SIGART Newsletter Number 36 October 1972 1

A Bimonthly Publication of the ACM Special Interest Group on Artificial Intelligence 1a

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 2 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), advertisements, puzzles, poems, cartoons, etc. 1e

Copy deadline for the December Issue: November 22. 1f

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. 1g

CHAIRMAN'S MESSAGE George W. Ernst 2

I would like to thank Ranan Banerji, Ralph London and Charles Rosen for giving talks at the tutorial session in artificial intelligence at the ACM National Conference in Boston. Each of these men is very busy; yet, each took the time to prepare an excellent talk which was enjoyed by both members and non-members of SIGART. 2a

The ACM conference this year was different in that most all of the sessions were organized by an ACM special interest group. This organization seemed to work out quite well because, I felt (and so did most other people that I talked to) that this year's conference was considerably better than many of the previous ACM conferences. In addition to the tutorial session, SIGART organized two technical sesions (7 papers). The overall quality of these papers was comparable to the quality of the papers in the two IJCAI conferences. In addition, many other SIG's had very interesting sessions. The point is that with this new format, the ACM national conference may be a worthwhile place for SIGART members to give and listen to papers. However, due to the IJCAI conference in San Francisco next summer, I doubt if there will be nearly as much SIGART participation in the ACM national conference next year as in succeeding years. 2b

There will be a SIGART meeting at the Fall Joint. Our speaker will be Dr. Antal K. Bejczy who will talk about "Machine Intelligence and Space Robots: Integrated Robot Research at Jet Propulsion Laboratory." 2c

EDITOR'S ENTRY Steve Coles 3

1. Rich Fikes and I hope you like our new outer cover format. Needless to say, we also welcome your comments on what's inside. Furthermore, we implore you to take serously our request, appearing on the inside cover, to send us your contributions. Our Newsletter can only be as good as our contributor's desire to make it that way. 3a

2. A major innovation in the publication and distribution of the Newsletter will begin with this issue--following the original suggestion of Prof. John McCarthy of the Stanford AI project, a parallel copy of the Newsletter will be accessible over the ARPA Network to interested SIGART members (see Rich Fikes' announcement of the details in the next article). 3b

Some obvious advantages to using the computer as the medium as well as the message are that readers can (1) get to see the Newsletter between three and four weeks sooner than they might otherwise, (2) comment on articles in the past issues, (3) easily submit articles for publication in future issues, (4) interact with other readers dynamically in the AI Forum even before the editors get to put their statements into print through the conventional medium, (5) access the SIGART membership list to locate particular individuals, and (6) apply possible information retrieval routines to past issues as a whole when a particular question arises. 3c

Of course, until we get more experence with this approach to publishing the Newsletter, we will move slowly and experimentally. At the present time we have no plans to eliminate the conventional publication medium, since we appreciate that much of our readership does not have easy access to the ARPA Network, and even those that do might resent the loss of convenience in having the normal printed form available. 3d

3. We would like to reinstitute the plan of designating Newsletter Reporters at each major AI Center* to act as a point of focus at his lab. Anyone who would like to volunteer for such an assignment is urged to contact us. Names of Reporters will be announced in the next ussue. 3e

* BBN, Case, CMU, MIT, NIH, SDC, SRI, S.U., USC, Xerox, Wisconsin, etc. 3e1

4. A major project for the coming year will be in the area technological forecasting and assessment. The aim of the project will be to determine the relative probabilities of specific technical achievements and their consequences to society. The San Francisco Bay Area Chapter's of SIGART, the World Future Society, and the IEEE Systems, Man, and Cybernetics Society have agreed to collaborate in the formulation of a Delphi-type questionnaire to develop forecasts or scenarios for future events in artificial intelligence. The Newsletter and/or the ARPA network may be an interesting vehicle for disseminating such a questionnaire nationally. More about this in future issues. Anyone with interest in partcipating in the design of such a questionnaire is invited to contact us. 3f

5. In conclusion , we would like to say a special word of thanks to our past editor, Woody Bledsoe, who helped us considerabley in making a graceful transition, and we hope that we can follow in the fine tradition which he and Gary Carlson established under their editorial regime. 3g

SIGART NEWSLETTER GOES ON-LINE Rich Fikes 4

Steve an I are in the process of making the SIGART Newsletter available on-line to the ARPA Network. SIGART members that have access to the network will be able to submit Newsletter items, make comments on items in previous issues, ask for opinions from other members on questons of interest to the AI community, and peruse items being collected for inclusion in forthcoming issues. 4a

The Newsletter will be stored on files in the NLS system at the ARPA Network Information Center (NIC). NLS is being developed by Doug Engelbart's Augmentation Research Center at Stanford Research Institute, and includes in its design the facilities we need for easily communicating Newsletter items over the Network and for allowing convenient access to the Newsletter files. 4b

We would like the SIGART reporter at each installation on the Network to be familiar with the Newsletter communication protocols so that he/she can submit items via the Network and can provide local assistance to other SIGART members who wish to use the Network. We will be in contact with the reporters individually to discuss our ideas for use of the Network in more detail. 4c

This looks to us like an interesting and worthwhile way to develop and gain some experience with one mode of ARPA Network usage, an we welcome your reactions to that point of view. Indeed, we encourage your suggestions as to the facilities and capabilities you would like to see made available in the system. 4d

AI FORUM 5

The following is a response to Bob Caviness at the University of Wisconsin received from T. M. P. Lee-- 5a

> In reply to your letter as published in the last issue of the SIGART Newsletter concerning a statement I made in my report on the Pajero Dunes Conference on Computer Vision, I wish to say that perhaps you are reading more into it than was intended. The point I was trying to make--and apparently did not--was that there are many areas of human endeavor in which AI research has already found useful (but not theoretically perfect) techniques that are "merely" waiting for an impresario or entrepreneur. 5a1
>
> I am given the impression that MATHLAB and similar efforts already could provide a service which is better (and cheaper, if you don't amortize all the AI research) than an average mathematician working for an average industrial or research organization when it needs some routine mathematics to be done. I believe, in fact, that someone in the Boston area is trying to offer such a service commercially, but I can't remember the source of that statement. 5a2
>
> I admit that there are many fundamental, and even engineering problems left--but there are also many problems which are closed in a practical sense, such as how to manipulate polynomials, or d most of the integrals or differential equations one can now do with a table, including,most importantly, all the symbol shuffling. Feldman's comment (which perhaps should have been challenged when it was made) was merely to indicate by analogy thpt in the vision and robotics fields there is a similar division between open and

closed problems. Of course faster and more composite algorithms are desirable and are of both theoretical and practical interest--but that shouldn't prevent a proper pride in what has already been done. 5a3

Theodore M. P. Lee
Univac Division
St. Paul, Minn. 5a3a

ACTIVITIES OF THE LOCAL SIGART CHAPTERS 6

The San Francisco Peninsula SIGART Chapter Completes its First Year, Rich Fikes 6a

During the spring of 1971 the San Francisco Peninsula SIGART ChaApter came into being with the purpose of "promoting among its members the acquisiton and exchange of information and opinion on current research and development related to the field of artificial intelligence, with emphasis on work being conducted in the San Francisco Bay Area." (From the bylaws.) 6a1

Officers of the new chapter (including Tom Binford chairman, Rich Fikes vice charman, and Mike Wilber secretary/treasurer) initiated a series of monthly evening technical meetings that produced presentations and discussions on a wide variety of AI research topics. The programs have included the following: 6a2

In June (1971), a short presentation was made by Art Samuel on aspects of learning in his checkers program, followed by a panel dscussion on learning programs in general with the speaker, Nils Nilsson, and John McCarthy forming the panel. 6a2a

In July, Pat Hayes gave a presentation on "Procedures vs. Statements as Representations of Knowledge" that prompted a lively discussion focusing on the use of PLANNER-like langages for deduction and problem solving. 6a2b

The discussion following Pat Hayes' talk prompted a presentation at the August meeting by Jeff Rulifson on "Languages for Expressing Ambiguous Unorganized Programs: QA4 and PLANNER." 6a2c

In September, the chapter held its frist joint meeting with the San Francisco Chapter of the IEEE Systems, Man, and Cybernetics Society. The meeting included a presentation by Dean Brown on "Future Possibilities for Computer Aided Instruction" and a demonstration of the CAI programs developed by his group at Stanford Research Institute. 6a2d

In October, John Chowning and Leland Smith from the Stanford AI Project demonstrated their work dealing with computerized music. Several topics were discussed during the evening including musical compositons in which the position of each instrumet is dynamically variable an specifiable by the composer, and the artificial production by computer of the sounds produced by standard musical instruments. 6a2e

In November, a second joint meeting with the IEEE Chapter included a presentation by Nils Niilsson on "Construction of Generalized Plans as an Approach to Learning" in which he discussed a new addition to the STRIPS planning program that allows plans to be saved and used as single steps in future plans. 6a2f

In December, a presentation was given by Raph London on methods for proving the correctness of programs. The talk included a brief survey of this area and described some recent work which the speaker has been doing. 6a2g

In January, a third joint meeting with the IEEE Chapter included a presentation by Lotfi Zadeh on "Fuzzy Sets and Fuzzy Logic." Discussion at the meeting focused on possible uses in AI research for the mathematical results that have been obtained from the consideration of fuzzy sets. 6a2h

In February, Tom Binford gave a presentation on "Depth Perception in an Automaton Eye" in which he described work at the Stanford AI Project on the development of a range finding device to augment the perceptual capabilities of a robot system. 6a2i

In March, Alan Kay gave a presentation on the subject "Children and A.I." in which he discussed some idas for using computers in elmentary education and described a new programming language similar to MIT's LOGO for interacting with children. 6a2j

The final meeting of the accademic year was in May and included a presentation by Richard Weyrauch entitled "A Logic for the Mathematical Theory of Commputation." The talk described some current work that the speaker was doing at the Stanford AI Project. 6a2k

CHESS PROLOGUE Steve Coles 7

An unprecedented wave of interest in chess, sparked by the recent Spassky-Fischer world championship series, again raises the issue of whether computers can be programmed to compete on equal terms with the best human players. 7a

In the present state they fall far short of internatonal grandmaster performance. The reasons for what may be called the "grandmaster barrier" are concerned with powers of abstraction, generalization, and learning all of which are still absent from today's chess programs. Chess at master level maks such searching demands on these abilities that it offers a life-time's dedication for outstanding intellects. Therefore, although it was one of the first task domains to be chosen for artificial intelligece studies, chess remains one of the most elusive. 7b

The distinguished applied mathmatician, I. J. Good, himself an expert chess player, believes that when a chess program has been developed capable of defeating the world champion, we shall be no more than five years away from the appearance of the "ultra-intelligent machine," a machine intellectually superior to man in all aspects of thought.* 7c

*D. J. Michie, "Programmer's Gabit" NEW SCIENTIST, pp. 329-332, Aug. 17, 91972. 7c1

The U.S. Chess Federation Rating Scale shown below gives us some perspective on where we stand. 7d

RATING CLASS	POINT RANGE	COMMENTS	7d1
Int'l. Grand Master	2600-2800	Boby Fisher - 2824	7d2
Grand Master	2400-2600	Samuel Reshevsky = 2580	7d3
Master	2200-2400		7d4
Expert	2000-2200	Strongest woman player	7d5
A	1800-2000	Strong Amateurs	
B	1600-1800		7d6
C	1400-1600	BEST CHESS PROGRAM = 1500	7d7
D	1200-1400	Most Amateurs	
E	1000-1200		7d8
F	800-1000	Average for all chess players = 800D	7d9

An individuals's rating is calculated on the basis of past performance in tournaments. With this as prologue, let's look at a summary of the Third Annual U.S. Computer Chess Tournament. 7e

SUMMARY OF THE THIRD UNITED STATES COMPUTER CHESS CHAMPIONSHIP

by Monroe Newborn, Department of Electrical Engineering and Computer Science, Columbia University, New York City 8

Without a single complaint about the lighting, chairs, television cameras, or the size of the squares on the chess board, Northwestern University's CDC 6400 computer and programming team of Larry Atkin, Keith Gorlen an David Slate won the United States Computer Chess Championship for the third consecutive year by topping a field of eight challengers. The three round Swiss style tournament was held at the Sheraton-Boston Hotel on August 13-15, 1972 as a Special Event at the ACM's 25th Annual Conference. David Levy, a chess master from Scotland, acted as tournament director. 8a

The Northwestern team won three straight games to extend its perfect record to 9 consecutive victories in the ACM tournaments. They have yet to even end a game in a draw. However they did have a more difficult time this year in knocking out their three opponents. Their first game required 77 moves, the second 72, and the third 51. Northwestern was relentless in its tactic to weaken its opponents' pawns and push its own pawns. Each of its victories was the result of this tactic. Their program was called CHESS 3.6 indicating that it was a slightly improved version of their program CHESS 3.5 used at ACM-71 in Chicago. 8b

The three round tournament ended in a three way tie for second place and a round robin playoff is in progress to break the tie. Tied are: 8c

Dennis Cooper and Ed Dozdrowicki using a UNIVAC 1108 at Bell Telephone Laboratories, Parsippany, New Jersey, 8c1

Jom Gillogly using a PDP-10 at Carnegie-Mellon University 8c2

George Arnold and Monroe Newborn using a Data General Supernova on the Columbia University Campus. (During the tournament in Boston, Arnold and Newborn had a DG Nova at the tournament site.) 8c3

In the only game played so far in the round robin the team of Arnold and Newborn has won a victory over Gillogly. The remaining games are expected to be completed by the end of September. 8d

The tournament owes its success to the help of many individuals. Financial support was provided by the Control Data Corporation. Terminal equipment was provided by National Data. The Massachusetts Chess Club, and in particular Mr. Ben Ladey provided chess equipment and help during the playing of the games. Fiinally, the Department of Electrical Engineering and computer Science at Columbia and Miss Sadie Silverstein, a technical typist in the Department, deserve a special thanks for their assistance in preparing this manuscript and other paperwork related to the tournament. 8e

CHESS CHAMPIONSHIP FINAL STANDINGS 9

Tournament held at Boston, Massachusetts, August 3-15 9a

TEAM AND LOCATION OF COMPUTER	RND 1	RND 2	RND 3	POINTS	9b
Larry Atkin, Keith Gorlen, David Slate; CDC 6400, Northwestern University, Evanston, Ill.	W2	W3	W4	3	9c
George Arnold, Monroe Newborn; Data General Nova, at tournament site.	L1	W7	W6	2	9d
Dennis Cooper, Ed Kozdrowicki; UNIVAC 1108, Bell Telephone Laboratoris, Parsippany, N. J.	W7	L1	W5	2	9e
Jim Gillogly; PDP-10, Carnegie-Mellon Universty.	W6	W5	L1	2	9f
Fredric Karlson, Charles Kalme, Al Zobirst; IBM 370/155, University of Southern California.	W8	L4	L3	1	9g
Franklin Ceruti, Rolf Smith; IBM 360/65, Texas A&M.	L4	W8	L2	1	9h
Mike Rackley, George Moore; L3 IBM 1106, Misissippi State Univ.	L2	D8	D8	1/2	9i
Bruce Leverett; PDP-10, Harvard University	L8	L6	D7	1/2	9j

CHESS CHAMPIONSHIP MOVES 10

Boston, Massachusetts August 3-15 10a

[Ed. Note: "+" stands for check.] 10b

Round 1 Board 1 Date: 8/13/72 10c

White 10c1

Larry Atkin, Keith Gorlen,
David Slate; CDC 6400,
Northwestern University,
Evanston, Ill. 10c1a

Black 10c2

George Arnold, Monroe Newborn;
Data General Nova, at
tournament site. 10c2a

	White	(sec)	Black	(sec)	10c3
1.	P-K4	1	P-QB4	1	
2.	N-KB3	1	N-QB3	1	
3.	P-Q4	1	PxP	1	
4.	NxP	1	P-K4	1	
5.	N-KB3	235	Q-N3	1	
6.	N-B3	140	B-B4	269	
7.	Q-Q2	199	P-Q3	227	
8.	N-Q5	181	Q-Q1	144	
9.	P-QN4	74	B-Q5	143	
10.	P-B3	64	B-N3	147	10c3a
11.	NxB	49	PxN	44	
12.	B-B4	99	B-K3	207	
13.	BxB	69	PxP	39	
14.	N-N5	92	Q-Q2	87	
15.	0-0	115	P-KR3	58	
16.	N-B3	56	0-0-0	220	
17.	R-Q1	65	N-B3	245	
18.	Q-K2	115	Q-QB2	230	
19.	B-N2	108	N-K2	195	
20.	N-Q2	135	P-Q4	67	10c3b
21.	P-QB4	95	P-Q5	264	
22.	Q-Q3	91	N-N3	154	
23.	P-N3	119	Q-K2	162	
24.	B-R3	70	K-B2	90	
25.	R(R1)-N1	122	R-R2	257	
26.	R-K1	88	R-Q2	89	

