive notion here is that if some man is moved, then it ceases to perform some of its functions (e.g., defending or attacking) and the opponent's reply which proves this fact has a high enough incidence in the game tree to be a likely candidate to generate a prune. Similarly, if a capture occurs on some square-to, then for any mover to this square, the capture is likely to exist. For the sake of completeness, I include "unspecified" to suggest that moves may simply be ranked, global to the tree, without any reference to local board or move conditions. 7c8

Of course, in addition to my refutation static ordering which is global to the search tree, 'DEPTH - 2' data from two plies above is also used in static ordering and 'DEPTH + 2' data is passed back for dynamic ordering." 7c9

Note for those implementing chess programs based on Bell's Algorithm: The published program fails to reverse searched plies which are captures with promotion, therefore failing on my problem #7. 7c9a

Antony Marsland (at the ACM 73 tournament): "What determined the arbitrary order of search in the control run of the problem set? What about random ordering?" 7c10

I replied: If square a1 is numbered 1 and square h8 is 64, then the plies of the piece occupying the highest numbered square are searched first. (This results from loading Bell piece lists with an algorithm which reads Cooper-Kozdrowicki board input notation. E.g., problem #4 of the problem set in COKO is 7c11

4N34P384P3884Q34K3,88884K34P388). 7c11a

Further notes on the program: 7c12

A brute force tournament program should be able to search nearly 250,000 nodes in three minutes. The Pascal implementation of my program is 1/40th this fast; to achieve tournament rate would require a rewrite in COMPASS (CDC assembler). However, Pascal has proven to be an ideal development tool for writing easily modifiable, readable, structured programs. 7c12a

Acknowledgments: 7c13

I wish to thank Lehigh University for their continued computer time funding of this project. 7c13a

[Ed. Note: A typographical error was made in the summary of Richard Cichelli's preliminary results in October SIGART Newsletter, s. (10d). The second sentence of the third paragraph should read: 7c14

"Without the heuristics, the program solved the 10 problems by generating 74,485 nodes at a rate of 41.5 nodes per second. With the heuristics, the program solved the problems by generating 33,724 nodes at 35 nodes per second. The overall improvement is 212%." We regret the error.] 7c15

LESSONS FROM PERCEPTION FOR CHESS-PLAYING PROGRAMS (AND VICE VERSA) by Herbert A. Simon
1972-73 Computer Science Research Review, pp.35-40
Department of Computer Science
Carnegie-Mellon University
Pittsburgh, Pennsylvania 7d

For nearly twenty years, artificial intelligence and cognitive psychology have maintained a close symbiotic relationship to each other. It has often been remarked that their cooperation stems from no logical necessity. That a human being and a computer are both able to perform a certain task implies nothing for the identity, or even similarity, of their respective performance processes. Each may have capabilities not shared by the other, and may build its performances on those peculiar capabilities rather than upon those they hold in common. 7d1

In spite of this logical possibility of total irrelevance of the one field for the other, during the last two decades there has been massive borrowing in both directions. Artificial intelligence programs capable of humanoid performance in particular task domains have provided valuable hypotheses about the processes that humans might use to perform these same tasks, and some of these hypotheses have subsequently been supported by evidence. Bobrow's STUDENT program, for example, which translated story problems into algebraic equations, provided a model, later tested by Paige & Simon for some of the human syntactic processes in performing that task. 7d2

Conversely, hypotheses and data about human performance have been important inputs to artificial intelligence efforts. The General Problem Solver, for example, received its early shape from analyses of human thinking-aloud protocols in a problem solving task. 7d3

The distance between AI and cognitive psychology has not been the same in all task domains. Until quite recently, for instance, AI research on theorem proving developed in directions quite different from those suggested by the study of human behavior in theorem proving tasks. There is little that is humanoid about resolution theorem proving. 7d4

In the domain of chess playing, the distance between AI and cognitive psychology has been neither so close as in the GPS example, nor so distant as in theorem proving. The early chess playing programs, in their reliance on brute force and machine speed, borrowed little from what was known of human chess playing processes. The clear demonstration by their relatively weak levels of performance that speed was not enough, produced a gradual movement toward incorporating into the programs some of the selective task-dependent heuristics that humans rely heavily upon in their chess playing. However, the strongest chess programs in existence today still rely heavily upon extensive rapid search, usually over thousands or tens of thousands of branches of the game tree. 7d5

I should like to describe [in this paper] some efforts on the other side of the line--attempts to explore chess playing mechanisms that can explain human chess performance. These mechanisms may turn out to have important implications for the future of chess playing programs motivated by AI goals. Their own motivation, however, was largely psychological. 7d6

THOUGHTS ON COMPUTER PROGRAMS THAT PLAY CHESS by Francis D. Tuggle
Departments of Computer Science and Business Administration
The University of Kansas at Lawrence 7e

I have never written a computer program to play chess, so read these remarks with a degree of tolerance and annoyance, both of which are warranted. (But to justify my second comment below, I may be forced to author one sometime.) As I read descriptions of chess programs, tournaments, heuristics, results, etc. in the SIGART NEWLETTER, the journal ARTIFICIAL INTELLIGENCE, and elsewhere, I succumb to uneasy feelings. Two of these I have been able to identify, isolate, and discuss. 7e1

First, emphasis in the field seems to be shifting toward computer-computer chess matches. There are undoubtedly many good reasons for this state of affairs, but despite them, it strikes me as a diversion from the main task of constructing computer programs able to defeat skilled humans at the game of chess. Perhaps this represents stagnation. Faster hardware, larger memory, subtler code, and clever heuristics may only result in small gains on the same plateau. Whatever the reasons, the programs need to be benchmarked against people. (If there was a reliable human TECH <*R1> benchmark, and if there were reliable TECH "other programs" benchmarks, then the thrust of this comment would be blunted). 7e2

Second, I am struck by an essential "sameness" to most of the chess programs. Let me use some Newell and Simon <*R2> terminology. Most (all?) chess programs operate in the problem space of Move Selection: game trees get generated (heuristically) and positions get evaluated (heuristically) so a move can be selected and made. Yet chess, human chess anyway, is more than a sequence of moves; the moves are selected to help fulfill a strategy. Let me next employ the thoughts of Botvinnik <p.7--*R3>: "...the [chess] program must be modelled on human thought processes." It seems to me that what is needed is a second problem space for (intelligent) chess programs, call it a Strategy Selection space. In the second space, a strategy is selected (say, King-side attack), then it is passed to the first problem space (Move Selection), perhaps in the form of specifying certain parameters (e.g., a depth bound, an evaluation function, a plausible move generator). That is, the specifics of choice of move should depend upon what strategy one is trying to follow. 7e3

One could argue that strategy selection is implicit in the choice of evaluation function, etc., but in reading the play of human-computer chess games, I get the impression of disjointed play on the part of the computer. It does not seem to smoothly flow. One could also argue that there is but one strategy, namely to obtain checkmate. Yet this is as non-operational as a corporation which announces it will act so as to maximize its long term profit. At least the firm has the good sense to produce 5 year and 10 year plans and to produce annual targets based upon those plans. Should not chess programs also produce and utilize realizable strategic plans? One might also contend that researchers are attempting to build in "strategic" and "long-range planning" into chess programs. Botvinnik <p. 81--*R3> (or perhaps Krinitski, or the translator Brown) feels that long-range planning could be enhanced if the goal were adopted of "...strengthen[ing] oneself rather than gain[ing] immediate material advantage." This may improve long-range planning, but it certainly is not the real-time selection of a strategy. 7e4

Let me heroically suppose that I have convinced you of the need for a second problem space for Strategy Selection. What would ensue therein? In that problem space, a determination would be made of several items; stage of the game (opening--e.g., no major pieces moved, midgame--e.g., Queen moved, endgame--e.g., both Queens off the board), state of the game (e.g., White is ahead by 2 pawns), history list of previously employed strategy (to provide some possible continuity), and an estimate of the opponent's strategy. These estimates would then be linked, via a decision process, to a strategy (e.g., an attack, the development of pieces, the coordination of pieces, obtaining or maintaining control of the center, responding to an attack, guarding a position, etc.). Since there are various tactics or plans by which any strategy could be accomplished, a second decision process might be employed to select a currently feasible plan. 7e5

It appears then that the major obstacles to be overcome in using this approach would be these; (i) the development of the list of alternative strategies to be considered; similarly, plans or tactics for each alternative might be developed, (ii) the features of the game and opponent to be "noticed", (iii) how the choice of a strategy influences search in the Move Selection problem space, and (iv) what decision process is used to relate the features of the game to the choice of a strategy. (My own research has been concerned with decision processes of this sort; see <*R4>. For one of the better articles discussing choice of corporate strategy, see <*R5>). 7e6

As an illustration of the use of decision process models in the study of strategy selection, refer to the paradigm of games against an uncertain nature, first stated by Von Neumann and Morgenstern <*R6>. For such games, there exist a number of different decision rules by which to select an action, e.g., maximax, maximin, minimax regret, etc. One can interpret these choice procedures as representing different strategies of play, e.g., the first is an optimistic one, the second is pessimistic, the third is ex post facto pessimistic, etc. Finally, given these several different strategies, Tuggle et al <*R4> offer an information processing simulation model of a subject selecting from a given set of alternative strategies. So it is possible to produce mechanisms which intelligently select from a set of strategies. 7e7

Now that you have seen the substance of this second, rather lengthy comment, let me briefly address some related issues. The above idea (of a second problem space) has some loose connections to the CP-1 program of Newell, Shaw, and Simon <*R7>, though it is clearly distinct from the ideas behind CP-1. That program was more of a "simulation of human thought" type than the others of its day; likewise, use of the second problem space method would (presumably) continue the tradition. 7e8

Zobrist and Carlson's <*R8> intriguing advice-taking chess program might be further improved if it could be given strategic as well as tactical advice (their program apparently is only receptive to tactical advice such as "keep your knights off the edge of the board".) It might also be cleaner conceptually to separate the program into two problem spaces. 7e9

Another way to interpret my two problem space suggestion is to view it as yet another heuristic; i.e., it should not be adopted until its benefits (strength of game played) are shown to outweigh its costs (increased processing time). My beliefs on this matter should be obvious (and I try to shore up their plausibility in the next paragraph), but, again, Botvinnik <p. xiii--*R3> goes to the crux: "the word is quickly spoken, but the deed takes longer." Ergo, I may be forced to write my own chess playing program. (Never having written a chess playing program, I am unexperienced in the practical difficulties that occur and the pragmatic compromises that must be effected, but at the same time, I have been able to maintain a sense of perspective over such programs, remaining a detached, objective observer.) 7e10

Lastly, anyone reading this who is even remotely linked to the "simulation of human thought" field will see another level to my comments. I am really suggesting that human thought, as regards problem-solving and allied cognitive activities, occurs in two problem spaces--one in which the problem is actually solved (or attempted), and one in which progress on the problem is monitored, solution strategies are selected for use, etc. Based on the evidence Newell and Simon <*R2> present, the residence times in the second problem space for most of their subjects is pretty minimal. (However, see the protocol of S8 on pp. 367-374 and their discussion of it on preceding pages. One can find several behaviors on his (S8's) part consistent with this idea of monitoring problem-solving progress, e.g., B13-B15, B110-B121, B131-B133, etc.) But investigations of human play of chess, human behavior on "impossible" problems, and human behavior on problems that admit many strategies (e.g., decision problems) may disclose the empirical validity (or falsity) of my contentions. 7e11

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<R2> Newell, A. and Simon, H. A., HUMAN PROBLEM SOLVING, (Prentice-Hall, 1972). 7e12b

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<R7> Newell, A., Shaw, J. C., and Simon, H. A., "Chess Playing Programs and the Problem of Complexity," in Feigenbaum and Feldman (eds.), COMPUTERS AND THOUGHT, (McGraw-Hill, 1963), pp. 39-70. 7e12g

<R8> Zobrist, A. L. and Carlson, F. R., Jr., "An Advice-Taking Chess Computer," SCIENTIFIC AMERICAN, Vol. 228, No. 6, June 1973, pp. 92-105. 7e12h

CONFERENCES 8

1. 2nd MILWAUKEE SYMPOSIUM ON AUTOMATIC CONTROL
March 29-30, 1974
The University of Wisconsin at Milwaukee
Milwaukee, Wisconsin 8a

Papers are being accepted on artificial intelligence, robotic systems, and speech processing. 8a1

Contact: Dr. Richard A. Northouse, Program Chairman
MSAC-74
Electrical Engineering Department
University of Wisconsin at Milwaukee
Milwaukee, Wisconsin 53201 8a2

2. 2nd EUROPEAN MEETING ON CYBERNETICS AND SYSTEMS RESEARCH
April 16-19, 1974
Vienna, Austria 8b

Contact: Dr. Robert Trappl, President
Austrian Society for Cybernetic Studies
Schottengasse 3
A-1010 Wien 1, Austria 8b1

3. 12th ANNUAL SIGCPR (COMPUTER PERSONNEL RESEARCH) CONFERENCE
July 18-19, 1974
Colorado University 8c

Contact: Robert W. Reinstedt, Chairman
SIGCPR Conference
RAND Corporation
1700 Main Street
Santa Monica, California 90406 8c1

4. FIRST ANNOUNCEMENT OF THE 2nd INTERNATIONAL JOINT CONFERENCE ON PATTERN RECOGNITION
August 13-15, 1974
Copenhagen, Denmark 8d

The Second International Joint Conference on Pattern Recognition will take place in Copenhagen in August 1974 under the chairmanship of Professor C. J. D. M. Verhagen, Delft University of Technology, The Netherlands. The Conference will cover all aspects of theoretical and applied pattern recognition. Papers on industrial applications, feature extraction, image processing, and scene analysis are particularly welcomed. It is intended that there will be a special session on pattern recognition applied to urban environmental problems. In addition to invited papers, there will be submitted papers of 10 and 25 minutes duration; also, sessions are planned for student papers and presentation of last minute results. The deadline for submission of first drafts of papers is March 15, 1974. Authors will be notified by May 1 as to acceptance of their papers. Camera-ready copies must be submitted before June 15. Excursions will be arranged and a Ladies Program is being planned. 8d1

Additional information may be obtained from: 8d2

Mr. E. Backer
E. E. Department
Delft University of Technology
Delft, The Netherlands 8d2a

5. 5TH INTERDISCIPLINARY MEETING ON STRUCTURAL LEARNING
April 20-21 1974
University of Pennsylvania at Philadelphia 8e

(Post-sessions are scheduled for April 22-23, 1974.) The meeting will emphasize multidisciplinary contributions of a theoretical and empirical nature with implications for behavioral science and for education. Individuals proposing contributions or wishing to attend the meetings should contact: 8e1

Joseph M. Scadura
University of Pennsylvania
3700 Walnut Street
Philadelphia, Pensylvania 8e1a

6. CALL FOR PAPERS: 8TH PRINCETON CONFERENCE ON INFORMATION SCIENCES AND SYSTEMS
March 28-29, 1974
Princeton University, Princeton, New Jersey 8f

Authors are invited to submit abstracts and summaries for consideration by January 11, 1974 to 8f1

Prof. M. E. Van Valkenberg
Princeton Conference Program Director
Department of Electrical Engineering
Princeton University
Princeton, New Jersey 08540 8f1a

Special sessions are planned this year for the following topics: Applications of error correcting codes, source encoding, games and decision making, picture processing, computer system theory, theory of intractable problems, transporatation systems, energy systems, state estimation, computer control, and resource planning and management. Papers need not nesessarily be in these areas to receive consideration. 8f2

7. CONFERENCE ON COMPUTER GRAPHICS AND INTERACTIVE TECHNIQUES
July 15-17, 1974
The University of Colorado at Boulder 8g

Contact: Robert L. Schiffman
Computing Center
University of Colorado
Boulder, Colorado 80302 8g1

8. EUROPEAN AISB SCIENTIFIC MEETING 8h

A one-day meeting will be held at the University of Edinburgh on Saturday, 5 January, 1974. The meeting, which is open to both members and non-members of the AISB will last from 9:30 A.M. to 6:00 P.M. 8h1

There will be four talks, followed by discussion, viz: 8h2

'World Models for Blind Robots', by Dr. M. H. E. Larcombe, of the School of Computer science, University of Warwick. 8h2a

'Problem Solving, And-Or Graphs, and Dynamic Programming', by Dr. U. Montanari, of the Instituto di Elaborazione della Informazione, Pisa. 8h2b

'Problem-Solving Paradigms', by Dr. R. Kowalski, of the Department of Computational Logic, University of Edinburgh. 8h2c

The fourth talk will probably be on structured programming by Professor Dijkstra, of the Department of Mathematics, Technische Hogeschol, Eindhoven. 8h2d

The registration fee of 4.00 will include lunch. Unfortunately, the University is unable to provide accommodation, but details of hotels and guest-houses in the Edinburgh area will be sent to prospective participants. 8h3

Further details are available from Lesley Daniel. 8h4

Those wishing to attend should send their fee to: - 8h5

Mrs. Lesley Daniel
Department of Computational Logic
School of Artificial Intelligence

University of Edinburgh
9 Hope Park Square, Meadow Lane
Edinburgh, EH8 9 NW
Scotland 8h5a

9. EUROPEAN ARTIFICIAL INTELLIGENCE AND SIMULATION OF BEHAVIOR (AISB) STUDY GROUP
7-10 July 1974
University of Sussex, Brighton, England 8i

CALL FOR PAPERS 8i1

Papers are requested from any of the following major research areas associated with Artificial Intelligence: 8i2

Natural-Language Understanding (Text and Speech)
Heuristic Problem Solving and Game Playing
Automatic Program Writing
Computer Perception (especially vision)
Artificial Intelligence and Psychology
Robots
Theoretical Foundations of Artificial Intelligence
Special Hardware and Software for AI
Applications of Artificial Intelligence
Social Consequences of AI 8i2a

(It has been decided not to accept papers dealing with statistical pattern-recognition techniques, clustering procedures, alphanumeric text recognition, and such like, since these topics seem to be adequately covered by their own special conferences.) 8i3

Complete manuscripts must be received by 1 February 1974. Authors should submit three copies in final draft form, typewritten, double-spaced, with a maximum of ten pages including figures (about 3000 words); a 100-word abstract and a set of descriptive terms characterizing the content should be included. 8i4

