BOOK REVIEWS

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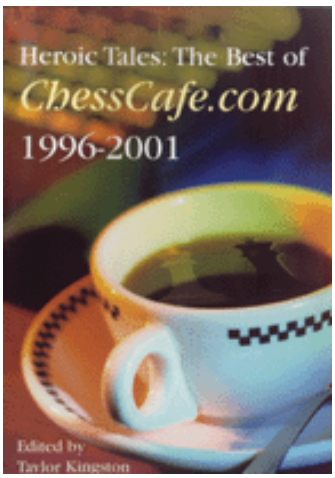
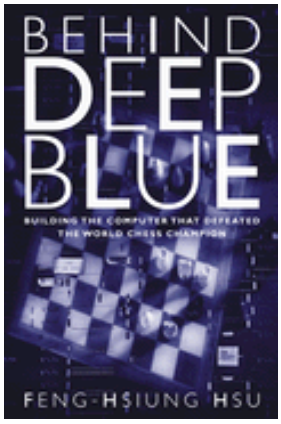


Toolmaker vs. Performer

Taylor Kingston

Behind Deep Blue: Building the Computer that Defeated the World Chess Champion, by Feng-hsiung Hsu, 2002 Princeton University Press, English Algebraic Notation, Hardcover, 298pp., $27.95.



Almost anyone not in hibernation through the 1990s, even a non-chessplayer, recalls the two matches between Garry Kasparov and Deep Blue. In 1996, Deep Blue became the first computer ever to beat a reigning world champion in a serious, slow (TL 40/2) game. Kasparov still won that match +3 –1 =2, but in 1997 an improved Deep Blue won a rematch +2 –1 =4, realizing a dream of mathematicians and engineers going back centuries, to Babbage and Von Kempelen.

Several more or less instant books followed the matches, mostly concentrating on the actual games, and playing up the obvious “Man vs. Machine” angle, without understanding the machine. *Behind Deep Blue* is quite different. The author, computer scientist Feng-hsiung Hsu, originally from Taiwan but now living in the United States, is perhaps the world’s best authority on his subject. He has spent much of the last 15 years working on chess-playing computers, playing a major role on the team that designed and developed Deep Blue. His book, a lengthy, handsomely bound hardback appearing five years after the second GK-DB match, is obviously not in the “instant” category.

Hsu’s specialty is chip design, the creation of “electronic blueprints” for the microscopic circuitry that is, in effect, a computer’s central nervous system. This is a specialized high-tech skill about which even very computer-literate laymen (including this one) know next to nothing and can find incomprehensible. On the other hand, Hsu himself is not really an avid chess player (he does not even have a USCF rating). One might therefore expect his book to fall between two stools, being on one hand too like a technical manual, full of dry prose, confusing acronyms and hacker jargon, and on the other hand lacking enough chess sophistication to keep serious players interested.

Not so. Instead, the technician has turned out to be quite a competent writer, able to convey both cybernetic esoterica and the human side of his story in an articulate, accessible and highly interesting fashion. No great

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computer knowledge (or chess knowledge for that matter) is necessary on the reader's part. And while the book is not heavy on games, serious chess players will find much of interest, especially if they have the least curiosity about how computers have become so good at the game, and about what really happened in the two GK-DB matches.

The story begins in 1982 with Hsu's graduate studies at Carnegie Mellon University in Pittsburgh, Pennsylvania. It proceeds as a mostly straight chronological narrative, in three main parts: (1) Hsu's university work, when he first became interested in and committed to "The Computer Chess Problem," and helped develop such machines as the inexpensive prototype ChipTest and the more sophisticated Deep Thought, the first computer to attain a GM performance rating; (2) his work for IBM, which culminated in the creation of Deep Blue and its triumph in the 1997 match; and (3) the immediate aftermath of the match, especially Kasparov's excuses and accusations, and the extended aftermath, including Deep Blue's "retirement" and various computer-related developments in chess up through 2001.

Several major threads weave in and out of the narrative. These include: (1) some background history of computer chess, (2) explanation in layman's terms of some technical details of computers and how they play chess, (3) how Hsu and his team tackled The Computer Chess Problem, (4) how Deep Blue was very much a team effort, with credit given to the many people who contributed, (5) correcting misconceptions and misinformation circulated by the press, and (6) identifying villains and bringing them to account. In all this, rather than the dryness we feared, Hsu shows a flexible writing style, fitting his prose to the subject at hand. Now and then it is highly technical, viz.:

"During the evaluation of the tools from VLSI Technology, I did a trial layout of one square of a simplified chess move generator. The trial layout was for a 0.8-micron CMOS process, which should have been about fourteen times denser than the 3-micron CMOS process that I used for the old move generator done in 1985."

Such technical terms and acronyms are explained, and while the casual reader can safely skip such parts without losing the main thread, the careful reader will find himself learning a thing or two about computer design. And at other points, no technical expertise is required to understand Hsu's point:

"Mike decided to work with a professor in Artificial Intelligence (AI). Andreas had a very low opinion of AI research in general. Mike did not share the same opinion at first but, after he split with his first advisor, both he and Andreas referred to AI as bullshit."