27.	K-N2	75	Q-Q1	69	
28.	P-R3	80	N-N1	257	
29.	R-N3	94	Q-N4	63	
30.	K-R2	115	R-B2	249	10c3c
31.	Q-K2	101	N-B3	94	
32.	R-KB3	130	P-R4	63	
33.	P-R4	80	N-N5+	249	
34.	K-R1	88	Q-K2	78	
35.	K-N2	110	RxR	216	
36.	NxR	65	Q-B3	52	
37.	B-B1	108	K-Q3	251	
38.	B-N5	106	Q-B2	63	
39.	B-Q8	176	R-R1	286	
40.	BxP	157	K-K2	63	10c3d
41.	N-N5	97	Q-K1	241	
42.	P-N5	185	Q-QB1	111	
43.	R-QN1	195	R-KB1	82	
44.	R-KB1	94	R-K1	335	
45.	Q-B3	173	R-B1	135	
45.	Q-R3+	78	K-Q2	82	
47.	B-B5	135	R-R1	94	
48.	N-B7	146	R-R2	104	
49.	R-B1	155	N-R3	88	
50.	N-Q6	26	Q-B2	234	10c3e
51.	P-N6	110	Q-B3	69	
52.	R-K1	149	R-R1	126	
53.	K-N1	36	N-N5	116	
54.	R-KB1	110	R-R3	299	
55.	N-B7	99	QxP(K5)	151	
56.	NxR	106	NxN	75	
57.	P-B3	56	Q-QB33	102	
58.	K-B2	67	K-Q1	128	
59.	R-QN1	96	Q-Q2	119	
60.	K-N2	109	N-B4	75	10c3f
61.	K-B2	100	Q-B1	232	
62	R-N5	88	K-Q2	99	
63.	R-N2	78	K-B3	288	
64..	Q-N4	234	K-Q2	80	
65.	Q-N5+	80	Q-B3	39	
66.	R-Q2	85	QXQ	227	
67.	PXQ	39	K-Q1	60	
68.	R-Q3	74	N(N3)-K2	165	
69	P-R4	129	P-N3	66	
70.	P-R5	79	K-Q2	211	10c3g

71.	P-R6	50	PxP	57	
72.	PxP	138	K-B1	231	
73.	P-R7	105	K-N2	129	
74.	R-R3	52	K-R1	85	
75.	P-N7+	27	KxP	1	
76.	P-R8=Q+	32	K-B2	1	
77.	R-R7 MATE	33			10c3h

Round 1 Board 2 Date: 8/13/72 10d

White 10d1

Franklin Ceruti, Rolf Smith;
IBM 360/65, Texas A&M. 10d1a

Black 10d2

Jim Gillogly; PDP-10,
Carnegie-Mellon Universty. 10d2a

	White	(sec)	Black	(sec)	10d3
1.	P-Q4	1	P-Q4	2	
2.	P-QB4	1	PxP	5	
3.	N-KB3	1	N-QB3	10	
4.	P-K4	72	P-QN4	1	
5.	P-Q5	174	N-QN5	25	
6.	B-N5	133	N-KB3	358	
7.	BxN	211	KPxB	269	
8.	B-K2	187	B-QB4	253	
9.	N-B3	101	B-Q2	261	
10.	O-O	157	O-O	104	10d3a
11.	N-KR4	175	Q-K2	311	
12.	P-QR3	256	N-R3	150	
13.	N-B5	195	Q-K4	1	
14.	N-K3	142	P-B3	648	
15.	PxP	248	BxP(B3)	402	
16.	NxP(B4)	204	NxP	42	
17.	BxP	153	N-B2	375	
18.	Q-N4	157	B-Q5	367	
19.	QR-B1	284	BxN	381	
20	RxB	121	BxP	1	10d3b
21.	R-K1	177	B-B6	108	
22.	RxQ	125	BxQ	1	
23.	R-K7	75	N-K3	1	
24.	BxN	93	BxB	42	
25.	P-KN3	220	KR-K1	93	

26.	RxR	40	RxR	1	
27.	R-B7	60	B-Q4	78	
28.	P-B4	106	P-QR3	50	
29.	R-Q7	41	B-K5	39	
30.	K-B2	95	K-B1	1	10d3c

31.	P-QN4	121	R-K3	343	
32.	R-Q8+	78	K-K2	39	
33.	R-Q1	96	R-Q3	142	
34.	R-K1	78	R-Q7+	191	
35.	K-N1	125	P-B4	191	
36.	P-KR4	56	R-KN7+	963	
37.	K-B1	544	RxP	1	
38.	P-R4	58	R-N6	1	
39.	P-KR5	209	RxP	44	
40.	P-R5	46	R-N8	1	10d3d

41.	K-B2	110	RxR	40	
42.	KxR	49	B-B6	1	
43.	P-R6	62	PxP	52	
44.	K-B2	30	B-Q4	85	
45.	K-K3	19	K-Q3	63	
46.	K-Q4	20	B-K3	78	
47.	K-Q3	34	B-R7	548	
48.	K-Q4	47	B-Q4	370	
49.	K-K3	72	K-B3	941	
50.	K-Q4	45	P-KR4	1	10d3e

51.	K-K5	49	B-K5	1	
52.	K-Q4	25	P-R5	1	
53.	K-K5	22	P-R6	1	
54.	K-Q4	24	K-N4	98	
55.	K-K5	43	KxP	175	
56.	K-Q4	34	P-R7	54	
57.	K-K5	46	P-R8=Q	764	
58.	K-Q4	87	P-KR3	1265	
59.	K-K5	68	Q-KR5	2	
60.	K-Q6	49	QxP+	2	10d3f

61.	K-Q7	63	K-QN3	11	
62.	K-Q8	58	P-KR4	46	
63.	Resigns				10d3g

Round 1 Board 3 Date: 8/13/72 10e

White 10e1

Fredric Karlson, Charles
Kalme, Al Zobirst; IBM

370/155, University of
Southern California. 10e1a

Black 10e2

Bruce Leverett; PDP-10,
Harvard University 10e2a

	White	Black	10e3
1.	P-K4	N-KB3	
2.	P-K5	N-K5	
3.	P-Q3	N-B4	
4.	N-QB3	N-B3	
5.	N-B3	P-Q4	
6.	B-K3	P-Q5	
7.	N-K4	NxKP	
8.	NxN(K4)	N-R5	
9.	N-N5	NxP	
10.	Q-B3	NxP+	10e3a
11.	BxN	B-K3	
12.	N(K5)xP	Q-Q4	
13.	NxR	QxQ	
14.	PxQ	BxP	
15.	BxQP	0-0-0	
16.	RxB	RxB	
17.	N-K6	R-Q3	
18.	NxB	R-KB3	
19.	NxP	RxP	
20.	RxP	P-B4	10e3b
21.	N-N6	R-B2	
22.	B-K4	P-K3	
23.	N-N5	R-B3	
24.	RxP	RxN	
25.	BxR	KxR	
26.	NxP	P-B5	
27.	NxP	K-B3	
28.	B-B7	K-N4	
29.	R-N1	K-N5	
30.	R-N4	K-R6	10e3c
31.	BxP	K-N7	
32.	K-Q2	K-R6	
33.	K-B3	K-R5	
34.	P-R3	K-R4	
35.	R-N5+	K-R5	

36. B-N3+ K-R6
37. R-R5 MATE 10e3d

Note: Neither side provided a record of their time. 10e3d1

Round 1 Board 4 Date: 8/13/72 10f

White 10f1

Mike Rackley, George Moore;
IBM 1106, Misissippi State Univ. 10f1a

Black 10f2

Dennis Cooper, Ed Kozdrowicki;
UNIVAC 1108, Bell Telephone
Laboratoris, Parsippany, N. J. 10f2a

	White	Black	(sec)	10f3
1.	P-K4	P-K4	56	
2.	B-N5	P-QB3	202	
3.	B-B4	P-Q4	280	
4.	PxP	PxP	180	
5.	B-N5+	B-Q2	175	
6.	P-QR4	B-QB4	340	
7.	N-KB3	BxB	168	
8.	PxB	P-K5	168	
9.	P-Q4	PxN	144	
10.	0-0	PxP	77	10f3a
11.	KxP	B-Q3	163	
12.	Q-N4	N-Q2	175	
13.	QxP	Q-B3	16	
14.	R-K1+	N-K2	75	
15.	B-R6	Q-N3+	61	
16.	QxQ	RPxQ	27	
17.	B-N7	RxP+	63	
18.	K-N1	R-R2	70	
19.	B-B8	B-KR7+	36	
20.	K-N2	NxB	31	10f3b
21.	P-N6	P-R3	47	
22.	R-R4	N-K3	77	
23.	RxN	PxR	8	
24.	P-QB4	PxP	60	
25.	RxP	N-Q4	68	
26.	N-R3	NxP	29	
27.	R-N4	N-Q4	12	

28.	R-B4	R-R5	136	
29.	P-N4	P-QN4	192	
30.	R-B6	K-Q2	158	10f3c
31.	R-B5	R-N5+	279	
32.	K-R3	R-KN4	224	
33.	RxN+	PxR	8	
34	KxB	R-R1 MATE	1	10f3d

Note: White did not record its time. 10f3d1

Round 2 Board 1 Date: 8/14/72 10g

White 10g1

Dennis Cooper, Ed Kozdrowicki;
UNIVAC 1108, Bell Telephone
Laboratoris, Parsippany, N. J. 10g1a

Black 10g2

Larry Atkin, Keith Gorlen,
David Slate; CDC 6400,
Northwestern University,
Evanston, Ill. 10g2a

	White	(sec)	Black	(sec)	10g3
1.	P-Q4	11	P-Q4	1	
2.	N-QB3	19	N-KB3	1	
3.	N-KB3	10	B-N5	80	
4.	Q-Q3	23	N-B3	137	
5.	N-K5	169	B-Q2	165	
6.	B-KN5	250	N-QN5	83	
7.	Q-Q1	245	B-B4	69	
8.	N-Q3	143	P-KR3	97	
9.	BxN	50	P(K2)xB	46	
10.	P-QR3	130	NxN	48	10g3a
11.	P(B2)xN	92	B-K3	67	
12.	Q-N3	29	P-QN3	38	
13.	P-K4	47	P-B3	37	
14.	Q-R4	92	Q-Q2	65	
15.	PxP	43	BxP)Q4)	36	
16.	NxB	73	QxN	59	
17.	R-QB1	148	K-Q2	117	
18.	Q-B4	224	B-Q3	134	
19.	QxQ	76	PxQ	36	
20.	B-K2	21	R(QR1)-K1	114	10g3b

21.	P-QR4	37	P-B4	38	
22.	P-QN3	27	B-N5+	44	
23.	K-Q1	24	R-QB1	57	
24.	RxR	28	RxR	29	
25.	B-B3	23	K-Q3	48	
26.	K-K2	137	R-K1+	31	
27.	K-Q1	16	B-B6	76	
28.	P-KN4	14	PxP	36	
29	BxNP	5	P-N3	58	
30.	P-B4	18	BxP	84	10g3c
31.	P-QN4	45	P-KR4	147	
32.	B-K2	26	R-QB1	124	
33.	R-B1	53	B-K6	53	
34.	K-K1	56	R-B7	120	
35.	P-B5	157	R-R7	98	
36.	PxP	40	PxP	205	
37.	R-B6+	49	K-K4	38	
38.	RxP(KN6)	41	K-Q5	276	
39.	K-Q1	169	RxP	95	
40.	P-QN5	87	R-R9+	264	10g3d
41.	K-B2	1	R-K8	124	
42.	B-Q1	53	R-B8	50	
43.	P-R4	176	R-B7+	63	
44.	K-QN3	12	R-B5	48	
45.	BxP	37	RxP	64	
46.	B-B3	41	K-B4	111	
47.	R-QB6+	135	KxP	46	
48.	BxP	58	R-Q5	69	
49.	B-BB3	57	RxP+	48	
50.	R-B3	15	RxR+	18	10g3e
51.	KxR	2	P-R4	95	
52.	B-Q5	12	P-R5	91	
53.	K-Q3	99	K-B4	144	
54.	B-N6	39	B-Q5	148	
55.	K-B2	19	P-N4	52	
56.	K-Q2	17	K-Q3	270	
57.	B-B7	14	K-K4	106	
58.	K-K1	32	K-B3	69	
59.	B-Q5	24	P-N5	58	
60.	K-K2	13	P-N6	41	10g3f
61.	K-B3	10	P-N7	75	
62.	B-K4	17	P-R6	49	
63.	B-N1	20	K-K4	119	
64.	B-R2	12	B-B6	69	
65.	B-N1	20	B-Q7	97	

66.	B-R2	18	B-N4	96	
67.	B-N1	31	K-Q4	129	
68.	B-R2	19	K-Q5	64	
69.	B-N1	17	K-B6	77	
70.	K-K2	11	K-N6	33	10g3g
71.	K-Q1	15	P-R7	19	
72.	RESIGNS				10g3h

Round 2 Board 2 Date: 8/14/72 10h

WHITE 10h1

JIM GILLOGLY; PDP-10,
CARNEGIE-MELLON UNIVERSTY. 10h1a

BLACK 10h2

FREDRIC KARLSON, CHARLES
KALME, AL ZOBIRST; IBM
370/155, UNIVERSITY OF
SOUTHERN CALIFORNIA. 10h2a

	WHITE	(SEC)	BLACK	(SEC)	10h3
1.	P-K4	1	P-QB4		
2.	N-KB3	1	N-QB3		
3.	P-Q4	1	PxP		
4.	NxP	1	N-B3		
5.	N-QB3	1	P-Q3		
6.	B-QB4	120	P-K4		
7.	N-B5	128	B-K3		
8.	Q-Q3	133	N-QN5		
9.	B-QN5+	75	B-Q2		
10.	Bx+	109	QxB		10h4
11.	Q-K2	148	P-KN3		
12.	B-N5	139	N-R4		
13.	P-QR3	396	P-KB3		
14.	PxN	191	PxB		
15.	N-Q5	324	Q-QB3		
16.	0-0	290	N-B5		
17.	NxN	15	NPxN(B5)		
18.	P-QN5	1	Q-N3		
19.	N-R4	115	B-K2		
20.	N-KB3	57	P-QR3		10h5
21.	Q-QB4	158	P-N4		
22.	KR	Q1	343	P-N5	

23.	N-Q2	1	P-KR4	
24.	R-R4	277	B-N4	
25.	Q-K6+	140	K-Q1	
26.	N-QB4	239	QxNP	
27.	QxP+	90	K-B1	
28.	N-QN6+	1	QxN	
29.	QxQ	96	R-R3	
30.	Q-B5+	61	R-B3	10h6
31.	Q-B8+	1	K-B2	
32.	QxR	849	RxP	
33.	Q-KN8	48	B-R5	
34.	R-B4	39	RxR	
35.	QxR+	1	K-N1	
36.	R-Q7	820	P-R4	
37.	Q-B7+	85	K-R2	
38.	QxP	MATE		10h7

NOTE: Black did not record its time. 10h7a

Round 2 Board 3 Date: 8/14/72 10i

White 10i1

George Arnold, Monroe Newborn;
Data General Nova, at
tournament site. 10i1a

Black 10i2

Mike Rackley, George Moore;
IBM 1106, Mississippi State Univ. 10i2a

	White	(sec)	Black	(sec)	10i3
1.	P-QB4	1	N-QB3	20	
2.	P-Q4	41	N-KB3	55	
3.	P-Q5	84	N-QN1	11	
4.	N-KB3	63	N-QR3	83	
5.	B-N5	104	N-K5	134	
6.	N(N1)-Q2	94	NxB	92	
7.	NxN	39	P-KB3	177	
8.	N-K4	47	P-KB4	111	
9.	N-KN3	229	P-KB5	79	
10.	N-KR5	233	N-QB4	204	10i3a
11.	P-QN4	295	P-K4	102	
12.	PxN	275	P-KN3	112	

13.	P-K3	255	PxP	150	
14.	PxP	74	BxP	163	
15.	Q-KB3	130	Q-R5+	180	
16.	N-N3	60	R-B1	1333	
17.	Q-K2	170	BN5	494	
18.	Q-Q3	158	P-KN4	874	
19.	0-0-0	103	R-B7	868	
20.	N-KB3	246	Q-N5	619	

10i3b

21.	NxP(K5)	214	QxR+	435	
22.	KxQ	56	P-Q3	528	
23.	N-K4	114	RxB+	236	
24.	RxR	29	PxN	142	
15.	N-B6+	248	K-K2	134	
26.	QxP+	242	K-Q1	106	
27.	Q-R8+	58	K-K2	42	
28.	Q-K8+	37	K-Q3	10	
29.	N-K4	MATE			10i3c

Round 2 Board 4 Date: 8/14/72 10j

White 10j1

Bruce Leverett; PDP-10,
Harvard University 10j1a

Black 10j2

Franklin Ceruti, Rolf Smith;
IBM 360/65, Texas A&M. 10j2a

	White	(sec)	Black	(sec)	10j3
1.	N-QB3	2	P-Q4	1	
2.	P-K4	3	PxP	1	
3.	NxP	13	P-K4	1	
4.	Q-R5	16.5	N-QB3	193	
5.	N-KB3	20	N-B3	170	
6.	NxN+	28	PxN	147	
7.	B-B4	35	Q-Q2	941	
8.	QxP+	35	QxQ	81	
9.	BxQ+	39	KxB	136	
10.	0-0	43	R-KN1	158	10j3a
11.	P-Q3	46	B-QB4	214	
12.	B-K3	55	N-Q5	179	
13.	NxN	62	PxN	153	
14.	B-B4	83	B-Q3	196	

15.	B-N3	89	B-K3	145	
16.	P-QR4	92	R-N4	130	
17.	P-R4	106	R-N5	112	
18.	P-N4	109	BxB	116	
19.	PxB	110	RxNP	93	
20.	R-B4	15	R-Q1	190	10j3b

21. FORFEITS ON TIME 10j3c

[Ed. Note: with considerable material advantage for black.] 10j3c1

Round 3 Board 1 Date: 8/15/72 10k

[Ed. Note: See the next article for commentary on this game by Sam Rashevsky]
[This was probably the best played game of the match.] 10k1

White 10k2

Larry Atkin, Keith Gorlen,
David Slate; CDC 6400,
Northwestern University,
Evanston, Ill. 10k2a

