THE SPORTING SCENE

YOUR MOVE

How computer chess programs are changing the game.

BY TOM MUELLER

Chrilly Donninger prefers to watch from a distance when Hydra, his computer chess program, competes, because he is camera-shy, but also because he rarely understands what Hydra is doing, and the uncertainty makes him nervous. During Hydra's match against the world's seventh-ranked player, Michael Adams, in London last June, Donninger sat with three grand masters at the back of a darkened auditorium, watching a video projection of the competition on the wall behind Adams. Most of the time, Donninger, a forty-nine-year-old Austrian, had little to worry about; Hydra won the match five games to none, with one draw. But in the second game, which ended in the draw, the program made an error that briefly gave its human opponent an advantage.

The game was played at a spot-lit table on a low podium. Adams sat in the classic chess player's pose—his elbows resting on the table, his chin cupped in his palms—reaching out now and then with his right hand to move a piece on a large wooden chessboard. Across from him was Hydra—a laptop linked by Internet connection to a thirty-two-processor Linux cluster in Abu Dhabi—and Hydra's human operator, who entered Adams's moves into the computer and recorded the program's replies on the board. On the laptop's screen was a virtual chessboard showing the current position in the game, as well as a pane of swiftly scrolling numbers representing a fraction of the thousands of lines of play that Hydra was analyzing, and a row of colored bars that grew or shrank with each move, according to the program's assessment of who was winning—green bars meant an advantage for white, red bars for black.

For much of the match, the bars showed Hydra comfortably in the lead. When Adams made a mistake, they spiked dramatically, but mostly they grew in small increments, recording the tiny advantages that the program was steadily accumulating. Many of these were so subtle that Donninger and the grand masters failed to grasp the logic of Hydra's moves until long after they had been made. But about twenty minutes into the second game, when Hydra advanced its central e-pawn to the fifth rank, there was a small commotion in the group. Yasser Seirawan, an American player formerly ranked in the top ten, who had coached Adams for the match, gave a thumbs-up sign. Christopher Lutz, a German grand master who is Hydra's main chess adviser, groaned. Only Donninger, who programs chess far better than he plays it, was baffled. He turned to Lutz in alarm.

"What was that? What did you see?"

"Now our pawn structure has become inflexible," Lutz replied. "Do we have anything in the program for flexibility?"