Hsu does an excellent job describing the trial-and-error nature of computer chess programming. Some sample passages:

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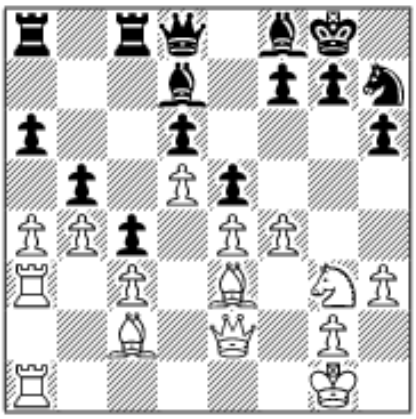
"The opponent made a move threatening to checkmate it on the next move, and Deep Though 0.02 did not bother to defend against the threat ... It turned out that Thomas' new dual-processor code ... had the side effect of causing the hardware microprogram to reverse the sign of the value for checkmates under certain conditions. Instead of avoiding being checkmated, Deep Thought was enjoying being checkmated!"

"[Danish GM] Bent [Larsen] traded off all the knights belonging to Deep Thought II and tried to keep the position blocked. Deep Thought II retained a pair of bishops, which is usually considered an advantage. The problem was that we had never programmed Deep Thought II to understand that it should trade some pawns to increase the scope of the bishop pair."

"It is well known in chess lore that if an outposted knight can no longer be challenged, then it can be as valuable as a rook ... Unfortunately, the software code that assigned the values, wrongly assigned unchallengeable bishops the same values as unchallengeable outposted knights."

"My least favorite chess rule came back to haunt me. The phantom queen only showed up when *en passant* was possible ... Under certain rare conditions, either a White queen on a1 or a Black queen on a8 could materialize out of thin air."

One of the most dramatically illustrated examples involves doubling of rooks. Early on, Deep Blue would only double rooks on already open files, while a good human player knows the value of doubling rooks on files not yet open but *potentially* open. When this idea was programmed into Deep Blue, it soon bore fruit in the second game of the 1997 match, where in this position



Deep Blue's doubled rooks on the a-file forced Kasparov into passivity. Hsu writes: "The new evaluation feature about rooks on potential open files was in play here. I smiled and said to Joe [Hoane], 'Not bad for an afternoon's work.'"

In addition to understanding technical matters, Hsu shows a keen eye for purely human foibles:

"It was interesting to note that, during the 1997 match ... several Grandmasters claimed that Deep Blue was playing at around number X in the world. The number X happened to be slightly below the ranking of the specific Grandmaster making the claim."

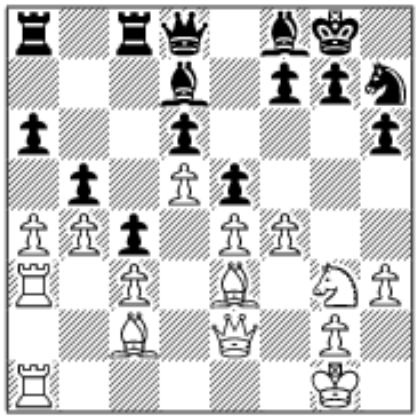
He also shows a good sense of humor, for example in explaining why "Deep Thought" was renamed "Deep Blue" under IBM, when too many

people, either deliberately or inadvertently, began referring to it as “Deep Throat”. An organization of IBM’s stature does not want its products confused with a porno film.

Hsu also gives good on-the-scene accounts of tournaments and matches, especially of the two GK-DB matches, which take up about a third of the book. He was often the actual game operator for Deep Blue, sitting opposite Kasparov and making the computer’s moves on the board. A sample passage, from game 1 of the first match:

“When I played move 13, Nb5 for Deep Blue attacking his queen, [Kasparov] was taken aback. Garry looked at the board intently for a moment, then raised his eyebrows and stole a glance at me. I could not help but smile momentarily on seeing his expression ... Garry was taking the position very seriously.”

Hsu deals primarily in factual matters, but on several occasions he permits himself an interesting speculation. In chess terms one of the most intriguing involves the last game of the 1997 match. In this position



Kasparov played 7...h6?!, Deep Blue immediately replied 8.Nxe6!, and eleven moves later Kasparov resigned a hopeless position. Many have wondered why Kasparov played the Caro-Kann at all, a defense ill-suited to his style, and the highly risky 7...h6 in particular. Hsu believes he knows, and explains what he calls “Garry’s $300,00 gamble.” The gamble backfired, and while Hsu was glad to win the historic match, he regrets that its last game was such a truncated 19-move anticlimax, instead of an Immortal Game.

The story has its heroes, but it is a sort of heroism by committee. Hsu does not seem to inflate his own importance; as he tells it, the Deep Blue team had no real leader, but was a group of associates united by a common interest and committed to a common goal, each bringing different essential skills to the project. With the exception of GMs Joel Benjamin and Miguel Illescas, who appear late in the book, their names are not familiar to chess-playing readers: Joe Hoane, Murray Campbell, C. J. Tan, Jerry Brody, Mike Browne, Thomas Anantharaman, Andreas Nowatzyk, and many others who worked with or advised Hsu on Deep Blue or its predecessors.