Black 10k3

Jim Gillogly; PDP-10,
Carnegie-Mellon Universty. 10k3a

	White	(sec)	Black	(sec)	10k4
1.	P-K4	1	P-K4	1	
2.	N-KB3	1	N-QB3	1	
3.	B-QN5	1	N-KB3	1	
4.	0-0	1	B-QB4	1	
5.	N-QB3	104	P-Q3	1	
6.	BxN+	55	PxB	99	
7.	P-Q4	79	PxP	1	
8.	NxP	62	0-0	27	
9.	B-KN5	109	B-KN5	92	
10.	Q-Q3	398	BxN	124	10k4a
11.	QxB	86	R-QN1	175	
12.	BxN	99	QxB	64	
13.	QxQ	46	PxQ	105	
14.	P-QN3	363	R-QN5	50	
15.	P-KR3	86	B-K3	45	
16.	P-KN4	108	R-Q5	65	

17.	QR/QR1-Z1	182	RxR	232	
18.	NxR	28	K-KN2	201	
19.	N-K3	44	K-KN3	242	
20.	P-KB4	49	K-KN2	206	10k4b

21.	K-KN2	341	R-QN1	299	
22.	K-KB3	120	R-QN4	586	
23.	P-QB4	55	R-QR4	317	
24.	P-KB5	44	B-Q2	56	
25.	R-KB2	88	R-K4	134	
26.	R-Q2	788	P-QR3	453	
27.	P-KR4	126	P-QB4	371	
28.	N-Q5	67	B-QB3	12	
29.	N/Q5xP(QB7)	47	BxP+	42	
30.	K-B4	37	P-KR4	1	10k4c

31.	PxP	49	P-QR4	178	
32.	RxP	82	BxP	271	
33.	P-KR6+	54	K-KN3	1	
34.	P-KR5+	30	KxP/R4	47	
35.	RxR	51	R-K7	55	
36.	KxB	22	R-KB7+	1449	
37.	K-K5	24	R-KR7	42	
38.	N-Q5	247	K-KN4	42	
39.	N-QB3	157	R-KR5	104	
40.	RxP	61	KxP	204	10k4d

41.	N-K4	82	R-KR4+	127	
42.	K-Q6	544	K-KN3	79	
43.	R-QR7	71	P-QR5	178	
44.	RxP	61	K-KB2	77	
45.	R-QR7+	67	K-KN3	305	
46.	P-QR4	148	R-KB44	315	
47.	P-QR5	88	R-KB66	54	
48.	R-QN7	102	K-KB4	79	
49.	NxP	50	R-QB6	234	
50.	P-QR6	182	R-KR6	1	10k4e

51.	P-QR7	61	TIME FORFEIT		10k4f

[Ed. Note: With a clear win for white.] 10k4f1

Round 3 Board 2 Date: 8/15/72 10l

White 10l1

Fredric Karlson, Charles
Kalme, Al Zobirst; IBM

370/155, University of
Southern California. 10l1a

Black 10l2

Dennis Cooper, Ed Kozdrowicki;
UNIVAC 1108, Bell Telephone
Laboratoris, Parsippany, N. J. 10l2a

	White (sec)	Black (sec)		10l3
1.	P/K2-K4	P/K2-K4	118	
2.	N/KN1-KB3	P/Q2-Q4	241	
3.	P/K4xP/Q5	Q/Q1xP/Q4	180	
4.	N/QN1-QB3	Q/Q4-QR4	64	
5.	B/KB1-QN5+	B/QB1-Q2	18	
6.	P/QR2-QR4	B/Q2xB/QN4	71	
7.	N/QB3xB/QN5	N/QN1-Q2	67	
8.	P/QB2-QB3	N/KN1-KB3	148	
9.	P/QN2-QN4	Q/QR4-QN3	220	
10.	P/Q2-Q4	P/QB2-QB3	419	10l3a
11.	P/Q4xP/K5	P/QB3xN/QN4	364	
12.	Q/Q1-Q3	N/NB3-KN5	263	
13.	B/QB1-K3	N/KN5xB/K6	167	
14.	P/KB2xN/K3	P/QN2xP/QR5	186	
15.	R/QR1xP/QR4	Q/QN3-K3	181	
16.	Q/Q3-QN5	Q/K3-QN6	181	
17.	R/KR1-KB1	Q/QN6xP/QB6+	175	
18.	K/K1-K2	Q/QB6-QB3	176	
19.	Q/QN5-QR5	Q/QB3-QB5+	174	
20.	K/K2-KB2	P/QN2-QN4	176	10l3b
21.	R/QR4-QR1	B/KB1xP/QN5	176	
22.	Q/QR5-QR6	B/QN5-QB6	176	
23.	R/KB1-QB1	0-0	176	
24.	R/QR1-QR3	N/Q2-QB4	176	
25.	R/QB1-QB2	N/QB4xQ/QR3	175	
26.	R/QB2xB/QB3	Q/QB5-K5	98	
27.	N/KB3-Q4	Q/K3xP/K4	115	
28.	R/QR3xN/QR6	R/KB1-Q1	166	
29.	P/KN2-KN3	P/QN4-QN5	160	
30.	R/QB3-QB4	R/Q1-Q3	163	10l3c
31.	R/QR6-QB6	P/Q1-Q3	163	
31.	R/QR6-QB6	P/QR2-QR4	167	
32.	R/QB6-QB8+	R/Q3-Q1	140	
33.	R/QB8-QB5	R/Q1-Q4	80	10l3d

Game adjucated a win for Black
(White's computer was required for other work after 10 PM.)
[Ed. Note: With significant material advantage for black.]
Note: White did not record its time. 10l3d1

Round 3 Board 3 Date: 8/15/72 10m

White 10m1

Franklin Ceruti, Rolf Smith;
IBM 360/65, Texas A&M. 10m1a

Black 10m2

George Arnold, Monroe Newborn;
Data General Nova, at
tournament site. 10m2a

	White	(sec)	Black	(sec)	10m3
1.	P-Q4	1	N-KB3	23	
2.	P-QB4	1	P-K3	77	
3.	N-QB3	1	B-QN5	56	
4.	Q-B2	1	0-0	60	
5.	P-K3	133	N-QB3	54	
6.	B-Q2	181	P-QR4	144	
7.	P-Q5	206	PxP	121	
8.	PxP	126	BxN	104	
9.	BxB	172	NxP	109	
10.	0--0-0	248	N(B3)-N5	210	10m3a
11.	BxN	150	NxB	106	
12.	Q-B4	173	P-Q4	151	
13.	Q-N3	240	B--B4	244	
14.	P-QR3	129	B-B7	119	
15.	Q-B3	178	N-QR7+	88	
16.	KxB	85	NxQ	42	
17.	PxN	125	Q-KN4	141	
18.	P-KB4	156	Q-N3+	67	
19.	K-N2	151	Q-QN3+	125	
20.	K-R2	183	P-QR5	169	10m3b
21.	R-Q3	224	Q-N6+	39	
22.	K-R1	1	QxP(R6)+	77	
23.	K-N1	17	R-R4	60	
24.	N-R3	936	R-N4+	174	

25.	K-B2	1	Q-R7+	211	
26.	RESIGNS				10m3c

Round 3 Board 4 Date: 8/15/72 10n

White 10n1

Mike Rackley, George Moore;
IBM 1106, Misissippi State Univ. 10n1a

Black 10n2

Bruce Leverett; PDP-10,
Harvard University 10n2a

	White	Black	10n3
1.	P-Q4	N-KB3	
2.	B-N5	N-K5	
3.	N-KB3	N-QB3	
4.	Q-Q3	NxB	
5.	NxN	P-K3	
6.	N-K4	B-N5+	
7.	P-QB3	P-KB4	
8.	N-B5	BxN	
9.	PxB	Q-K2	
10.	Q-N5?	P-QR3	10n3a
11,	Q-B4	0-0	
12.	P-K3	P-KN4	
13.	B-K2	PP-KB5	
14.	B-R5	P-KR3	
15.	P-K4	P-R4	
16.	K-Q2	K-N2	
17.	P-QR4	K-R1	
18.	P-R3	R-Q1	
19.	R-KR2	R-R2	
20.	P-B3	Q-KB3	10n3b
21.	N-R3	R-R1	
22.	N-N5	Q-K4	
23.	B-N6	K-N2	
24.	B-R5	R-R1	
25.	K-Q3	R-B1	
26.	P-QN3	N-N5+	
27.	K-Q2	N-B3	
28.	R-R2	N-K2	
29.	Q-Q4	QxQ	
30.	NxQ	P-K4	10n3c

31.	N-N5	R-R3	
32.	NxP	R-B3	
33.	N-K8+	RxN	
34.	BxR	RxP	
35.	K-Q3	P-Q4	
36.	R-Q2	B-K3	
37.	R-N2	P-N3	
38.	B-R5	B-Q2	
39.	R-KB2	B-B3	
40.	R-Q2	K-R1	10n3d
41.	B-B7	PxP+	
42.	PxP	P-N4	
43.	P-QN4	PxNP	
44.	BPxP	R-B8	
45.	B-Q5	PxP	
46.	BxB	NxB	
47.	R-N2	R-KN8	
48.	P-N5	R-Q8+	
549.	K-K2	R-Q3	
50.	PxN	P-R4	10n3e
51.	R-N8+	K-R2	
52	R-K8	RxP	
53.	RxP	P-R5	
54.	K-Q3	P-R6	
55.	R-K7+	K-N3	
56.	R-QR7	R-Q3+	
57.	K-B2	R-B3+	
58.	K-Q3	R-Q3+	
59.	K-B4	R-B3+	
60.	K-Q4	R-Q3+	10n3f
61.	K-B3	R-B3+	
62.	K-Q3	R-Q3+	
63.	DRAWN BY REPETITION		10n3g

[Ed. Note: Although White had a material advantage.
I tried to reconstruct the transcription error at Move 10 as best I could.
This game is so bad, if it weren't for the fact that I'm obliged to include it for the sake of completeness, I'd be ashamed to have published it at all]
Note: Neither side recorded its time. 10n3g1

Play-off for 2nd Place Date: 8/15/72 10o

White 10o1

George Arnold, Monroe Newborn;
Data General Nova, at
tournament site. 10o1a

Black 10o2

Jim Gillogly; PDP-10,
Carnegie-Mellon Universty. 10o2a

	White	(sec)	Black	(sec)	10o3
1.	P-QB4	1	P-K4	1	
2.	N-QB3	1	N-KB3	2	
3.	P-K4	1	N-QB3	1	
4.	P-Q3	1	B-B4	3	
5.	B-KN5	1	O-O	26	
6.	N-KB3	213	P-Q3	1	
7.	B-K2	111	B-K3	77	
8.	O-O	103	N-Q5	1	
9.	N-Q6	196	P-QB3	1	
10.	BxN	196	NxN+	64	10o3a
11.	BxN	82	PxB	1	
12.	N-QB3	97	B-Q5	101	
13.	Q-N3	151	Q-R4	171	
14.	N-K2	227	R/R1-N1	157	
15.	R/R1-K1	205	P-N4	145	
16.	NxB	229	PxN	1	
17.	Q-R3	266	QxQ	77	
18.	PxQ	51	PxP	1	
19.	R-QB1	117	R-QN4	326	
20.	PxP	111	R-QB4	454	10o3b
21.	R/KB1-Q1	134	BxP	368	
22.	RxP	97	B-K3	158	
23.	R/QB1-Q1	143	K-N2	537	
24.	P-KR4	256	R-QB1	730	
25.	RxP	219	BxP	265	
26.	P-KR5	91	B-K3	97	
27.	R/1-Q3	114	R-QN1	97	
28.	B-Q1	123	R-QB1	159	
29.	P-KB4	63	R-K1	189	
30.	R-KN3+	93	K-B1	66	10o3c
31.	P-R6	185	K-K2	81	
32.	R-Q2	71	R-QB1	76	
33.	P-KB5	80	B-B5	71	
34.	R-KN7	104	R-K4	78	
35.	RxP/R7	170	RxP/K5	85	

36.	B-QB2	132	R-KR5	61	
37.	P-N3	94	R-KN1	350	
38.	R-KN2	174	R-Q5	602	
39.	K-R2	131	TIME FORFEIT		10o3d

[Ed. Note: With a slight advantage for White.] 10o3d1

ANALYSIS
by Samuel Reshevsky Former U.S. Title Holder as published in the New York Times, August 17, 1972 11

The computer chess match in Boston proved one thing: computers have a long way to go before they become international grandmasters. But their game was an interesting experiment nonetheless. 11a

At the opening, TECH's reply to Chess 3.6's first move of PK4 was P-K4. An irregular variation of the Ruy Lopez then developed. 11b

The first mistake was made by Chess 3.6 playing white, when he failed to win a pawn with 9 NxP, instead of 9 B-N5. But what is a pawn between computers? 11c

Black's reply on the ninth move of ... B-KN5 was amazing. But TECH had calculated that its move was not a blunder. 11d

It must have realized that if 10 BxN, QxB, then: 11 QxB, BxN, with a playable game. And when White concluded it would not profit from the above continuation, it correctly continued 10 Q-Q3. 11e

On the 11 move, TECH allowed its opponent to break up its king pawn position. Prudent was 11 . . . P-B4 (instead of R-N1) and if Chess 3.6 persisted in its apparently intended continuation of 12 BxN, then 12 . . . PxQ; 13 BxQ, PxN; 14 BxP, PxP; 15 QR-N1, KR-B1; 16 BxP, RxP, with an even position. But that was really too much to expect from a computer. 11f

Tech was saddled with two doubled pawns in the end game. Chess 3.6 pressed its advantage reasonably well. 11g

Chess 3.6 displayed good judgment on its 18th turn when it recaptured the rook with its Knight instead of its own rook, realizing that the knight could be better utilized at K3 than at QB3. 11h

White's 20 P-KB4 was a mechanical but useful stroke. It threatened to win the bishop with P-B5ch, and Tech, seeing it, moved its king away. 11i

White's 25th move, R-B2, protected his queen rook pawn. How did Chess 3.6 ever see that it was attacked by black's rook? Tech slipped on its 27th move when it advanced its queen bishop pawn. Correct was 27 . . .P-R3 with an even position. 11j

White's 28th move, N-Q5, was a star move for a computer. Black's position was untenable from here on. Tech's 30 . . .P-K4 was a good try but insufficient. 11k

White's 33 P-KR6ch, on the other hand, was a computer stroke of genius Of course, 33 . . .KxP; 34 RxPch would have finished it off right thee. White was really concentrating when it played 34 P-R5ch. 11l

After 35 RxP, Tech could have resigned, but being a good computer it fought until the bitter end. 11m

ADDITIONAL BACKGROUND ON THE TOURNAMENT Steve Coles 12

In a telephone interview with Monte Newborn of Columbia, I gleaned some additional background on the tournament: 12a

In 1968 John McCarthy (Stanford), Seymour Papert (MIT), and Donald Michie (Edinburgh) combined to make a bet with David Levy (ACM-72 Chess Tournament Director) that he would be beaten by some computer chess program before August 1978. Incidentally, Levy is now an international master 12b

The original wager was for 1000 pounds, but Ben Mittman (North Western) joined on the side of Levy with an additional $250.00 at ACM-71 in Chicago bringing the total pot to $2,500, as reported in the New York Times. 12c

[Ed. Note: I will be happy to coordinate any raising of the ante by those having a stake in the matter.] M. M. Botvinnik, the former world champion, has reportedly told Levy "I feel sorry for your money," but Max Euwe, also an ex-world champion, thinks otherwise. By the way, doesn't this wager remind you of a similar ten-year prediction made in 1957 by a gentleman from Pittsburgh? 12d

Botvinnik from the U.S.S.R. has a program running of his own, but declined a formal invitation to compete at ACM-72. He has high hopes to enter in 1973. 12e

Hans Berliner of Carnegie-Mellon and U.S. Postal-Chess Champion, had planned to enter J.BIT, his own program, but dropped out at the last minute, since he wasn't quite ready yet. We expect to see him next year also. 12f

Richard Greenblatt of MIT and principal architect of MACHAK, reputed to be the the best computer chess program around (it is rumored to play at class B now), has consistently declined invitations to participate at ACM sponsored tournaments. Although he is somewhat evasive about this, we surmise his reasoning as follows: 12g

"If I were to enter my program in an all-computer tournament, as I have in human tournaments, I would want it to do well. To do well, I would hope to capitalize on all the idiosyncracies of my opponent's play. This would lead ultimately to an elaboration of my program along lines that would be irrelevant to good play against humans, my ultimate objective. Therefore, such an effort represents too much of a digression of my valuable time and energy." 12h

Yet, three or four of the ACM-72 programs can consistently beat the circa 1968 version of MACHACK which is publically available. So, why not release the current MACHACK for public use (not much of a diversion of resources) and let other competitors try their hand privately? The gauntlet has been thrown. Let's see if Mr. Greenblatt takes it up. [Eds. Note: We would be happy to receive other opinions on this controversy for possible inclusion in the next issues of the AI Forum. 12i

In a technical session associated with the match many of the teams were excited to learn about a new approach developed by the U.S.C. team of Zobrist, Kalme, and Karlson. They hope to simulate the pattern-directed search of chess masters. Their program contains only 45 such patterns at present and is too rudimentary to do well yet, but most agreed that this is the best approach for the future. However, it may turn out that their stragegy is little more than a rewording of what others are already doing and the true test will not come until ACM-74. 12j

A PROGRESS REPORT ON SPEECH UNDERSTANDING AT SRI

by Don Walker, Artificial Intelligence Center, Stanford research Institute, Menlo Park, California 13

SRI is one of a number of organizations engaged in a major program of research on tha anlysis of continuous speech by computer (cf. Newell et al., 1971). 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 SRI project involves the actions of a simulated robot manipulating blocks in a simulated three-dimensional environment. A person speaking to the cmputer will be able to ask questions about this environment. to give commands that will modify it, and to add information to augment its structure. The procedures being developed to provide these capabilities integrate pragmatic, semantic, syntactic, lexical, phonological, phonetic, and acoustic analyses. 13a