Each paper will be reviewed; acceptable papers will be returned to the authors by March 30, 1974 for recommended modifications and for retyping on special pages that can be reproduced photographically or by stencil. Final versions of accepted papers will be due by May 15, 1974. 8i5

Besides submitted papers, the conference will feature tutorial talks on current topics in AI, special informal discussion sessions, and films. 8i6

A preprint volume containing the papers to be presented at the conference will be distributed to attendees. There will be no hard cover volume of these papers published. The conference committee has no objections to conference authors submitting their papers for publication elsewhere, provided that the paper contains a statement that it was previously presented at AISB. 817

General enquiries about the Conference should be directed to: 818

Dr. K. Oatley
General Chairman, AISB Summer Conference, 74
Laboratory of Experimental Psychology
University of Sussex
Brighton, Sussex BN1 9QG,
England, U.K. 818a

Manuscripts and enquiries about the program should be directed to: 819

Dr. H. G. Barrow
Program Chairman, AISB Summer Conference, 74
School of Artificial Intelligence
University of Edinburgh
Hope Park Square, Meadow Lane
Edinburgh, Eh8 9NW
Scotland 819a

Reservations to attend the Conference should be made by writing to: 8110

Dr. Margaret Boden
School of Social Sciences
University of Sussex
Brighton, Sussex BN1 9QG
England, U.K. 8110a

enclosing a conference fee of 4.00 for non-members of AISB, or 3.00 for members of AISB. This fee will entitle registered participants to attend the sessions, and to receive the booklet of pre-circulated papers. Those wishing to stay at the University will be expected to arrive during the evening of 7 July (though no meal will be provided on that evening) and leave after lunch on 10 July. The total charge for accommodation and meals will be of the order of 14.00 (including VAT), payable on arrival. Application and payment of conference fees should be made as soon as possible, and preferably not later than 30 March 1974. Reservations for accommodations can be accepted between this time and 15 June

1974 with a surcharge of 1.00. We unfortunately cannot guarantee accommodation to people applying after 15 June. 8i11

BOOK REVIEW 9

PURPOSIVE EXPLANATION IN PSYCHOLOGY by Margaret A. Boden
Harvard University Press
Cambridge Massachusetts, 1972 9a

Reviewed by Kenneth Mark Colby of the Stanford University AI Project 9b

Artificial Intelligence is a type of theoretical psychology studying mental symbol-processing functions in living and nonliving, real and abstract systems. Psychology's methods have been limited to experimental, survey, mathematical, interview, and participant-observation approaches. AI adds a new formal method in which theories are cast in the formalism of a programming language. Many workers in AI lack knowledge about psychological theories relevant to their interest. This is the perfect book for them. 9b1

Boden, a Lecturer in psychology and philosophy at the University of Sussex, England, provides a thorough and authoritative analysis of the concept of purpose which is fundamental in explaining both human behavior and the behavior of computer models emulating or simulating it. A great puzzle of the past, how final causes or purposes or goals can determine behavior, now becomes clear if one takes computer models as the key analogy. For it is not the goal-state, which has not yet come into being, which determines behavior but a system's CONCEPT or MODEL of the goal-state which directs its behavior. A convincing argument is then made to show that teleological and mechanistic explanations are complementary, and the latter cannot replace the former without losing explanatory power. 9b2

This scholarly work is packed with information not only about psychological issues central to AI, but also about surrounding and beclouded philosophical problems. Our philosophy and even metaphysics should be clear to us because they influence the system of concepts we choose in trying to understand the world. 9b3

Some of Dreyfus' inanities and confusions are dealt with firmly and without malice; for example, his confounding of a symbolic code with the information coded. Boden suggests McDougall's theory of the mind as an example of a rich theory to be simulated. I would have some reservations about this task, but only because the theory seems too holistic. Model building involves a strategy of simplification and partial approximation by investigating part-processes. But it may be that in case of the mind, we will need all the parts or most of them to have an adequate simulation. 9b4

I not only highly recommend this book--I would insist that any AI theoretician worthy of the name must be familiar with it, and the issues it addresses. My one criticism is directed at the publisher who stodgily sticks to the convention of putting the notes at the end of the book, requiring a serious reader to keep fingers in three positions as he awkwardly flips back and forth between text, notes, and bibliography. 9b5

AI IN OTHER MEDIA 10

1. "The Robot Who Looked Like Me" short story by Robert Sheckley, COSMOPOLITAN MAGAZINE, pp. 192-195, August 1973. (An updated tale of infatuated androids.) 10a

2. "Do Androids Dream of Electric Sheep?" paperback novel by Philip K. Dick (Panther Books Ltd., 1972). 10b

3. "Murder in the Computer" ABC-TV late night movie, Tuesday, December 4, 1973. Garry Merrill plays a science writer who is one of six suspects in the murder of a computer genius. The computer plays chess and wins! Look for the Summer rerun in 1974. 10c

ABSTRACTS 11

ON LOCATING OBJECTS BY THEIR DISTINGUISHING FEATURES IN MULTISENSORY IMAGES by Jay M. Tenenbaum
SRI Artificial Intelligence Center
Technical Note 84, September 1973 11a

This paper reports preliminary work on a knowledge-based perceptual system for a robot that must function in an actual office environment. This system is distinguished by the following pragmatic considerations: 11a1

1. It is designed to find specific objects needed by the robot in the performance of a task rather than attempting the usually unnecessary and very much harder job of completely describing an environment of potentially overwhelming complexity. 11a1a

2. It is based on the premise that in real scenes there is a sufficient redundancy of perceptual clues, as well as contextual constraints among objects, so that an intelligent system can devise a relatively simple strategy for

distinguishing the specific objects of interest from others likely to be present. 11a1b

3. It relies heavily on multisensory (i.e., color and range) data to increase the likelihood of finding distinguishing surface attributes for a particular object. Similarly, detailed descriptive representations for complex attributes (e.g., shape and color) are avoided in favor of the simplest representations sufficient to distinguish the object of interest. 11a1c

(Presented at the Japanese/American Seminar on Picture Processing and Scenee Analysis, Kyoto, Japan.) 11a1c1

COMPUTATION AND DEDUCTION by P. J. Hays
Essex University, England
(Appeared in Proceedings of The 2nd MFCS Symposium, Czechoslovakian Academy of Sciences, 1971) 11b

I argue that the usual sharp distinction that is made between the processes of computation and deduction, is misleading. An intepreter for a programming language and a theorem-proving program for a logical language are structurally indistinguishable. Important benefits, both practical and theoretical, are obtained by combining the best of both methodologies. On the one hand, looking upon the activity of a programming language interpreter as being the generation of proofs of statements often clarifies the semantic structure of the language and allows the design of more efficient interpreters. On the other hand, regarding a theorem-prover as a device which is to be PROGRAMMED (i.e., whose behavior is to be CONTROLLED by its input language), enables the considerable body of work on computational logic technique to be put to practical use in Computer Science, and especially in Artificial Intelligence (AI) applications. In particular, one obtains a new perspective upon problem-solving languages such as PLANNER (Hewitt 1971) and CONNIVER (Sussman & McDermott 1972). 11b1

More specifically: I argue that computation is best regarded as a process of CONTROLLED deduction. It will be furter argued that the two aspects (specifying the base logic and specifying the control mechanism) of programming are best seperated explicitly, as the kinds of language involved have quite distinct semantics. Of course, a theorem-proving program also engages in a process of controlled deduction of consequences of its inputs. The outstanding difference between a conventional theorem-proving program and a conventional interpreter is that in the latter case the control is part of the input statement supplied by the user, while in the former case it is fixed in the program. The techniques of computational logic in no way depend upon this limited notion of control, however. It is the METHODOLOGY of conventional theorem-proving which is responsible for this restriction, and which is here rejected. 11b2

The ideas expounded here are the foundation of a research project begun at Edinburgh and now underway at Essex University. The practcal aim of this work is the design and implementation of a new programming-logical system, called GOLUX <*R1>, suitable for AI work and complex non-numerical computing generally. In part, therefore, this paper is a progress report on GOLUX. 11b3

<R1> "I am the Golux," said the Golux proudly, "the only Golux in the world, and not a mere device." from THE 13 CLOCKS by James Thurber. 11b4

THE LOGICIANS' FOLLY by D. Bruce Anderson
Department of Machine Intelligence
and
Patrick J. Hayes
Department of Computational Logic
University of Edinburgh 11c

Among claims made for the usefulness of theorem-proving to A.I. are that it will enable computers to do formal mathematics (via logic) and that its methods are useful for robot reasoning. We believe that the techniques developed in this field, and indeed any techniques which could be developed by its current methodology (so aptly described as 'Computational Logic') are not useful in either of these ways, though in this paper we argue mainly the latter point. Robot reasoning is central to our philosophy of artificial intelligence - and there seems to be no doubt that knowledge of how to construct a machine which can reason about and act in the real world as well as converse about itself in natural language is a necessary (but not sufficient!) condition for achieving a real artificial intelligence. 11c1

AN EFFICIENT UNIFICATION ALGORITHM by Lewis Denver Baxter
Technical Report CS-73-23
Department of Applied Analysis and Computer Science
University of Waterloo
Waterloo, Ontario, Canada 11d

In "Machine Intelligence" vol. 6, Robinson gives an implementation of the unification algorithm which is the basic pattern matching procedure used in computational logic. He purports that his method is "very close to maximal efficiency."

However, in this paper, it is shown that his method requires exponential amounts of resources. 11d1

Also, an efficient algorithm to unify sets of expressions of first order logic is presented. The algorithm consists of a simplifying transformational phase followed by a (topological) sorting phase. The space required to implement this efficient algorithm is linear in relation to L, the length of the input. It is conjectured that the time requirement is O(L log L), however, a precise estimate is difficult to make due to a connection with the equivalence algorithm. 11d2

INFERENCE AND THE COMPUTER UNDERSTANDING OF NATURAL LANGUAGE by Roger C. Schank
Report No. CS358
Computer Science Department
Stanford University
Stanford, California 11e

The problem of inference and how it affects language understanding is discussed. Ten classes of inference are isolated. A program that accomplishes a limited class of inference tasks from a natural language input is described. 11e1

THE FOURTEEN PRIMITIVE ACTIONS AND THEIR INFERENCES by Roger C. Schank
Report No. CS344
Computer Science Department
Stanford University
Stanford, California 11f

In order to represent the conceptual information underlying a natural language sentence, a conceptual structure has been established that uses the basic actor-action-object framework. It was the intent that these structures have only one representation for one meaning, regardless of the semantic form of the sentence being represented. Actions were reduced to their basic parts so as to affect this. It was found that only fourteen basic actions were needed as building blocks by which all verbs can be represented. Each of these actions has a set of actions or states which can be inferred when they are present. 11f1

THE DEVELOPMENT OF CONCEPTUAL STRUCTURES IN CHILDREN by Roger C. Schank
Report No. CS369
Computer Science Department
Stanford University
Stanford, California 11g

Previous papers by the author have hypothesized that it is possible to represent the meaning of natural language sentences using a framework which has only fourteen primitive acts. This paper addresses the problem of when and how these acts might be learned by children. The speech of a child of age 2 is examined for possible knowledge of the primitive acts as well as the conceptual relations underlying language. It is shown that there is evidence that the conceptual structures underlying language are probably complete by age 2. Next a child is studied from birth to age 1. The emergence of the primitive acts and the conceptual relations is traced. The hypothesis is made that the structures that underlie and are necessary for language are present by age 1. 11g1

THE GOALS OF LINGUISTIC THEORY REVISITED by Roger C. Schank and Yorick Wilks
Report No. CS368
Computer Science Department
Stanford University
Stanford, California 11h

We examine the original goals of generative linguistic theory. We suggest that these goals were well defined but misguided with respect to their avoidance of the problem of modelling performance. With developments such as Generative Semantics, it is no longer clear that the goals are clearly defined. We argue that it is vital for linguistics to concern itself with the procedures that humans use in language. We then introduce a number of basic human competencies, in the field of language understanding, understanding in context and the use of inferential information, and argue that the modelling of these aspects of language understanding requires procedures of a sort that cannot be easily accommodated within the dominant paradigm. In particular, we argue that the procedures that will be required in these cases ought to be linguistic, and that the simple-minded importation of techniques from logic may create a linguistics in which there can not be procedures of the required sort. 11h1

PREFERENCE SEMANTICS by Yorick Wilks
Report No. CS377
Computer Science Department
Stanford University
Stanford, California 11i

Preference semantics [PS] is a set of formal procedures for representing the meaning structure of natural language, with a view to embodying that structure within a system that can be said to understand, rather than within what I would call the derivational paradigm, of the transformational grammer [TG] and generative semantics [GS], which seeks to determine the well-formedness, or otherwise, of sentences. I outline a system of preference semantics that does this: for each phrase or clause of a complex sentence, the system builds up a network of lexical trees with the aid of structured items called templates and, at the next level, it structures those networks with higher level items called paraplates and common-sense inference rules. At each stage the system directs itself towards the correct network by always opting for the most "semantically dense" one it can construct. I suggest that this opting for the "greatest semantic density" can be seen as an interpretation of Joos' "Semantic Axiom Number 1." I argue that the analysis of quite simple examples requires the use of inductive rules of inference which cannot, theoretically cannot, be accommodated within the derivational paradigm. I contrast this derivational paradigm of language processing with the artificial intelligence paradigm. 11i1

THE CONCEPT OF A LINGUISTIC VARIABLE AND ITS APPLICATION TO APPROXIMATE REASONING by L. A. Zadeh
Memorandum No. ERL-M411 (170 pp.), October 15, 1973
Department of Electrical Engineering and Computer Sciences
University of California at Berkeley 11j

By a linguistic variable we mean a variable whose values are words or sentences in a natural or artificial language. For example, "age" is a linguistic variable if its values are linguistic rather than numerical, i.e., young, not young, very young, quite young, old, not very old and not very young, etc., rather than 20, 21, 22, 23,... . 11j1

In more specific terms, a linguistic variable is characterized by a quintuple (, T( ), U,G,M) in which is the name of the variable; T( ) is the term-set of , that is, the collection of its linguistic values; U is a universe of discourse; G is a syntactic rule which generates the terms in T( ); and M is a semantic rule which associates with each linguistic value X its meaning, M(X), where M(X) denotes a fuzzy subset of U. 11j2

The meaning of a linguistic value X is characterized by a compatibility function, c : U -> [0,1], which associates with each u in U its compatibility with X. Thus, the compatibility of age 27 with young might be 0.7 while that of 35 might be 0.2. The function of the semantic rule is to relate the compatibilities of the so-called primary terms in a composite linguistic value - e.g., young and old in not very young and not very old - to the compatibility of the composite value. To this end, the hedges such as very, quite, extremely, etc., as well as the connectives And and Or are treated as nonlinear operators which modify the meaning of their operands in a specified fashion. 11j3

The concept of a linguistic variable provides a means of approximate characterization of phenomena which are too complex or too ill-defined to be amenable to description in conventional quantitative terms. In particular, treating Truth as a linguistic variable with values such as true, very true, completely true, not very true, untrue, etc., leads to what is called fuzzy logic. By providing a basis for approximate reasoning, that is, a mode of reasoning which is not exact nor very inexact, such logic may offer a more realistic framework for human reasoning than the traditional two-valued logic. 11j4

It is shown that probabilities, too, can be treated as linguistic variables with values such as likely, very likely, unlikely, etc. Computation with linguistic probabilities requires the solution of nonlinear programs and leads to results which are imprecise to the same degree as the underlying probabilities. 11j5

The main applications of the linguistic approach lie in the realm of humanistic systems - especially in the fields of artificial intelligence, linguistics, human decision processes, pattern recognition, psychology, law, medical diagnosis, information retrieval, economics, and related areas. 11j6

SEMANTIC MEMORY OF A PROBLEM SOLVER GENERATOR by Franco Sorovich
Computer Science Department
Carnegie-Mellon University
Pittsburgh, Pennsylvania 11k

This paper is concerned with computer semantic memory, i.e., with the problem of representing general knowledge about a given world. The semantic memory issue is raised in the context of the problem of machine learning of heuristics, and the connection with the problem of machine representation of knowledge is emphasized. A brief overview is made of what is known about the mechanisms responsible for the observed human memory behavior. The guidelines for the implementation of a sematic memory are presented. The problem of knowledge representation is tackled in its general form, so that the proposed semantic memory may be of interest also in other fields, like natural language understanding, question answering, or theorem proving. 11k1

A MODEL FOR ADAPTIVE PROBLEM SOLVING APPLIED TO NATURAL LANGUAGE

ACQUISITION by Larry R. Harris
Ph.D. Thesis, TR-133
Computer Science Department
Cornell University
Ithaca, New York 1l1

Adaptive problem solving is the application of artificial intelligence learning techniques to practical problems. The approach taken in studying Adaptive Problem Solving is three-fold. First, to develop a model for Adaptive Problem Solving in order to specify the processes involved in computer learning, as well as the interaction between these processes. Second, theoretically well-founded, practical algorithms are developed for each of these learning processes. Third, as an application of these theories, the Natural Language Acquisition Problem is formulated in terms of the adaptive model. 1l1l

The specification of algorithms to perform learning processes leads to the development of a Bandwidth Heuristic Search, an extension of heuristic search, that includes many practical considerations without forfeiting any theoretical capabilities. A modification of this algorithm, the Bandwidth Heuristic Search for Min/Max trees, is shown to be superior to the - minimax process. 1l12

INFANTS IN CHILDREN'S STORIES - TOWARDS A MODEL OF NATURAL LANGUAGE COMPREHENSION by Garry S. Meyer
M.I.T. AI Memo No. 265, August 1972
Massachusetts Institute of Technology
Cambridge, Massachusetts 1lm

How can we construct a program that will understand stories that children would normally understand? By understand we mean the ability to answer questions about that story. Here we are interested in the understanding of natural language in a very broad area. In particular, how does one understand stories about infants? We propose a system which answers such questions by relating the story to background real-world knowledge. We make use of the general model proposed by Eugene Charniak in his Ph.D. thesis. The model sets up expectations which can be used to help answer questions about the story. There is a set of routines called BASE routines that correspond to our "real world knowledge" and routines that are "put in," called DEMONs, that correspond to contextual information. Context can help to assign a particular meaning to an ambiguous word or pronoun. 1lm1

