Chess 4.7 versus David Levy

The Computer Beats a Chess Master

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After 29 years, computer chess finally achieved a victory in human competition at the master class tournament level. During the fourth game of a match held at the Canadian National Exhibition from August 26 to September 4 1978, International Master David Levy resigned to Chess 4.7/ CYBER 176 after 56 moves, although he did win the tournament, 3½ to 1½.

David Levy was three years old in 1949, when the American mathematician and computer science pioneer Claude Shannon produced the first paper describing the methodology for producing chess playing computer programs. Not until 1956 did any machine win a game against a human opponent: MANIAC, a system developed at the Los Alamos Scientific Laboratory, won a greatly simplified chess game against a novice player in 23 moves.

12 years later, Levy, expert rated and Scottish National Champion, attended the Fourth Annual Machine Intelligence Workshop. There he took exception to the views of John McCarthy of Stanford University and Prof Donald Michie of Edinburgh University, who agreed that within ten years a computer system would be World Champion of chess. Levy countered that not only would computers fall short of that goal, but they would be unable to defeat *him* in a tournament style match within that 10 year period. Neither side was able to shake the other's convictions and, as a result, Levy wagered £1250 sterling that he could defend against the computer advances.

The machine intelligence community had expected Levy to be defeated by a large network of computers participating in the game, until 1970, when a Northwestern University program called Chess 3.0, written by Larry Atkin, Keith Gorlen and David Slate, clearly emerged as the leading effort in the first US Computer Chess Championship. David Levy was then 24.

The original feeling of confidence Levy held must have been somewhat shaken as the years 1973 and 1974 saw Chess 4.0 achieve a United States Chess Federation rating higher than that of the average US tournament chess player. [**Note:** *the version number of the program increases along with its skill.*] Then, in 1976 and 1977, when Chess 4.5 and 4.6 won the class B championship at the Paul Masson Open Chess Tournament and won outright at the Minnesota Open, Levy conceded that he had begun to think that his match with Chess 4.7, "would not be a formality but could be just a bit of work."

The latter part of 1977 and early 1978 saw a series of 2 game matches between Levy and Chess 4.6, the Duchess program from Duke, Greenblatt's MIT program, and Kaissa from the USSR. Levy handily defeated all the programs in the first game.

Chess 4.7, running on a Control Data Corp (CDC) CYBER 176, had compiled a rating of 2030 after 31 tournament games and a speed chess performance rating of 2450, when the last challenge was given. The issue was to be resolved on the tenth anniversary of the original wager, with play to begin on Saturday, August 26.

Getting a computer to a chess match, which was the duty of this author and Dr Dave Cahlander, is a considerably more difficult task than getting a human to a match. Crossing the Canadian border with microprocessor controlled chessboards, and setting up and testing telephone lines and modems between Toronto and the CYBER 176 in Arden Hills MN consumed most of a week.

The glass box in which the match was held, standing beside three bowling lanes and a fencing exhibition, faced a large demonstration chessboard and seats for onlookers. A square of chess tables used in simultaneous play filled the rest of the room. Opposite the glass box was the stand

Photo 1: International Master David N L Levy ponders his move while sitting in the glass enclosed booth at the Canadian National Exhibition. A crucial position in one of the match games appears on the electronic chessboard, which is connected by telephone lines to a Control Data Corp CYBER 176 computer.