Efforts after "speech understanding" contrast with those directed toward "speech recognition" both in goal and approach. Speech recognition work has aimed at providing an orthographic transcription of the sounds and words corresponding to the speech signal. Analysis has concentrated on acoustic processing, although phonetic, phonemic, and sometimes even morphological segmentations have been attempted. In contrast, speech understanding research seeks to determine the message intended in spite of indeterminacies and errors in the generation, transmission, and reception of an utterance. Special emphasis is placed on semantiics, syntax, and pragmatic information, and a question-answering system is used as a major processing component. The SRI approach in particular stresses the critical role of semantics and pragmatics in reducing the amount of acoustic processing necessary to understand an utterance. 13b

In the SRI system design, knowledge of the world, a model of the user, and a grammar combine to constrain the selection of a small set of words which might be expected to be present at a particular place in the speech stream. These words are processed to identify their distinctive phonetic features, and detector algorithms are invoked to determine which word corresponds most closely to the acoustic data. Successive steps through the utterance result in a determination of its structure. 13c

The SRI system has an integrated design rather than a modular one. However, a significant part of the project will be the development of a grammar for spoken English. It will integrate prosodic features--intonation, stress, juncture, rhythm, duration--with syntactic rules. Prosodic information will enter into the system in various ways; it should aid in the identification of sentence-type, clause and phrase boundaries, content words, and the like. Further developments in semantics, syntax, and the modeling of pragmatic structures are expected to depend heavily on Fillmore's work on case grammars (Fillmore, 1971). 13d

Fillmore, C.J. Some problems for case grammar. In R.J. O'Brien (Ed.), 22ND ANNUAL ROUND TABLE ON LANGUAGES AND LINGUISTICS. Washington, D.C.: Georgetown University Press, 1971, pp. 35-56. 13d1

Newell, A., et al. Speech understanding systems: final report of a study group. Pittsburgh: Carnegie-Mellon University, May 1971. 13d2

CONFERENCES 14

1972 International Conference on Cybernetics and Society, October 9-12, 1972 Shoreham Hotel, Washington, D.C. 14a

Sponsored jointly by the IEEE Systems, Man, and Cybernetics Society and the American Society for Cybernetics. 14a1

ICCC-72, October 24-26, 1972, International Conference of Computer Communication Washington Hilton Hotel, Washington, D.C. 14b

Sponsored jointly by the ACM, IEEE Computer Society, and the IEEE Communication Technology Group. 14b1

FJCC, December 5-7, 1972, Anaheim Convention Center, California 14c

The last* Fall Joint Computer Conference will be held December 5-7, 1972 in the Anaheim Convention Center. The Conference is expected to attract more than 20 thousand persons and include an exhibit which officials claim will be one of the world's largest displays of computer hardware, software, and services. The technical program theme is "The Coming of Age," including 45 technical sessions. As George Ernst mentioned in the Chairman's Message, two of the sessions will be sponsored by SIGART. Dr. Robert Balzer of USC's Information Sciences Institute will chair one session on Programming Languages for Artificial Intelligence. MIT's PLANNER (CONNIVER) and SRI's QA4 will be represented. See your program guide for details. 14c1

*By vote of the JCC Board the Fall and Spring Joint Computer Conferences were cancelled for 1973 To take their places a single National Joint Computer Conference will be held in New York City during the first week of June 1973. 14c1a

Computer Science Conference, February 20-22, 1973, Neil House, Columbus, Ohio 14d

A group of universities and industrial organizations is sponsoring a Computer Science Conference jointly with the National Science Foundation. This innovative conference will be devoted primarily to short current research reports (15 minutes each, including discussions). It will be held coordinately with the Third Technical Symposium of SIGCSE. 14d1

Research reports are invited from any area of the computer and information sciences. An attempt will be made to schedule all appropriate papers. Thesis and dissertation research reports as well as submissions from laboratories, institutions, and industry are particularly desired. Abstracts only will be required. The printed proceedings (the program) will consist of these abstracts only and will be distributed to all attendees. 14d2

A number of invited papers will also be presented. Invited speakers will include Bernard Galler, Michael Harrison, Allen Newell, and Joseph Traub. 14d3

An Employment Register will be available at the Conference. Its purpose is to bring employers and prospective employees together. Two listings will be available: (a) prospective employees, and (b) employer openings (an employer may have more than one listing). 14d4

IJCAI-73, August 20-24, 1973, Stanford University, Stanford, California, during the week of August 20-24, 1973. 14e

CALL FOR PAPERS 14e1

The international Joint Conference on Artificial Intelligence (IJCAI) has announced plans for its Third International Conference, IJCAI-73, to be held at Stanford University, Stanford, California, during the week of August 20-24, 1973. 14e2

Papers are requested from any of the following major research areas associated with Artificial Intelligence: 14e3

* 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 A.I.
* Applications of Artificial Intelligence
* Social Consequences of A.I. 14e3a

(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 international conferences.) 14e4

Complete manuscripts must be received by February 15, 1973. Authors should submit five copies in final draft form, typewritten, double-spaced, with a maximum of twenty pages including figures (about 6000 words); a 100-word abstract and a set of descriptive terms characterizing the content should be included. Papers may also be submitted in machine-readable form or via the ARPA net. 14e5

(Queries regarding this method of paper submission should be addressed to Professor John McCarthy, Stanford University, Stanford, California, 94305.) Each paper will be reviewed; acceptable papers will be returned to the authors by April 30, 1973 for recommended modifications and for retyping on special pages that can be reproduced photographically. Camera-ready versions of accepted papers will be due by June 15, 1973. 14e6

Besides submitted papers, the conference will feature tutorial talks on current topics in A.I., special informal discussion sessions, and field trips to nearby laboratories. 14e7

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 contain a statement that it was previously presented at IJCAI-73. (The Editors of the journal ARTIFICIAL INTELLIGENCE have indicated that papers submitted to IJCAI may also be submitted to the Journal. They will of course be subject to the normal refereeing procedures of the Journal.) 14e8

General inquiries about the Conference should be directed to: 14e9

Dr. Max B. Clowes
General Chairman, IJCAI-73
Laboratory of Experimental Psychology
University of Sussex
Brighton, Sussex BN1 9QY
England, U.K. 14e9a

Manuscripts and inquiries about the program should be directed to: 14e10

Dr. Nils J. Nilson
Program Chairman, IJCAI-73
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025. 14e10a

COURSES 15

University of California Extension Course to be given during Fall Quarter in San Francisco: 15a

HUMAN MINDS, BRAINS, AND COMPUTERS 15b

Men and computing machines: Is it enlightening or misleading to compare them? Could a machine be sentient? If it were, could we tell? What is sentience and how are beings that have it enabled to do things that robots cannot do? Is the mind the same as the brain? Is there any interesting difference between human freedom and that of uncaged animals? 15b1

Instructor: Wallace Matson, Professor, and former Chairman, Department of Philosophy, University of California, Berkely. Professor Matson is a distinguished scholar in the field of the philosophy of religion; his most recent books are: A HISTORY OF PHILOSOPHY and THE EXISTENCE OF GOD. He has just returned from a year's study at Cambridge University where, as recipient of a Senior Fellowship from the National Endowment for the Humanities, he has been writing a book on the nature of the human mind and consciousness. 15b2

For further information telephone 415-642-4141. 15b3

ABSTRACTS 16

ROBOTS, PRODUCTIVITY, AND QUALITY

Charles A. Rosen
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 16a

There is a growing national need to increase the real productivity of our society, wherin "productivity" is redefined to include such major factors as the quality of life of workers and the quality of products, consistent with the desires and expectations of the general public. This paper proposes the development of automation technology designed to increase quality, in all its aspects, at an acceptable cost to society. 16a1

The proposed program is divided into two phases. The first phase is designed to catalyze the potential resources of industrial concerns by developing two demonstrable systems that include general-purpose programmed m manipulation and automated inspection. The second phase, with longer term objectives, would aim at devising techniques to broaden the utilization of programmed manipulators and sensors, to provide supervisory control of these systems by human speech, and to develop a capability for automatic manipulation of two or more sensor-controlled "hands" working cooperatively. 16a2

AN INTERACTIVE THEOREM-PROVING PROGRAM

John Allen and David Luckham
MACHINE INTELLIGENCE 5, pp. 321-336
(Edinburgh University Press, 1970) 16b

The results of Notice 72TH2 of the Notices of the American Mathematical Society of June 1972, Issue 138, were proven using the Theorem Proving Program of Alen and Luckham at Stanford University. 16b1

The announcement by R.H. Cowen, Queens College, City University of New York, Henry Frisz, Bronx Community College, C.U. of N.Y., and Alan Grenadir, Queens Village, N.Y., entitled SOME NEW AXIOMATIZATIONS IN GROUP THEORY, a Preliminary Report, appears on page A-547 of NAMS: 16b2

> "We give axiomatizations of group theory and abelian group theory in terms of the binary group operation $f(a,b)=ab'$. Suppose G is a first order theory with equality with a binary operation sysmbol f, whose non-axioms are: (G1 $f(x,x)=f(y,y)$, (G2) $f(x(f(y,y))=x$, (G3) $f(f(x,z),f(y,z))=f(x,y)$. Then G is an axiomatization of group theory [1 is defined as the (unique) element $f(x,x)$ and xy as $f(x,f(1,y))$]. For abelian groups, G1, G2, G3 are replaced by: (A1) $f(x,f(y,z))=f(z,f(y,x))$, (A2) $f(x,f(xy))=y$, or, by the single axiom (A), $f(f(x,y),f(f(x,z),y))=z$. Some other single axioms for abelian groups are (A') $f(f(x,f(ycz,z)), f(x,y))=z$ and (A'') $f(x,f(y,f(z,f(x,y))))=z$. (Received March 20, 1972.)" 16b2a

Proofs of these announcements and an extension of these results, namely, a new single axiom characterizing abelian groups, were found with the aid of the Interactive theorem-proving program. Another promising candidate for such characterizations was also generated by the program. 16b3

Times varied from instantaneous for easy proofs to 45 seconds of cpu time on a PDP-10 computer for the hardest. The problem of finding proofs was left entirely to the program and the correctness of the results was not known to the user in advance. The role of the user was to direct the process of checking the announced theorems by (a) formulating the problems and presenting them to the machine for solution; and (b) monitoring the progress (e.g. the program sometimes solved another problem in the course of searching for a solution to a given one.) Some simple heuristic criteria were employed in using the program to find additional single axiom characterizations. 16b4

CONTRACTED RESOLUTION

Hartmut G.M. Huber and Alfred H. Morris, Jr.
U.S. Naval Weapons Laboratory
Dahlgren, Virginia
NWL Technical Report TR-2655
January 1972 16c

In order to improve the capability of resolution programs for automatic decision making, a new rule of inference more literals are often eliminated than in a pairwise Robinson resolvent. Contracted resolution is shown to be sound and complete, requiring only refutations that are input deductions in the Chang and Slagle sense. Subsumption is defined in this environment, and it is shown that subsumed clauses can be deleted. 16c1

THE USE OF MODELS IN AUTOMATIC THEOREM-PROVING
Raymond Reiter
Department of Computer Science
University of British Columbia
Vancouver, B.C., Canada 16d

This paper is an extended argument in favor of the use of models in auto-matic theorem-proving. Gelernter's Geometry Machine is taken as a rototype of such a theorem-prover, and is analyzed with the objective of extracting its underlying semantic and syntactic formal system. This system is later generalized to permit, among other things, arbitrary well-formed formulae, arbitrary models, the use of models in making inferences and the dynamic modification of models as the proof unfolds. The purely logical component of this generalzed system resembles natural deduction, rather than resolution. The various semantic features of the formal system are discussed and illustrated through a number of examples. 16d1

In particular, the system is seen to possess a very smooth and natural interface between the semantics and the deductive syntax. These syntactic and semantic subsystems interact continuously during hhe search for a proof, each suggesting to the other how next to proceed. Another feature is the use of semantic information to minimize back-up due to dead-end searches. Particualrly appealing is the naturalnes of the system and its close correspondence with many "people oriented " techniques for proof discovery. 16d2

The notions of "model" and truth in a model" are defined for quantifier free formulae. it is found that the semantic theory so defined is, in some respects, too weak. Infinite models are considered and an attempt is made to deal with the problem of finitely representing such models 16d3

Finally, relationships are indicated between the semantic approach to theorem-proving and other areas of artificial intelligence, specifically natural language processing, generalization and hypothesis formation, and the representation of new knowledge. 16d4

RESOLUTION GRAPHS
Robert A. Yates and Bertram Raphael
Stanford Research Institute
Menlo Park, California

Timothy P. Hart
L.G. Hanscom Field
Bedford, Massachusetts 16e

This paper introduces a new notation, called "resolution graphs," for deductions by resolution in first-oorder predicate calculus. A resolution graph consists of groups of modes that represent initial clauses of a deduction and links that represent unifying substitutions. Each such graph uniquely represents a resultant clause that can be deduced by certain alternative but equivalent sequences of resolution and factoring operations. 16e1

EFFICIENCY OF EQUIVALENCE ALGORITHMS
Michael J. Fischer
Massachusetts Institute of Technology
Cambridge, Massachusett 16f

The equivalence problem is to determine the finest partition on a set that is consistent with a sequence of assertions of the form "x=y". A strategy for doing this on computer processes the assertions serially, maintaining always in storage process the command "x=y", the equivalence classes of x and y are determined. If they are the same, nothing further is done; otherwise the two classes are merged together. 16f1

DESCRIPTION AND THEORETICAL ANALYSIS (USING SCHEMATA) OF PLANNER: A LANGUAGE FOR PROVING THEOREMS AND MANIPULATING MODELS IN A ROBOT
Carl Hewitt
Ph.D. Thesis, MIT, April 1972 16g

PLANNER is a formalism for proving theorems and manipulating models in a robot. The formalism is built out of a number of problem-solving primitives together with a hierarchical multiprocess backtrack control structure. Statements can be asserted and perhaps later withdrawn as the state of the world changes. Under BACKTRACK control structure, the hierarchy of activations of functions previously executed is maintained so that it is possible to revert to any previous state. 16g1

Thus programs can easily manipulate elaborate hypothetical tentative states. In addition PLANNER uses multiprocessing so that there can be multiple loci of control over the problem-solving. Conclusions can be drawn from the various changes in state. Goals can be established and dismissed when they are satisfied. The deductive system of PLANNER is subordinate to the hierarchical control structure in order to maintain the desired degree of control. 16g2

The use of a general-purpose matching language as the basis of the deductive system increases the flexibility of the system. Instead of explicitly naming procedures in calls, procedures can be invoked implicitly by patterns of what the procedure is supposed to accomplish. The language is being applied to solve problems faced by a robot, to write special purpose routines from goal oriented language, to express and prove properties of procedures, to abstract procedures from protocols of their actions, and as a semantic base for English. 16g3

A LANGUAGE FOR WRITING PROBLEM-SOLVING PROGRAMS

Jeff Rulifson, Richard Waldinger, and Jan derksen
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Menlo Park, California 16h

This paper describes a language for constructing problem-solving programs. The language can manipulate several data structures, including ordered and unordered sets. Pattern matching facilities may be used in various ways, including ordered and unordered sets. Pattern matching facilities may be used in various ways, including the binding of variables. Implicit backtracking facilitates the compact representation of search procedures. Expressions are treated analogously to atoms in LISP. A "context" device is used to implement variable bindings, to effect conditional proofs, and to solve the "frame" problem in robot planniing. 16h1

LEARNING AND EXECUTING GENERALIZED ROBOT PLANS*

Richard E. Fikes, Peter E. Hart, and Nils J. Nilsson
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Stanford Research Institute
Menlo Park, California 16i

In this paper we describe some major new additions to the STRIPS robot problem-solving system. The first addition is a process for generalizing a plan produced by STRIPS so that problem-specific constants appearing in the plan are replaced by problem-independent parameters. 16i1

The generalized plan, stored in a convenient format called a TRIANGLE TABLE, has two important functions. The more obvious function is as a single macro action that can be used by STRIPS--either in whole or in part--during the solution of a subsequent problem. Perhaps less obviously, the generalized plan also plays a central part in the process that monitors the real-world execution of a plan and allows the robot to react "intelligently" to unexpected consequences of actions. 16i2

We conclude with a discussion of experiments with the system on several example problems. 16i3

SOME NEW DIRECTIONS IN ROBOT PROBLEM SOLVING

Richard E. Fikes, Petter E. Hart, Nils J. Nilsson
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For the past several years research on robot problem-solving methods has centered on what may one day be called "simple" plans: linear sequences of actions to be performed by single robots to achieve single goals in static environments. Recent speculation and preliminary work at several research centers has suggested a variety of ways in which these traditional constraints could be relaxed. In this paper we describe some of these possible extensions, illustrating the discussion where possible with examples taken from the current Stanford Research Institute robot system. 16j1

APPLICATION OF THEOREM PROVING TO INFORMATION RETRIEVAL

L. Stephen Coles
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Menlo Park, California 16k

Most conventional computer information-retrieval systems are limited by rigid data structures and inflexible query languages. Computer question-answering systems designed to overcome either or both of these limitations have been built, but for the most part they have been restricted to small data bases. In this paper we will describe an approach to combining and extending recently developed question-answering techniques to reasonably large data files. A compilation of widely used physical laws and effects of interest to both engineers and scientists consisting of 10↑5 basic data items will be used as a basis for demonstrating theorem-proving techniques on a large file. A restricted natural-language input for querying the file is also described. 16k1

LAKOFF ON LINGUISTICS AND NATURAL LOGIC
Yorick Wilks
Stanford Artificial Intelligence Project
Memo No. AIM-170
Stanford, California 16l