The problem of formalizing our real-world knowledge to fit into the model is the primary problem here. I discuss a first-level attack on formalizing information about infants and then baby bottles. The contrast between the two leads me to suggest that the same methods can not be used for both inanimate and animate objects. Finally, I outline how a finite-state model of infant behavior can be used to understand infants in children's stories better. 11m2

A COMPUTER MODEL OF SIMPLE FORMS OF LEARNING IN INFANTS by Thomas L. Jones
Graduate School of Business
Howard University
Washington, D.C.
(In Proceedings of the AFIPS 1972 Spring Joint Computer Conference, p. 885.) 11n

A major obstacle in artificial intelligence research has been the cost and difficulty of writing large computer programs. We would like the computer to program itself based on its experience. There has been extensive research on machine learning; this report describes a new form of machine learning, i.e., program learning, in which a subroutine called an experience-driven compiler is used. 11n1

The system solves causality-chain problems of the type solved by human infants; thus, it constitutes a synthesis of artificial intelligence and developmental psychology. The system exhibits several forms of learning considered fundamental by psychologists, including operant conditioning, discrimination learning, and behavior chaining. A detailed proposal for a second version of the system, with higher capability, is available from the author. 11n2

AN INFORMATION PROCESSING THEORY OF ASPECTS OF THE DEVELOPMENT OF WEIGHT SERIATION IN CHILDREN (REV.) by George W. Baylor and Jean Gascon
Psychology Department
University of Montreal
M.C.P. #14 July 1973
(To appear in COGNITIVE PSYCHOLOGY, Vol. 6, 1974.) 11o

Children varying in age from 6 to 11 years were video-tape recorded while trying to seriate seven blocks according to weight with the aid of a scale. The typical behavior patterns that Piaget first described for the stages of intellectual development on this task were observed. Our protocols are analyzed in terms of stage specific base strategies coupled with a mechanism for translating them into task specific production systems. The actual simulation programs, written as production systems in a specially constructed language, BG, are evaluated in terms of how well they regenerate the protocols. 11o1

LITERARY TEXT PROCESSING by Sally Yeates Sedelow
University of Kansas
Lawrence, Kansas 11p

To date, computer-based literary text processing bears much greater similarity to techniques used for information retrieval and, to some degree, for question-answering, than it does to techniques used in, for example, machine translation of 'classical' artificial intelligence. A literary text is treated not as 'output' in a process to be emulated nor as a string to be transformed into an equivalent verbal representation, but, rather, as an artifact to be analyzed and described. 11p1

The absence of process as an integrating concept in computer-based literary text processing leads to very different definitions of linguistic domains (such as semantics and syntactics) than is the case with, for example, artificial intelligence. This presentation explores some of these distinctions, as well as some of the implications of more process-oriented techniques for literary text processing. 11p2

TYPES OF PROCESSES ON COGNITIVE NETWORKS by David G. Hays
State University of New York at Buffalo 11q

The main storage area in a computer simulation of human thought is often organized as a network. Numerous investigators have recently put forth diverse views of the basic issues in network design, of which the first is what types of nodes and arcs are admitted? Recognition of this issue can only lead, however, to the awareness of a more basic problem, namely, what kind of evidence would influence the design of cognitive networks? For some investigators, practical effectiveness is the sole consideration; their field is artificial intelligence, and their purpose is to write computer programs that can be used with profit. For others, the evidence must ultimately come from observation of human beings, on the level of gross behavior or, ultimately, on the level of microscopic activity in the nervous system. 11q1

(Prepared for the 1973 International Conference on Computational Linguistics, Pisa, August 27 - September 1, 1973.) 11q2

LINGUISTICS AND THE FUTURE OF COMPUTATION by David G. Hays
State University of New York at Buffalo 11r

My subject is the art of computation: computer architecture, computer programming, and computer application. Linguistics provides the ideas, but the use I make of them is not the linguist's use, which would be an attempt at understanding the nature of man and of human communication, but the computer scientist's use. In ancient India, the study of language held the place in science that mathematics has always held in the West. Knowledge was organized according to the best known linguistic principles. If we had taken that path, we would have arrived today at a different science. Our scholarship draws its principles from sources close to linguistics, to be sure, but our science has rather limited itself to a basis in Newtonian calculus. And so a chasm separates two cultures. 11r1

PROGRESS IN COMPUTING TECHNOLOGY AND RESEARCH IN ARTIFICIAL INTELLIGENCE by Nicholas V. Findler
Department of Computer Science
State University of New York at Buffalo
Amhurst, New York 11s

An attempt is made in this paper to show how and why work in Artificial Intelligence contributes to progress in computing technology in general. The objectives of two on-going research projects are outlined as illustrative examples. Finally, it is argued that the categories set up in the recent Lighthill report are arbitrary, counterproductive and, for a large number of projects, unusable. 11s1

HEURISTIC PROGRAMMERS AND THEIR GAMBLING MACHINES by Nicholas V. Findler, Heinz Klein, R. Channing Johnson, Alexander Kowal, Zachary Levine, and John Menig
Department of Computer Science
State University of New York at Buffalo
Amherst, New York 11t

Following our paper given at the IFIP Congress 71, another progress report is presented of our ongoing research efforts aimed at human decision making under uncertainty and risk. We have studied many aspects of human and machine learning processes, inductive and deductive inference-making methods, how heuristic rules are formed and optimized by human players, and how similar results can be arrived at by machines. Although the investigations have been within the general framework of the game of Poker, our findings are considered to have a rather wide range of applicability. Also, the complex information processing system at hand incorporates both normative and descriptive theories of certain human behavior. Finally, the results of some empirical explorations are followed by an account of present and planned activities. 11t1

THE INTERPRETATION OF MASS SPECTROMETRY DATA USING CLUSTER ANALYSIS by Stephen R. Heller, Chin L. Chang, Heuristics Laboratory
Kenneth L. Chu, Computer Science Laboratory
Division of Computer Research and Technology
National Institutes of Health
Bethesda, Maryland 11u

The application of a graph-theoretical method of cluster analysis has been used to investigate the classificaton of mass spectral data. The method, the shortest spanning path (SSP), has been used to classify and characterize the mass spectra of straight-chain monofunctional alkyl-thiol esters. 11u1

PATTERN RECOGNITION BY NEAREST NEIGHBOR CLASSIFIERS by Chin-Liang Chang
Division of Computer Research and Technology
National Institutes of Health
Bethesda, Maryland 11v

A nearest neighbor classifier is one which assigns a pattern to the class of the nearest prototype. In this paper, an algorithm is given to find prototypes for a nearest neighbor classifier. The idea is to start with every sample in a training set as a prototype, and then successively merge any two nearest prototypes of the same class so long as the recognition rate is not downgraded. The algorithm is very efficient. For example, when it was applied to a training set of 514 cases of liver disease, only 34 prototypes were found necessary to achieve the same recognition rate as the one using the 514 samples of the training set as prototypes. Furthermore, the number of prototypes need not be specified beforehand in the algorithm. 11v1

SKELETON PLANNING SPACES FOR NON-NUMERIC HEURISTIC OPTIMIZATION by L. Siklossy and M. A. Maecker
The University of Texas at Austin
November 1973 TR-29 11w

The AFTERMATH system implements a heuristic technique for improving long solutions (up to about 250 steps) for robot planning problems. AFTERMATH transforms the given solution into a skeleton solution that focuses attention on repetitious and opposite moves. AFTERMATH attempts to obtain an alternate, improved skeleton. From the alternate skeleton, an alternate solution is built (if possible) to the original problem. If the alternate solution is an improvement, AFTERMATH accepts it as input, and cycles. 11w1

Although not guaranteeing optimality, AFTERMATH improves many solutions, sometimes gradually in several cycles. Examples can be built for which AFTERMATH obtains an arbitrarily large improvement in one cycle. 11w2

COLLABORATIVE PROBLEM-SOLVING BETWEEN OPTIMISTIC AND PESSIMISTIC PROBLEM-SOLVERS by L. Siklossy and J. Roach
The University of Texas at Austin
November 1973 TR-30 11x

An optimistic problem-solver assumes that a problem has a solution and attempts to find such a solution. A pessimistic problem-solver assumes that a problem has no solution, and tries to prove this lack of a solution. When one of the problem-solvers fails to achieve its goal, it is an indication that the other problem-solver may succeed. Moreover, information may be extracted from the failure to help the other problem-solver in its success. In such a case, the two complementary systems are said to collaborate. 11x1

We give examples of collaboration between an optimist, LAWALY, and a pessimist, DISPROVER, which operate on worlds of simulated robots. When collaborating, each system can solve more problems than if it worked alone. 11x2

ENGLISH AS A COMMAND LANGUAGE FOR MACHINES AND THE SEMANTICS OF "LEFT" AND "RIGHT" by Norman Sondheimer
Computer Sciences Department
University of Wisconsin-Madison
Madison, Wisconsin 11y

A speech-understanding system for man-machine communication in unrestricted English is a distant goal. A more feasible task is the development of systems for the control of machines. The English in these command languages should be confinable to small sets of words, simple sentences, and phrases. This should avoid many problems but those of spatial reference would still remain. These include the noncorrespondence of frames of reference and the nonconformity of heuristics that identify the sides of objects. This paper looks at the problems of understanding "left" and "right" as examples of the general phenomena. Conclusions are drawn from these problems that effect the structure of any command language and the general hope for English-based command languages. 11y1

ENGLISH AS A VERY HIGH LEVEL LANGUAGE FOR SIMULATION PROGRAMMING by George E. Heidorn
IBM Thomas J. Watson Research Center
Yorktown Heights, New York

RC 4536 (#20187)
September 21, 1973 11z

An automatic programming system which produces simulation programs from information obtained through natural language dialogue has been implemented under CP/CMS on the IBM 360/67. In the current version the information obtained from an English conversation about a simple queuing problem is used to build a language-independent entity-attribute-value data structure. From this structure both an English description of the problem and a GPSS simulation program for it can be produced. This processing is done by a FORTRAN program which interprets sets of decoding and encoding rules written in a specially developed grammar-rule language. The paper includes a complete sample problem with a discussion of its processing and examples of decoding and encoding rules. 11z1

CLASSIFIED ADVERTISING 12

Situations Wanted: 12a

Edward G. Yalow (Apt. 1-D; 45 Linden Blvd.; Brooklyn, New York 11226) is seeking AI-related employment in the New York City area. He has a BS in Math and is finishing a Masters in Computer Science from Stevens Institute of Technology. 12a1

Employment Opportunities: 12b

University of Edinburgh 12b1

Research Fellow required to work in the Department of Computational Logic, School of Artificial Intelligence. The research of the department is on automatic theorem-proving and related topics in artificial intelligence. 12b1a

The applicant's background and experience should be in one or more of the following subjects: artificial intelligence, computer science, logic, and mathematics. 12b1b

The appointment, funded by a Science Research Council grant, will be for a period from as soon as possible until 30th September 1975. Renewal thereafter will be dependent upon continued Science Research Council support. The salary will be on the University Lecturer scale in the range 1,929 to 2,553 per annum, with normal increments and F.S.S.U. benefits. 12b1c

Applications, giving curriculum vitae, an account of professional experience and publications, and names of two referees, should be sent as soon as possible to: 12b1d

Professor Bernard Meltzer
Department of Computational Logic
8 Hope Park Square
Edinburgh EH8 9NW, SCOTLAND. 12b1d1

[Ed. Note: Classified advertising is accepted for positions wanted or offered in the field of AI. We reserve the right to edit unsolicited ad copy.] 12c

AI IN THE MOVIES by Steve Coles 13

WESTWORLD, one of the two films suggested to arrive in 1974 <*R1>, already appeared in late October 1973. The film, written and directed by Michael Crichton (Andromeda Strain, The Terminal Man <*R2>, Pursuit), stars Yul Brynner, Richard Benjamin, and James Brolin. Brynner plays the role of a "robot gunslinger" in a giant amusement park of the future styled after Disneyland. Guests pay $1000 a day to relive the excitement of the Old West, including the opportunity to engage the gunslinger in a showdown fight in which they are guaranteed to outdraw and kill it. The guarantee is somewhat dubious, however, since the alleged advertisement for Westworld says, "Boy, have we got a vacation for you...where nothing can possibly go worng." 13a

Perhaps the greatest disappointment in Westworld, however, is the total abandonment of intellectual standards by Michael Crichton in bringing the story premise to a logically coherent as well as visually exciting conclusion. From the time Westworld begins to disintegrate, the plot also begins to degenerate into a rising crescendo of internal inconsistencies with ruthless violence seemingly the only message. It seems strange that inconseqential perturbations in the script (that could not possibly have influenced the films success or failure in the market place, but which could have salvaged its internal consistency) were not made by a man who I know should know better (He has an M.D. degree from Harvard). I counted at last a dozen instances of this sort, ranging from the implausibility of mechanical systems subject to a biological-style epedemic infection to the unlikely prospect that a gunslinger robot could easily drink a shot of wiskey at the bar (at the beginning of the film) while a female android, based on the same technology, could not (at the end of the film) take even a sip of water without going up like a Christmas tree of electrical sparks. Maybe next time Crichton treats the subject of robots in a film or novel he will call for advice from an AI expert. Do I hear any volunteers? 13b

REFERENCES 13c

<R1> SIGART Newsletter, No. 41, p. 56, June 1973 13c1

<R2> SIGART Newsletter, No. 36, pp. 43-44, October 1972. 13c2

DISCOUNT ON THE MACHINE INTELLIGENCE SERIES By George Ernst
Case Western Reserve University
Cleveland, Ohio 14

Last Spring, David Gelperin, a SIGART member, informed me that Halsted Press, the publisher of the Machine Intelligence Series, has a group discount plan. ACM Headquarters has given SIGART permission to make use of this discount plan provided that SIGART does all of the paper work, which I have agreed to do. 14a

The last four volumes of MACHINE INTELLIGENCE are available under this plan. The following table summarizes the saving that a SIGART member will realize: 14b

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Volume 4	$15.00	$11.10	$3.90
Volume 5	22.50	26.45	6.05
Volume 6	30.25	22.00	8.25
Volume 7	30.00	21.80	8.20

14b1

Note that the SIGART price is list price-discount + handling + postage. 14c

It is very important to realize that Halsted Press will not bill individuals. In fact, we only get the discount if we order 10 or more books at one time. For this reason, a SIGART member who wishes to participate in this discount plan must precisely carry out the following steps: 14d

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Step 4: Send the mailing labels, the check or money order, and the order form to 14d1

Prof. George W. Ernst
Computing and Information Sciences Department
Case Western Reserve University
Cleveland, Ohio 44106

BEFORE FEBRUARY 15, 1974. 14d1a

On February 15, I will forward the orders as a group to Halsted Press and you should receive them shortly thereafter. 14d2

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[] Send me one (1) copy of MACHINE INTELLIGENCE, Vol. 4 at a cost of $11.10. 14e1

[] Send me one (1) copy of MACHINE INTELLIGENCE, Vol. 5 at a cost of $16.45. 14e2

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[] Send me one (1) copy of MACHINE INTELLIGENCE, Vol. 7 at a cost of $21.80. 14e4

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SIGART NEWSLETTER Number 43 December 1973

(J25198) 23-JAN-75 20:40;;;; Title: Author(s): L. Stephen Coles, Richard E. Fikes/LSC REF; Distribution: /DVN([INFO-ONLY]) KIRK([INFO-ONLY]) GCE([INFO-ONLY]) ; Sub-Collections: NIC; Clerk: DVN; Origin: <SIGART>DEC73.NLS;46, 26-DEC-73 09:39 KIRK ;####;

SIGART NEWSLETTER Number 43 February 1974

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SIGART NEWSLETTER

The SIGART Newsletter is a bimonthly publication of the Special Interest Group on Artificial Intelligence of the Association for Computing Machinery. The Newsletter reports on projects being conducted by the artificial intelligence research community and generally reviews current progress in the state-of-the-art. Correspondents report news from local SIGART Chapters and other AI Centers.

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 6 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), Advertisements (New Products or Classified Advertising), Puzzles, Poems, Cartoons, etc. Material may be reproduced from the Newsletter for non-commercial purposes with credit to the author and SIGART.

Anyone interested in acting as editor for a special issue of the Newsletter devoted to a particular topic in AI is invited to contact the Editor. Letters to the Editor will be considered as submitted for publication unless they contain a request to the contrary. Technical papers appearing in this issue are unrefereed working papers, and opinions expressed in contributions are to be construed as those of the individual author rather than the official position of SIGART, the ACM, or any organization with which the writer may be affiliated.

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Copy deadline for the February Issue: March 25th.

