how I beat the monster

Until quite recently, computer chess was regarded by even mediocre chess players as little more than a joke — 'Computers are such stupid things'! However, recent computer chess tournaments have demonstrated that the best programs are becoming quite good. Even so, a lingering doubt remains: one computer may be able to convincingly wipe up another, but how will it fare when confronted with a human player?
Recently, Mr. Levy — an international chess master — was challenged by the reigning world champion computer. His description of the historical background and of the contest itself should prove of interest! Perhaps it should be noted, however, that Mr. Levy had an 'unfair advantage' in this contest: as an ex-computer programmer he has a fairly good idea of how his opponent 'thinks' . . .

David Levy

One evening during August 1968 I was playing chess at a cocktail party in Edinburgh. My opponent was John McCarthy, Professor of Artificial Intelligence at Stanford University, California, and one of the world's leading experts in his field. At that time I was the reigning Scottish Chess Champion.
I won the game against McCarthy who then remarked that although he was not strong enough for me there would be, within ten years, a computer program which could win a match against me. I was amazed by his suggestion because in the preceding two decades there had been very little progress made on computer chess, and the strongest programs were very, very much weaker than I was. We began to debate the point and when I realised that he was completely serious I suggested that we test our opinions with a £ 500 bet. Our host for the evening, Professor Donald Michie of the Department of Machine Intelligence and Perception at Edinburgh University, joined in our conversation and agreed to share the bet with McCarthy, each of them wagering £ 250 against me.
During the next few years the bet grew in size. Two more academicians joined the consortium, Seymour Papert from M.I.T. and Ed Kozdrowicki from the University of California at Davis. Donald Michie also increased his original stake to £ 500 and added a further £ 500 wager that if I did lose the original bet it would be to a program written by him or under his guidance. The total staked in the original bet was therefore £ 1,250.
One of the beneficial effects of this bet was that it created publicity and encouraged programmers to work on computer chess. During the decade following August 1968 computer chess became so popular that a number of tournaments were arranged in which all the competitors were chess programs. There is an annual competition in the U.S.A. and there have been two World Championships and one European Championship. Computer chess is growing in popularity at an amazing rate, and recently there was a tournament in London for chess programs running on

microprocessors (a similar event had been held in California a few months earlier). Why all this interest?
There are many reasons why people write chess programs. Firstly, it is great fun. But the principal purpose is that chess is widely considered to be the most difficult and challenging of all intellectual games and it can be argued that to play good chess requires a high degree of intelligence. Taking this argument one step further it can be said that if we succeed in producing a computer program that can play chess as well as a Grandmaster or even a World Champion, it will also be possible to write programs that will perform other intellectually difficult tasks in long range planning. Indeed, when a group of Artificial Intelligence biggies sat down some years ago to formulate a list of the aims of their science, one of their targets was a program that could win the World Chess Championship.
With the increased interest in computer chess there was a steady though undramatic increase in the strength of the best programs. Until late in 1976 computer chess was regarded by the chess playing community as little more than a joke, but suddenly everything changed. The leading American program, CHESS 4.6, won the class-B section at the Paul Masson chess tournament in Saratoga, California. This was the first time that a computer program had ever won an event intended for humans and it caused considerable consternation amongst some of the competitors, even though the programmers had announced in advance that they would forsake any prize money. The following February the same program won the Minnesota Open Championship. In March it demonstrated that it was at least as strong as I am at blitz chess, a form of the game in which each player must make all of his (or its) moves at great speed. I had never expected, when I made the bet in 1968, that computer programs would have made so much progress so quickly. In fact, I thought it unlikely that there would be a program strong enough to challenge me to a match, and I expected to win the bet by forfeit.
In April 1977 I was formally challenged

to play a match against CHESS 4.6. It was to be a two game match, though if I won the first game the match would be over since in order to lose the bet I would have to lose the match by at least 1½ points to ½. Play took place under perfect conditions at Carnegie Mellon University in Pittsburgh, one of the leading centres for Artificial Intelligence. I won the first and only game of the match fairly convincingly, though at one time the program did have the advantage against me.