The paper examines and criticizes Lakoff's notions of a natural logic and of agenerative semantics described in terms of logic. I argue that the relationship of these notions to logic as normally understood is unclear, but I suggest, in the course of the paper, a number of possible interpretations of his thesis of generative semantics. I argue furhter that on these interpretations the thesis (of Generative Semantics) is false, unless it be taken as a mere notational variant of Chomskyan theory. I argue, too, that Lakoff's work may provide a service in that it constitutes a reductio ad absurdum of the derivational paradigm of modern linguistics; and shows, inadvertently, that only a system with the ability to reconsider its own inferences can do the job that Lakoff sets up for linguistic enquiry--that is to say, only an "artificial intelligence" system. 16l1

AN ARTIFICIAL INTELLIGENCE APPROACH TO MACHINE TRANSLATION
Yorick Wilks
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Memo No. AIM-161
Stanford, California 16m

The paper describes a system of semantic analysis and generaton, programmed in LISP 1.5 and designed to pass from one paragraph length input in English to French via an interlingual representation. A wide class of English input forms will be covered, but the vocabulary will initially be restricted to one of a few hundred words. With this subset working, and during the current year (71-72), it is also hoped to map the interingual representation on to some predicate calculus notation so as to make possible the answering of very simple questions about the translated matter. The specification of the translaton system itself is complete, and its main points of interest that destinguish it from other systems are: 16m1

1. It translates phrase by phrase--with facilities for reordering phrases and establishing essential semantic connectivities between them--by mapping complex semantic structures of "message" onto each phrase. These constitute the interlingual representation to be translated. This

matching is done without the explicit use of a conventional syntax analysis, by taking as the appropriate matched structure the "most dense" of the alterative structures derived. This method has been found highly successful in earlier versions of this analysis sytem. 16m1a

2. The French output strings are generateed without the explicit use of a generative grammar. That is done by means of STEREOTYPES: strings of French words, and functions evaluating to French words, which are attached to English word senses in the dictionary and built into the interlingual representation by the analysis routines. The generation program thus receives an interlingual representation that already contains both French output and implicit procedures for assembling the output, since the stereotypes are in effect recursive procedures specifying the content and production of the output word strings. Thus the generation program at no time consults a word dictionary or inventory of grammar rules. 16m1b

It is claimed that the system of notation and translation described is a convenient one for expressing an handling the items of semantic information that are ESSENTIAL to any effective MT system. I discuss in some detail the semantic information needed to ensure the correct choice of output prepositions in French; a vital matter inadequately treated by virtually all previous formalisms and projects. 16m1b1

A COMPUTERIZED MATCHMAKER THAT IS CAPABLE OF LEARNING

Nicholas V. Findler* and Edward Goit
Department of Computer Science
State University of New York at Buffalo
Buffalo, New York 16n

This paper describes a self-adaptive, learining system which can be used in a variety of personality tests, beyond the humorous task environment into which it is presently placed. Possible applications range from market research studies to quasi-optimum game playing programs. It is hoped that Women's Libbers will recognize the tongue-in-cheek approach. 16n1

Phase I of the earning program MATER aims at discoverng the terms of the evaluation function to be patterned and computes the weights of importance of its features approximately. Phase II adjusts furhter those weights, if needed, to match those of the subject imitated. 16n2

*Nicholas V. Findler's address during the 1972-73 academic year is: Institute of Numerical Mathematics, Technical University of Vienna, a-1040 Vienna, Darlsplatz 13, Austria. 16n2a

A "UNIVERSAL" PUZZLE SOLVER
Nicholas V. Findler* and Edward Goit
Department of Computer Science
State University of New York at Buffalo
Buffalo, New York 16o

There are thousands of fans of word puzzles. Sunday newspapers and a variety of different publications present these brain teasers to their readers regularly. A fairly large subset of the word puzzles have a common logical structure. The program described in this paper can solve both single- and multi-segmented puzzles in which a one-to-one correspondence is to be found between items of different sets and the correspondence has to satisfy certain restrictions and side conditions. Ten examples with results and detailed flowchart are included in the paper. 16o1

*Nicholas V. Findler's address during the 1972-73 academic year is: Institute of Numerical Mathematics, Technical University of Vienna, a-1040 Vienna, Darlsplatz 13, Austria. 16o1a

AUTOMATICAL ANALYSIS OF NUCLEAR MAGNETIC RESONANCE SPECTRA BY HEURISTICS
Pham Chi-Cong
Laboratoire de Mathematiques Applquees
Universite de Caen
3rd Cycle Thesis
University of Paris 16p

In this thesis, an interative method for the least-squares analysis of an observed high-resolution NMR spectrum is described. At each iterative step, the computer program uses heuristics, to automatically assign the theoretical lines to observed lines (pattern recognition problem), to choose the interesting lines and the appropriate parameters (chemical shifts) for applying the least-squares method. This program is tested with success for the different spin systems: 16p1

Asub2 Bsub2, Asub2 Bsub2 C, Asub4 Bsub2, Asub2 Bsub2 Csub2, 16p1a

A PROGRAM THAT COMPUTES LIMITS USING HEURISTICS TO EVALUATE INDETERMINATE FORMS
Jean-Pierre Laurent
Laboratoire de Mathematiques Applquees
Universite de Caen

3rd Cycle Thesis
University of Paris 16q

The object of this work is to find the limiting value of an expression f(x) when the variable x approaches a value xsub0, whether finite or not, and when replacing x by xsub0 does not allow one to compute this limit. It is a case study in the fields of theorem-proving and formula manipulation. 16q1

Using canonical forms, the program is able to operate on polynomials which are inside the expression, to use finite series, and compare powers with exponentials or logarithms. Unfortunately, it is not always sufficient because some expressions must be transformed several times before these methods can succeed. Then the program uses heuristics to find the best transformtion to apply to the given expression. It will be transformed as many times as necessary until the methods related above can give a solution. 16q2

In the appendix we give a hundred examples that have been tested with success, in a few seconds. Also we give the transformations successively used to deal with some particularly difficult cases. 16q3

SOME LINGUISTIC AND STATISTICAL PROBLEMS IN PATTERN RECOGNITION*
Ranan B. Banerji
Case Western Reserve University
Cleveland, Ohio 16r

It has been pointed out that all pattern recognition activities depend on writing and reading descriptions of patterns and pattern classes in some special purpose language. This uniform point of view allows all these languages to be considered in terms of some predicate calculus. The feature extraction problem then turns out to be the problem of simplification of sentences by defining new predicates in the language. It has been suggested that the problem can be looked upon as one in the presentation of algebeas. 16r1

*in Pattern Recognition, Vol. 3, pp. 409-419, Pergamon Press 1971. 16r2

BOOKS (TECHNICAL) Steve Coles 17

1. WHAT COMPUTERS CAN'T DO: A CRITIQUE OF ARTIFICIAL REASON
by Hubert L. Dreyfus
(Harper and Row, New York, 1972) 160 pp. $8.95. 17a

In spite of the fact that it has been reviewed extensively elsewhere,[1,2,3] I feel that this book needs to be cited in these pages, since it will probably assume a definitve role as the document of choice for those outside the field seeking to refute the possibility of artificial intelligence. Moreover, it is difficult to review a book with any kind of perspective when one has been so personally close to its controversies. I have had friendly arguments with Bert on many occasions about the contents of his book--in our respective classrooms at Berkeley, at cocktail parties, in lengthy correspondence. I have followed the evolution of his thinking since 1965,[4] his loss to the Greenblatt Chess Program,[5] his controversy with Papert,[6] and have read several of his other papers as well as manuscripts for the book under review while it was still in the draft stage. Subsequently, as a term project, two of my graduate students wrote a definitive critique of his arguments.[7] 17a1

1. Robert K. Lindsay, SCIENCE, Vol. 176, pp. 630-31 (May 12, 1972). 17a1a

2. E. A.. Weiss, COMPUTING REVIEWS, #26,463, pp. 304-5 (July 1972). 17a1b

3. Michael Scriven, THE BERKELEY BOOK REVIEW (Spring 1972). 17a1c

4. Hubert L. Dreyfus, "Alchemy and Artificial Intelligence," RAND Paper P3244, RAND Corporation, Santa Monica, California (1965). 17a1d

5. SIGRT Newsletter #6, pp. 8-9 (October1967). 17a1e

6. Seymour Papert, "The Artificial Intelligence of Hubert L. Dreyfus: A Budget of Fallacies," Artificial Intelligence Memo 1954, Project MAC, MIT, Cambridge, Massachussetts (January 1968). 17a1f

7. K. Tachibana and P. M. Look, University of California, Berkeley, California (June 1972). 17a1g

Nevertheless, I will try and make a few BRIEF comments: 17a2

1. Dreyfus' thinking has actually evolved considerably since his early days. He is no longer as dogmatic, although he still holds as tenaciously as ever to the proposition thet "artificial intelligence is impossible IN PRINCIPLE>" 17a2a

2. His proof contains several fallacies, although the thread of his logic is difficult to extract, being embedded in a considerable body of prose. 17a2b

3. The principal fallacy concerns the notion of "infinity," whether the seemingly unquantifiablity of human thought or the seemingly infinite regress of world-contexts can ever be bounded, and thus dealt with by a finite machine. The major distinction here between arguments IN PRINCIPLE and arguments IN PRACTICE is that "large" does not equal "infinite." 17a2c

4. A major contribution of the book in my judgment is his requirement that truly intelligent machines have bodies, i.e., that there can be no such thing as a DISEMBODIED intelligence. 17a2d

As a footnote, however, I should mention that Dreyfus recently watched the SRI robot in action at a showing of our latest film in his own classroom. When asked whether he thought that Shakey had a body, he replied, "No." I guess this ignominious conclusion was forced by the need to preserve internal consistency with his earlier arguments. 17a2d1

2. THE METAPHORICAL BRAIN by Michael A. Arbib
(Wiley-Interscience, 1972) 243 pp. illus. 17b

Michael Arbib's "The Metaphorical Brain: An Introduction to Cybernetics as Artificial Intelligence and Brain Theory," is a fine Sequel to his "Brains, Machines, and Mathematics"* although the present volume requires no special mathematical background. It should be accessible to anyone who reads SCIENTIFIC AMERICAN and is fairly self-contained. 17b1

*McGraw-Hill,1964 17b1a

The Chapters include: 17b2

Brains, Behavior, and Metaphor
Action-Coding and Neural Networks
An Introduction to System Theory
Artificial Intelligence and Robotics
Neural Control of Movement
Memory and Perception in a Layered Computer
Resolving Redundancy of Potential Command
Where do we go from here? 17b2a

The concluding chapter contains such insights as "... We must beware, when we use the metaphor 'humans and machines,' of the fallacy that we have reduced men to the machines that we currently know. When the Darwinian Theory of Evolution made it possible to say that 'humans are animals' there was a violent reaction because many people were convinced that they were not just animals. The point is of course, that evolution did not REDUCE us to the level of other animals. Rather it BROADENED our concept of animal to indicate that there was an essential continuity in all living things on earth, and that man was not apart from this continuity." 17b3

The book ends in a flight of poetry "... Whether we are religious or not, in a cathedral our senses soar, as we feel the rise of the building, and bathe in the beauty of light playing through stained glass. And yet, if the builders of that cathedral hadn't been brilliant engineers, it would have fallen down three hundred years ago. As we reshape our own society, we use our knowledge to achieve this aesthetics, this joy." 17b4

The book is well illustrated and the only distraction, aside from a few typographical errors, is Arbib's idiosyncrasy of systematically referring to arbitrary humans in the feminine gender. For example, "... in the neworn baby if she is to develop...", "... each individual can express herself...," etc. Can Mike be accused of being a "female" chauvinist? 17b5

3. UNDERSTANDING NATURAL LANGUAGE by Terry Winograd (Academic Press, New York, 1972) 192 pp. $8.95. 17c

See Abstract in SIGART Newsletter No.. 24, p. 10 (October 1970). 17c1

NOVELS Steve Coles 18

The following four novels were read by your editor during the summer-- 18a

1. THE TERMINAL MAN by Michael Crichton (Alfred A. Knopf, New York, 1972) $6.95. 18a1

If you liked ANDROMEDA STRAIN, an earlier novel by the same author (or saw and liked the movie), then you certainly will enjoy his current best-selling* effort. To briefly relate the plot--the terminal man is actually Harry Benson, a computer scientist with Autotronics, a hypothetical Los Angles based think tank, engaged in secret artificial intelligence research for the Department of Defense to devise a ping-pong playing robot. 18a1a

*"The terminal Man" has been on the New York Times Best Seller List for the last 18 weeks and has also been chosen as a Book-of-the-Month Club selection. 18a1a1

Apparently, he suffers from an unusual form of psychomotor epilipsy. A miniaturized computer is surgically implanted in his brain to control his fleeting bursts of uncontrollable rage, but due to unforseen positive feedback in the control circuit his condition becomes more acute. This in turn leads to a fast paced adventure story and superb entertainment. 18a1b

Chicton's background in medicine (recent M.D. from Harvard Medical School) has certainly added much credibility to his novel. For example, this is the first novel I've ever seen with an annotated bibliography of technical papers or such a substantial use of graphs, charts, and anatomical diagrams of the human brain to support the story. His knowledge of computer science, however, leaves much to be desired. I counted at least five errors--three flagrant ones (concerning power requirements, reliability, and miniaturization) and two conceptual ones. Nevertheless, I can recommend it highly. By the way--if you don't like to read novels, Warner Bros. has bought the film rights and you can see the movie in about two years. 18a1c

2. WHO IS JULIA? by Barbara S. Harris (David McKay Company, Inc., New York 1972) $6.95. 18a2

If you really liked the TERMINAL MAN, a good sequel is WHO IS JULIA? Mary Frances suffers a cerebral hemorrhage, just as Julia North is struck down in an automobile accident. The two injured women reach the emergency room of the local university hospital within munutes of each oher. There, a team of surgeons discover a medical situation for which they have spent years preparing. Julia's body is destroyed, but her brain is intact; Mary Frances' brain has been hopelessly damaged, but her body continues to function. You guessed it: After the most hazardous of neurosurgical operations, Julia wakes up in the body of the other woman 18a2a

This is Ms. Harris' first novel and is based on extensive research in medical libraries and scientific journals. (It has been rumored that it may be serialized in COSMOPOLITAN Magazine.) 18a2b

3. CYBORG by Martin Caidin (Arbor House, New Yok, 1972) $6.95 18a3

There is no more case-hardened, chrome-finished, science-fiction writer than Martin Caidin, especially in the aerospace field. His DESTINATION MARS, MAROONED, THE CAPE, and his recent MARY JANE TONIGHT AT ANGELS TWELVE are probably his best known efforts of this game. A CYBORG (cybernetic organism), as defined by Manfred Clynes at Rockland State Hospital in 1960, is an artificially-extended, biological organism that incorporates various exogenous, electro-mechanical components, functioning unconsciously as a homeostatic control system, to better adapt the organism to a wider variety of environments. 18a3a

In this case the cyborg is Lt. Col. Steve Austin, a test pilot and former astronaut (member of the crew of Apollo XVII, the last mission to the moon). As his experimental, NASA-M3F3 test plane crashed against the desert floor in a flash of searing metal, much of Austin's body is mutilated. Near death, he is literally reconstructed: artificial, computer-controlled limbs powered by a miniature nuclear reactor, but indistinguishable from the originals and articulated by normal brain impulses, together with advanced super-human sensors for hearing, seeing, heat-sensing, etc. 18a3b

Money for the reconstruction, however, comes from a CIA-type organization and the novel settles down about the half-way point to a James Bond adventure story of international spying and cold war conflict. Nevertheless, it still makes fun reading. Again if you're willing to wait, it too is promised as a movie, and possibly even the basis for a television series. 18a3c

4. WILDSMITH by Ron Goulart (Ace Books, New York, 1972) 75cents Paper 18a4

The subtitle of this escapist drivel is "What does one do with a willful robot?" Yet what Goulard really means is how does one prevent Wildsmith, an android author with absurdly human qualities, from periodically unsewing his hands and mailing them around the country to his female admirers. Judging by the quality of the writing, he probably turned this trash out of his typewriter in 48 hours. Don't waste your eyesight. 18a4a

AI ON TV Steve Coles 19

Two new entries this Fall are worth mentioning: SEARCH (Thurs. 10 p.m. on NBC) and UFO (Sat. 7 p.m. on CBS). 19a

1. In "Search," the PROBE Control computer is OUTASITE (many ideas plagiarazed from "Andromeda Strain"). I've asked my boss to order one, but he hasn't gotten around to it yet The plot-premise is somewhat lacking, however. If you had a system

with such fantastic capabilities why would you waste it by making its principal use the catching of a few bad guys? 19a1

2. "UFO" is the British answer to "The Invaders," an ABC entry circa 1968. The premise is again somewhat dubious--Why would an alien civilization that has conquered the problem of aging and can fly faster than the speed of light, need to come to earth surreptitiously in order to obtain organ transplants from human victims? Why wouldn't they just grow what-ever organs they needed in vitro or for that matter replace them with more efficient artificial counterparts? If the producers can budget such an obviously large amount of money for set design, special effects, and costumes, why can't they hire some competent writers? 19a2

I would suggest that SIGART begin a consulting service for potential science fiction writers and movie makers, but they probably wouldn't listen to us anyway. 19a2a

AI IN THE MOVIES Steve Coles 20

1. SHAKEY: EXPERIMENTS IN ROBOT PLANNING AND LEARNING 20a

This 25-minute film reviews some recent experiments performed with Shakey, the Stanford Research Institute robot. The film begins by explaining the general features of Shakey and of his controlling programs. One feature of special interest is Shakey's ability to use the solutions to old problems as an aid in planning the solution to a new problem. Shakey also has the ability to recover from a variety of errors and accidents that may occur as he executes problem solutions in a laboratoy environment. The film concludes with a demonstration of Shakey performing two tasks that exercise these various abilities. 20a1