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ABSTRACTS

CLASSIFIED ADVERTISING

AI IN THE MOVIES
by
Steve Coles

(J25199) 23-JAN-75 20:42;;;; Title: Author(s): L. Stephen Coles, Richard E. Fikes/LSC REF; Distribution: /DVN([INFO-ONLY]) KIRK([INFO-ONLY]) GCE([INFO-ONLY]) ; Sub-Collections: NIC; Clerk: DVN; Origin: <SIGART>FEB74.NLS;3, 7-DEC-73 17:46 KIRK ; .D=On; .DLD='<; <DRD='>;
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<H1Sw=Off> <H2Sw=Off> <SNF=0> ####;

SIGART NEWSLETTER Number 40 June 1973 1

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-- 1a

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 6 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), Advertisements (New Products or Classified Advertising), Puzzles, Poems, Cartoons, etc. Material may be reproduced from the Newsletter for non-commercial purposes with credit to the author and SIGART. 1b

Anyone interested in acting as editor for a special issue of the Newsletter devoted to a particular topic in AI is invited to contact the Editor. Letters to the Editor will be considered as submitted for publication unless they contain a request to the contrary. Technical papers appearing in this issue are unrefereed working papers, and opinions expressed in contributions are to be construed as those of the individual author rather than the official position of SIGART, the ACM, or any organization with which the writer may be affiliated. 1c

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Copy deadline for the August Issue: July 23th. 1e

CHAIRMAN'S MESSAGE

2

The SIGART Chairmanship has a two year term of office, and thus, this is my last Chairman's message. I am very happy to announce that the new Chairman of SIGART will be Bob Balzer. Bob was appointed to this position by Tony Ralston, the president of ACM, and will take over at the end of June. 2a

Bob got his Ph.D. in Electrical Engineering through the Systems and Communication Sciences program at Carnegie Institute of Technology in 1966. From Carnegie, he went to RAND until last year when he left to help form the Information Sciences Institute at the University Of Southern California. Bob has had various publications in AI but is known for his work in automatic programming. 2b

I would like to take this opportunity to thank the people who have donated their time and services to SIGART over the past two years. These include people who have helped referee papers for SIGART sessions at national conferences and the speakers and the panelists who gave SIGART a series of stimulating meetings at national conferences. I would like to thank Larry Travis for serving as Vice-Chairman and Richard Lee who has been the Secretary-Treasurer during my term of office. But most of all, I would like to thank the two newsletter editors, Woody Bledsoe and Steve Coles, that I have had the pleasure to work with. Both of these men have done an outstanding job on the newsletter, which costs them a large amount of their personal time, and they are mainly responsible for the steady growth of SIGART during my term of office. 2c

G.W.E. 5/30/73 2d

EDITORS' ENTRY

3

1. ON-LINE NEWSLETTER 3a

As you probably know, recent issues of the SIGART Newsletter are available on NLS files in the directory <SIGART> of the Network Information Center (NIC) at SRI. We are continuing to expand the user facilities for the on-line Newsletter with the goal of making interaction easier, so that it will be a meaningful addition to the ACM published version of the Newsletter. Since each issue is prepared on-line and there is typically a four to six week delay between the time Steve and I finish preparation of an issue and the time you receive it in the mail, material in the latest on-line issue is considerably "fresher" than the mail-delivered version. 3a1

In addition, there is now a facility for easily making comments on any item in any issue of the on-line Newsletter. Pointers to all comments on a particular item are added to the on-line version of the item so that anyone accessing the item will be aware of the comments and can easily access them. All such comments will also be reproduced in the FORUM section of the mail-delivered Newsletter. Finally, items for upcoming issues can be submitted to Steve and me over the NET by using the JOURNAL subsystem in NLS. Your SIGART reporter is familiar with this procedure and can assist you when necessary. 3a2

There is a documentation file named <SIGART>NEWS.NLS that contains the basic information needed to use the on-line Newsletter. This file can be accessed by first logging in to host SRI-ARC (obtain an "ident" from your local SIGART reporter), and then carrying out the following sequence of commands: 3a3

@TNLS 3a3a

*load file <SIGART>NEWS.NLS <CR> 3a3b

*print <CR> 3a3c

For on-line help anytime in the SRI-ARC system, type a question mark and the system will list possible commands and possible/required user input as appropriate. To access information in the NIC on-line library from the TENEX EXEC level type "NIC". This makes NIC informaton available, e.g., the Network Resource Notebook and phone numbers for calling NIC. In addition, the SIGART reporters have been sent information on how to use the NLS system and can provide further assistance. 3a4

R.E.F. 6/13/73 3a5

2. CORRECTIONS
----------- 3b

Professor Donald Michie, of Edinburgh University, has asked us to correct a mis-statement which appeared in item 7 of the Editor's Entry in the last issue of the SIGART Newsletter (Number 39, April 1973, p. 6). Sir James Lighthill did indeed visit the School of Artificial Intelligence at Edinburgh University while he was preparing his report. The invitation which he declined was to visit the meeting at Loch Tay held around that time by the Firbush Robot Group. The source of our report appears to have confused these two matters. 3b1

Another error was pointed out by Hans Berliner in his letter on p. 21 of the last issue. His opening paragraph should have read, "Though I usually prefer to smile (benignly) when chess amateurs discuss chess positions, or computer amateurs discuss computer problems, the discussion in the SIGART Newsletter of February 1973 was a little too much for me." A typist's omission inadvertently deleted the phrase "chess positions, or computer amateurs discuss." We regret these errors. 3b2

3. AI DEBATE
--------- 3c

We have had more than 28 requests for the cassette tape of the Berkley Debate on Artificial Intelligence, as advertised in the February SIGART Newsletter (No. 38, p. 6, #5). Since this number exceeded our requirement for a minimum of 20 orders and appropriate permissions were obtaned from the participants, requesters should expect to recieve their copy soon if they haven't already done so. (Since a C-120 cassette was needed to cover the full duration rather than a C-90 as originally believed, the price per copy was $6.00 rather than the $4.00 initially quoted.) 3c1

4. PAJARO DUNES
------------ 3d

The Third Pajaro Dunes Conference on Computer Vision is summarized in this issue (p. 14) by Jay M. Tenenbaum and Harry Barrow. The Pajaro Dunes Conference on Automatic Problem Solving held shortly thereafter will be summarized in the next issue by Nils Nilsson. 3d1

5. ADDITIONAL NEWSLETTER REPORTERS
-------------------------------- 3e

(1) Mrs. A. Patricia Ambler — The University of Edinburgh, Scotland
(2) Prof. Makoto Nagao — Kyoto University, Japan
(3) Dr. Nagob A. Badre — IBM, Yorktown Heights
(4) Mr. William Henneman — The University of Texas at Austin 3e1

6. LIGHTHILL REPORT AVAILABLE 3f

The final published version of the Lighthill Report (plus comments) has now been released and can be obtained by writing for "Artificial Intelligence: A Paper Symposium," dated April 1973, to the 3f1

Public Relations Unit
Science Research Council
State House
High Holborn
London WCIR 4TA, ENGLAND 3f1a

7. IJCA-73 3g

A. The Advanced Schedule and Conference Data for IJCAI-73 can be found in this issue on p. 24. Prof. Max Clowes has asked us to tell you that registration information not already contained in this issue cannot be obtained from him. One should write directly to 3g1

Mr. Lester Earnest
Local Arrangemens Chairman
Aritificial Intelligence Project
Stanford University
Stanford, California 94305
U.S.A. 3g1a

B. I look forward to seeing you all in August. 3g2

L.S.C. 6/17/73 3h

USC INFORMATION SCIENCES INSTITUTE - A BRIEF OVERVIEW by Rob Hoffman
USC Information Sciences Institute
Marina Del Rey, California 4

ISI was founded in May 1972, as part of the University of Southern California School of Engineering, and reports to the Dean of Engineering, Dr. Zohrab Kapriellian. The Institute has grown to a staff of approximately 55 people, including 25 full-time researchers and 10 graduate students, and has obtained its initial funding through a 3-year ARPA contract. 4a

Institute Charter
----------------- 4b

Broadly, the Institute is dedicated to developing and applying advanced techniques to significantly enhance the use of computers in major areas of national need. We do not wish to compete with commercial software firms in the development of applications software, nor to be solely an AI laboratory. Instead, a major goal is to use real-world problems. We intend to produce well-developed, advanced applicatons systems that exemplify the AI viewpoints on the tolerance, extensibility, flexibility, and power that good systems can provide their users. The Advanced Automation and Software Assurance/Verification projects described below are directly motivated by this goal; the Network Communications and MLP-900 projects are complementary tool-building efforts; and Automatic Programming is an AI research program designed to increase the base on which AI applications can grow. In the near future, we hope to begin building intelligent automated environments in the medical and office services areas. 4b1

There are currently five major projects at ISI (project leaders are shown in parentheses): 4b2

Software Assurance/Verification (Ralph London)
-- 4c

This research involves three areas: 4c1

First, a survey of contemporary operating systems to characterize them in a security sense, to identify their strengths and vulnerabilities, and to develop an empirical methodology for discovering security flaws; 4c2

Second, the formalization of issues relating to protection in operating system design. The goal is to identify the necessary elements of a protection mechanism, to develop a formal methodology for characterizing and modelling various protection schemes, and to evaluate them with respect to sufficiency; and 4c3

Third, the development of an automated program verification system. In this system, the author of a computer program can interactively submit the source code of the program, augmented by assertions to be proven about the code. The output of the system would either be a formal proof of the assertions or a description of why the assertions cannot be proven. 4c4

Advanced Automation (Robert Anderson)
--------------------------------------- 4d

This project has just finished a detailed study of the potentials for increasing manufacturing productivity through the use of advanced computer-based methods such as robotics, scene analysis, and problem solving. 4d1

An ISI report entitled "Advanced Computer-Based Manufacturing Systems for Defense Needs" will be published soon containng the findings of this study. The report includes a detailed economic analysis of DOD procurement which pinpoints the products, labor categories, and technologies which dominate defense spending for discrete manufactured goods. 4d2

Our study has shown that the vast majority of manufactured goods for DOD use are batch manufactured. Consequently, the allocation and control of resources in a batch manufacturing environment is one of the greatest problems existing today on which computers could have a major impact. 4d3

We have also concluded that the range, diversity, and precision of assembly and inspection tasks required for DOD products makes it unlikely that robotics and pattern recognition will have major impacts in these areas within this decade. 4d4

During the next several months, we intend to analyze and document the various information and control transactions currently existing within several batch manufacturing facilities; this analysis will lead to specifications for a real-time information system which can both improve the existing information flow and, more importantly, provide a "window" into a complex information environment. This window will allow the evaluation of various AI software techniques for scheduling, modeling, decision-making, and natural man-machine interface in a real production situation. 4d5

Automatic Programming (Robert Balzer)
-------------------------------------- 4e

This project is studying methods for significantly reducing the effort needed to get a task performed by a computer. The work is part of a focused national program to provide a working definition of automatic programming, determine goals for such systems, and identify key technical problem areas. Among the areas of required development, the group is investigating "Problem Acquisition": the acquisition of models of problem domains from natural language discourse with the user. 4e1

Network Communications (Tom Ellis)
------------------------------------ 4f

Two Network activities are underway, the largest of which is a study of the effects of a packet-switched network on continuous speech signals in interactive communication. This project will develop ways of partitioning and reconstructing voice-stream signals to provide the appearance of real-time. A dedicated computer has been modified for initial in-house real-time experiments using full bandwidth signals while simulatng the characteristics of present and possible future packet-switch communication facilities. The processing requirements implied by human-factors considerations and communication system characteristics are likewise being studied. A signal processor will be attached to the ARPANET for implementation of speech compression algorithms. 4f1

The second project is an effort to identify the problems of transparent networking in a heterogenous network. The problem domain is the cooperation of remote subroutines and processes. 4f2

Programmable Research InstruMent - PRIM
(Lou Gallenson, Donald Oestreicher)
------------------------------------ 4g

The aim of this project is to create a fully protected experimental computing environment with continuous multi-user access. The I/O and user interaction facilities will be provided by TENEX. The computational facilities will be provided by the STANDARD Computer prototype MLP-900, a flexible and powerful microprogrammed processor. Each researcher will be able to create his own specialized computing engine capable of being changed and adapted to his specific needs. This facility will be available to users in late 1973 through the existing ISI TENEX host configuration on the ARPANET. 4g1

The initial task of this project has been to complete the prototype MLP-900, a vertical-word synchronous 200ns cycle-time microprocessor with 4K words of writeable control store, and to interface it to the PDP-10 memory via paging facilities. 4g2

Thus, the PRIM project will create an ARPANET based shareable design environment, which will be used as a means of exploring computer architecture, language development, and special purpose processor design. 4g3

Institute Computing Facilities (John Melvin)
-- 4h

To support the above projects, and also for remote use via the ARPANET, the Institute operates a large TENEX time-sharing facility. This system runs on a DEC PDP-10 with 256K words of core, a high-performance paging drum, 4 disks, and associated peripherals. Local access is through 25-line alphanumeric display terminals in most offices. These will be replaced within a year by a TV based system capable of displaying a full page of high-quality text and graphics. The installation of a Xerox Graphics Printer is planned shortly to provide for the formal printing and graphics needs of the Institute. Finally, a STANDARD IC-4000 computer (roughly IBM 7094 class) is available for special projects, and is currently being used by the Network Communicatons project in speech processing experiments. 4h1

For further information on ISI please contact any of the people named above, or Keith Uncapher, Director, Telephone: 213-822-1511. 4h2

HIGHLIGHTS OF RESEARCH ACTIVITIES IN THE NIH HEURISTICS LABORATORY
by
R.C.T. Lee
Heuristics Laboratory
Division of Computer Research and Technology
National Institutes of Health
Bethesda, Maryland 5

The research scope of the Heuristics Laboratory has been recently extended to fields outside of artificial intelligence and has been emphasizing the application of A.I. techniques to solve bio-medical problems. During the six month period, ending April 15, 1973, members of this laboratory have been engaged in research on clustering analysis, pattern recognition, theorem proving, tissue-typing, radiology treatment planning, chemical information searching, information storage and retrieval, modelling of hormone-cycles, computer scheduling problems and interactive mathematical modeling. The following are some highlights of our results. 5a

(1) The Clustering Analysis Project:
--------------------------------- 5b

Slagle and Lee developed a hierarchical clustering analysis program which is based on a one-dimensional clustering algorithm. They applied their program to human chromosome data, aromatic ring data, and composition of mammal's milk data (see Slagle and Lee 1973). Slagle also cooperated with Chang and developed a clustering program which is based upon minimal spanning paths. The output of their program is a reorganization of the input data matrix and will show clusters if there are any. The program worked very well on some mass spectra data (see Slagle, Chang, and Heller 1973). Both clustering programs have been applied to a set of drug data (tranquilizers, sedatives) and yielded encouraging results. The experimental results will be reported in a paper which is being drafted. 5b1

(2) The Pattern Recognition Project: 5c

Chang developed a piecewise pattern recognition procedure. His paper has been accepted by IEEE Trans. on Computers (see Chang 1973). Hodes showed that many problems from the general area of linear inequalities can be expressed in the elementary theory of addition on the real numbers (EAR). He also described a method for eliminating quantifiers in EAR and demonstrated its usefulness in solving problems related to linear programming (see Hodes 1972). Lee and a group of chemists and a pharmacologist have reported that it is possible to predict drug activities by analyzing the mass spectra of the drugs. The result was published in Science (see Ting, Lee, Milne, Shapiro, and Guarino, 1973). 5c1

(3) The Tissue-typing Project: 5d

The immunological test involves mixing some of the testee's white blood cells with each serum in a panel of 60 human serum samples. The antibodies in some of the sera will attack the white cells. In other sera there is no attack. From these test results the tissue types (HL-A numbers) of the testee may be deduced. There are approximately 30 different HL-A types and each individual's tissues is characterized by 4 (not necessarily distinct) HL-A types. The problems is complicated by the fact that it is very difficult to obtain mono-specific sera. Most in the panel of 60 sera attack two or more HL-A types. Thus the problem of deducing the HL-A types from the test results is non-trivial. Allowances must also be made for cross reactions and laboratory errors. Dixon and Norton wrote programs to determine HL-A numbers, given the test results. A talk was given by Dixon on this work in Kansas City. 5d1

(4) The Radiology-treatment Planning Project: 5e

Hodes has developed a semi-automatic optimization technique for external radiation-treatment planning. The result was reported in (Hodes 1973) and accepted by Radiology. 5e1

In the past six months, the following papers have been published: 5e2

(1) Chang, C.L. and Lee, R.C.T. (1971). A Heuristic Relaxation Method for Nonlinear Mapping in Cluster Analysis, IEEE Trans. on SMC, Vol. SMC-3, No. 2, March 1973, pp. 197-200. 5e2a

(2) Dixon, J. (1973) Z-Resolution: Theorem Proving with Compiled Axioms, JACM, Vol. 20, No. 1, Jan. 1973, pp. 127-147. 5e2b

(3) Hodes, L. (1972): Solving Problems by Formula Manipulation in Logic and Linear Inequalities, Artificial Intelligence, Vol. 3, 1972, pp. 165-174. 5e2c

(4) Ting, K.L.H., Lee, R.C.T., Milne, G.W.A., Shapiro, M., and Guarino, A.M. (1973): Applications of Artificial Intelligence: Relationships between Spectra and Pharmacological Activity of Drugs, Science, Vol. 180, 1973, pp. 417-420. 5e2d

Inthe past six months the following papers have been accepted: 5e3

(1) Chang, C.L. (1973): Pattern Recognition by Piecewise Linear Discriminant Functions, accepted by IEEE Trans on Computers. 5e3a

(2) Chang, C.L., Lee, R.C.T., and Dixon, J. (1973): The Specialization of Programs by Theorem Proving, accepted by SIAM J. on Computing. 5e3b

(3) Hodes, L. (1973): Semiautomatic Optimization of External Beam Radiation Treatment Planning, accepted by Radiology. 5e3c

In the past six months the following papers have been written: 5e4

(1) Slagle, J.R., and Lee, R.C.T., (1973): A Hierarchical Cluster Analysis Program based on a One-Dimensional Clustering Algorithm. 5e4a

(2) Slagle, J.R., Chang, C.L., and Heller, S.R. (1973): A Data Reorganizing and Clustering Algorithm and an Application to Chemistry. 5e4b

(3) Hodes, L. (1973): Solving Linear Inequalities and an Application to Pattern Classification. 5e4c

(4) Slagle, J.R. (1973): Automated Theorem-proving for Theories with Simplifiers, Commutativity, and Associativity. 5e4d

All of the above mentioned papers can be obtained by writing to the Heuristics Laboratory, N.I.H., Bethesda, Md. 20014. 5e5

SUMMARY OF THE THIRD PAJARO DUNES CONFERENCE ON COMPUTER VISION by Jay M. Tenenbaum (SRI) and Harry Barrow (University of Edinburgh) 6

The Third Annual Pajaro Dunes Conference on Computer Vision brought together twenty-five researchers and graduate students representing most of the major research centers. Several industrial firms interested in applying perception research to advanced automation also sent attendees. 6a

Such a gathering provides an excellent opportunity to survey current research themes. Here we can only list some of the interesting work. Details can be obtained by writing directly to the people involved, or to Jay Tenenbaum at Stanford Research Institute. 6b

Bob Chien (University of Illinois) is initiating a research program in computer vision and is in the process of constructing a facility for doing on-line experimentation. David Waltz will be leaving MIT to join him in this effort. 6c

