Psyching Out Computer Chess Players

Chess programs keep getting better, but grandmasters have learned to anticipate their game

The more deeply a computer chess program is allowed to calculate, the better it plays, and with the inexorable march of Moore's Law, the programs have gotten much better over the years. Why, then, do the very best grandmasters still hold their own against the silicon beasts?

A few months ago, in New York City, Garry Kasparov, the top-rated player in the world, drew a match against a leading chess program from Germany that runs on an Intel Xeon server with four 2.8-GHz processors and 4GB of RAM. Kasparov faced a special, three-dimensional-display version of his opponent [see photo, "3-D Chess"]. The previous year he had drawn the Israeli program Deep Junior in the same venue. Sometime before that match, Vladimir Kramnik, ranked second worldwide, had drawn an earlier version of Fritz.

Yet while the computers are running on faster hardware, with better software and larger databases of chess openings, humans are pretty much stuck with the brains they have. We carbon-based life forms don't get upgrades every 20 months, at least not after our mid-20s, when grandmasters tend to peak. Kasparov, the most successful player ever, is 40, with more than a few gray hairs, and, if anything, he ought to be getting weaker.

Why, then, can the machines still not blow him off the board?

Sheer hardware power ought to tell—some day. Way back in 1982, the legendary programmer Kenneth Thompson staged a landmark experiment that determined exactly how much better a chess program would play if given the opportunity to look further ahead. (Thompson, a researcher at Bell Laboratories in Murray Hill, N.J., was a designer of Unix.) Thompson pitted his then-top chess machine, Belle, against itself in hundreds of games, calculating its play on one side of the board a half-move deeper than its play on the other side. (A half-move is a move by one player; the full move is completed when the other player replies.)

The side with the extra half-move won three games out of four, corresponding to a 200-point gap in chess rating—roughly the difference between a typical grandmaster (about 2600) and Kasparov (2830). Increased search depth continues to this day to provide the same edge—for programs playing other programs.

Human opponents are a different story because carbon and silicon players have different strengths and weaknesses, the proper exploitation of which has not been fully worked...
out. There is therefore plenty of room for improvement.

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The human weak point lies in calculation, while the computer's is in long-term strategy. The trick is to prepare openings that push the other side into the kind of game that accentuates its weaknesses. A good example came in the third game of the recent match, when an opening innovation on move nine gave Kasparov not merely the superior game but one that Fritz could not understand—a barricaded position that required each side to mount glacially slow maneuvers against carefully chosen targets. So slow were the maneuvers that the machine could not see their point until it was too late.

The situation was that Kasparov, playing white, advanced on the queenside (the side of the board to white's left), leaving Fritz free to advance on the kingside. Fritz should have begun by pushing its king bishop pawn from its initial square, on f7, to f4, where it could be exchanged for white's king pawn, on e3. That would have opened lines for black's rooks and created weaknesses around the square f2 (white's king bishop pawn) for black to attack the uncastled white king.

Kasparov made sure that Fritz would never see the light at the end of that tunnel by making the tunnel longer. He played his rook on the left side up a square to b2 [see chessboard, "Touché!"], thereby defending the f2 square even though it wasn't yet attacked. The future weakness at that point was therefore pushed beyond the computer's search horizon, so it never got around to advancing on the kingside at all.

Instead, Fritz dithered, moving its pieces back and forth while Kasparov methodically shoved a pawn down its throat, to make a new queen. Michael Greengard, a veteran chess commentator, called Kasparov's move "a classic piece of anticomputer play, the sort of thing I did against the laptop chess machines of the 1980s."

Fritz did better in the games where it could get its pieces flying about. Indeed, Kasparov says it plays better than IBM's Deep Blue did in 1997, when it shockingly defeated Kasparov. In a critical position from that match, Deep Blue missed a subtle line of play that would have led to a draw, which Kasparov also overlooked. "Fritz today finds the draw in two minutes," Kasparov said with a smile. "But, of course, we humans are learning too."

—PHILIP E. ROSS