If the picture of the heroes in *Behind Deep Blue* is a bit crowded and fuzzy, the villains are few and clear-cut. There are three chiefly, two minor and one major, their names fairly to very well known in the chess world. The first is Dr. Hans Berliner, former world correspondence chess champion and a member of the Carnegie Mellon faculty. Until Hsu and his associates

started on the path that led to Deep Blue, Berliner's machine HiTech had been the best chess computer. Hsu feels that Berliner sought to undercut his work at CMU, perhaps out of jealousy. He now bears Berliner no grudge, but paints Berliner's role as more obstructive than constructive.

The second minor villain is British journalist Dominic Lawson, who when he and Hsu crossed paths in 1989 was deputy editor of *The Spectator* magazine (Lawson later was amanuensis for GM Nigel Short during the 1993 world title match, and eventually became editor of the *London Sunday Telegraph*.). Hsu takes Lawson to task for writing an absurd *Spectator* article rife with misinformation about Deep Thought, including the false claims that it had military applications and was funded by the US Department of Defense. Lawson's article purported to be an "investigative report," yet he never interviewed a single member of the Deep Thought team. As depicted by Hsu, Lawson thoroughly merits Hans Ree's description of him as "a chess Philistine," if not in fact the tag "yellow journalist."

The third and by far biggest villain is none other than Garry Kasparov. Hsu considers several demands Kasparov made before the second Deep Blue match as preposterous and unreasonable. And he regards Kasparov's behavior during and after the match, especially allegations that some of Deep Blue's moves were actually of human origin, as at best the unsportsmanlike whining of a sore loser, and at worst the lies of an amoral egoist. About one such incident in game 2 of the second match Hsu writes: "Garry was apparently accusing us of cheating ... Every one of us was fuming. I was tempted to grab the microphone, go to the Deep Blue model on the stage, and say, 'Well, shall we see if Bobby Fischer is inside?' Over the years, Garry had been almost like a friend to me ... Suddenly, I felt that I no longer wanted to have anything to do with him."

Though we know people who still take Kasparov's insinuations and excuses seriously, after reading *Behind Deep Blue* it is hard not to see them as a propaganda smokescreen similar to what clouded the termination of the first Karpov match. The plain truth seems to be that Kasparov, exemplar of determination and detailed preparation, met his match on both counts. Hsu writes of his own work leading up to the second GK-DB match:

"For the next month and a half ... I was working close to 100 hours per week. There were no weekends. Every night when I drove home from the lab late at night, I would tell myself repeatedly, 'I want to win.'"

In short, Kasparov did not get cheated, he simply got out-worked.

The book's overarching theme is the reverse of the overused "man vs. machine" cliché. Hsu sees Deep Blue's match victory not as a loss for mankind, but rather a case of "Man the Performer" being surpassed by "Man the Toolmaker." Die-hard romantics may disagree, but this seems a perfectly logical and infinitely more optimistic view. In this light,

Kasparov's loss is no more to be bewailed than a forklift's outperforming Arnold Schwarzenegger, and Deep Blue is seen not as a soulless robot monster, but as a marvelous extension of human faculties, the product of diligent and intelligent human effort. And the quest to create it, which Hsu repeatedly calls a computer engineer's Holy Grail, springs from motivations as romantic as a Spielmann sacrifice:

"If I went after the Computer Chess Problem, I would be going for the glory of knowing that I solved the problem. I probably would not be financially destitute, but there would be major personal sacrifices. The opportunity cost would be extremely high. I could be spending many of the most productive years of my life on a project that had a very slim payoff. The decision was a difficult one. In the end, after serious soul searching, I decided to go for the glory. You don't get a chance to make history every day."

Descending to the consideration of literary nuts and bolts, we should mention that this man from Taiwan writes much better English than most native speakers. He has a few problems with commas and hyphens, and once says "flare" when "flair" was meant, but on the whole it was very nice to read a book relatively free of the bad grammar, misspelling and sloppy structure all too frequent in today's chess-related writing.

On the negative side, we note a few shortcomings. The lack of an index lessens the book's usefulness for writers and historians (and makes things more difficult for the reviewer!). Hsu's informal style makes for easier reading, but he carries it too far by using first names almost exclusively. It becomes hard to keep the cast of characters straight when, for example, Hsu refers to Joe and Joel instead of Hoane and Benjamin. Chess-playing readers will probably wish for a few more games. For example, there is an intriguing description of a game between Deep Thought and IM Igor Ivanov, but we never see the moves. Full scores are given just for the two Kasparov matches, plus two other games, one by ChipTest against another computer, and one by Deep Thought against Bent Larsen.

Such quibbles aside, this is an excellent book. And a timely one — with the recent Kramnik - Deep Fritz match, "man vs. machine" is again a hot topic in the chess world. For anyone interested in chess and computers, or who just likes to read a good story about how a goal long thought impossible was achieved, we recommend *Behind Deep Blue* highly.

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