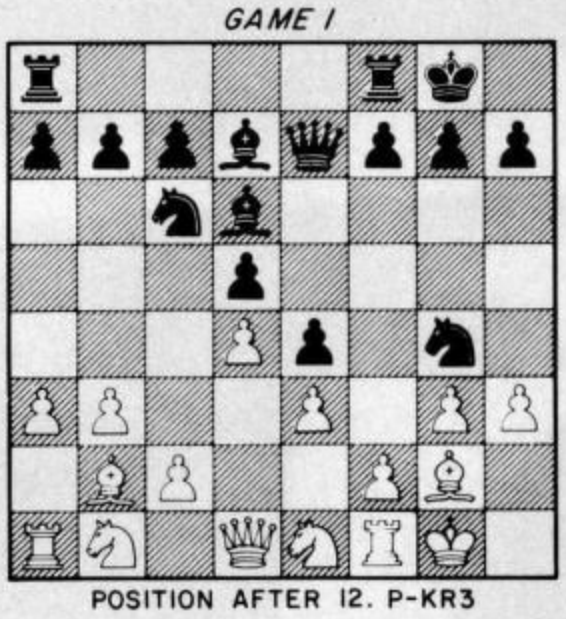

Figure 1: Position occurring in round 1 after White's 12th move. The player of Black next unleashes an attack which wins material and disrupts White's Kingside.

1.	P-KN3	P-Q4	33.	NxR	RxN
2.	B-N2	P-K4	34.	B-N4	R-KB6
3.	P-Q3	N-KB3	35.	R-Q8	P-KR3
4.	N-KB3	N-B3	36.	RxP	RxP
5.	O-O	B-Q2	37.	R-Q8	R-KB6
6.	P-N3	B-QB4	38.	R-R8	P-KN4
7.	B-N2	Q-K2	39.	P-Q5	P-KR4
8.	P-QR3	P-K5	40.	P-Q6	K-N2
9.	N-K1	O-O	41.	RxP	R-B2
10.	P-Q4	B-Q3	42.	R-R5	K-B3
11.	P-K3	N-KN5	43.	B-B3 check	K-N3
12.	P-R3	NxP/6	44.	R-K5	R-B6
13.	PxN	Q-N4	45.	B-N4	R-B5
14.	P-KN4	QxP/6 check	46.	R-K7	R-B2
15.	R-B2	B-N6	47.	RxP/4	R-Q2
16.	Q-K2	QxR check	48.	R-K7	P-R5
17.	QxQ	BxQ check	49.	K-N2	P-N5
18.	KxB	P-B4	50.	K-R2	P-N3
19.	PxP	N-K2	51.	K-N2	R-Q1
20.	P-B4	RxP check	52.	P-R4	N-Q2
21.	K-N1	P-B3	53.	P-R5	N-B3
22.	N-QB3	R-R4	54.	PxP	N-Q4
23.	K-R2	R-KB1	55.	P-N7	NxR
24.	N-Q1	N-N3	56.	PxN	R-KR1
25.	R-B1	BxP	57.	B-Q6	K-B3
26.	BxB	R-B8	58.	P-N8=Q	RxQ
27.	N-N2	R-B6	59.	BxR	KxP
28.	PxP	R/4XB check	60.	B-B4	K-B3
29.	K-N1	PxP	61.	B-Q2	K-N3
30.	R-B8 check	N-B1	62.	B-K1	K-N4
31.	B-B3	R-Q6	63.	B-B2	K-R4
32.	N/1-K3	R/RxN		Game agreed drawn.	

Table 1: The score (record of moves) of game 1 of the match. The reader is asked to examine this game, and to form an opinion concerning which player had which color of pieces.

About the Author

J R Douglas has 16 years of experience as a microprogrammer, and maintains an interest in artificial intelligence. His hobbies include photography and amateur radio (callsign KA0ACN).

of Josef Smolij, local speed chess king and guru of the all-night, outdoor Yonge Street Chess Association. Josef, we were to learn, would play a large part in the first win ever for a chess machine at the master level.

The relationship between the opponents in the Levy match is difficult to describe. The two Davids, Levy and Slate, and the CDC folks stayed in the same hotel and ate meals, travelled and generally spent the entire time together as friends. Levy even considered the machine to be sort of a friendly foe. Each night the entire group found itself on the sidewalks of Yonge Street playing chess on overturned milk cartons with Joe Smolij until the small hours of the morning. Joe demonstrated his "Smash-Crash" Gambit (also known as the Greco Counter Gambit for those who have not yet met Josef) for 50 cents a lesson.