This color and sound film may be rented from SRI for a $20 rental fee (to cover costs of film reproduction and mailing). Contact: 20a2

Dee Leitner
Room G037
Stanford Research Institute
Menlo Park, California 94025. 20a2a

2. SILENT RUNNING, a commercial film directed by Douglas Trumbull 20b

Quoting from Vincent Canby, New York Times film critic, 20b1

"Silent Running" is no jerry-built science fiction film, but it's a little too simple-minded to be consistently entertaining. Douglas Trumbull, whose first frature this is as a director, learned his craft as an assisant to Stanley Kubrick on '2001'. It is not surprising, therefore, that 'Silent Running' has some beautifully eerie and majestic special effects--lparticularly its space ships that look like horizontal Eiffel Towers attached to gigantic oil tankers." 20b1a

Hewy and Dewy, two of the robots, engender so much human compassion in this film about space and ecology, it's hard to imagine them as non-biological. 20b2

COMPUTER-BASED JOURNAL 21

Professor John McCarthy has outlined a project to develop a new interactive journal which would (at least initially) reside somewhere in the ARPA Network. The concept here is quite intriguing and represents an important and useful application of computer technology. The idea is simply that his journal would not exist as a printed-paper journal; its articles, once accepted, would be stored in the computer and would be available for reading either via display or regular terinals. Initially--to get this journl moving--it would use articles from existing paper-journals, but as soon as the capabilties and advantages of this communications medium became evident, the journal would be able to survive on its own merits. 21a

The advantages of such a journal include: (1) much faster dissemination time, (2) ease of loading materials, (3) elimination of the need to store paper-journals in one's home or office, (4) ability for readers to comment on articles interactively, and (5) ability for authors to update, correct, add to, or improve their papers on-line. Moreover SUCH A PROJECT MIGHT SERVE AS THE FIRST STEP IN CONVINCING PEOPLE OF THE UTILITY OF MAKING ALGORITHMS (PROGRAM MODULES) AVAILABLE FOR OTHERS TO USE, JUST AS PRESENT DAY JOURNALS MAKE KNOWLEDGE AVAILABLE FOR OTHERS TO BUILD UPON. 21b

At this point, Professor McCarthy is seeking some help in getting such a system operational. He is looking for able-bodied and knowlegeable people to help develop the programming for this system. (Anyone with access to a teletype terminal would be able to dial in to Stanford's computing facilities and do the programming from a distance--no proximity to Stanford is required.) If you, or any one of your associates, are interested in participating in the project's development, please write to Professor McCarthy at the Artificial Intelligence Project, MIT, Cambridge, Mass. 02139. 21c

FIRBUSH ROBOT GROUP NEWSLETTER 22

An irregularly published newsletter of the Firbush Robot Group (the name derives from the location in Scotland where their first meeting was held), comprised primarily of AI researchers from Edinburgh and SRI, is now available. Write to: 22a

Mrs. Betty Berry, Firbush Girl
Department of Machine Intelligence
Hope Park Square
Edinburgh EH8 9NW 22a1

The second issue of Firbush News (33 pages) contains articles by Burstall, Meltzer, And Michie on future prospects for AI research. 22b

SALES PROMOTIONAL ANDROID (SPA), Quasar Industries, Inc. 23

The SPA (Sales Promotional Android), a remote controlled Mechanical Humanoid designed primarily to function in the areas of Entertainment and General Sales Promotion, has unquestionably proven during the past year of Field Trials to be one of the most versatile and successful Public Relations "PERSONALITIES" of our time. 23a

Quasar Industries, Inc., after an intensive TWO-YEAR Market Research found a fantastic need for a new and different Sales Promotional Tool that possesses the multiple capabilities of creating general consumer attention, maintaining basic interest, while developing a DESIRE TO BUY. 23b

The SPA is psychologically designed to demand the center-of-attention at Grand Openings, Trade Shows, Conventions, Shopping Malls, Organizational Meetings and any other HAPPENING where the primary purpose is to attract a group of spectators and stimulate their interest. 23c

Utilizing mobile and mechanical animation coupled with directed intelligent conversation, SPA can entertain any age group under almost any weather or temperature conditions. Through a system of pre-programmed messages and "live" monitor back-up, SPA creates SPONTANEOUS CONVERSATION in virtually any language, rallying a desire for the Sponsor's product or service, while producing ORGANIZED EXCITEMENT at every appearance. 23d

Sponsors who wish to directly project their image can utilize SPA equipped with a customized body design, exactly duplicating their product bigger than life at trade shows, shopping centers, and other promotions, with the product accomplishing the most sought after goal of all time, that of actually SELLING ITSELF. 23e

Sales Promotional Androids because they are able to take direction, "act-on-cue" and memorize a written script, are now available for general motion picture and television work. Being Robots, of course, they never forget a line. The SPA is presently being quoted on a rental and lease basis from one day upwards to two years. Direct purchase is also available. 23f

For specialized promotional purposes, with minor mechanical customization, SPA can distribute literature, business cards, or a product, whether it be powder, solid or liquid. This is a most unique marriage of two highly effective sales techniques, verbal and physical presentation of a product. 23g

Sales Promotional Androids are produced only by Quasar Industries, Inc., the first and only company in the world to mass produce humanoid Robots. Advance notice is required to assure the availablility of an android at your next promotion. Contact KLATUA our Robot salesman for specific details at 380 Main Street, Hackensack, New Jersey 07601 or (201) 488-8803, he is PROGRAMMED TO PLEASE. 23h

Specifications 23i

Height, 5 feet 6 inches 23i1

Weight, 240 pounds 23i2

Mobility, remote control or programmed with monitor 23i3

Range, one mile 23i4

Function, General Promotion 23i5

SIGART Newsletter Number 36 October 1972

(J21203) 26-DEC-73 15:33; Title: Author(s): L. Stephen Coles, Richard E. Fikes/LSC REF; Sub-Collections: NIC ; Clerk: KIRK; Origin: <SIGART>OCT72NEWSLETTER.NLS;1, 6-FEB-73 18:31 KIRK ;

SIGART NEWSLETTER Number 37 December 1972
A Bimonthly Publication of the
ACM Special Interest Group on Artificial Intelligence 1

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The Editors encourage contributions from authors, including Letters to the Editor (AI Forum), Technical Contributions (1 to 2 pages), Abstracts (preferably 100-200 words), Book Reviews, Bibliographies of Special Topics in AI, News Items (Conferences, Meetings, Course Announcements, Personals, etc.), advertisements, puzzles, poems, cartoons, etc. 1d

Copy deadline for the February Issue: January 22. 1e

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 hard copy issue. 1f

CHAIRMAN'S MESSAGE G.W.E. 12/7/72 2

As I am writing this message, I have not yet received the October newsletter. ACM Headquarters had the newsletter in camera ready form on October 2, which means that the news will be at least 2 months old. Normally there is a one month delay in getting the newsletter from the editor's desk to the members. Most of this delay is due to the slow speed of third class mail. We are currently looking for the cause of the additional month delay in the October Newsletter so that such delays can be avoided in the future. The main reason for the above comments is that the

October issue was Steve Coles' first newsletter and I wanted to make sure that the delay was not blamed on him, since he did meet his deadline. 2a

I would like to thank Bill Whitney, Tony Bejczy, and Len Friedman for a very interesting presentation at the SIGART meeting at the FJCC. Their talk is summarized in a separate part of this newsletter. 2b

I would also like to remind you of the Computer Science Conference in Columbus on February 20-22. This conference will be informal in the sense that only the abstracts of papers will be published. This makes registration inexpensive ($10) and allows more recent work to be presented. I have talked to several people in AI who plan to attend this conference which indicates that it may be a worthwhile conference for members of SIGART. 2c

EDITOR'S ENTRY L.S.C. 12/19/72 3

1. We apologize for the lengthy delays in getting the October issue to your mailbox, but as soon as we pinpoint the source of the sluggishness we will try to put things back on schedule in subsequent issues. This in part explains why this December issue contains so little feedback from the earlier issue. People just haven't had time to respond yet. 3a

2. We are still soliciting Newsletter Reporters at major AI centers and are especially interested in persons with experience using the ARPA Network, although this is not a prerequisite. Anyone who would like to volunteer his services is urged to contact either Rich or myself. 3b

3. In a telephone conversation with Prof. Joseph Weizenbaum of MIT (@437) I learned that his recent article in SCIENCE, (@438) "On the Impact of Computers on Society, "generated over 250 letters of response, but with the disappointing qualification that only 3 or 4 of those responses came from computer scientists The article deals largely with artificial intelligence and the treatment is substantially negative. Yet, of the small number of computer scientists that did respond, two were favorable to the article, and only one reply, my own, was seriously critical. This last response has now been published in SCIENCE (@439) together with Prof. Weizenbaum's letter of rebuttal. 3c

Both Prof. Weizenbaum and I would hope that SIGART members would read up on this controversy and send us your own thinking for possible inclusion in the AI Forum Section of future issues of the Newsletter. This request is not intended as a "rally 'round the flag" entreaty but a request for serious participation in a dialog about important social implications of our own field. What do you think? 3c1

4. Another vital topic for debate on the future social significance of artificial intelligence has been thrust upon us by the engineering sector of the computer industry. As you know, we rarely need to pay much attention tc our hardware cousins, since that's not where our current bottle-necks seem to lie. One might even say sarcastically, "everything's coming up roses in the hardware field (modulo the speed of light) " Yet you may not be aware of how "rosy" things are actually predicted to be: 3d

In another recent article in SCIENCE (@440) Professors Parker and Dunn of Stanford University predict that by means of cable television, an information utility could be made available to most U.S. houses by 1985. The system they propose to establish 3d1

> "...might be visualized as a communication network providing access to a large number of retrieval systems in which nearly all information, entertainment, news, library archives, and educational programs are available at any time to any person wanting them. Many of these services, such as retailing in the home, entertainment, and various specialized business services would be provided by private enterprise. Other services would depend on public support. The social goal of such an information utility could be to provide all persons with equal opportunity of access to all available public information about society, government, opportunities, products, entertainment, knowledge, and educational services. From the subscriber perspective such a system would look like a combination of television set, telephone, and typewriter. It would function as a combined library, newspaper, mail-order catalog, post office, classroom, and theatre." 3d1a

They go on to estimate the rental cost in 1985 of the hardware necessary to support such a system in the home for an interactive TV with subscriber-response feedback and single-frame local storage (including the national average costs for underground, buried cables) as 14 cents per terminal hour 3d2

To put this seemingly low estimate in proper perspective, it has been recently been established by others (@441) that before 1980 a general-purpose, micro-computer complete with central processor and internal working memory (but no peripherals) will be available on a single chip in small quantities for a cost of between $1.00 and $10.00. About this time, frame magnetic-bubble memory technology is heralded to bring the cost of high speed bulk core memory down from about $0.01/bit to $0.001/bit. The size and power requirements of such a micro-computer will also be an order of magnitude less. Would you believe a hand-held, battery-powered model? In a recent SCIENTIFIC AMERICAN article (@442) Messrs. Broers and Hatzakis predict, "by using an electron beam to trace the patterns of electronic circuits it should be soon possible to put 100,000 transistors and similar divices on a silicon chip a few millimeters square." This represents two orders of magnitude over today's optical techniques. 3d3

Extrapolating further, it is predicted that in 25 years we will have a single-chip computer capable of executing instructions at the rate of one every 50 nanoseconds (or 20 million instructions per second) with 65K of internal memory selling for about $1.00 (@441) Even if this estimate were off by an order of magnitude either way, the social significance is staggering. So the next logical question is what are the implications of having all this fantastic hardware around for AI? What do you think? 3d4

5. ON-LINE NEWSLETTER--The October and December issues of the SIGART Newsletter have already been entered as NLS files in the directory "SIGART" of the Network Information Center (NIC) at SRI. SIGART members who already have local network installation user names and passwords may log-in and access these files on a "read-only" basis. At a future time you may wish to check this directory periodically since future newsletter materials may appear there one to two months before you receive them in the mail. Details of how to submit articles (or comment on previous articles) over the Net will be made known to SIGART Newsletter Reporters as they become available. 3e

6. RAISE IN DUES DISCUSSED--Although no formal decision has been made one way or another, I would like to take this opportunity to air a suggestion that was made at the FJCC to raise the annual SIGART membership dues to $5.00 for regular members (leaving it at $3.00 for student members). The arguments in favor were as follows: 3f

Compared with each of the other 28 ACM Special Interest Groups, we are one of the largest (@443) and oldest (@444), have one of the smallest membership dues (@445), and have a current deficit in our treasury (@446). In spite of the wage-price guidelines, printing costs have risen 35% in the last two years both in the cost of paper and the cost of labor. Additionally, postage rates have gone up significantly for third class mail. Therefore, we cannot continue to provide the same quality of services as before (let alone expand) without a dues increase.

Moreover, the professional (nonstudent) members of SIGART will readily appreciate the need for such an increase. 3f1

The arguments against can be summarized as follows: 3f2

We have just experienced a significant increase in overall ACM membership dues. Another increase by SIGART would only force us to lose members. 3f3

If you have any strong feelings regarding these arguments please call us or put them in writing so we can factor them into the decision process. 3f4

7. Happy. New Year 3g

--------------- 3h

@437 Currently on leave of absence for one year at the Center for Advanced Studies in the Behavioral Sciences at Stanford University. 3h1

@438 SCIENCE, Vol. 176, No. 4035, May 12, 1972, pp. 609-614. This article was reprinted in COMPUTERS AND AUTOMATION, Vol. 21, No. 7, July 1972, pp. 18-23, and excerpts also in the New York Times, May 28, 1972, p. E13. 3h2

@439 Science, Vol. 178, No. 4061, Novermber 10, 1972, pp. 561-563. In SCIENCE a four or five month delay in publishing controversial letters is not uncommon even though it is a weekly magazine. The debate has continued in THE SAN JOSE NEWS, Dec. 2, 1972, p. 14 in an article by Dale F. Mead, Science Staff Writer for the SAN JOSE NEWS/MERCURY, based on telephone interviews with the principals. 3h3

@440 E. B. Parker and D. A. Dunn, "Information Techonolgy: Its Social Potential," SCIENCE, Vol. 176, No. 4042, June 30, 1972, pp. 1392-1399. 3h4

@441 C. C. Foster, "A View of Computer Architecture," COMMUNICATIONS OF THE ACM, Vol. 15, No. 7, July 1972, pp. 557-565. 3h5

@442 A. N. Broers and M. Hatzakis, "Microcircuits by Electron Beam," SCIENTIFIC AMERICAN, November 1972, pp. 34-44. 3h6

@443 With 1577 members we are fourth largest in total members (and third largest in student members). Only SIGOPS (Operating Systems), SIGBDP (Business Data Processing), and SIGPLAN (Programming Laguages) are larger. 3h7

@444 SICART was formed from the Los Angeles Chapter under the leadership of Rebecca Prather back in November 1966. We became a SIG in June 1968. 3h8

@445 Our dues have been $3.00 annually since they were instituted back in December 1970. For reference, SIGBDP charges $8.00 for a quarterly newsletter and SIGPLAN charges $11.00 for a monthly bulletin and numerous other activities. 3h9

@446 We were $229.00 in the red ink as of March 1972. No other established SIG is in such a poor financial state. Based on our estimated revenues and expenses for the next year, we cannot predict a closing of this gap. 3h10

NEWS OF THE FJCC by Steve Coles 4

Although there were many activities of interst to AI people at the recent Fall Joint in Anaheim, I will venture to report on just three of them: the Wednesday evening SIGART meeting and the two Thursday morning sessions of "Robotics and Teleoperators" and "Languages for Artificial Intelligence." 4a

1. For those who attended, the Wednesday evening SIGART meeting proved to be a highly enjoyable and educational introduction to the projected role of robots and teleoperators in planetary exploration. (@453) Tony Bejczy, Len Friedman, and Bill Whitney spoke on the development of an AI Facility at JPL that would provide a feasibility demonstration of robot technology that could be incorporated into a Mars Mission circa 1984. (@454) Note that advanced Viking missions based on a Mars Rover with 500 Km range are currently planned for 1978-1979. Distinguishing features of the JPL effort in robotics (in contrast with conventional AI robot research) are the severe requirements for high reliability and comparatively long lead-times. 4b

Five year lead-times are typically needed to program a NASA mission. This means that JPL must design its systems based on currently available technology with a demonstration of feasibility coming by 1975 at the latest. 4b1

Their plans for an AI lab are sketched in the first drawing (p.9 hard-copy Newsletter) with the qualification that the PDP-10 shown will be available only over the ARPA-Network. The vehicle shown in the following four drawings in the hard-copy Newsletter is now under construction at JPL. The vehicle frame was obtained on loan from another NASA facility and modified to permit Volkswagon tires for wheels, replacing the large balloon-style wheels used on lunar rovers. A Stanford University Scheinman Arm is currently being modified to function as a vehicle manipulator. It will be lower to the ground in order to pick up rocks, and have a substatially longer reach than the Stanford version. A laser-ranging technique is planned to provide depth perception for the visual system. They expect to achieve remote computer control of the vehicle motors in the near future. 4b2

2. The Thursday morning (8:00 a.m.--Sigh) Session on "Robotics and Teleoperators" dealt in the main with teleoperators. The first paper by Dr. M. L. Moe of the University of Denver presented a novel method for control for a Rancho Electric Arm (normally used by quadriplegics as an orthotic, exoskeletal arm/hand) using an infrared transducer that monitors eye-pupil motions. Infrared reflections from the pupil provide a clean control signal, since smooth eye motion is available in even the most severely paralyzed patients. The infrared ocular transducer was incorporated into a pair of specially designed eyeglasses. A fascinating side-effect of this work was the use of eye motions to effect handwriting on a CRT display. A movie presented at the session showed quite legible handwriting being produced by a subject wearing the special eyeglasses in essentially real-time. 4c