In December 1977 I was asked to play again, this time against KAISSA, written at the Institute for Control Science in Moscow. KAISSA had been World Computer Champion from 1974 to 1977 but I found it to be slightly weaker than CHESS 4.6 and managed to win without much trouble.
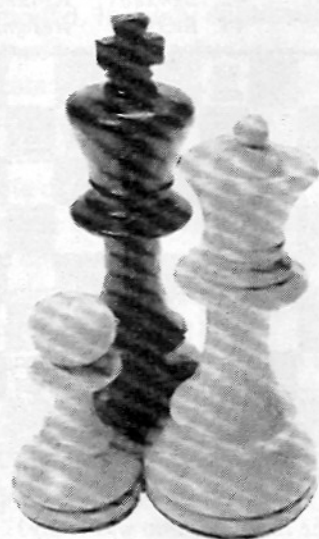
By then the interest in my bet was really hotting up. It had only eight months to run and it soon became known that David Slate, one of the programmers of Northwestern University's CHESS 4.6, was going over to part time work so that he could devote six man months to his program, in an attempt to produce my downfall. His partner, Larry Atkin, was working on a robot arm which would move the program's pieces and punch the button on the chess clock.

Shortly before the August deadline I was challenged to play a two game match at M.I.T. against an updated version of the program named MacHack VI, which was the world's strongest program at the time I first made the bet. MacHack was written by Richard Greenblatt and was running on some special purpose chess hardware, which enabled it to analyze 150,000 positions per second. Although this special analyzer could detect certain tactical traps, the program exhibited no more strategic understanding than CHESS 4.6. I won the first game of the encounter and then played the second game, just for fun, and won that as well.

The end of August approached. I went from Boston to Toronto where I was about to face my final challenge. The hoped for version CHESS 5.0 had not been completed in time, so my opponent was CHESS 4.7, an upgraded 4.6. The program was running on a CDC Cyber 176 computer, the world's fastest commercially available machine.

We played at the Canadian National Exhibition, a gigantic fair which takes place in Toronto at the same time each year. I was seated in an almost sound-proofed glass booth, wearing a dinner jacket. I played on a special chess board which had been designed and built by CDC consultant David Cahlander. This board could detect the movement of my pieces by means of magnetic sensitive switches beneath each square – the lead weights in the pieces had been replaced by magnets. Another feature of this board was a small red light on each square. When the program had decided on its move it would illuminate the lights on the 'from' square and the 'to' square, as well as those on the intervening squares.

The match was to be a six game encounter. Under the terms of the bet I would win if I scored 3 points or more. The program needed 3½ to beat me. In the very first game I suffered an extremely unpleasant shock after only twelve moves:

White: Levy
Black: CHESS 4.7

1.	g2-g3	d7-d5
2.	Bf1-g2	e7-e5
3.	d2-d3	Ng8-f6
4.	Ng1-f3	Nb8-c6
5.	0-0	Bc8-d7
6.	b2-b3	Bf8-c5
7.	Bc1-b2	Qd8-e7
8.	a2-a3	e5-e4
9.	Nf3-e1	0-0
10.	d3-d4	Bc5-d6
11.	e2-e3	Nf6-g4
12.	h2-h3??	

79037 - 1
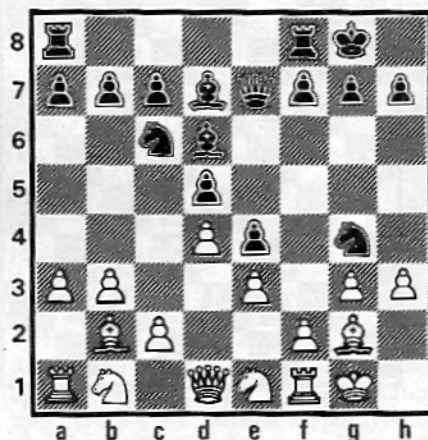
I took several minutes over this move, but no sooner had I made it on the board than the program, which thinks in its opponents' time, replied with . . .

      12. . . .   Ng4xe3!!

I had considered this move to be hopeless, because I had not seen the follow-up.

      13. f2xe3   Qe7-g5!

And suddenly I realized that my position was in shreds. Black's queen threatens the pawns on e3 and g3, and once the queen gets to g3 Black will be able to capture the h3 pawn with its bishop. In short, White is helpless. But 'nil desperandum'.

      14. g3-g4!

The best practical try.

      14. . . .   Qg5xe3+
      15. Rf1-f2!

I played this move because programs know that they should exchange material when they are ahead, so after . . .
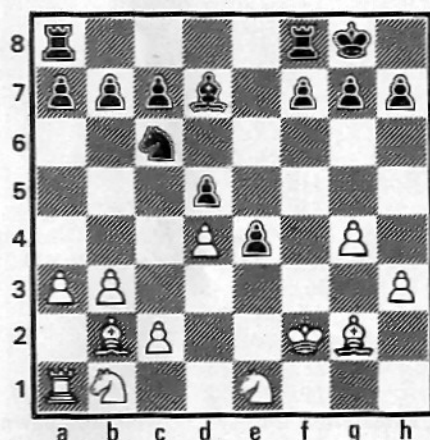
      15. . . .   Bd6-g3
      16. Qd1-e2

. . . instead of taking the exchange (16 . . . Bg3xf2+) and then keeping the queens on so as to launch an attack against my king, the program played . . .