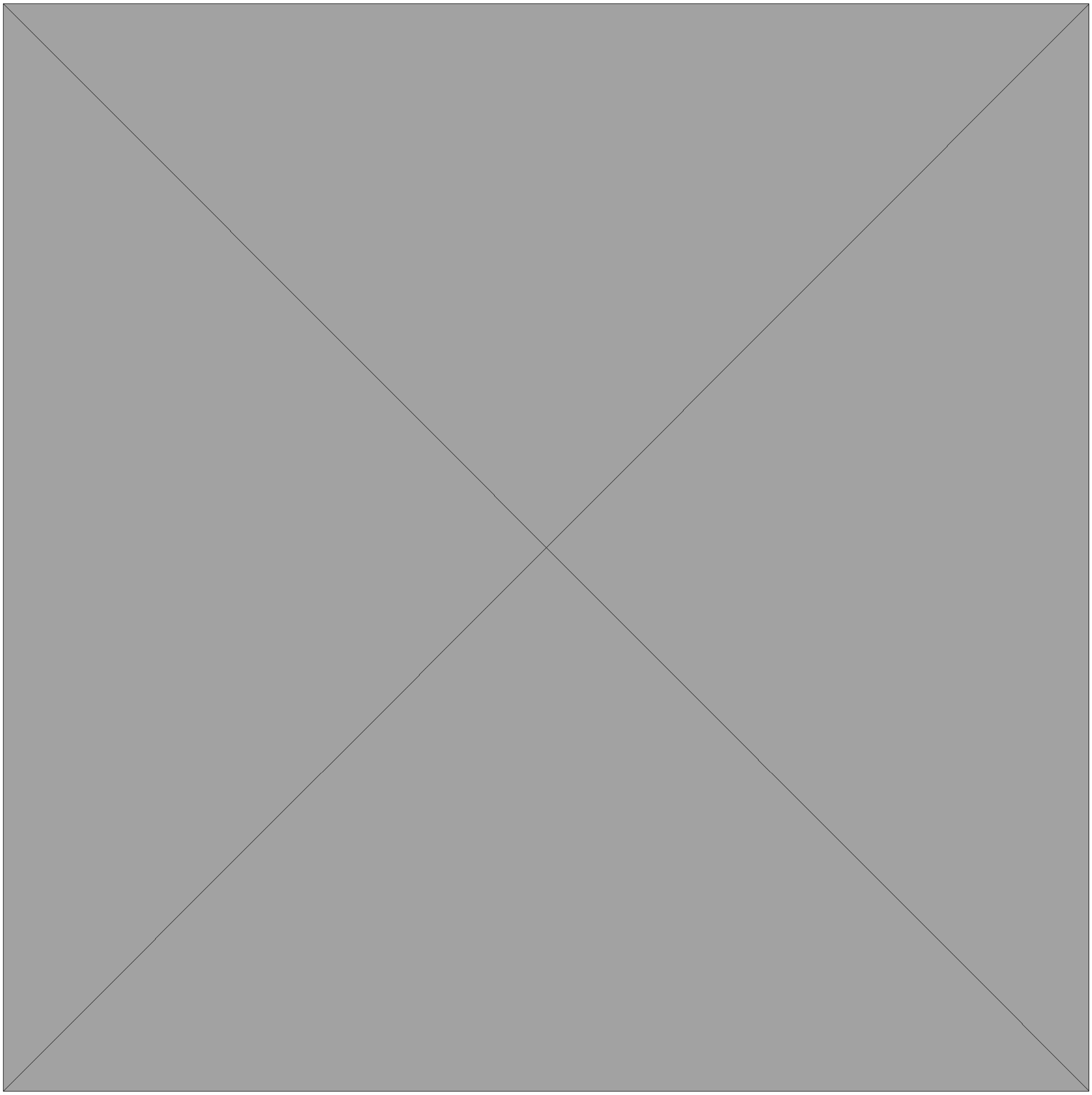
"What do you mean by 'flexibility'?"

Lutz frowned. He sensed that Hydra had hemmed itself in, giving Adams the upper hand. Bishop to b7 was the correct move, Lutz believed—the most natural way for Hydra to preserve its attacking chances and its room to maneuver. But explaining his nebulous insights to a lesser player like Donninger was a challenge.

"This position lacks flexibility," he repeated, shaking his head.

"When you can define 'flexibility' in twelve bits, it'll go in Hydra," Donninger told him, twelve bits being the size of the program's data tables.

Adams locked up Hydra's center with his next move and managed, several hours later, to eke out a draw. "Hydra didn't play badly, but 'not bad' isn't good enough against a leading grand master," Donninger said after the game. His program is widely considered to be the world's



Chrilly Donninger's program Hydra is widely considered to be the world's strongest chess player. Photograph by Peter Rigaud.

strongest chess player, human or digital, but it still has room for improvement.

Lean and restless, with a scraggly beard and a large Roman nose, Donninger says that he approaches programming less like a scientist than like a craftsman—he compares himself to a *Madonnenschnitzer*, one of the painstaking Baroque and rococo wood-carvers whose Madonna sculptures adorn the churches near Altmelon, the village in northern Austria where he lives and works. He speaks German with a thick Austrian brogue and frequently uses expressions like "*Das ist mir Wurscht!*"—"That's all sausage to me!" For the past two years, he has led the Hydra project, a multinational team of computer and chess experts, which is funded by the Pal Group, a company based in the United Arab Emirates which makes computer systems, desalinization plants, and cyber cafés. Pal's owner, Sheikh Tahnoon bin Zayed al-Nahyan, is a member of the country's royal family and a passionate chess player; he hired Donninger with the goal of creating the world's best chess program. Pal is also using the same kind of hardware that runs Hydra for fingerprint-matching and DNA-analysis applications, which, like computer chess, require high-speed calculations. The program's main hardware resides in an air-conditioned room in Abu Dhabi, and Donninger is frequently unable to access it, because the Sheikh and Hydra, playing under the name zor_champ, are on the Internet, taking on all comers.