Ruzena Bajacsy (University of Pennsylvania) has been interested in obtaining semantic descriptions of furniture and room scenes, and in using these descriptions to guide a scene analysis program. She has also written a top-down program that finds bridges in multi-sensory earth resource satelite imagery. 6d

Harry Barrow (University of Edinburgh) reported on an assembly system which can assemble simple toys given a kit of parts scattered on the work table. The system is programmed to recognize the various parts by showing it examples (See Figures 1-4). 6e

Azriel Rosenfeld (University of Maryland) talked about recent work in his group: The application of an edge operation to detect sharp angles in chain encoded curves; a comparative study of the cost-effectiveness of several well-known edge operators; a study with McLeod which showed one could account for the experimental evidence concerning relative detectability of different frequency square waves (used by physiologists to hypothisize the existence of Fourier analysis in the human visual system) by postulating an edge detector with a cross-sectional sensitivity; a paper based on work of the psychologist J.S. Beck at his laboratory, promoting the value of non-purposive scene organization as a preliminary stage of goal-directed perception. 6f

6g

M. Weinstein and Martin Levine (Jet Propulsion Laboratory) described work on a vision system for a Mars robot that will enable it to describe rocks and obtain information needed for navigation and manipulation. An efficient heuristic approach to stereo correlation has been demonstrated on scenes of natural terrain. 6h

Ken Kastleman (Jet Propulsion Laboratory) described work on biological image processing: a computer attached to a microscope can classify or tabulate chromosomes, blood cells, etc. Objects are automatically detected on a moving stage and brought into focus. A system was also developed for aiding the study of 3-dimensional cell structure; stereo image pairs are generated from a stack of individual focus planes slicing the specimen. 6i

Joe Olszen (General Motors Research Laboratry) reported on the establishment of a new group concerned with vision for industrial automation. An important goal is real time inspection of parts on a moving assembly line (e.g., check dimensions, part integrity, surface finish, etc.). They are currently setting up a vision laboratory consisting of a PDP 11/45, interfaced to a TV camera and an IBM 370/165 time-sharing system. The latter supports a 2250 graphics console. The group has already accomplished an impressive demonstration wherein a wheel is automatically mounted on a hub using vision to align the holes and studs. 6j

Claude Fenemma (3M Company) revealed similar intentions on the part of his company to apply artificial intelligence techniques to industrial problems such as inspecting tapes for surface flaws. 3M will use a PDP 11/45 and an image disector camera for experimentation. 6k

Jay Tenenbaum, Dick Duda, Tom Garvey, Peter Hart, and David Nitzan (Stanford Research Institute) outlined their current research. A basic industrial inspection system has been developed which can recognize objects viewed on a moving belt and determine their orientation. The system can be rapidly reprogrammed by showing it examples of new objects and pointing out (in a graphics display) key distinguishing features. Also, a knowledge-based perceptual system is being built that will enable a robot to acquire information necessary to function in an actual office-environment. This system is based on the premise that in real scenes there is a sufficient redundancy of perceptual cues, as well as contextual constraints among objects, so that an intelligent system can devise effective means of finding specific objects of interest. 6l

Jerry Feldman (Stanford University) presented films of the Stanford hand-eye system assembling an automobile water-pump. The program relies mainly upon the force-feedback arm routines of Lou Paul, using vision on only two occasions. It locates the pump body (painted white on a black background) visually and computes its position and orientation (assuming it's right way up). The pump is then moved into a standard position, guide pins inserted, and a gasket fitted over them by feel. The position of the gasket is checked visually by taking a second picture and performing a differencing operation. The top of the pump is fitted over the guides and a power screw-driver is picked up. Screws are picked from a feeder with the screw driver, inserted in place of the guide pins, and tightened. The importance of this demonstration lies in the illustration that current hand-eye expertise can deal with real tasks, abeit by highly customized programs. 6m

Feldman next described the thesis work of Gunnar Grape. Grape's program interprets real pictures of polyhedral scenes. It runs an edge finder and line fitter on the picture and concocts tentative vertices. At an early stage it looks for features consisting of a few lines (typically two adjacent vertices and the edge joining them). These suggest object models (essentially 2-D) which in turn suggest locations to look for further features. Objects are pulled out one by one, and an interpretation of the picture is sought that minimizes imperfections of matching. 6n

Walter Perkins (Stanford University AI Laboratory) developed a program which finds corners in cluttered polyhedral scenes. It uses a Hough transformation of data from a Heuckel edge operator to locate strong lines and models of the desired corner (including intensity information) to guide the search. 6o

Y. Yakomavsky (Stanford University AI Laboratory) talked about his work on analyzing pictures of real road scenes. The crucial feature of his work is a segmentation algorithm that merges elementary regions with similar attributes and semantic interpretations (essentially 2-D). Merging is also guided by the likelihood of the resulting global interpretation. Figures D-1 to D-5 illustrate the analysis. 6p

Lynn Quam (Stanford University) reported on a heuristic approach to picture matching (correlation). Two scenes are each partitioned into cells. Likely pairs of corresponding cells are determined by matching cell properties (e.g., color, average brightness, brightness variance). The best set of topologically consistent pairings is then found by a heuristic search. This system can successfully analyze stereo pairs taken from a relatively wide separation without explicit camera models. Quam then described a new project, which will use this technique to compare consecutive scenes observed by a moving cart. The match will enable the computer to infer the relative change in position of the cart between pictures, which in turn will allow incremental scene analysis. 6q

6r

Pat Winston (MIT AI Laboratory) intimated that his vision group had reached a plateau; the blocks world was sufficiently well understood and interest was being directed towards objects with curved surfaces and texture. A crucial problem is 3-D representation and description of such objects. A new field of activity is beginning. It is intended to study the practical application of AI techniques, including vision, to the assembly and repair of printed-circuit electronics. 6s

Nick Horn (MIT AI Laboratory) reiterated Pat Winston's point about 3-D modelling and expressed interest in depth cues, particularly motion parallels. 6t

Raj Reddy (Carnegie-Mellon) listed a set of criteria by which perception research should be evaluated. For example, are the techniques extendible or are they ad hoc and tied to the characteristics of a particular environment? Raj also listed some disclaimers which he felt should be explicitly included in research reports to help readers properly evaluate the contributions, e.g., what types of knowledge were utilized (syntactic, probabilistic, semantic, etc.), what is the underlying perceptual model (analysis by synthesis, heterarchy, goal-directed, etc.), how were the results affected by the particular sensor used, how constrained was the environment (absence of glare or shadows, limited number of objects, absence of occlusions, etc.). 6u

Tom Binford and Ram Navatia (Stanford University AI Laboratory) described a shape representation appropriate for a class of curved objects, and a system for obtaining such representations using a laser range-finder. The representation is based on the notion of generalized translational invariance; parts of objects are described by a 3-dimensional medial axis and a cross section which can vary in size and shape along the axis. Parts are segmented at an abrupt change in cross section. Object descriptions can be summarized in gross terms such as the number of parts, the length and maximum radius of each part, etc. to facilitate retrieval during recognition. 6v

CHESS
----- 7

[Ed. Note: In the recently published game between MAC HACK (White) and Grivet/Marshall/Yommi (Black) [SIGART Newsletter, No. 39, April 1973, p. 23], an interested reader suggests that Black has a win even at the point where they thought they were lost! In particular, if 7a

26. B-K2, QXR!!
27. NxQ, B-K5!
28. QxB (else P-R7 wins), PxQ
29. B-B1, P-R7
30. B-N2, R-K1 7a1

followed by R-K3, P-B4, R-N3 or R3 yields a winning line.] 7a2

AN ADVICE-TAKING CHESS COMPUTER * by Albert L. Zobrist and Fredric R. Carlson, Jr.
University of Southern California 7b

It has now been 24 years since Claude Shannon outlined how a computer could play chess. This paper describes how a chess program can take lessons from a master (Charles I. Kalme, rating 2,455, also of U.S.C.). 7b1

HISTORICAL NOTE Von Kempelen's Chess Automaton
Magazine Section
Chicago Tribune
April 8, 1973 7c

Over 150 years ago New Yorkers flocked to watch chess games played by a near unbeatable automaton--a wooden figure of a Turk seated at a chess board atop a cabinet full of machinery. The Turk was built in 1769 by a Baron von Kempelen to amuse Austrian Empress Maria Theresa. It outplayed such notables as Frederick the Great, George III, Ben Franklin, and Napoleon. Napoleon cheated, and the Turk swept the pieces off the board in anger. 7c1

----
*Scientific American, Vol 228, No. 6, June 1973, pp. 92-105. 7c2

Eventuallythe machine was bought by Johann Maelzel, a German inventor and promoter. In 1825, one step ahead of the sheriff, Maelzel came to America and set New York on its ear. For 50 cents a head (big money then), the public flocked to see the wooden Turk move the chess pieces with a sure hand--and beat all comers. 7c3

Before each performance Maelzel opened the cabinet to show the complicated machinery. Then he closed the box, wound the machine with a key, and the game began. How did it work? Everyone wondered. Then one day a couple of smart kids spied through a skylight after a performance. From the cabinet emerged a man. The kids couldn't wait to reveal their discovery.* 7c4

The cabinet was a clever magician's box, so constructed that a grown man could slide back and forth inside to remain concealed when the doors were opened. The machinery was all for show. The man inside observed play from below and manipulated the Turk by levers to pick up the pieces and make the usually winning moves. 7c5

Of the many players who worked in the candle-lit cabinet through the years (including a girl Maelzel brought from Paris), a wino Alsatian chess bum, William Schlumberger, lasted the longest. Drunk or sober he was nigh unbeatable. In 1837 he died. Maelzel followed in 1838. In 1854 the Turk, by then a museum piece, was destroyed by fire. 7c6

While the Turk was a hoax, the 1914 chess machine of the Spanish inventor, L. Torres Y Quevado, was not. His mechanical device played the simple end game of a king and rook against its human opponent's king and won every time. 7c7

Now, of course, we have computers that outplay most chess buffs. It would be a mere technicality to install one inside a human figure. Maybe it's time to update the Turk. 7c8

[Ed. Note: Whatever happened to MIT's prediction that they would soon be able to pick up actual wooden pieces with their hand/eye system?] 7c9

------------------------- 7c10

*[Ed. Note: Edgar Allan Poe also deduced the secret of the Turk; c.f., E.A. Poe, "Maelzel's Chess-Player," in The Works of Edgar Allan Poe, Vol. VI, Miscellaneous Essays, Marginalia, Etc., pp. 1-31 (J.B. Lippincott Company, Philadelphia).] 7c11

A META-META COMMENT ON THE ARROGANCE OF CHESS-PLAYERS by I.J. Good Former Cambridgeshire Chess Champion 7d

I would like to make the following points in reply to Mr. Hans Berliner's letter in SIGART of April 1973, which seemed like a personal attack. 7d1

(a) If anyone points out errors in my statistical work, and it has happened several times, I kick myself, not the person who points it out, irrespective of his reputation as a statistician. 7d2

(b) I have some qualifications as a chess-player and writer. I once beat C. H. O'D. Alexander three times running in friendly semi-serious games (and Alexander once beat Botvinnik in a radio game). I wrote an article on chess programming which David Levy (an International Master) praised very much in Machine Intelligence 6. Fourteen of my games have been singled out for individual publication, twelve of which I won, and some of them were at least of master class. But, apart from several prizes that I have won, I am, as Mr. Berliner says, an amateur. 7d3

(c) Amateurs can sometimes find faults in the analyses even of World Champions, so I am surprised that Mr. Berliner thinks I should "know better" than to question a Grandmaster's judgment on isolated occasions. Among my published analyses there were positions in grandmaster games Keres vs. Panno, Tal vs. Minic, and Korchnoy vs. Tal, published in CHESS, two of which were correct; and I have a letter from Max Euwe (a copy of which I am sending to the editor as evidence) in which he agrees that I had found a fault in some of his opening analysis. [Ed. Note: copy of letter by Euwe dated April 11, 1949 was enclosed.] 7d4

(d) Does Mr. Berliner think that the move N-N2 was not worth mentioning? One of the programmers phoned and said the program had just missed trying this move. The analysis of it was interesting; the game was the best played one in the annual computer chess tournament; and many readers of SIGART are interested in chess, so I think the editor was right to publish the analysis. Mr. Berliner did not mention any errors in the analysis. 7d5

(e) I am glad that Mr. Berliner has said that 90% of what he knows about chess is impossible to program, for this creates a challenge to programmers. Of course some semantics has to be put into the programs, not just tree searches. I said this in my 1967 paper. 7d6

(f) There is nothing wrong with chess-players that not being human wouldn't put right. 7d7

REPLY TO THE META-META COMMENT by Hans Berliner 7e

I am afraid I do not quite understand this credentials fight. I certainly did not mean to single out Mr. Good and subject him to criticism. I find it rather strange that Fischer and

Reshevsky should make comments about the quality of chess players working on computer chess. They (Fisher* and Reshevsky) are clearly not in tune with reality. I also find it strange that so much analysis should be heaped on a position, which has little intrinsic chess interest, nor reflects in any way the capabilities of the players who produced the game position. 7e1

That is the sum and substance of my meta-comment. 7e2

*[Ed. Note: Although Mr. Brad Darrach is not one of my favorite writers, I highly recommend, "The Day Bobby Blew It," by B. Darrach, PLAYBOY, Vol. 20, No. 7, July 1973, p. 80... to document Berliner's claim regarding Mr. Fisher.] 7e3

CONFERENCES 8

INTERNATIONAL JOINT CONFERENCE ON ARTIFICIAL INTELLIGENCE STANFORD UNIVERSIY AUGUST 20-23, 1973 ADVANCED SCHEDULE AND CONFERENCE DATA 8a

Building on the stimulating conferences of 1969 (Washington, D.C.) and 1971 (London), an outstanding four day program will be presented. 8a1

HIGHLIGHTS 8a2

Contributed Papers 8a2a

There will be 16 sessions of contributed papers covering the entire breadth of current A.I. research. Major topics will include Natural Language processing, Robotics, A.I. Languages, Problem Solving, Automatic Programming, Theorem Proving, and Psychology. 8a2a1

Tutorial Lectures 8a2b

Seven leading experts will present 50-minute invited tutorial lectures on topics of current importance in A.I. research. These lectures will be video-taped so that attendees can view them later in the conference. The tapes will be made available to colleges and universities. 8a2b1

Free Sessions 8a2c

As a special innovation this year, we are having a series of "free sessions" (in parallel with the regular sessions) in which unrefereed, last minute results may be presented. There will probably be room for around fifty 20-minute presentations. If you desire to present material in one of these sessions, send the title of your talk to the Program Chairman. A list of titles for the Free Sessions will be posted at the Conference. 8a2c1

"Computers and Thought" Lecture 8a2d

Dr. Patrick Winston of the MIT Artificial Intelligence Laboratory has been selected to give the 1973 "Computers and Thought" public lecture. This lecture is made possible through royalties earned on the book COMPUTERS AND THOUGHT, edited by E. Feigenbaum and J. Feldman. 8a2d1

Panel Discussion 8a2e

Prominent persons concerned with Artificial Intelligence will discuss whether or not we can make computers that emulate (i.e., equal or excel) the cognitive and/or affective facilities of humans. They will also consider the concomitant issue of which, if any, intelligent behavior it might be inappropriate or unethical to emulate. The moderator for the panel will be Louis Fein, Computer Consultant. 8a2e1

The panel discussion will be preceded by some remarks by Professor William F. Miller, Vice President and Provost of Stanford University. 8a2e2

Demonstration of A.I. Programs 8a2f

Several A.I. Programs will be demonstrated (some over the ARPA net) at the Conference. If you have a program that you would like to demonstate, write to 8a2f1

Warren Teitelman
Xerox Palo Alto Research Labs
3406 Hillview Avenue
Palo Alto, California 94304 8a2f1a

A.I. Film Festival 8a2g

We will arrange showings of any films that Conference participants bring. These films will probably be shown continuously, so that attendees can drop in at any time to see them. A schedule will be posted at the Conference.