Levy's plan for the match was not difficult to anticipate, since he had demonstrated that, while tactical positions favored the computer, strategic positions favored him. He had used close, quiet games to defeat the computers in each defense of the wager, playing a strategic game until a weakness developed in the computer's position, then winning against that weakness.

The game score of round 1 is presented in the form of a Turing experiment. For those not familiar with him, Alan Turing proposed a method for determining whether a machine should be called "intelligent." In this test, a human, linked via teletypewriter with a machine, is told that he is communicating with either a machine or another human. If he is unable to determine with which of them he is communicating, the machine can be termed "intelligent." The question: was Levy White or Black in game 1? Consult table 1 and form an opinion. The answer appears in the text box on page 90.

The first game was a draw. This created a great deal of speculation, as most of the

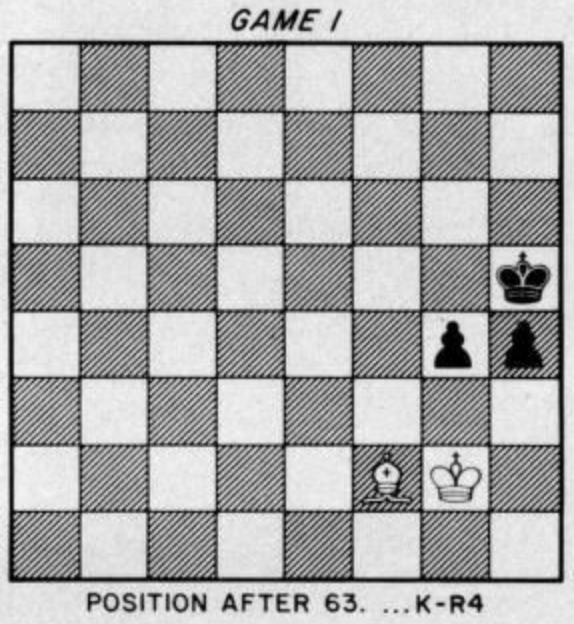

Figure 2: The final position reached in game 1. The participants agreed to a draw.

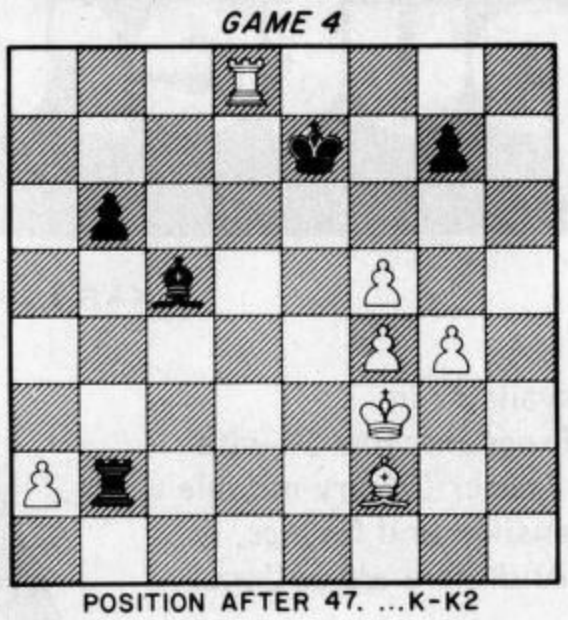

Figure 3: Position reached in game 4 after Black has made his 47th move. The human chess masters present, including Canadian Master Bruce Amos and 14 year old US National Master Joel Benjamin, were of the opinion that White must lose material. White did have a move they missed, and played it.