3. The following session on "Languages for AI" chaired by Bob Balzer, now at USC's Information Science Institute, was very well attended and perhaps the most interesting AI session this reporter ever witnessed in ten years of sporatically attending Fall and Spring Joint, ACM, or IFIP Conferences. It was unique in that Balzer defined a common problem for all the speakers to use as a vehicle for comparing their respective languages. The "elementary" problem to be considered was as follows: 4d

Three blocks (named A, B, and C) are distributed randomly on a table top. Block C has three distinct locations on its top, named "left," "right," and "middle." The size of the area on top of block C is defined to be such that it can support both blocks A and B only when neither A nor B resides on the "middle" location of block C. the problem is to design a program (in the appropriate language) that will take the initial configuration of blocks as input and produce as output an optimal sequence of primitive actions (pick up a single block, move it somewhere, put it down, etc.) that will result in both blocks A and B residing on top of C, subject to the constraint that the "middle" location is in no way distinguished from the "left" and "right" locations A PRIORI in the program, i.e., the program must infer for itself that the "middle" location is in not a legal location for a block. For example, see drawing in hard-copy Newsletter. 4d1

Of course the problem becomes less trivial as one seeks to capitalize on whatever idiosyncrasies of the initial configuraton may fortuitously reduce the amount of physical effort necessory to solve the problem. For example, if block A is already sitting on top of block C in the "middle" position, it is required merely to slide it over to the left or right in order to continue. Note that the program which finesses these idiosyncrasies by initializing the top of C to always be "clear" before continuing violates the spirit of the problem. (@455) 4e

Additionally, the program should handle pathological configurations such as one in which block C is initially on top of block B, etc. When the problem is considered in full generality the resulting programs are by no means trivial. 4f

Prof. McCarthy in his concluding remarks sought to embed all the languages presented in a spectrum defined by LISP at one extreme, ALGOL-like languages somewhere in the middle, and production-like languages at the other extreme. He characterized QA4, SAIL, and HACKER as being on the left wing of the spectrum and therefore somewhat revealing of their limitations. He went on to deplore that the programs presented in these languages reflected very little HUMAN-LIKE intelligence and hoped that through the use of more production-oriented languages "knowledge," accumulated by systems from experience with block worlds, would somehow be more accessible in the construction of intelligent programs to accomplish particular tasks. 4g

The main presentations were given by Jeff Rulifson of SRI, Jerry Feldman of Stanford, and Gerald Sussman of MIT, concerning the languages QA4, SAIL, and HACKER respectively. The three principal speakers were preceded by Nils Nilsson of SRI who provided an overview talk on new features of these AI languages; they were followed subsequently by John McCarthy of Stanford as panelist and critic. All speakers made excellent presentations and SIGART members are invited to read and contrast their papers as published in the FJCC Proceedings. 4h

Taking a Newell/Simon-like protocol of humans solving this task is not terribly satisfying either, since children at an age for whom this is difficult seem too young to comprehend a linguistic formulation of the problem. One almost senses that by the time the child is mature enough to have sufficiently mastered a linguistic formulation of the task for the first time, he already has developed a proficiencey for not being able to do it AT ALL, to having mastered all variations of the problem virtually over night. 4i

Because of the considerable length of some of these programs, one researcher was later heard to say, "I don't think that we REALLY

UNDERSTAND very much about problems of this sort," the implication being that once they are understood such programs will become considerably more parsimonious and legible. It was felt by others that we are in a Pre-Copernican era with respect to problem-solving languages and that once the correct model is revealed, the complexity of all the "epicycles" will vanish. This optimistic forecast is not shared by your Editor, however, since I believe that the complexity observed in these programs is intrinsic in the nature of this seemingly superficial problem and cannot be dissolved or evaporated by mere reformulation. Perhaps some of the complexity can be made less visible by precipitation to lower levels of structure, but I would venture that it will still appear somewhere or other in the final analysis. 4j

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@453 Apollo 17 landed safely on the moon while the meeting was in progress. 4k1

@454 The budget for such a mission is contemplated to be in the order of one billion dollars This is not so astonishing however, in view of the fact that a typical Apollo mission is estimated to cost $450 million 4k2

@455 This distinction is reminiscent of the classical allegory of the "engineer" and the "mathematician" each of whom is asked to solve the problem of boiling a pot of water. The mathematician's solution, as you my recall, was to empty the pot of water on the ground so as to reduce it to a problem he had already solved 4k3

4k4

CHESS 5

1. As reported in the British AI Newsletter, AISB (May 1972), Professor V. Keilis-Borok of the Soviet Union writes, "could you recommend someone who cares to test his chess program against ours, for a better understanding of the problems involved?" Since they run their chess program on an ICL system 4-70 (language unspecified), perhaps a postal chess game could be arranged. Anyone interested should write to Prof. Keilis-Borok at the Soviet Geophysical Committee, Molodezhnaya 3, Moscow B-296, U.S.S.R. 5a

2. Update on the Third Annual Computer Chess Tournament Round Robin Playoff by James Gillogly Carnegie-Mellon University 5b

(a) The playoff for 2nd, 3rd, and 4th has been completed. Tech defeated COKO III in the longest game ever (145 moves), and Ostrich defeated COKO III. The final standings are thus: 5b1

2. Ostrich (Arnold, Newborn)
3. Tech (Gillogly)
4. COKO III (Cooper, Kozdrowicki). 5b1a

(b) The program which Hans Berliner was considering entering in the 3rd ACCC was not J. BIIT, as stated in the article, but a new (as yet unnamed) program, built on different lines. 5b2

(c) Greenblatt's program is available on the ARPA net at MIT. The user version is (I think) current. It certainly has a lot that the 1968 version doesn't have. 5b3

CONFERENCES 6

1. Cognitive Verfaharen und Systeme Conference (Artificial Intelligence and Systems), 11-13 April 1973, Hamburg, German Federal Republic. It is sponsored jointly by the Nachrichtentechnische Gessellschaft im VDE (NTG) and the Gessellschaft fur Informatik (GI) together with the Institute fur Informatik of the University of Hamburg. A detailed program will be available in January 1973. For information write the Technical Program Chairman, Herrn Professor Dr. H. H. Nagel, Institute fur Informatik, Universitat Hamburg, 2 Hambug 50, Luruper Chausse 149, German Federal Republic. 6a

2. IJCAI-73, August 20-24, 1973, Stanford University, Stanford, California, during the week of August 20-24, 1973.
[Ed. Note: Call for papers appeared in the October issue.]

Proposed Outline Description of the Conference
by Nils Nilsson, Program Chairman 6b

Major Events 6b1

* Contributed papers
* Invited tutorial lectures
* Informal discussion sessions
* "Computers and Thought" lecture
* Field trips to nearby laboratories
* A.I. "film festival" 6b1a

Contributed Papers
Papers have been requested from the following major research areas associated with Artificial Intelligence: 6b2

* 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 A.I.
* Applications of Artificial Intelligence
* Social Consequences of A.I 6b2a

(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 international conferences.) 6b3

Invited Tutorial Lectures 6b4

We are planning to have six tutorial lectures on currently popular topics in Artificial Intelligence. These lectures will be approximately 50 minutes long. There is a possibility that we will video-tape each lecture to enable conference attendees to view them later. The IJCAI might also consider making copies of these tapes available to colleges and universities. We have arranged the following lectures: 6b4a

(1) Artifcial Intelligence & Psychology 6b4a1

Allen Newell
Carnegie-Mellon University 6b4a1a

(2) Automatic Problem Solving 6b4a2

David Luckham
Stanford University 6b4a2a

(3) Natural Language Understanding 6b4a3

Terry Winograd
M.I.T. 6b4a3a

(4) Automatic Programming 6b4a4

Zohar Manna
Weizmann Institute of Science 6b4a4a

(4) Programming Languages for A.I. 6b4a5

Daniel Bobrow, Xerox Research Center
Bertram Raphael, SRI 6b4a5a

(6) Perception 6b4a6

Patrick Winston (tentatively)
M.I.T. 6b4a6a

Informal Discussion Sessions 6b5

We want to provide the opportunity for people to participate in informal discussions on various A.I. topics. Candidate topics include those of the tutorial lectures plus other matters of interest such as social implications of A.I. the ARPA network, and A.I. and education. We will be flexible about the subject matter; perhaps some controversial topics will arise between now and August 1973. We will select discussion leaders for each topic; the format will be up to the participants. 6b5a

"Computers and Thought" Lecture 6b6

A public lecture on some aspect of Artificial Intelligence will be scheduled for an evening during the Conference. The lecturer will be selected from among several candidates suggested to the Council through Max Clowes. This lecture follows in the tradition of the IJCAI-71 lecture by Terry Winograd on "Language and the Structure of Intelligence." We will probably video-tape the lecture. 6b6a

Field Trips 6b7

Several interesting computer science projects are being conducted at laboratories in the immediate vicinity of Stanford. These include the Stanford Artificial Intelligence Laboratory, the Stanford Research Institute Artificial Intelligence Center and Augmentation Research Center, the NASA-AMES laboratories (site of Illiac IV), and the Xerox Palo Alto Research Center. We will attempt to arrange visits to these laboratories. The A.I. projects in particular will probably exhibit special demonstrations of advanced A.I. programs. Attempts will be made to exhibit programs running over the ARPA network. 6b7a

A.I. Film Festival 6b8

We will arrange showings of any films that Conference participants submit. These films will probably be shown continuously so that attendees can drop in at any time to see them. A schedule will be published. 6b8a

Facilities and Local Arrangements 6b9

The sessions will be held in various buildings and auditoriums at Stanford University. University housing and food service will be available, at reasonable cost, for approximatlly 300 of the attendees. Stanford also will provide facilities for participants to purchase lunches. There are numerous hotels and motels in the area but NO public transportation. We will also arrange some interesting activities for spouses of Conference attendees. 6b9a

Publication Policy 6b10

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 contain a statement that it was previously presented at IJCAI-73. (The Editors of the journal ARTIFICIAL INTELLIGENCE have indicated that papers submitted to IJCAI may also be submitted to the Journal. They will of course be subject to the normal refereeing procedures of the Journal.) 6b10a

Further Information 6b11

General inquiries about the Conference should be directed to: 6b11a

Dr. Max B. Clowes
General Chairman, IJCAI-73
Laboratory of Experimental Psychology
University of Sussex
Brighton, Sussex BN1 9QY
England, U.K. 6b11a1

Manuscripts and inquiries about the program should be directed to: 6b11b

Dr. Nils J. Nilsson
Program Chairman, IJCAI-73
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025. 6b11b1

3. ACM '73, August 1973, Atlanta, Georgia. 6c

"Computers in the Service of Man" will be the theme of the 1973 annual conference of the Association for Computing Machinery, it was announced recently by Dr. I. E. Perlin, conference chairman. Dr. Perlin also announced that the Hyatt Regency Atlanta has been selected as the site for ACM '73. 6c1

"In the first 25 years of it's development, the computer was thought of primarily as a business and scientific tool," said Dr. Perlin. "But now, as we enter the second quarter century, we are seeing more and more computers dedicated to the benefit of mankind in widely diverse areas ranging from law enforcement and welfare assistance to medicine, education and pollution control. 6c2

"We intend to present the most advanced and most meaningful of these humanitarian applications at ACM '73." Scientists, educators and data processing professionals interested in submitting papers for the conference can secure detailed information on format requirements by writing to Dr. W. Buell Evans, program chairman, ACM '73, P. O. Box 4566, Atlanta, Georgia 30302. 6c3

4. Symposium on the Simulation of Computer Systems, June 19-20, 1973, National Bureau of Standards, Gaithersburg, Maryland. Sponsored by The National Bureau of Standards and SIGSOC (Special Interest Group on Simulation). This symposium is the first ever devoted exclusively to the simulation of computer systems. The 1 1/2 day meeting will include invited and submitted papers plus workshops, with attendance and participation limited to expert practitioners in the field. There will be no parallel sessions. 6d

Papers are solicited in the areas of: 6d1

* Applications of Computer System Simulation
* Simulators in Current Use
* Workload Models
* Simulation Validation
* Outstanding Unresloved Problems. 6d1a

Workshops will provide attendees with a forum for state-of-the-art information in the areas of applications, simulator/simulation language design, software and hardware simulation. Abstracts for a five to ten minute talk for these sessions should be submitted by the paper due date. 6d2

The deadline for 250-1,000 word abstracts (paper or talk) is January 2, 1973. Deadline for paper submission is February 1,

1973. Authors will be notified of acceptance by March 1, 1973, and final versions of the paper for publication in the proceedings will be due by April 1, 1973. 6d3

Papers and abstracts should be addressed to the Program Chairman: 6d4

Mr. Philip J. Kiviat
Federal ADP Simulation Center
Hoffman Building
Alexandria, Virginia 22314 6d4a

5. National Computer Conference & Exposition, New York Coliseum, June 4-8, 1973. 6e

The First National Computer Conference and Exposition will usher in a new conference concept with the objective of bringing together at one time and in one place all of the interests of the computing community on a once a year basis. The conference program will serve the technologist, the end-user, and various levels of business management by providing forums for the exposition of problems, requirements, theory, and solutions in both the application and technology of information processing. Consistent with general conference objectives, the program emphasizes both Science and Technology and Methods and Applications. 6e1

New hitherto unpublished papers are hereby solicited; their total length should not exceed 5000 words; each paper must include an abstract, not to exceed 200 words. Deadline for submission of advance abstracts: December 31, 1972. Deadline for submission of complete papers: February 1, 1973. 6e2

Professor Harvey L. Garner
General Chairman 6e2a

Dr. Carl Hammer, Chairman
Science and Technology Program
c/o Univac
2121 Wisconsin Avenue, NW
Washington, D.C. 20007 6e2b

ABSTRACTS 7

ELIJAH: AN INTELLIGENT ASSISTANT FOR NATURAL LANGUAGE PROGRAMMING
by Kenneth L. Modesitt
Division of Mathematical Sciences
Purdue-Fort Wayne

2101 Coliseum Boulevard East
Fort Wayne, Indiana 46805 7a

An interactive extensible natural language programming system modeled after the 'intelligent assistant' is presented. The system integrates natural language question-answering and natural language procedure construction in such a manner as to permit the expression and construction of declarative, interrogative and imperative statements in natural language. The user may build a data base in his own format, query it, and construct flowchart-like procedures which reference the data. These operations may be performed in an order decided upon by the user. The knowledge contained in the system ELIJAH can be extended by the user, with virtually all extensions being performed online. ELIJAH will query the user when it realizes that a part of its knowledge is incomplete. 7a1

EQUALITY ATOM TERM LOCKING
by Dallas Sylvester Lankford IV
Ph.D. Dissertation, Department of Mathematics
University of Texas, Austin, Texas 78712 7b

Equality atom term locking is a restriction of resolution-paramodulation-based deductive systems which is analogous to locking (see SIGART Newsletter, August 1971, pp. 11-12). An arbitrary symbol, *, is assigned to one or both terms of each equality atom of each clause. Each such clause is said to be term locked. Paramodulation is restricted by requiring that subsutitution be done only with terms which are assigned the symbol *. The restricted paramodulants are term locked hereditarily; that is, a term of an equality atom of a restricted paramodulant is assigned the symbol * if and only if at least one parent had the symbol * assigned to its corresponding term. 7b1

Resolution is not restricted, but resolvents of term locked clauses are term locked hereditarily. Equality atom term locking is shown to be complete for the first order logic with equality. Equality atom term locking is combined with locking (see SIGART Newsletter, October 1971, p. 4) and the resulting restriction is shown to be complete. The combination of locking and equality atom term locking significantly reduces the number of resolvents and the number of paramodulants produced at each round. Equality atom term locking is shown not to be compatible with set of support, linearlity, and R-renamable resolution and paramodulation. In addition, a new ground completeness theorem for resolution-paramodulation-based deductive systems is established without appealing to the maximal model theorem. 7b2

CONSTRAINED RESOLUTION: A COMPLETE METHOD FOR HIGHER ORDER LOGIC
(@487) by Gerard Peirre Huet
Case Western Reserve University
Cleveland, Ohio 7c

This dissertation presents a system of logic L for a language of order omega based on lambda-calculus with types. This system is designed to permit a mechanical implementation on a computer; in particular, there is no rule of substitution. This rule has been combined with the cut rule in a rule called constrained resolution, which is a generalization of Robinson's resolution rule in first order logic. The difficult computation of unifiers in higher order logic is not effected in L at the level of resolvents generation, but is rather delayed until a potential refutation is obtained. Unification will then attempt to validate all the cuts in the refutation. The main saving here is that only the existence of a unifier needs to be detected. However, it is shown that even this simpler problem is not decidable if we have third order objects. 7c1

The logic L is shown to be sound and complete; i.e., the existence of a refutation in L is equivalent to unsatisfiability by general Henkin Models. Functional extensionality is an option of the system. Numerous heuristic modifications of our system to improve its efficiency are proposed and discussed. Comparison with existing systems for higher order logic are briefly discussed, and a few hand-simulated examples are commented upon. 7c2

(@487)Ph.D. Thesis, Report 1117, Jennings Computing Center. 7c3

LOOK-AHEAD AND ONE-PERSON GAMES by Richard S. Rosenberg
Department of Computer Science
University of British Columbia
Vancouver 8, B.C., Canada
Technical Report 72-06
September 1972 7d

A preliminary investigation of the role of look-ahead in one-person games is presented. The use of look-ahead in comparing the effectiveness of different heuristic functions is discussed. There is a survey of recent work in tree-searching including that of Michie and Doran (1966), Hart, Nilsson, Raphael (1968), and Pohl (1969, 1970). Based on some of Pohl's results, two theorems are proven in Section 2 which suggest a possible use for look-ahead. Some experimental results are presented in Section 3 which satisfy to a limited degree the aforementioned theorems and some additional observations are made. In conclusion, an attempt is presented to relate look-ahead to the notion of 'informedness' introduced by Hart, Nilsson, and Raphael. Finally, some futher directions for research are suggested. 7d1