If you are planning to bring a film, please write to the Program Chairman, giving details. 8a2g1

Tours for Spouses 8a2h

Tours of nearby points of interest will be available for spouses during the first two days of the Conference. One will visit the facilities of Sunset Magazine, followed by luncheon in "Old Town" Los Gatos and a visit to the vinyards of Paul Masson for a wine tasting. The second trip will visit some of the high points (literally) of San Francisco and the DeYoung Museum, with a stop for lunch at Fisherman's Wharf. 8a2h1

Recreational Facilities 8a2i

Stanford recreational facilities will be open to you, including swimming pools, tennis courts, and an 18 hole golf course. You may also wish to explore the Stanford Museum, the Art Gallery, the Bookstore, and campus libraries. 8a2i1

Winetasting 8a2j

The winegrowers of California will present a special tasting for Conference attendees. Tables will be staffed by winery people, who will serve the wines and comment on their characteristics. Besides wine, there will be bread and cheese provided by the Marin French Cheese Company. 8a2j1

PRELIMINARY CONFERENCE SCHEDULE 8a3

Sunday, August 19, 1973 6:30 p.m. -- 9:30 p.m. 8a3a

Informal Reception
------------------ 8a3a1

Place: Faculty Club 8a3a2

Persons who arrive by Sunday evening are invited to visit the Faculty Club to pick up registration materials and meet other participants. Refreshments while they last. 8a3a3

Monday, August 20, 1973 9:00 a.m. -- 12:00 noon 8a3b

1. Invited Tutorial Lectures: I
------------------------------ 8a3b1

Chairman: 8a3b1a

Peter Hart
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025 8a3b1a1

Place: Dinkelspiel Auditorium 8a3b1b

1. "Automatic Programming," Z. Manna, Department of Applied Mathematics, Weizmann Institute of Science, Rehovot Israel 8a3b1c

2. "Languages for Artificial Intelligence," D. Bobrow, Computer Science Division, Xerox Palo Alto Research Center; B. Raphael, Artificial Intelligence Center, Stanford Research Insitute, Menlo Park, California 8a3b1d

3. "Artificial Intelligence & Psychology," A. Newell, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a3b1e

2. Theory of Heuristic Search
-------------------------- 8a3b2

Chairman: 8a3b2a

Ron Coleman
California State University at Fullerton
Fullerton, California 92634 8a3b2a1

Place: Skilling Auditorium 8a3b2b

1. "Additive AND/OR Graphs," A. Martelli, U. Montanari, Istituto di Elaborazione della Informazione del Consiglio Nazionale della Ricerche, Pisa, Italy 8a3b2c

2. "The Avoidance of (Relative) Catastrophe, Heuristic Competence, Genuine Dynamic Weighting and Computational Issues in Heuristic Problem Solving," I. Pohl, Information and Computer Science, University of California at Santa Cruz, Santa Cruz, California 8a3b2d

3. "Some Theoretical Results on Automated Game Playing," T. Boffey, Department of Computational and Statistical Science, University of Liverpool, United Kingdom 8a3b2e

4. "The Bandwidth Heuristic Search," L. Harris, Department of Mathematics, Dartmouth College, Hanover, New Hampshire 8a3b2f

3. Theorem Proving and Logic: I
------------------------------ 8a3b3

Chairman: 8a3b3a

J Moore,
Department of Comutational Logic
University of Edinburgh
Edinburgh, Scotland 8a3b3a1

Place: Physics Lecture Hall 100 8a3b3b

1. "The Q* Algorithm -- A Search Strategy for a Deductive Question-Answering System," J. Minker et. al., Computer Science Center, University of Maryland, College Park, Maryland 8a3b3c

2. "A Semantically Guided Deductive System for Automatic Theorem-Proving," R. Reiter, Department of Computer Science, University of British Columbia, Vancouver, Canada 8a3b3d

3. "Deletion-Directed Search Strategies for Resolution-Based Proof Procedures," D. Gelperin, Department of Computer Science, Ohio State University, Columbus, Ohio 8a3b3e

4. "A Definition-Driven Theorem Prover," G. Ernst, Department of Computer and Information Sciences, Case Western Reserve University, Cleveland, Ohio 8a3b3f

5. "A Man-Machine Theorem Proving System," W. Bledsoe, P. Bruell, Department of Mathematics, University of Texas at Austin, Texas 8a3b3g

Monday, August 20, 1973 1:30 p.m. -- 5:30 p.m. 8a3c

4. Invited Tutorial Lectures: II
-------------------------------- 8a3c1

Chairman: 8a3c1a

Saul Amarel
Department of Computer Science
Rutgers University
New Brunswick, New Jersey 08903 8a3c1a1

Place: Dinkelspiel Auditorium 8a3c1b

1. "Computer Vision," Y. Shirai, Electrotechnical Laboratory, Tokyo, Japan 8a3c1c

2. "Artificial Intelligence and Education," S. Papert, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 8a3c1d

3. "Automatic Problem Solving," D. Luckham, Stanford University, Stanford, California 8a3c1e

4. "Natural Language Understanding," T. Winograd, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 8a3c1f

5. Applications and Implications of A.I. 8a3c2

Chairman: 8a3c2a

V.L. Stefanyuk
Institute for Information
Transmission Problems
Academy of Sciences
Ul. Aviamotornaya 8, Korpus 2
Moscow E-24, U.S.S.R. 8a3c2a1

Place: Skilling Auditorium 8a3c2b

1. "Rule Formation on Non-Homogeneous Classes of Objects," B. Buchanan, Computer Science Department, Stanford University, Stanford, California 8a3c2c

2. "Some Necessary Conditions for a Master Chess Program," H. Berliner, Computer Science Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a3c2d

3. "Artificial Intelligence and Automatic Programming in CAI," E. Koffman, S. Blount, University of Connecticut, Storrs, Connecticut 8a3c2e

4. "Search Strategies for the Task of Organic Chemical Synthesis," N. Sridharan, Computer Science Department, Stanford University, Stanford, California 8a3c2f

5. "Forecasting and Assessing the Impact of Artificial Intelligence on Society," O. Firschein, M. Fischler, Lockheed Reserach Laboratory, Palo Alto, California; L. S. Coles, J. M. Tenenbaum, Artificial

Intelligence Center, Stanford Research Insitute, Menlo Park, California 8a3c2g

6. Theorem Proving and Logic: II 8a3c3

Chairman: 8a3c3a

Robert Yates,
Centro de Investigacion
en Mathematicas Aplicadas y en Sistemas
University of Mexico
Apartado Postal 20-726
Mexico 20, D. F. 8a3c3a1

Place: Physics Lecture Hall 100 8a3c3b

1. "Steps Toward Automatic Theory Formation," J. Brown, Department of Computer Science and Information, University of California, Irvine, California 8a3c3c

2. "Doing Arithmetic with Diagrams," A. Bundy, Department of Computational Logic, School of Artificial Intelligence, Edinburgh, Scotland 8a3c3d

3. "A Mechanization of Type Theory," G. Huet, IRIA Laboria, France 8a3c3e

4. "On the Mechanization of Abductive Logic," H. Pople, Machine Intelligence Systems Group, University of Pittsburgh, Pittsburgh, Pennsylvania 8a3c3f

5. "The Relevance of Resolution or The Hole in Goal Trees," D. Loveland, M. Stickel, Department of Computer Science, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a3c3g

6. "Discovering Classification Rules Using Variable-Valued Logic System VL1," R. Michalski, Department of Computer Science, University of Illinois at Urbana-Champaign, Illinois 8a3c3h

Winetasting 7:30 p.m. -- 9:00 p.m. 8a3d

Place: Bowman Oak Grove 8a3d1

This event is free to registrants and their spouses while the tickets last. At most 600 persons can be accomodated. 8a3d2

Tuesday, August 21, 1973 9:00 a.m. -- 12:00 noon 8a3e

7. Natural Language: Speech
------------------------ 8a3e1

Chairman: 8a3e1a

Christopher Longuet-Higgins,
School of Artificial Intelligence
Theoretical Psychology Unit
2 Buccleuch Place
University of Edinburgh
Edinburgh, EH8 9LW, Scotland 8a3e1a1

Place: Physics Lecture Hall 100 8a3e1b

1. "A Procedure for Adaptive Control of the Interaction between Acoustic Classification and Linguistic Decoding in Automatic Recognition of Continuous Speech," C. Tappert, N. Dixon, IBM Corporation, Thomas J. Watson Research Center, Yorktown Heights, New York 8a3e1c

2. "The Hearsay Speech Understanding System: An Example of the Recognition Process," R. Reddy, et. al., Computer Science Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a3e1d

3. "Systems Organizations for Speech Understanding," L. Erman, et. al., Computer Science Department, Carnegie-Mellon University, Pittsubrgh, Pennsylvania 8a3e1e

4. "Mechanical Inference Problems in Continuous Speech Understanding" W. Woods, J. Makhoul, Bolt, Beranek, and Newman, Incorporated, Cambridge, Massachusetts 8a3e1f

5. "Speech Understanding Through Syntactic and Semantic Analysis," D. Walker, Artificial Intelligence Center, Stanford Research Institute, Menlo Park, California 8a3e1g

6. "A Parser for a Speech Understanding System," W. Paxton, A. Robinson, Artificial Intelligence Center, Stanford Research Institute, Menlo Park, California 8a3e1h

8. Formalisms for A.I.
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Chairman: 8a3e2a

Place: Skilling Auditorium 8a3e2b

1. "D-SCRIPT: A Computational Theory of Descriptions," R. Moore, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 8a3e2c

2. "Conversion of Predicate-Calculus Axioms, Viewed as Nondeterministic Programs, to Corresponding Deterministic Programs," E. Sandewall, Datalogelaboratoriet, Uppsala, Sweden 8a3e2d

3. "A Universal Modular ACTOR Formalism for Artificial Intelligence," C. Hewitt, et. al., Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 8a3e2e

4. "A Model for Control Structures for Artificial Intelligence Programming Languages," D. Bobrow, R. Wegbreit, Computer Science Division, Xerox Palo Alto Research Center, Palo Alto, California 8a3e2f

5. "Some Aspects of Artificial Intelligence Research in the U.S.S.R." D. Pospelov, et. al., Council for Cybernetics and Computer Center, Academy of Sciences, Moscow, U.S.S.R. 8a3e2g

9. Free Session
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Place: Physics Lecture Hall 101 8a3e3a

Tuesday, August 21, 1973 1:30 p.m. -- 5:00 p.m. 8a3f

10. Natural Language: Systems
------------------------- 8a3f1

Chairman: 8a3f1a

L. Stephen Coles,
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025 8a3f1a1

Place: Skilling Auditorium 8a3f1b

1. "MARGIE: Memory, Analysis, Response Generation and Inference on English," R. Schank, et. al., Computer Science Department, Stanford University, Stanford, California 8a3f1c

2. "Language Processing Via Canonical Verbs and Semantic Models," G. Hendrix, et al, Department of Computer Science and Artificial Intelligence Laboratory, University of Texas at Austin, Austin, Texas 8a3f1d

3. "Understanding Without Proofs," Y. Wilks, Artificial Intelligence Project, Computer Science Center, Stanford University, Stanford, California 8a3f1e

4. "Idiolectic Language-Analysis for Understanding Doctor-Patient Dialogues," H. Enea, et. al., Department of Computer Science, Stanford University, Stanford, California 8a3f1f

5. "Mechanism of Deduction in a Question Answering System with Natural Language Input," M. Nagao, J. Tsujii, Department of Electrical Engineering, Kyoto University, Kyoto, Japan 8a3f1g

11. Robot Implementations
---------------------- 8a3f2

Chairman: 8a3f2a

Marvin Minsky,
Artificial Intelligence Laboratory
Massachusetts Institute of Technology
545 Technology Square
Cambridge, Massachusetts 02139 8a3f2a1

Place: Physics Lecture Hall 100 8a3f2b

1. "Design of a Computer Controlled Manipulator for Robot Research" B. Dobrotin, Jet Propulsion Laboratory, Guidance and Control Division, Pasadena, California; V. Scheinman, Artificial Intelligence Laboratory, Stanford University, Stanford, California 8a3f2c

2. "A Versatile Computer-Controlled Assembly System," A. Ambler, et. al., School of Artificial Intelligence, University of Edinburgh, Edinburgh, Scotland 8a3f2d

3. "Planning Considerations for a Roving Robot with Arm," R. Lewis, A. Bejczy, Jet Propulsion Laboratory, Califronia Institute of Technology, Pasadena, California 8a3f2e

4. "Control Algorithm of the Walker Climbing over Obstacles," D. Okhotsimsky, A. Platonov, Institute of Applied Mathematics, U.S.S.R. Academy of Science, Moscow, U.S.S.R. 8a3f2f

5. "Design of a Low-Cost, General-Purpose Robot," M. H. Smith, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, California; L. S. Coles, Artificial Intelligence Center, Stanford Research Institute, Menlo Park, California 8a3f2g

12. Free Session<BM=65>
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Place: Physics Lecture Hall 101 8a3f3a

Tuesday, August 21, 1973 8:00 p.m. -- 9:30 p.m. 8a3g

13. Computers and Thought Lecture [open to the public]
-- 8a3g1

Lecturer: 8a3g1a

Patrick Winston
Artificial Intelligence Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139 8a3g1a1

Place: Memorial Auditorium 8a3g1b

Wednesday, August 22, 1973 9:00 a.m. -- 12:00 noon 8a3h

14. Natural Language: Semantics & Parsing
------------------------------------- 8a3h1

Chairlady: 8a3h1a

Joyce Friedman,
Computer Science Department
University of Michigan
Ann Arbor, Michigan 48103 8a3h1a1

Place: Physics Lecture Hall 100 8a3h1b

1. "Jack and Janet in Search of a Theory of Knowledge," E. Charniak, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 8a3h1c

2. "Natural Semantics in Artificial Intelligence," J. Carbonell, A. Collins, Bolt, Beranek, and Newman, Incorporated, Cambridge, Massachusetts 8a3h1d

3. "Some Frills for the Modal Tic-Tac-Toe of Davies and Isard: Semantics of Predicate Complement Constructions," A. Joshi, R. Weischedel, Moore School of Electrical Engineering and Department of Linguistics, University of Pennsylvania, Philadelphia, Pennsylvania 8a3h1e

4. "Semantic Modeling for Deductive Question-Answering," K. Biss, et. al., Coordinated Science Laboratory, University of Illinois, Urbana-Champaign, Illinois 8a3h1f

5. "Case Structure Systems," B. Bruce, Department of Computer Science, Rutgers Univerity, New Brunswick, New Jersey 8a3h1g

6. "A Multi-Processing Approach to Natural Language," R. Kaplan, Department of Psychology and Social Relations, Harvard University, Cambridge, Massachusetts 8a3h1h

15. Robot Problem Solving
--------------------- 8a3h2

Chairman: 8a3h2a

Jack Buchanan
Computer Science Department
Carnegie-Mellon University
Pittsburgh, Pennsylvania 15213 8a3h2a1

Place: Skilling Auditorium 8a3h2b

1. "Proving the Impossible is Impossible is Possible; Disproofs Based on Hereditary Partitions," L. Siklossy, J. Roach, Department of Computer Science, University of Texas at Austin, Austin, Texas 8a3h2c

2. "Robot Planning System Based on Problem Solvers,"

T. Nagata, et. al., Electrotechnical Laboratory, Tokyo, Japan 8a3h2d

3. "DECIDER-1: A System that Chooses Among Different Types of Acts," L. Uhr, Computer Science Department, University of Wisconsin, Madison, Wisconsin 8a3h2e

4. "Robot Decisions Based on Maximizing Utility," W. Jacobs, M. Kiefer, The American University, Department of Mathematics and Statistics, Washington, D. C. 8a3h2f

5. "Planning in a Hierarchy of Abstraction Spaces," E. Sacerdoti, Artificial Intelligence Center, Stanford Research Institute, Menlo Park, California 8a3h2g

6. "An Efficient Robot Planner which Generates Its Own Procedures," L. Siklossy, J. Dreussi, College of Arts and Sciences, University of Texas at Austin, Austin, Texas 8a3h2h

16. Free Session
------------ 8a3h3

Place: Physics Lecture Hall 101 8a3h3a

Wednesday, August 22, 1973 1:30 p.m. -- 5:00 p.m. 8a3i

17. Psychology & A.I.
----------------- 8a3i1

Chairman: 8a3i1a

Edward Feigenbaum,
Computer Science Department
Stanford University
Stanford, California 94305 8a3i1a1

Place: Skilling Auditorium 8a3i1b

1. "An Interactive Task-Free Version of an Automatic Protocol Analysis System," D. Waterman, A. Newell, Department of Psychology, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a3i1c

2. "Outlines of a Computer Model of Motivation," G. Kiss, MRC Speech and Communication Unit, University of Edinburgh, Edinburgh, Scotland 8a3i1d

3. "Active Semantic Networks as a Model of Human

Memory," D. Norman, D. Rumelhart, Department of Psychology, University of California, San Diego 8a311e

4. "Towards a Model of Human Game Playing," M. Eisenstadt and Y. Kareev, Department of Psychology, University of California at San Diego, La Jolla, California 8a311f

5. "A Model of the Common-Sense Theory of Intention and Personal Causation," C. Schmidt, Psychology Department, Rutgers University, New Brunswick, New Jersey J. D'Addamio, Computer Science Department, Rutgers University, New Brunswick, New Jersey 8a311g

6. "The Symbolic Nature of Visual Imagery," T. Moran, Department of Computer Science, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a311h

18. Automatic Programming
-------------------- 8a312

Chairman: 8a312a

Place: Physics Lecture Hall 100 8a312b

1. "A System which Automatically Improves Programs," J. Darlington, R. Burstall, Department of Machine Intelligence, University of Edinburgh, Edinburgh, Scotland 8a312c

2. "Proving Theorems about LISP Functions," R. Boyer, J Moore, School of Artificial Intelligence, University of Edinburgh, Edinburgh, Scotland 8a312d

3. "A Global View of Automatic Programming," R. Balzer, Information Science Institute, University of Southern California, Marina del Rey, California 8a312e

4. "A Heuristic Approach to Program Verification," S. Katz, Z. Manna, Applied Mathematics Department, Weizmann Institute of Science, Rehovot, Israel 8a312f

5. "Iterated Limiting Recursion and the Program Minimization Problem," L. Schubert, Department of Computer Science, University of Alberta, Canada 8a312g

6. "Heuristic Methods for Mechanically Deriving Inductive Assertions," B. Wegbreit, Bolt, Beranek, and Newman, Incorporated, Cambridge, Massachusetts 8a312h

7. "Automatic Program Synthesis in Second-Order Logic," J. Darlington, Geselshcaft fuer Mathematik und Datenverarbeitung, Bonn, Germany 8a3i2i

19. Free Session
------------ 8a3i3

Place: Physics Lecture Hall 101 8a3i3a

Wednesday, August 22, 1973 8:00 p.m. -- 10:00 p.m. 8a3j

20. Invited Discussion [Open to the public]
-- 8a3j1

Place: Memorial Auditorium 8a3j1a

1. "Practical & Theoretical Impacts of Artificial Intelligence," William F. Miller, Vice President and Provost, Stanford University, Stanford, California 8a3j1b

2. "How Much of Human Intelligence Could and Should Computers be Made to Equal or Excel? A Discussion," Louis Fein, Synnoetics, Incorporated, Moderator (Speakers and discussants will include E. Fredkin and J. Weizenbaum of M.I.T. Others to be announced.) 8a3j1c

Thursday, August 23, 1973 9:00 a.m. -- 12:00 noon 8a3k

21. Computer Vision
--------------- 8a3k1

Chairman: 8a3k1a

Place: Physics Lecture Hall 100 8a3k1b

1. "Finding Picture Edges through Collinearity of Feature Points," F. O'Gorman, M. Clowes, Laboratory of Experimental Psychology, University of Sussex, Brighton, Sussex, England 8a3k1c

2. "Interpreting Pictures of Polyhedral Scenes," A. Mackworth, Laboratory of Experimentl Psychology, University of Sussex, Brighton, Sussex, England 8a3k1d

3. "Detection of Homogeneous Regions by Structural Analysis," F. Tomita, et. al., Department of Control Engineering, Osaka University, Osaka, Japan 8a3k1e

4. "Computer Description of Textured Surfaces," R.