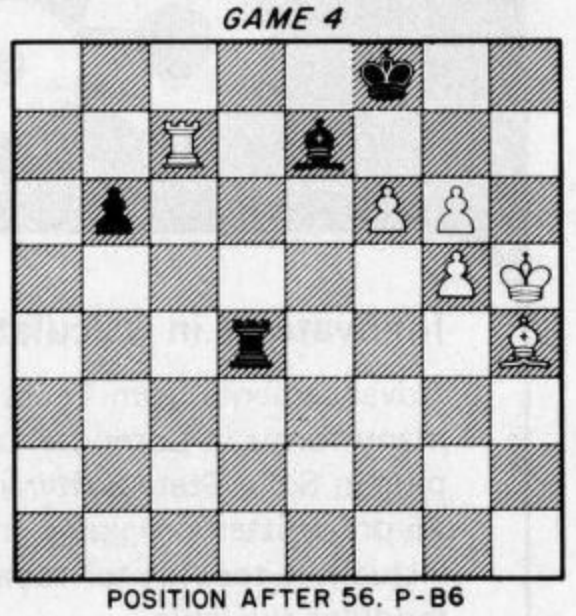

Figure 4: The final position of game 4. White's pawns will march irresistibly to the eighth rank and become Queens. Black can find no way to stop them, and resigns.

	Chess 4.7	Levy
1.	P-K4	P-K4
2.	N-KB3	P-KB4
3.	PxP	P-K5
4.	N-K5	N-KB3
5.	N-N4	P-Q4
6.	NxN check	QxN
7.	Q-R5 check	Q-B2
8.	QxQ check	KxQ
9.	N-B3	P-B3

At this point, Levy announced to the spectators that he was playing the "Smash-Crash" Gambit, attributed to Josef Smolij of Toronto.

10.	P-Q3	PxP
11.	BxP	

Possessing a one pawn advantage, the computer has forced Black's King to remain in the center of the board.

11.	. . .	N-Q2
12.	B-KB4	N-B4
13.	P-KN4	NxB check
14.	PxN	B-B4
15.	O-O	P-KR4
16.	N-R4	B-Q5
17.	B-K3	B-K4
18.	P-Q4	B-Q3
19.	P-KR3	P-QN3
20.	R/B-K1	B-Q2
21.	N-B3	PxP
22.	PxP	R-R5
23.	P-B3	R/1-R1

Levy has seized command of the King Rook file. The defense is not at all obvious.

24.	K-B1	B-N6
25.	R-K2	B-B1

The move 25. . . R-R8 with check fails because of the reply B-N1.

26.	K-N2	B-Q3
27.	B-N1	R-R6
28.	R/1-K1	R-N6 check
29.	K-B2	R/1-R6
30.	R-K3	B-R3
31.	N-K2	

Chess 4.7 forces the exchange of minor pieces, and thereby defangs Levy's attack.

31.	. . .	BxN
32.	R/1xB	P-B4
33.	P-B4	RxR
34.	RxR	R-R5
35.	K-N3	R-R8
36.	B-B2	R-Q8
37.	R-R3	PxP
38.	RxP check	K-B1
39.	R-Q7	R-Q6 check
40.	K-N2	B-B4
41.	RxP/5	R-Q7
42.	P-N4	BxP
43.	R-Q8 check	K-B2
44.	R-Q7 check	K-B1
45.	RxP/4	R-N7
46.	K-B3	

This move avoids the pin of the Bishop to the King — see why in the next move.

46.	. . .	B-B4
47.	R-Q8 check	K-K2
48.	B-R4! check	

The human masters present did not see this move. They thought the computer was certain to lose material.

48.	. . .	K-B2
49.	P-N5	P-N3
50.	R-Q7 check	K-B1
51.	PxP	RxP
52.	P-B5	R-R6 check
53.	K-N4	R-R5 check
54.	K-R5	R-Q5
55.	R-QB7	B-K2
56.	P-B6	

Black has no way to prevent the steamroller pawns from advancing to the eighth rank.

56.	. . .	Resigns.

Table 2: The score of the fourth round game. The computer had the White pieces and the first move. After Levy lost the game, Joe Smolij complained that the Smash-Crash Gambit was for use against people, not machines.