      16. . . .   Qe3xf2+
      17. Qe2xf2   Bg3xf2+
      18. Kg1xf2

79037 - 2

and despite my material deficit I was able to draw the ending through a combination of resourcefulness (on my part) and ineptitude (by my opponent).

This was the first time that a computer program had ever drawn with an International Chess Master under strict tournament conditions. The final result of the match was a win for me by 3½ - 1½. Out of the next four games I scored three wins and one loss. I am unable to give all the games here, for reasons of space, so I shall invite the reader to examine only the most interesting game of the match. At first I shall keep you in the dark as to which of us was White and which of us won the game. Please acquire pen and a small piece of paper before you play through this game, so that you can perform a little experiment.
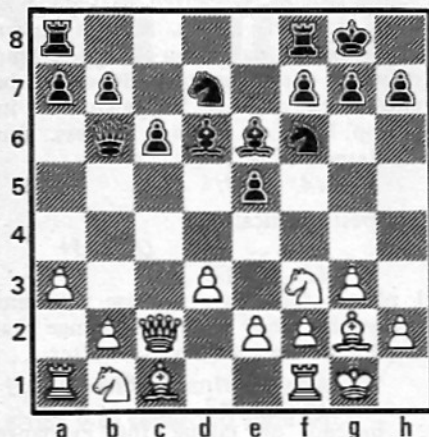
1.	c2-c4	Ng8-f6
2.	a2-a3	c7-c6
3.	d2-d3	d7-d5
4.	Qd1-c2	d5xc4
5.	Qc2xc4	e7-e5
6.	Ng1-f3	Bf8-d6

7.	g2-g3	Bc8-e6
8.	Qc4-c2	Nb8-d7
9.	Bf1-g2	0-0
10.	0-0	Qd8-b6

79037 - 3

Now, write down who you think was White: Man or machine?

11. Nb1-d2

Preventing 11...Be6-b3.

11. ...	Qb6-c5
12. Qc2-b1	h7-h6

Preventing 13 Nf3-g5 followed by Nd2-e4 and Bc1-e3, with an active position.

13. b2-b4	Qc5-b5
14. Qb1-c2	Nd7-b6

Hoping to jump in on a4.

15. Bc1-b2   a7-a5

If 15...Nb6-a4 16 Nd2-c4!, winning the pawn on e5 (if 16...Na4xb2? 17 Nc4xd6).

16. a3-a4	Qb5-a6
17. b4xa5	Qa6xa5
18. Bb2-c3	Qa5-c5
19. Rf1-c1	

Threatening 20 Bc3xe5, winning a pawn.

19. ...   Nb6-d7
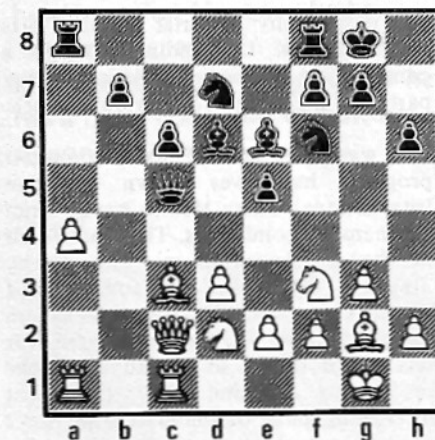
79037 - 4

Defending e5. Now, write down once again who you think is White.

20. a4-a5	Qc5-a7
21. Qc2-b2	Nf6-g4
22. Nd2-e4	Bd6-c7
23. h2-h3	

Now, if the knight on g4 retreats to f6, White can simply capture the pawn on e5.

23. ...   f7-f5

The white knight on e4 cannot move because of the threat of 24...Qa7xf2+, and so the following sequence is forced.
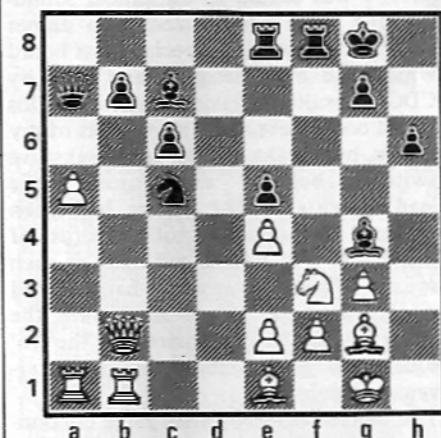
24. h3xg4	f5xe4
25. d3xe4	Be6xg4
26. Bc3-e1	Nd7-c5

Attacking the e4 pawn.