Bekczy, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania 8a3k1f

5. "A Semantics-Based Decision Theoretic Region Analyzer," Y. Yakimovsky, J. Feldman, Computer Science Department, Stanford University, Stanford, California 8a3k1g

22. General Problem Solving
----------------------- 8a3k2

Chairman: 8a3k2a

Richard Fikes,
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025 8a3k2a1

Place: Skilling Auditorium 8a3k2b

1. "POPS: An Application of Heuristic Search Methods to the Processing of a Nondeterministic Programming Language," G. Gibbons, Naval Post Graduate School, Monterey, California 8a3k2c

2. "CASAP: A Testbed for Program Flexibility," R. Balzer, Information Science Institute, University of Southern California, Marina del Rey, California 8a3k2d

3. "A Numbeer Theory Approach to Problem Representation and Solution," S. Shen, E. Jones, Virginia Polytechnic Institute and State University, Balcksburg, Virginia 8a3k2e

4. "On a Local Approach to Representation in Problem Solving," V. Stefanyuk, Institute for Information, Transmission Problems, Academy of Science, Moscow, U.S.S.R. 8a3k2f

5. "The Architecture of a Coherent Information System; A General Problem Solving System," C. Srinivasan, Department of Computer Science, Rutgers University, New Brunswick, New Jersey 8a3k2g

23. Free Session
------------ 8a3k3

Place: Physics Lecture Hall 101 8a3k3a

Thursday, August 23, 1973 1:30 p.m. -- 5:00 p.m. 8a31

24. Perception for Robots
-------------------- 8a311

Chairman: 8a311a

Harry Barrow,
School of Artificial Intelligence
University of Edinburgh
Hope Park Square
Edinburgh EH8 9NW, Scotland 8a311a1

Place: Physics Lecture Hall 100 8a311b

1. "Computer Description of Curved Objects," G. Agin, Stanford University, Stanford California, T. Binford, IBM Corporation, Endicott, New York 8a311c

2. "Structured Descriptions of Complex Objects," R. Nevatia, T. Binford, Artificial Intelligence Laboratory, Stanford University, Stanford, California 8a311d

3. "On Calibrating Computer Controlled Cameras for Perceiving 3-D Scenes," I. Sobel, Technion, Israel Institute of Technology, Haifa, Israel 8a311e

4. "Thoughts About a Visually Guided Grasp Reflex," R. Didday, Computer Science Program, Colorado State University, Fort Collins, Colorado 8a311f

5. "Pattern Classification of the Grasped Object by the Artificial Hand," G. Kinoshita, et. al., Department of Electrical Engineering, Chuo University, Tokyo, Japan 8a311g

25. Hardware and Software for A.I.
------------------------------ 8a312

Chairman: 8a312a

Place: Skilling Auditorium 8a312b

1. "A Linguistics Oriented Programming Language," V. Pratt, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachsetts 8a312c

2. "The LISP70 Pattern Matching System," L. Tesler, et. al., Stanford University, Stanford, California 8a312d

3. "Backtracking in MLISP2," D. Smith, H. Enea, Stanford University, Stanford, California 8a312e

4. "CLISP - Conversational LISP," W. Teitelman, Xerox Palo Alto Research Center, Palo Alto, California 8a312f

5. "1-pak: A SNOBOL-based Programming Language for Artificial Intelligence Applications," J. Mylopoulos, et. al., University of Toronto, Toronto, Canada 8a312g

6. "A LISP Machine with Very Compact Programs," L. P. Deutsch, Xerox Palo Alto Research Center, Palo Alto, California 8a312h

26. Free Session
------------ 8a313

Place: Physics Lecture Hall 101 8a313a

CLIMATE 8a4

Weather on the San Francisco Peninsula is very pleasant during the summer months. Rain is almost unheard of, mornings and nights are cool, and afternoons are sunny and warm. The average low temperature is 54 degrees Farenheit (12 degrees C.), the average high temperature is 75 degrees Farenheit (24 degrees C.), and the humidity is 58 per cent at noon, 50 per cent at 4 p.m. 8a4a

Operationally this means rainwear is not needed, while light sweaters or jackets are desirable during the early morning and the evening. It should be noted, however, that temperatures and humidity levels differ significantly throughout the San Francisco Bay Area. Visitors to San Francisco, particularly, should be prepared for cooler temperatures, especially in the afternoon. 8a4b

AIRPORT TRANSPORTATION 8a5

Charter bus service will be available from San Francisco Airport to Stanford University on Sunday, August 19. Buses will load on the lower level of the central terminal. If you would like to use this service, indicate your flight information on the registration form so that we can schedule the buses properly. 8a5a

Charter buses will also operate from Stanford to San Francisco Airport on Thursday, August 23 and on Friday morning. 8a5b

At other times, limousines and moderately-priced buses (Airporter and Greyhound) operate between the airport and Palo Alto. Taxis can easily be hired upon reaching Palo Alto. 8a5c

Taxis to or from the airport are rather expensive; about $15 for San Francisco and $13 for San Jose. 8a5d

LOCAL TRANSPORTATION 8a6

Local public transportation is almost nonexistant. Inasmuch as most of the local motels and hotels are beyond normal walking distance, a shuttle bus service is planned for use of conference participants. The runs will take place in the early morning and late afternoon only. Off-campus pickup points will be at or near the motels indicated by (*) on the attached list. The campus pickup point will be near Physics Lecture Hall 100. 8a6a

Auto rentals are available at the three Bay Area airports (San Francisco, Oakland, San Jose). There are also a number of local auto rental firms, most of which are situated in Palo Alto along El Camino Real between Arastradero Road and San Antonio Road. 8a6b

An excellent way to travel around the Stanford campus and nearby areas is by bicycle. The Campus Bike Shop will have at least 75 bicycles available at $2.50 per day or $7.50 per week. 8a6c

LIVING ACCOMMODATIONS AT STANFORD 8a7

Stanford University has made its Stern Residence Hall and Murrielees Apartments available to Conference registrants and their families. 8a7a

Stern Hall is a confortable residence complex located near the center of the campus. Rooms are nicely furnished singles or doubles (twin-bedded). The complex includes pleasant lounges and recreation areas. Maid service (five days a week), blankets, linens, and lamps are provided. Bathrooms are shared. Stern Hall office staff receives mail and takes messages. 8a7b

Mirrielees Apartments were opened in September 1972. They are completely furnished with one bedroom (twin beds), living room, private bath, and kitchenette (kitchen and dining utensils not included). Cleaning service, blankets, and linens are provided. Only a limited number of apartments are available; they will be allocated on a first request received basis with overflow assigned to Stern Hall. Occupancy is intended for one or two adults per room except in the case of couples with infants. 8a7c

Cribs may be rented for $4.00 during the Conference. 8a7d

During the period of the Conference (August 19-23) the rates for a room for four nights (Sunday through Wednesday nights) include meals beginning with breakfast on Monday through lunch on Thursday, served cafeteria style at nearby Wilbur Hall. Stern Hall: $47 per person (single occcpancy) $39 per person (double occupancy) Children less than 12 years of age are half price 8a7e

Mirrielees Apartments: 8a7e1

$69 per person (single occupancy)
$51 per person (double occupancy) 8a7e1a

Early arrivals and late departures can be accommodated in both Stern Hall and Mirrieless Apartments at the following rates (not including food). 8a7f

Stern Hall: 8a7f1

$6.50 per person per night (single)
$4.50 per person per night (double) 8a7f1a

Mirrielees Apartments: 8a7f2

$12.00 per person per night (single)
$7.50 per person per night (double) 8a7f2a

Food service will be available at Wilbur Hall on a cash basis for individual meals. 8a7g

No advance room deposit is required. Fees for Stern Hall and 8a7h

Mirrielees Apartments are payable by cash or check upon arrival at the Stern Hall Office. Keys and room assignments will be issued at that time. 8a7i

Ample free parking is available adjacent to all University residence halls. Laundry facilities are available within the residence halls. Pets are unwelcome in University residence halls. 8a7j

MOTELS AND HOTELS 8a8

As an alternative to the use of University living quarters, there are numerous motels and hotels in Palo Alto and nearby communities. Registrants wishing to secure accommodations in motels or hotels are requested to make their own reservations. 8a8a

Restaurants are abundant, varied, and conveniently located. Registrants and their families residing off campus may also purchase tickets for individual cafeteria-style meals at Wilbur Hall or may eat at Tresidder Memorial Union. 8a8b

TOURS FOR SPOUSES 8a9

Tours will be offered to spouses of conference attendees on the first two days as follows. 8a9a

Tour #1: Monday, August 20, 10:30 a.m. -- 4:00 p.m. 8a9b

A visit to the home of Sunset Magazine, tour of the grounds, information on how recipes are tested. Next, to Los Gatos' quaint Old Town for a Mexican luncheon, with time to visit some of the interesting shops. Finally, a tour of the Paul Masson Winery in Saratoga with ample time for tasting. Cost: $4, not including lunch. 8a9b1

Tour #2: Tuesday, August 21, 8:45 a.m. -- 4:00 p.m. 8a9c

A scenic drive up the Skyline route to San Francisco stopping by the Cliff House; on into Golden Gate Park and a visit to the famous De Young Museum, featuring an extraordinary collection of oriental art. Next, to Fisherman's Wharf for browsing and luncheon at any of a number of restaurants. Returning via the Twin Peaks section of San Francisco. Cost: $5, not including lunch. 8a9c1

FOREIGN EXCHANGE AND CHECK CASHING 8a10

All fees connected with the Conference must be paid in U.S. currency. The foreign currency exchange office at San Francisco Airport is open seven days a week from 7 a.m. until midnight. It is located in the Bank of America section in the South Terminal near the Pan American facility. Apart from the currency exchange office, the bank itself is open every day from 8:30 a.m. to 5:00 p.m. (6 p.m. on Friday). Checks may be cashed upon presentation of Driver's License and suitable credit card. 8a10a

There may be some limited foreign currency exchange at the Wells Fargo Bank on the Stanford University campus during banking hours from 10 a.m. to 3 p.m. Campus courtesy cards, given to registrants, may be used to cash personal checks drawn on U.S. banks in amounts up to $100 at Wells Fargo. 8a10b

THIRD INTERNATIONAL JOINT CONFERENCE ON ARTIFICIAL INTELLIGENCE
August 20-23, 1973 at Stanford University
ADVANCED REGISTRATION FORM 8a11

Name ,

(last) (first)
Mailing Address

Affiliation
------------------------------------ 8a11a

Registration fees are as follows: 8a11b

	Before August 6	After August 6	
Regular	$40	$45	
Student	20	25	8a11b1

Advance fees will be refunded if cancellation is received by August 6. 8a11b2

All registrants are entitled to one free copy of the Advance Papers of the Conference. Additional copies may be picked up at the Conference for $10 each or will be mailed for $15 each. 8a11c

Please send a check made out to 3IJCAI for the registration fee ONLY and mail it with this form to: 8a11d

3IJCAI
P. O. Box 2989
Stanford, Calif. 94305
U.S.A. 8a11d1

Please do NOT send advance payment for housing or tours. 8a11e

If you wish to use the IJCAI bus from San Francisco airport on Sunday, August 19, please give: 8a11f flight number ------------ arrival time ------------ 8a11f1

STANFORD HOUSING AND MEAL RESERVATIONS 8a11g

Please reserve the following rooms for August 19-22:
Stern Hall; single rooms ($47 per person)....double ($39 per person)....
Mirrielees; single apt. ($69 per person)....double ($51 per person)....
To be shared with (if known)............... Children (ages)....
Please reserve room(s) for the extra nights of: Aug. 18...., Aug. 23.... 8a11g1

SPECIAL EVENTS 8a11h

Please indicate which of the following events you or your spouse expect to participate in. This is not a firm commitment, but estimates are needed. 8a11h1

Monday evening winetasting (free) . . . .
Spouse's Tour #1 (Sunset, Old Town, Paul Masson; $4) . . .
Spouse's Tour #2 (San Francisco; $5). 8a11h2

ACM 73 RESEARCH ABSTRACT SESSIONS 8b

ACM 73, Atlanta, Georgia, August 27-29, 1973 8b1

In addition to a technical program balanced between commercial and academic subjects with full papers in the proceedings and a commercial program in the style of ACM 72 in Boston, ACM 73 will feature several research abstract sessions for which abstracts are invited from laboratories, institutes, industry, and universities. Presentations will be scheduled on the basis of abstracts only and the abstracts only will be published. There will be special sessions for theses and dissertations if desired. Inquiries should be directed to 8b2

Dr. Leland H. Williams
Triangle Universities Computation Center
Research Triangle Park
North Carolina 27709
Telephone: 919-549-8291. 8b2a

CALL FOR ABSTRACTS - 1974 COMPUTER SCIENCE CONFERENCE 8c

Detroit Hilton, Detroit, Michigan, February 12-14, 1974 8c1

Abstract Deadline: December 1, 1973 8c2

Announcing the second annual COMPUTER SCIENCE CONFERENCE sponsored by many Computer and Information Science Departments of universities and industrial organizations throughout the United States and Canada: A MEETING PRIMARILY DEVOTED TO SHORT CURRENT RESEARCH REPORTS (15 minutes including discussion). The response to the first conference in Columbus clearly demonstrated the need for a second similar conference. Reports of research are invited from any area of the computer and information sciences. An attempt will be made to schedule all appropriate papers. Submissions from laboratories, institutes, industry and universities are particularly desired. Thesis and dissertation research reports are also welcome. Abstracts only will be required. No full texts will be available. The printed program will be prepared directly from the abstracts submitted so abstracts must be in camera ready form. The original and two duplicates of the abstracts must be received by DECEMBER 1,1973. Registration fees will be low. A number of invited papers will be presented. There will be a special luncheon meeting for computer science department chairmen. 8c3

There will also be an extensive textbook exhibit and an interactive terminal exhibit is planned. An employment register will be available to assist computer science professionals at all levels to find employment. Special forms, which can be obtained from the address below, must be filled out by prospective employers and employees for this employment register. 8c4

In addition, the Association for Computing Machinery Special Interest Group on Computer Science Education will hold its Fourth Technical Symposium February 14 and 15, 1974, in cooperation with the Computer Science Conference. Papers for this are being solicited in all areas of computer science education. The American Society for Engineering Education, Computers in Education Division will also be meeting on February 14 and 15, 1974, in cooperation with the Computer Science Conference and SIGCSE/ACM. 8c5

Reply to: 8c6

Seymour J. Wolfson
COMPUTER SCIENCE CONFERENCE

643 Mackenzie Hall
Wayne State University
Detroit, Michigan 48202 8c6a

COURSE ANNOUNCEMENTS
-------------------- 9

1. Stanford University
Computer Science Department
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Robotics -- CS227 -- Spring 1973 (First Offering)
Instructors: Prof. Jerome Feldman and Dr. Thomas Binford 9a1

Day	Lecturer	Topic	
			9a2
April 3	Feldman	Formalities, Introduction, Robotics Movie	
April 5	Binford	Sensors, optics, projective geometry	
April 10	Feldman	Region Growing, decision theory	
April 12	Feldman	Scene Analysis Overview (incl Guzman, Falk, Grape)	
April 17	Binford	Line Finders and low level organization	
April 19	Binford	Interpret line drawings (Huffman, Clowes, Waltz)	
April 24	P. Hart	SRI Robot project	
April 26	Paul	Arm design, control, trajectory planning	9a2a
May 1		Visual Feedback	
May 3	Binford	Color, texture	
May 8	Feldman	System Design for Robotics	
May 10	Anderson	Strategies for Blocks World	
May 15	Binford	Curved Object-Representation	
May 17	Binford	Curved Objects-Ranging techniques, description	
May 22	Quam	picture Processing, correlation techniques	
May 24	Quam	Operation of a Mobile cart in outdoor environments	
May 29		Automation	
May 31		Automation	9a2b
June 5	Sproull	Computer Graphics	
June 7		Computer Graphics	9a2c

Typical homework problems involved the colineation problem (the use of a small number of points in the image plane of a T.V. camera and the solution of simultaneous equations to establish the parameters of a three-dimensional projection) and the use of an edge follower (a problem which finds edges in a T.V. image using the Huekel operator). 9a2d

2. University of California at Berkeley
Department of Electrical Engineering and Computer Sciences
-- 9b

Robotics - EECS 290G (will become CS222 next year) -- Spring 1973
(Fifth Offering, First taught in Spring 1969) 9b1

Instructor: Prof. L. Stephen Coles; T.A.: Michael Smith 9b2

Day	Topic (two-hour lectures)	
		9b3
April 2	Integrated Artificial Intelligence Systems	
April 9	Speech Recognition Systems	
April 16	Language Understanding Systems	
April 23	Problem Solving Systems -- Richard Fikes	9b3a
May 7	Perception -- Jay M. Tenenbaum	
May 14	Learning	
May 14 (8:00 p.m.)	JASON, the Berkeley Robot -- Michael Smith	
May 2	Navigation Algorithms, Uncertainty	9b3b
June 4	Industrial Robots	9b3c

Typical homework problems involved recognizing connected speech (given a phonenic transcription of an acoustic wave form plus a vocabulary and context), understanding children's stories, deriving a STRIPS triangle-table, resolution proof of a theorem involving the "frame problem," and flow chart for recognizing simple polyhedra. The term project this year broke students up into teams to develop software for JASON. 9b3d

3. University of Guelph
Ontario, Canada
Department of Computing and Information Sciences
-- 9c

Artificial Intelligence -- 27-450 -- Fall 1973 9c1

Instructor: Prof. Lawrence J. Mazlack 9c2

This course is aimed at Senior-level Canadian university students. One aspect of the course is going to be the student writing of a program to play the simply-ruled Japanese board game, Go-Moku. The game is to be played using an interactive facility (APL terminals). Thirty-five percent of a student's grade will depend on his ability to write this program. Students will compete with each other in a round-robin fashion. The student's final ranking will determine how much of the thirty-five points he receives. 9c3

At the end of the course (early December), we will attempt to play other schools. Play is to be on an individual student basis. (The rules of the game shall be as defined by Lasker, Go and Go-Moku, Dover, 1960, pp. 205-212). 9c4