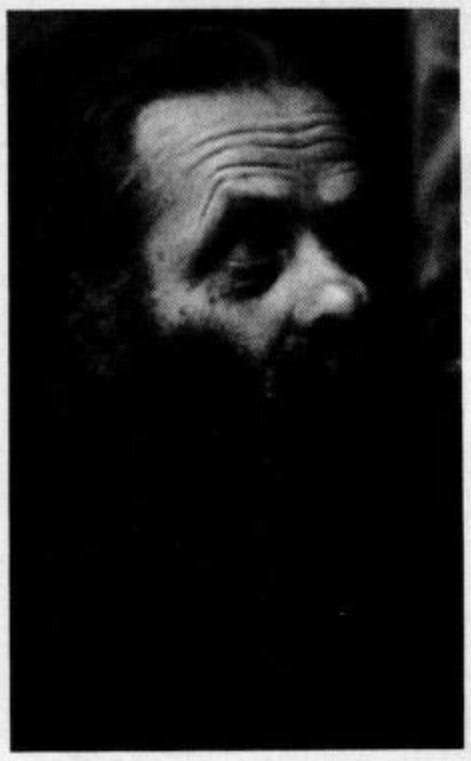

Photo 2: Josef Smolij, the guru of the Yonge Street Chess Association, as he presides over his midnight lessons in the Smash-Crash Gambit.

Photo 3: In game 4, David Levy stolidly ponders the position after his move 51 . . . . RxP. The computer's material and positional advantage is large, but tenaciously he seeks the best defense.