LISP 1.6 INTERPRETER WRITTEN IN ALGOL FOR THE B-6700 by Mario Magidin and Raymondo Segovia
National University of Mexico
Center for Systems and Applied Mathematics (CIMASS)
Cuidad Universitaria
Mexico 20, D. F., Mexico 7e

A LISP 1.6 interpreter has been implemented for the B-6700 computer at the University of Mexico, CIMASS. The System is written in Burroughs Extended Algol. It is oriented basically towards a batch processing environment, additional work is being done to develop an interactive version. 7e1

Most of the standard 1.6 LISP functions have been implemented, plus special I/O and file definition instructions. The system is capable of handling arrays of any dimensions whose elements can be of mixed type. 7e2

The LISP Interpreter operates on an array divided into "pages" of 256 words. Each page is used to store data items of one type and are assigned dynamically. The system now has 4 data types: list nodes, atoms, numbers, and arrays. 7e3

A list node occupies 1 word, which contains two pointers. An atom is any sequence of characters not including (,), [,], ., -, +, $ or blanks, not starting with a number. The maximum length allowed is 256 characters. An atom uses 3 words or more, which include pointers to the value, property list, its print name, and fields to handle tracing, garbage collection, etc. 7e4

Small numbers are stored as a pointer to 2↑21 + n for positive numbers and 2↑21 + 2↑20 + n for negative numbers. Large numbers are stored in the normal B-6700 format. The input routine recognizes as a nuumber a sequence of digits of the form +or-xx***x.yy***y E+or-zz***z. The maximum length of a number sequence is 12. An integer followed by Q is recognized as octal. 7e5

Arrays of any size or dimension may be declared. The elements of an array are pointers and may be of different types. Multidimensional arrays are implemented as arrays of arrays. 7e6

Full advantage is taken of the virtual memory system of the

B-6700 in implementing the garbage collector. Educational or research institutions may obtain a copy free of charge by writing to the above address. A complete description will be available soon. 7e7

SCENE ANALYSIS USING RANGE DATA by David Nitzen
Technical Note 69
August 1972
Artificial Intelligence Center (@498)
Stanford Research Institute
Menlo Park, California 94025 7f

This analysis obtains information about the geometry of polyhedral objects on the basis of quantized range data. Methods are proposed for determining planar regions and their boundaries, taking into account the various types of data errors. 7f1

The analysis deals with the following topics: (1) range data, including definitions of image coordinates, measurement increments, and classification of errors, (2) detection of data points belonging to horizontal surfaces, (3) determination of the points of various planar region boundaries by different methods, (4) the adverse effects of errors in the range data on the computed region-boundary points and some possible ways to minimize those effects, and (5) grouping the boundary points into gap-free vertical boundaries, horizontal boundaries, and three dimensional boundaries. 7f2

TECHNIQUES FOR INFORMATION RETRIEVAL USING AN INFERENTIAL QUESTION-ANSWERING SYSTEM WITH NATURAL LANGUAGE INPUT
(final Report to NSF, November 1972.) by L. Stephen Coles
Artificial Intelligence Center (@498)
Stanford Research Institute
Menlo Park, California 94025 7g

Most conventional computer information-retrieval systems are limited by rigid data structures, inflexible query languages, and the lack of conversational error-recovery procedures. Computer question-answering systems designed to overcome one or more of these limitations have been built, but for the most part they have been restricted to small data bases. This report describes the current state of a two-year research project aimed toward the combining and extending of recently developed question-answering techniques to reasonably large data files. 7g1

During this time, the project has made significant progress toward the ultimate goal of building a general English language communication interface between men and machines. A compilation of 128 widely used physical laws and effects of interest to engineers, scientists, and inventors taken from a reference textbook of 291 pages has been used as a data base for demonstrating our techniques of natural-language input, deductive inference, and query negotiation. The resulting system known as ENGLAW is now operational. 7g2

Chapter I of this report gives a brief introduction to ENGLAW and its research objectives. The syntactic, semantic, and pragmatic components of ENGLAW are described in subsequent chapters. Finally, the appendices to the report list the grammar and various lexicons as they would be entered into the computer. 7g3

QA4: A PROCEDURAL CALCULUS FOR INTUITIVE REASONING (@498)
by Jeff Rulifson, Jan Derksen and Richard Waldinger
Technical note 73, Novermber 1972, 363p.
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025 7h

This report presents a language called QA4, designed to facilitate the construction of problem-solving systems used for robot planning, theorem proving, and automatic program synthesis and verification. QA4 integrates an omega-order logic language with canonical composition, associative retrieval, and pattern matching of expressions; process structure programming; goal-directed searching; and demons. 7h1

Thus it provides many useful programming aids. More importantly, however, it provides a semantic framework for common sense reasoning about these problem domains. The interpreter for the language is extraordinarily general, and is therefore an adaptable tool for developng the specialized techniques of intuitive, symbolic reasoning used by the intelligent systems. 7h2

Chapter Two is a primer for the QA4 language. It informally presents the language through the use of examples. Most of the unusual or complicated features of the language are not discussed. The Chapter concludes with a presentation of a small robot planning system that uses only the language features presented in the Chapter. Chapter Three presents a series of examples chosen to illustrate solutions to automatic programming problems. The QA4 programs used in Chapter Three rely on language features not presented in the primer. They are, however, explained as they occur. These programs illustrate most of the programming just discusssed. Chapter

Four is a complete reference guide to the language. It provides the semantics of all the features of the language together with many implementation notes and design rational. Chapter Five discusses extensions to the language that will probably be done during the next year. 7h3

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SEMI-ANNUAL PROGRESS REPORT OF THE NIH HEURISTICS LABORATORY by R. C. T. Lee
Heuristics Laboratory
Division of Computer Research and Technology
National Institutes of Health
Bethesda, Maryland 20014 8

In the past six months, the following papers have been published: 8a

1. Chang, C. L., "Theorem Proving with Variable-Constrained Resolution," INFORMATION SCIENCES, Vol. 4, 1972, pp. 217-231. 8a1

2. Knott, G., and Reece, D. K. "MLAB: A Civilized Curve Fitting System," ONLINE '72 PROCEEDINGS. 8a2

3. Lee, R. C. T., "An Algorithm to Generate Prime Implicants and Its Application to the Relection Problem, "INFORMATION SCIENCES, Vol. 4, 1972, pp. 251-259. 8a3

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In the past six months, the following papers have been accepted: 8b

1. Chang, C. L., and Lee, R. C. T., "A Heuristic Method for Nonlinear Mapping in Cluster Analysis," accepted by IEEE Transactions on Systems, Man and Cybernetics. 8b1

2. Jones, T. and Slagle, J. R., "Pattern Recognition," to appear as a chapter in COMPUTER GRAPHICS (M.A. Musperatt, editor). 8b2

3. Slagle, J. R., and Norton, L. M., "Experiments with an automatic Theorem Prover having Partial Ordering Inference Rules," accepted by the COMM. OF THE ACM. 8b3

In the past six months, the following papers have been written: 8c

1. Chang, C. L., "Pattern Recognition by Piecewise Linear Discriminant Functions." 8c1

2. Chang, C. L., "A Note on Piecewise Linear Programming." 8c2

3. Chang, C. L., "A Method in Multiple Piecewise Linear Regression Analysis." 8c3

4. Lee, R. C. T. and Ting, K. L. H., "Fisher Ration and the Weighting of Features." 8c4

5. Lee, R. C. T., "A Direct splitting clustering Algorithm." 8c5

6. Slagle, J. R., "Automated Theorem-Proving and Theories with Simplification, commutativity and Associativity." 8c6

CORRECTION TO "A FORMAL BASIS FOR THE HEURISTIC DETERMINATION OF MINIMUM COST PATHS"

by Peter E. Hart
Nils J. Nilsson
Bertram Raphael
Artificial Intelligence Center
Stanford Research Institute
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Our paper on the use of heuristic information in graph searching defined a path-finding algorithm, A*, and proved that it had two important properties. In the notation of the paper, we proved that if the heuristic function h(n) is a lower bound on the true minimal cost from node n to a goal node, then A* is admissible;

i.e., it would find a minimal cost path if any path to a goal node existed. Further, we proved that if the heuristic function also satisfied something called the consistency assumption, then A* was optimal; i.e., it expanded no more nodes than any other admissible algorithm A no more informed than A*. These results were summarized in a book (@489) by one of us. 9a

We are grateful to Professor Ron Colman of the California State University at Fullerton who wrote us to point out that our proof of optimality did not use the consistency assumption at all THUS OUR RESULT IS TRUE UNDER MORE GENERAL CONDITIONS THAN WE THOUGHT. Professor Colman correctly observed that in our proof of optimality given in Nilsson (Theorem 3-2, page 65, near the end of the proof), we claim to use the result g(n)=g(n) which does depend on the consistency assumption, whereas all we needed was the fact that g > or= g(n) which does not depend on the consistency assumption at all but follows directly from the definition of g. We leave it to the reader to verify for himself the result that we overlooked, namely, that the inequalites needed in the proof are still maintained using only g >or= g. 9b

We can make the corresponding strengthening corrections to Theorems 2 and 3 of our paper. In the proof of Theorem 2 (page 105) we also claim to use g(n)=g(n) when all we needed was the fact that g(n) >or= g(n). The proof of Theorem 2 also claimed to use Lemma 3 of the paper (page 105) which does depend on the consistency assumption. However, we needed only the corollary to Lemma 3, which can be proved without the consistency assumption. 9c

The needed corollary and its proof are as follows: 9d

LEMMA 4 Suppose h(n)= h(n) for all n and suppose A* has not terminated. Then if node n is closed, f(n) >or= f(s). 9d1

PROOF Node n is not a goal node, since by hypothesis A* has not terminated. By the corollary to Lemma 1 of the paper (page 103), at the time node n was closed there existed an open node n' on an optimal path P from s to a preferred goal node of s with f(n') <or= f(s). Since node n was closed in preference to n' it must have been the case that 9d1a

f(n) <or= f(n') <or= f(s) 9d1a1

completing the proof. 9d1b

The consistency assumption is still needed to prove Lemma 2 and 3 of the paper but our main theorems depended only on a weaker corollary. Lemma 2 (namely that g(n) = g(n) for closed nodes) is of independent interest since it allows a simpler implementation of algorithm A*. With g(n) = g(n) when node n is closed, there is no need to consider re-opening closed nodes. Thus, satisfying the consistency assumption may have practical consequences. 9e

We thank Professor Colman for his observation. 9f

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@489 Nils J. Nilsson, PROBLEM-SOVING MEHTCDS IN ARTIFICIAL INTELLIGENCE, McGraw-Hill Book Co., New York, New York, 1971. 9g1

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BIBLIOGRAPHY ON COMPUTER SEMANTICS by Bertram Raphael and Ann Robinson
Technical Note 72, October 1972
Artificial Intelligence Center
Stanford Research Institute
Menlo Park, California 94025 11

This bibliography and topical index lists more than 200 references, almost all published since 1965, in a growing research area known as Compuer Semantics. This area lies at the boundaries of three major disciplines: Linguistics, Psychology, and Computer Science (especially Artificial Intelligence). It is not yet clear whether this ill-defined interface region really constitutes an independent, cohesive field of study; however, it is clear that studies of the following are highly interrelated: 11a

(1) The fundamental structure of natural language 11a1

(2) Processes by which humans understand language 11a2

(3) Algorithms that enable machines to understand language. 11a3

In all three areas, the most prominent unsolved problems are those of SEMANTICS: how to acquire, represent, and make use of the MEANINGS of the linguistic utterances under consideration. 11b

During the summer of 1971 a two-week conference on Computer Semantics was held at Woods Hole, Massachusetts, sponsored by the Mathematical Social Science Board Supported by a grant from the Natinal Science Foundation. The participants of this conference, who had varied technical backgrounds, engaged in a fruitful exchange of ideas and approaches while examining the basic processes needed to model human knowledge, linguistic interaction, and thought capability. One conclusion of the conferenc was that a need exists for more-available material to help new researchers to enter Computer Semantics and to move across the established boundaries of its component disciplines. this bibliography is intended to help answer that need. 11c

In the interests of producing a useful listing of reasonably accessible documents that represent the current state of a rapidly changing field, we have pruposely omitted 11d

(1) Unpublished reports or dissertations
(2) References before 1965, except for a few texts and "classic" papers
(3) References clearly belonging to only one of the component fields;
e.g., Linguistics or Psychology, without obvious broader applicability. 11d1

The result is the following list of more than 200 references. 11e

In selecting categories for the Topical Index, we rejected the obvious break-down -- Linguistics, Psychology, computer Science -- That emphasizes method of approach, in favor of a breakdown by target subject matter -- Language, Memory, Decision-Making. We hope this arrangement will encourage users of the Bibliography to break out of the mold formed by their own training and look at other approaches to the problems in which they are interested. 11f

The Topical Index also attempts to separate theoretical discussions from descriptions of implimented (or clearly implementable) computer algorithms. In the natural language section, this latter topic has been further divided into two sections: I-A.2, covering systems that attempt to perform complete transformations from natural language into a different formal structure for some particular application. 11g

We have attempted to minimize the number of occurrences in the Index of each reference by placing it in no more than three categories, and preferably only one. Since many papers seem to fall between any firm topic divisions, this restricted classification has resulted in many arbitrary and perhaps erroneous decisions, for which we apologize. 11h

For the beginning reader in Computer Semantics, we have selected (with the help of some of the Woods Hole conference participants) a few of the references to suggest as entry points into the literature. these selections are marked by asterisks; they include surveys, collections, key papers, and typical reports that, as a group, span and perhaps help define the research area we call computer Semantics. 11i

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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.

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SIGART NEWSLETTER Number 39 April 1973

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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

SIGART NEWSLETTER Number 39 April 1973

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 SPECTRCMETRY 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. Crganik
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 OQY, 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

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545 Technology Square
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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

Dr. N. S. Shridharan
Computer Science Department
Stanford University
Stanford, California 94305 12j6a

Prof. H. Gelernter

Computer Science Department
State University of New York at Stony Brook
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
General Electric Research and Development Center
P.O. Box 8
Schenectady, New York 12305
518-346-8771, ext. 6346 or 6476. 14a4a

-- 14b

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SIGART NEWSLETTER Number 39 April 1973

(J21205) 26-DEC-73 15:45; Title: Author(s): L. Stephen Coles, Richard E. Fikes/LSC REF; Sub-Collections: NIC ; Clerk: KIRK; Origin: <SIGART>APR73.NLS;2, 14-APR-73 09:09 LSC ;

SIGART NEWSLETTER Number 40 June 1973 1

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. 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

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. 1d

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 lock 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. l, 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

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*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

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*[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. 8a3e2

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 8a3e3

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, Calfironia 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> 8a3f3

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 8a3i1e

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 8a3i1f

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 8a3i1g

6. "The Symbolic Nature of Visual Imagery," T. Moran, Department of Computer Science, Carnegie-Mellon University, Pittsburgh, Pennsylvania 8a3i1h

18. Automatic Programming

8a3i2

Chairman: 8a3i2a

Place: Physics Lecture Hall 100 8a3i2b

1. "A System which Automatically Improves Programs," J. Darlington, R. Burstall, Department of Machine Intelligence, University of Edinburgh, Edinburgh, Scotland 8a3i2c

2. "Proving Theorems about LISP Functions," R. Boyer, J Moore, School of Artificial Intelligence, University of Edinburgh, Edinburgh, Scotland 8a3i2d

3. "A Global View of Automatic Programming," R. Balzer, Information Science Institute, University of Southern California, Marina del Rey, California 8a3i2e

4. "A Heuristic Approach to Program Verification," S. Katz, Z. Manna, Applied Mathematics Department, Weizmann Institute of Science, Rehovot, Israel 8a3i2f

5. "Iterated Limiting Recursion and the Program Minimization Problem," L. Schubert, Department of Computer Science, University of Alberta, Canada 8a3i2g

6. "Heuristic Methods for Mechanically Deriving Inductive Assertions," B. Wegbreit, Bolt, Beranek, and Newman, Incorporated, Cambridge, Massachusetts 8a3i2h

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 8a3l2d

3. "Backtracking in MLISP2," D. Smith, H. Enea, Stanford University, Stanford, California 8a3l2e

4. "CLISP - Conversational LISP," W. Teitelman, Xerox Palo Alto Research Center, Palo Alto, California 8a3l2f

5. "1-pak: A SNOBOL-based Programming Language for Artificial Intelligence Applications," J. Mylopoulos, et. al., University of Toronto, Toronto, Canada 8a3l2g

6. "A LISP Machine with Very Compact Programs," L. P. Deutsch, Xerox Palo Alto Research Center, Palo Alto, California 8a3l2h

26. Free Session 8a3l3

Place: Physics Lecture Hall 101 8a3l3a

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 9a

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

Order back volumes (at $29.00) or enter your subscription for Vol. 4 by writing to the publishers: 10d4

North-Holland Publishing Company
Journal Division
P.O. Box 211
Amsterdam, The Netherlands. 10d4a

ABSTRACTS
--------- 11

Eyes and Ears for Computers by D. Raj Reddy
Computer Sciences Department
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
Computer Sciences Department
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
Computer and Information Science Research Center
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. Mazlack
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 cf 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 varicus 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

(J21206) 26-DEC-73 15:48; Title: Author(s): L. Stephen Coles, Richard E. Fikes/LSC REF; Sub-Collections: NIC ; Clerk: KIRK; Origin: <SIGART>JUN73.NLS;4, 18-SEP-73 12:23 KIRK ;