9c5

[Ed. Note: Prof. Mazlack writes, "A challenge...if someone else has individual students who have or will have written a Go-Moku playing program, we would be happy to compete with them in December by telephone. Although our only interactive computer is an IBM 310/155, I don't think that facility-commonality is very important." Anyone desiring to engage in a national computer Go-Moku competition is invited to write in care of the Editor, and I will see what can be arranged.] 9c6

RECENT TEXTS
------------ 10

Symbolic Logic and Mechanical Theorem Proving by C.L. Chang and R.C.T. Lee
Academic Press, New York, 1973 10a

This book introduces symbolic logic and provides a thorough discussion of mechanical theorem proving and its applications. It is divided into three parts. The first part introduces both propositional logic and first-order predicate logic; the second part covers various theorem-proving techniques--including Herbrand's method, resolution principles, linear resolution, semantic resolution, and paramodulation; and the third part shows how theorem-proving techniques can be applied to such areas as program analysis, program synthesis, and question answering. 10a1

Proceedings of the First National Conference on Remotely Manned Systems for Exploration and Operations in Space edited by Ewald Heer
California Institute of Technology
1973 10b

The First National Conference on Remotely Manned Systems was held at the California Institute of Technology in Pasadena, September 13-15, 1972, under the sponsorship of NASA. The proceedings, an impressive collection of papers ranging from Free-Flying Teleoperator Systems to AI and covering 528 pages, has just been published in hard-cover form. Especially of interest to the AI community will be the chapters on "Remote Sensor and Display Technology" and "Control and Machine Intelligence." 10b1

Mentality and Machines * by Keith Gunderson
Doubleday Anchor, 1971,
173 pages, $1.95 (paper) 10c

Descartes held that all animals but man are machines; what appears in these animals to be "feelings," "purpose," etc., are but the simulation of thoughts and emotion, not thought and emotion themselves. If thus were not the case, argued Descartes, then animals would have souls, much to the discomfiture of Christian theology. 10c1

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*[Ed Note: Reviewed by T.D.C. Kuch in Computers and Society (SIGCAS, Vol. 4, No. 1, May 1973, pp. 40-41)] 10c2

Thisposition, which must seem a little queer to most people (Aristotle, for instance, had no trouble in ascribing souls to animals) was made more consistent by La Mettrie: animals are machines, but so are men. Exactly what this means is not easy to fathom, but since that day philosophers have kept up a running debate on this and related topics. Since the introduction of the computer, and especially since one provided a novel proof for a theorem in Russell and Whitehead's Principia Mathematica and another learned to play an acceptable game of chess, the debate has turned round: not "are people machines?", but "are machines people?" That is, can they think? Can they "feel"? Can they have pain? Can they simulate these activities? 10c3

Discussions of this sort become absurdity-prone in the hands of programmers and specialists in artificial intelligence (AI), so this cleaning of the conceptual stables by a philosopher was long overdue, and is very welcome. 10c4

Gunderson does not attempt to answer all the hard questions directly, but clarifies, in the best philosophical tradition, the concepts and arguments involved, so that further work can proceed unhindered by foggy ideas and flawed conceptions. He is largely successful, and this book must be read by anyone doing work in AI, and can be read with profit by any educated reader. 10c5

There is no point in summarizing the nature of Gunderson's clarifications--to understand them and why they are necessary, the whole book must be read. Because he is writing for an essentially interdisciplinary readership, he assumes very little prior knowledge of AI, or computers, or perhaps, philosophy, although his method of attack and some of his stylistic quirks will be puzzling to the reader who does not know the work of Wittgenstein and his followers. 10c6

One problem: The argument in Chapter 5 is much more convoluted than in the other chapters, due apparently to the author's unsureness of his knowledge of computers. In any case, he has apparently confused the capabilities and limitations of (1) the IPL-V programming language, (2) the computer he uses on which IPL-V is implemented, and (3) the nature of the general-purpose computer in the abstract. Indeed, he speaks of "the IPL-V computer" as if there were such a thing, and seems to be saying that if an action cannot be simulated in IPL-V or an extension of it, then either it is impossible to simulate that action, or hardware changes must be made to the computer to accomplish it. In fact, the modern computer is capable of doing many things that caanot be done in IPL-V, but what is required is not a hardware modification, but the use (or invention) of another language. 10c7

All things considered, a fine and important book, and a bargain, too! 10c8

Artificial Intelligence 10d

Artificial Intelligence, which commenced publication in 1970, is now the generally accepted, quarterly international forum for the publication of results of current research in the field. Two special issues are now in preparation on the representation of knowledge and on speech-understanding systems. 10d1

The contents of Volume 3, now complete, is as follows: 10d2

A model for temporal references and its applications in a question answering program (B.C. Bruce). Computer proofs of limit theorems (W.W. Bledsoe, R.S. Boyer and W.H. Henneman). A program for timetable compilation by a look-ahead method (A. L. Cherniavsky). Augmented transition networks as psychological models of sentence comprehension (R. M. Kaplan).

Interpretation of imperfect line data as a three-dimensional scene (G. Falk). The technology chess program (J. J. Gillogly). Solving problems by formula manipulation in logic and linear inequalities (L. Hodes). A note on linear resolution strategies in consequence-finding (E. Minicozzi and R. Reiter). On the inference of Turing machines from sample computations (A. W. Biermann). Turing-like indistinguishability tests for the validation of a computer simulation of paranoid processes (K. M. Colby, F. D. Hilf, S. Weber, and H. C. Kraemer). Strategy construction using homomorphisms between games (R. B. Banerji and G. W. Ernst). Learning and executing generalized robot plans (R. E. Fikes, P. E. Hart, and N. J. Nilsson). 10d3

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ABSTRACTS
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Eyes and Ears for Computers by D. Raj Reddy
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Carnegie-Millon University 11a

This paper presents a unified view of the research in machine perception of speech and vision in the hope that a clear appreciation of similarities and differences may lead to better information-processing models of perception. Various factors that affect the feasibility and performance of perception systems are discussed. To illustrate the current state of the art in machine perception, examples are chosen from the HEARSAY speech understanding system and the image processing portion of the SYNAPS neural modelling system. Some unsolved problems in a few key areas are presented. 11a1

Keynote speech presented at the Conference on Cognitive Processes and Artificial Intelligence, Hamburg, April 1973. 11a2

Automatic Inference of Semantic Deep Structure Rules in Generative Semantic Grammarsby
Sheldon Klein
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University of Wisconsin 11b

This paper reports on techniques and methodology for the automatic inference of semantic deep structure rules in generative semantic grammars. The key conceptual devices include a representation of semantic deep structure in the notation of a 4-dimensional network with properties of at least the 2nd-order predicate calculus, and also in the notation of a compiler-driven behavioral simulation language that describes and modifies the linguistic and extra-linguistic conceptual universe of speakers. The system is able to make grammatical-semantic inferences within the frameworks of all current generative semantic linguistic models, including the case grammar of Fillmore, the presuppositional model of Lakoff, and the 1972 semantic theory of Katz. 11b1

Clause Deletion in Resolution Theorem Provingby David Gelperin
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Ohio State University
Columbus, Ohio 11c

Much of the recent work in automatic theorem proving has dealt with the refinement and utilization of the resolution principle--a machine-oriented inference rule for first-order logic. One of the principal concerns of a resolution-based proof procedure is the number of unnecessary intermediate results which develop during the search for a proof. Unnecessary intermediates can be controlled by a refined inference rule which restricts their generation or by a deletion rule which eliminates them after they appear. 11c1

This dissertation deals with elimination control. It describes two new deletion rules and provides the theorems which support them. Various methods for utilizing these rules are presented along with a discussion of their computational expense. The principal method of utilization involves a new search strategy which is not only concerned with the development of a proof, but also with the control of unnecessary intermediate results. This deletion-directed strategy has a built-in facility for recognizing deletable intermediates and operates by creating conditions in which an intermediate result can be eliminated. Several versions of this strategy are described. 11c2

D-Script: A Computational Theory of Descriptionsby Robert C. Moore
MIT A.I. Laboratory
AI Memo No. 278
February 1973 11d

This paper describes D-SCRIPT, a language for representing knowledge in artificial intelligence programs. D-SCRIPT contains a powerful formalism for descriptions, which permits the representation of statements that are problematical for other systems. Particular attention is paid to problems of opaque contexts, time contexts, and knowledge about knowledge. The design of a theorem prover for this language is also considered. 11d1

Elementary Geometry Theorem Provingby Ira Goldstein
MIT A.I. Laboratory
AI Memo No. 280
April 1973 11e

An elementary theorem prover for a small part of plane Euclidean geometry is presented. The purpose is to illustrate important problem-solving concepts that naturally arise in building procedural models for mathematics. 11e1

A Linguistics Oriented Programming Languageby Vaughan R. Pratt
MIT A.I. Laboratory
AI Memo No. 277
February 1973 11f

A programming language for natural language processing programs is described. Examples of the output of programs written by using it are given. The reasons for various design decisions are discussed. An actual session with the system is presented, in which a small fragment of an English-to-French translator is developed. Some of the limitations of the system are discussed, along with plans for further development. 11f1

Grammar for the People: Flowcharts of SHRDLU'S Grammarby Andee Rubin
MIT A.I. Laboratory
AI Memo No. 282
March 1973 11g

The purpose of these flowcharts is to make available to the general, non-SHRDLU-hacking public, the parser which SHRDLU uses. There have been many who have tried to decipher its code; most have either become hopelessly entangled or painfully made their way through its web. Now, at last, even you can have in your home a complete set of SHRDLU flowcharts. Besides making the code generally more comprehensible, the flowcharts de-emphasize the linearity of the parsing program and instead organize it into modules. Thus the reader can see the outline of a large part of the process at a fairly high level and only later turn to another page to ponder the details. Hopefully, their availability will encourage other system implementers to use the parser as a front end and will spark some cross-cultural communication between the non-computing linguistic community and AI language workers. 11g1

Pretty-Printing Converting List to Linear Structureby Ira Goldstein
MIT A.I. Laboratory
AI Memo No. 279
February 1973 11h

Pretty-printing is a fundamental debugging aid, for LISP. List structure presented as an unformatted linear string is very difficult for a person to understand. The purpose of pretty-printing is to clarify the structure of a LISP expression. The simplest class of pretty-printers accomplishes this by the judicious insertion of spaces and carriage returns. Section II analyzes the computational complexity of such algorithms. [See section IV for suggestions for more sophisticated schemes which break the code into separate expressions.] The existence of algorithms which are only linearly more expensive than the standard LISP printing routines is demonstrated. Various extensions for adding semantic knowledge to the pretty-printer are then considered. Section III documents the pretty-print package currently available for MACLISP. Section IV suggests additional improvements to be considered for the future. 11h1

Generative Computer Assisted Instruction: An Application of Artificial Intelligence to CAI*by Elliot B. Koffman
University of Connecticut
Storrs, Connecticut 11i

Limited progress has been made in software for computer-assisted instruction. Frame-oriented CAI systems have dominated the field. These systems are classically mechanized programmed texts and utilize the computational power of the computer to a minimal extent. In addition, they are difficult to modify and tend to provide a fairly fixed instructional sequence. 11i1

Recently, generative CAI systems have appeared. These are systems for CAI which are capable of generating their own questions or problems and deriving their own solutions. Hence, they can provide unlimited drill and tutoring with little effort required from the course-author to define an instructional sequence. 11i2

These systems are supplied with knowledge of their subject matter. Therefore, they can often interpret and answer questions or problems posed by the student. They are also capable of diagnosing the degree of inaccuracy in a student response and providing remedial feedback on an individual basis. Most of these systems incorporate techniques and concepts which are outgrowths of Research in Artificial Intelligence. 11i3

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*USA-Japan Computer Conference 11i4

An Intelligent CAI Monitor and Generative Tutorby Elliot B. Koffman, Sumner E. Blount,
Thomas Gilkey, James Perry, Martin Wey
Annual Report, 1973
University of Connecticut
Storrs, Connecticut 11j

This paper describes design techniques for generative computer-assisted instruction (CAI) systems. These are systems which are capable of generating problems for students and deriving and monitoring the solutions to these problems. The difficulty of the problem, the pace of instruction, and the depth of monitoring are all tailored to the individual student. Parts of the solution algorithms can also be used to analyze an incorrect student response and determine the exact nature of the student's error in order to supply him with meaningful remedial comments. 11j1

A generative CAI system which teaches logic design and machine-language programming will be discussed. This CAI system covers the material in an introductory course in digital systems aimed at electrical engineering Juniors. It does not replace classroom lectures or the textbook, but instead serves to provide practice and instruction in applying this material to solve problems. 11j2

In addition, a companion system to teach laboratory principles has been designed. This system teaches a student how to construct a combinational or sequential logic circuit using standard integrated circuits. The student's logic circuit is automatically interfaced to the computer and tested; the computer then aids the student in debugging his circuit. 11j3

Work in progress on the design of a tutor for high-school algebra, which teaches students how to solve algebra word problems, is also described. Finally, a formal mathematical approach to problem generation and solution is presented. 11j4

A Self-Modifying SNOBOL4 Program
for Studying Adaptive Program Schemataby Robert J. Baron and John

B. Johnson
Department of Computer Science
The University of Iowa
Iowa City, Iowa
June 1973 11k

This paper presents a complete SNOBOL4 program which is capable of learning, self-adaptation, and self-reproduction. A simple basis for self-modifying programs is suggested, and two examples are given which illustrate the use of the program. The first example shows the program being extended during execution to answer simple questions in English. The second example shows the program being further extended to modify itself automatically to process new syntactic types of inputs. The program currently uses the IIT SPITBOL compiler (version 2.2) under OS/360 but is fully compatible with BTL SNOBOL4. 11k1

An Investigation of Computer-Generated Crossword Puzzle Techniquesby Lawrence J. Maziack
Washington University
Sever Institute of Technology
Saint Louis, Missouri
December 1972 11l

The purpose of this dissertation is to investigate methods of computer construction of crossword puzzles. The initial input to the computer is to be a puzzle matrix with all the intended null or blank squares filled in. An initial key word or words would also be provided to establish a beginning point for the puzzle constructor. 11l1

A dictionary format and search structure was chosen. The format selected was that of a letter table. A letter table is essentially a tree construction with the root nodes of the tree beginning either the first or last letters of the words in the letter table. With respect to which end of the words was used as the root, there was found to be little difference in terms of storage efficiency. Beginning at the first letter of the word is psychologically less confusing and so the letter tables were constructed from the left hand letter of each word. For speed of search, a tableau form of the letter was adopted. 11l2

Two different approaches to constructing the puzzles were considered. These were: filling each possible word space immediately by a whole word; and constructing words by filling the puzzle's letter spaces one by one, in a non-serial manner. 11l3

Upon investigation, it was found that the whole word entry method was not suitable because the dictionary construction would require an excessive amount of disk accesses. This was bad both because the system used did not have adequate disk capacity, and because of the seek times required. Another reason for the failure of the whole word entry method is that the words had to be inserted and deleted many times for the same word space, because two inserted parallel words would often result in an impossible letter combination for the construction of a word perpendicular to and intersecting the previously inserted words. 11l4

The letter-by-letter approach was successful. It was found that usually when a word was validly formed by the letter-by-letter puzzle constructor, it could remain permanently in the constructed puzzle. In addition, it was found that the number of iterations per letter space remained between a linearly constant set of boundaries. This is important because it indicates that the effort expended by the constructor per space to be filled does not increse in a multiplicative manner as the size of the puzzle increases. 11l5

The puzzle constructor results described herein were performed using an IBM 360/50 in a 212K partition. Puzzle sizes from 3x3 to 13x13 were attempted with solutions. Whether or not a puzzle was solved depended on dictionary richness and initial puzzle configuration rather than upon puzzle dimensions. CPU time consumption was approximately 2000 iterations an hour. An iteration is defined as the generation of a new stage of puzzle completeness. The average ratio of blanks to iterations was 0.5735. 11l6

Simulation of Executing Robots in Uncertain Environmentsby L. Siklossy and J. Dreussi
TR-16
Department of Computer Sciences
University of Texas at Austin
May 1973 11m

A simulated robot solves tasks in an environment which is known only approximately. The robot is given a description of the uncertain environment and of its own capabilities. From the latter, it generates procedures that are evaluated to solve tasks. As tasks are solved, the robot improves its knowledge of the environment and the efficiency with which it can solve problems. 11m1

The design used, that of an executing robot, is contrasted with the design of planning robots. It is shown that executing robots are more efficient than planning robots. In uncertain environments, planning robots are inadequate. 11m2

An analysis of the Field of Artificial Intelligenceby H. C. Bunt
Report No. 4793
Philips Research Laboratories
Eindhoven, The Netherlands 11n

In this report an analysis of the field of Artificial Intelligence is presented along the following lines. Section 1 gives an outline of the field: Artificial Intelligence is that branch of computer science concerned with the design of "intelligent" information processing systems. The meaning of "intelligent" in this context is explained using a very simple model of an information processing system. 11n1

In section 2 the intelligence of information processing systems is considered more closely by discussing a number of characteristic aspects of such systems. In section 3 the subjects of Artificial Intelligence research are discussed that constitute basic problems in the design of intelligent systems. In section 4 the systems are considered with which work in Artificial Intelligence is at present concerned. For each of these systems an analysis is made concerning the problems involved, the present state of the art with respect to these problems, the problems that remain to be solved, and the prospects for the future. The report concludes with discussion in section 5 of various approches to the realization of intelligent systems. 11n2

The Terminal Man
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Note: "The Terminal Man" by Michael Crichton (reviewed in the SIGART Newsletter, No. 36, October 1972, p. 43) is now available in paperback, Bantam Press, $1.75. 11o1

"...So much of what was once not very long ago the most fanciful speculation in science fiction, such as going to the moon, is now not merely fact, but so much taken for granted by the layman that it is worthwhile predicting what parts of today's science fiction may become reality in the near future. Of course, my own specialty in science fiction has always been the field of robots, and I for one am looking forward to the time when intelligent robots will become commonplace. Moreover, I can anticipate the day when a robot will actually be my friend." 12

Remarks by Isaac Asimov
on the Mike Douglas Show
KFTY-TV; April 20, 1973 12a

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