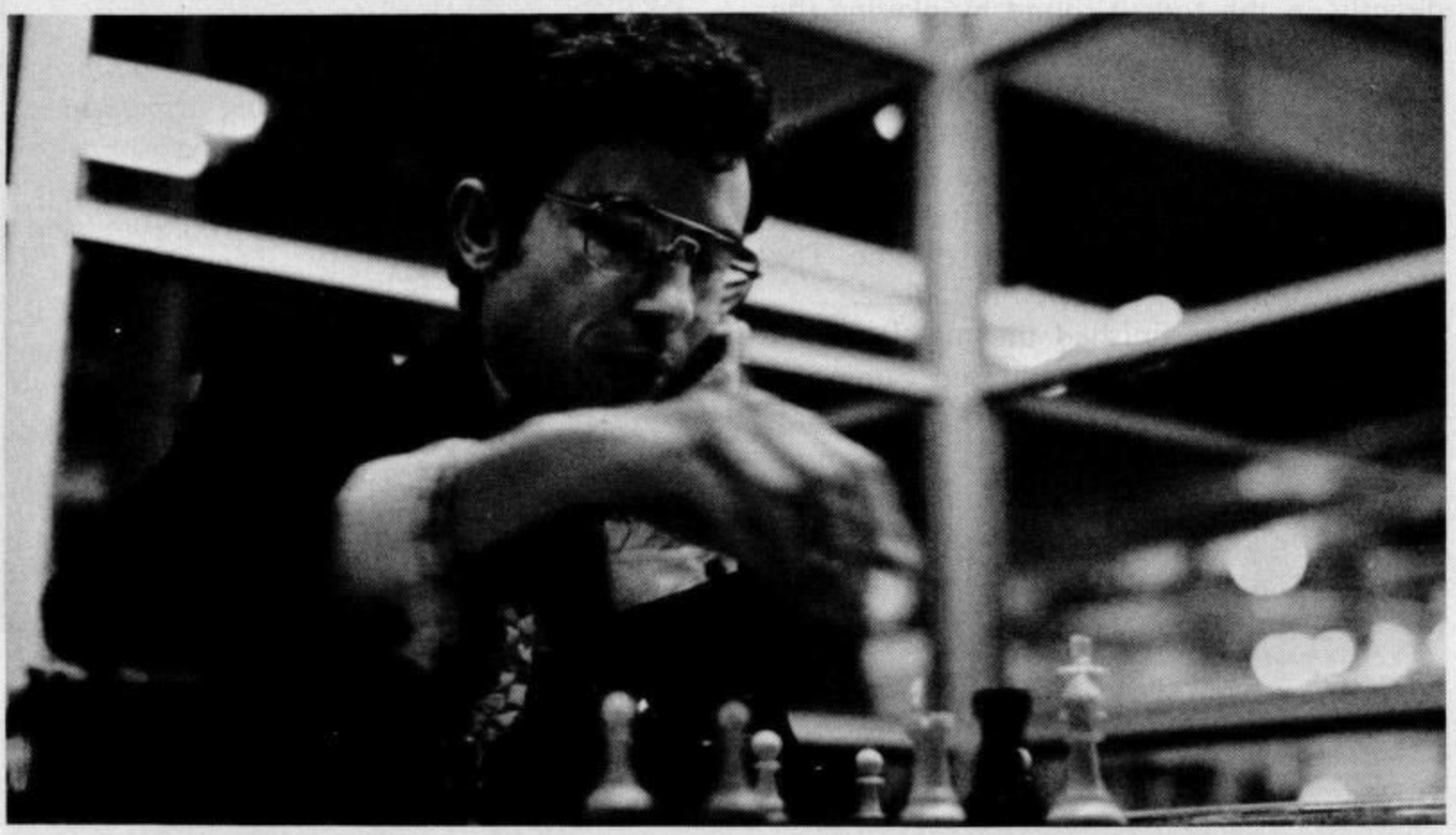

Photo 4: Levy forms his plan, and reaches out over the flickering electronic chessboard to put it into effect. He may persuade the computer to trade Rooks. Getting rid of Chess 4.7's troublesome Rook would allow some freedom of movement for Levy's beleaguered King.

Photo 5: The computer decides not to trade Rooks. Levy pulls his Bishop back to act as a shield against the final assault. He smiles as he sees that the steamroller pawns will not stop.

assembled experts had predicted a 3 game conclusion to the 6 game match. The rules required that Levy obtain only three points to win his wager. Now play would be forced to at least four rounds. Levy's concentration during the opening phase of the second game did not falter as he quietly put away the machine without apparent trouble.

Round 3 was not scheduled for six days, so the glass booth, looking much like an abandoned bus stop enclosure, sat empty while various masters played simultaneous exhibitions against spectators, amidst the sounds of three bowling lanes and the clank of sabers from the adjacent fencing matches.

Play resumed on September 2. The third round was another closed and quiet game which Levy won without apparent effort. The score then stood ½ to 2½, with Levy needing only a draw to win the match. However, he chose to confront Chess 4.7 directly in the fourth round by playing the Greco Counter Gambit. His decision was made only hours before, while sitting on a milk carton playing chess against Joe Smolij, the Smash-Crash Gambit expert.

Round 4 commenced with fireworks that never died out during the entire game. The moves of that game are given in table 2.

Though Levy finished the match in the fifth round with another closed game and held his 10 year wager, those on the computer chess side of the contest did demonstrate the ability to produce master level games. The most frequently heard comment after the match was that there were no losers in Toronto.

What happens now? A new version of the program, Chess 5.0, waits in the wings, the CYBER 176 spends most of its waking hours hard at work aiding in the design of its successor, and Levy has offered a prize of $5000 to the developer of a system which is able to defeat him in match play within the next five years. Here we go again.■

The answer to the Turing experiment question (page 86):

David Levy was playing White; Chess 4.7 was playing the Black pieces.

The computer found a surprising combination in game 1. The diagram of figure 1 shows the position immediately following Levy's move 12, P-R3. In the opinion of the computer operators, Chess 4.7 did not have any definite plan when it moved its Knight to the fifth rank. But Levy took 510 seconds to advance his Rook pawn. The program, calculating during all this time, explored enough move trees to find the hidden benefit in the otherwise unlikely appearing move of Knight takes King pawn.

The key move in the combination came after Black played its Queen to King Knight 4. Levy later said that if a human master had played the Knight sacrifice against him, he would have resigned immediately. As it was, he played on, confident that he could outmaneuver the machine in the endgame. His confidence was justified, and he managed to salvage a draw.

Photo 6: David Slate (left), of Northwestern University, and David Cahlander of Control Data Corp watch the computer terminal as it displays one of Chess 4.7's moves in game 4.

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