27. Rc1-b1

White is happy with 27...Nc5xe4 28 Qb2xb7.

27. ...   Ra8-e8

79037 - 5

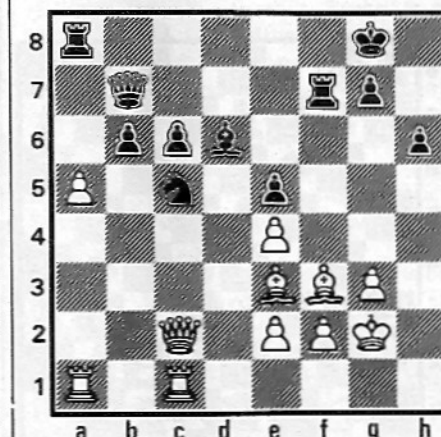The pawn on e5 was attacked twice. Now who do you think was White?

28. Be1-d2	Rf8-f7
29. Bd2-e3	Bc7-d6
30. Qb2-c2	Bg4xf3
31. Bg2xf3	

Threatening 32 Bf3-h5.

31. ...   Re8-a8

32. Rb1-c1   b7-b6

White has considerable pressure on the Q-side but if 33 a5xb6 Qa7xa1! 34 Rc1xa1 Ra8xa1+ 35 Kg1-g2 Ra1-a5, and it is not clear how White makes progress.
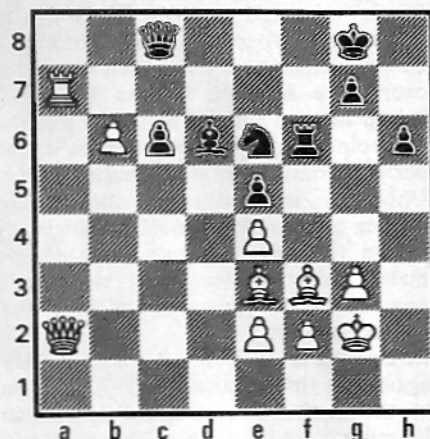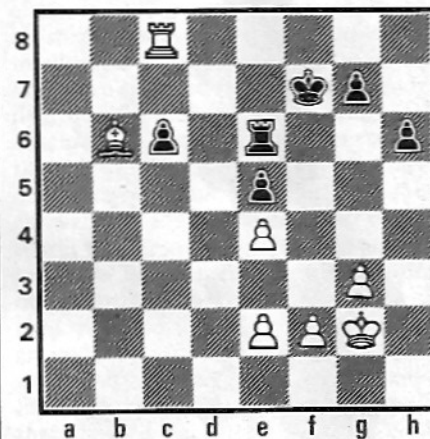
33. Kg1-g2   Qa7-b7

79037 - 6

Write down who you think is White.

34. a5xb6	Ra8xa1
35. Rc1xa1	Nc5-e6
36. Ra1-a7	Qb7-c8
37. Qc2-a2	Rf7-f6

79037 - 7

38. Ra7-a8	Bd6-b8
39. Bf3-g4	Kg8-f7
40. Qa2-a7+!	Bb8xa7
41. Ra8xc8	Ba7xb6
42. Bg4xe6+	Rf6xe6
43. Be3xb6	Resigns

79037 - 8

For the last time, who was White? Now turn the page.

◀
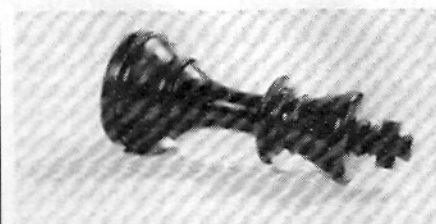
I was White. Many of you probably guessed, at least once during the game, that the program was white. The point of this experiment is that the program plays chess so well that it is almost impossible to tell for certain who is White and who is Black, and the program must therefore be considered in some sense to be intelligent. The English mathematician Alan Turing devised a test for machine intelligence and our experiment here is a kind of Turing test for chess programs. One might argue that CHESS 4.7 is definitely intelligent because it could take 1½ points off me in a five game match, but since the program 'thinks' by examining hundreds of thousands of positions every time it makes a move (15...a7-a5) required 906,758 positions) its method of play can hardly be called intelligent in the human sense.