As a child, Donninger was so attached to puzzles that his mother worried that he was disturbed. At the age of four, he spent months building houses out of four colors of Lego bricks, in which no bricks of the same color ever touched;

ANTI-LOVE POEM

Sometimes you don't want to love the person you love
you turn your face away from that face
whose eyes lips might make you give up anger
forget insult   steal sadness of not wanting
to love   turn away then turn away   at breakfast
in the evening don't lift your eyes from the paper
to see that face in all its seriousness a
sweetness of concentration   he holds his book
in his hand   the hard-knuckled winter wood-
scarred fingers   turn away   that's all you can
do old as you are to save yourself from love

—*Grace Paley*

two decades later, when he was an undergraduate at the University of Vienna, he learned that this was a famous conundrum in topology—the Four-Color Problem. After completing a doctorate in statistics, he worked as a programmer for Siemens, where he earned a reputation as a bug fixer, the computer equivalent of a puzzler. In 1989, he was transferred to the Dutch city of Noordwijk. It was there, during a period of intense loneliness, that Donninger joined a local chess club, and started writing his first chess program. "I found my ecological niche," he says.

He had also found the ultimate puzzle. With about 10^{128} possible unique games—vastly more than there are atoms in the known universe—chess is one of mankind's most complex activities. In an average arrangement on the board, white has thirty-five possible moves and black has thirty-five possible replies, yielding twelve hundred and twenty-five potential positions after one full turn. With subsequent moves, each of these positions branches out exponentially in further lines of play—1.5 million positions after the second turn, 1.8 billion after the third—forming a gigantic map of potential games that programmers call the "search tree."

How human beings confront this complexity and seize on a few good moves remains a mystery. Experienced players rely on subconscious faculties known variously as pattern recognition, visualization, and aesthetic sense. All are forms of educated guesswork—aids to making choices when certainty through exhaustive calculation is impossible—and may be summed up in a word: intuition. Even a novice player uses intuition to exclude most moves as pointless, and the more advanced a player becomes the less he needs to calculate. As the eminent Cuban grand master José Raúl Capablanca once told a weaker player, "You figure it out, I know it."

Computers have the advantage of formidable analytical power, but even the fastest machine is quickly overwhelmed by the sheer number of moves that it must assess. (Donninger estimates that Hydra would need 10^{30} years to "solve" chess, starting from the first move and analyzing all possible sequences of play.) To produce world-class chess of the sort that Hydra played against Michael Adams, programmers must somehow teach their machines intuition.

This turns out to be a highly personal task, which every programmer approaches differently. Stefan Meyer-Kahlen, a thirty-seven-year-old German who wrote the four-time world-champion program Shredder, was inspired by Anatoly Karpov, the Russian player known for his calm, ruthlessly logical play and his masterly defense. Amir Ban and Shay Bushinsky, Israeli programmers who created Junior, another four-time world champion, draw on a large collection of computer chess games to shape their program's style. "We don't use grandmaster games for this, because they're too full of errors," says Ban, who made a fortune in the nineteen-nineties as an entrepreneur in flash memory. (Bushinsky is a professor of computer science and artificial intelligence, or A.I., at the University of Haifa.) Ban and Bushinsky believe that their method accounts for Junior's "speculative" play—its keen understanding of time and space, and its unrivalled knack for sacrifice—and they gleefully describe how Junior trounced an early version of Hydra two years ago, because Hydra (or, rather, Donninger) had badly misjudged a position. (Ban and Donninger detest one another, and, after getting into a shouting match at a tournament in 1997, they no longer speak.)

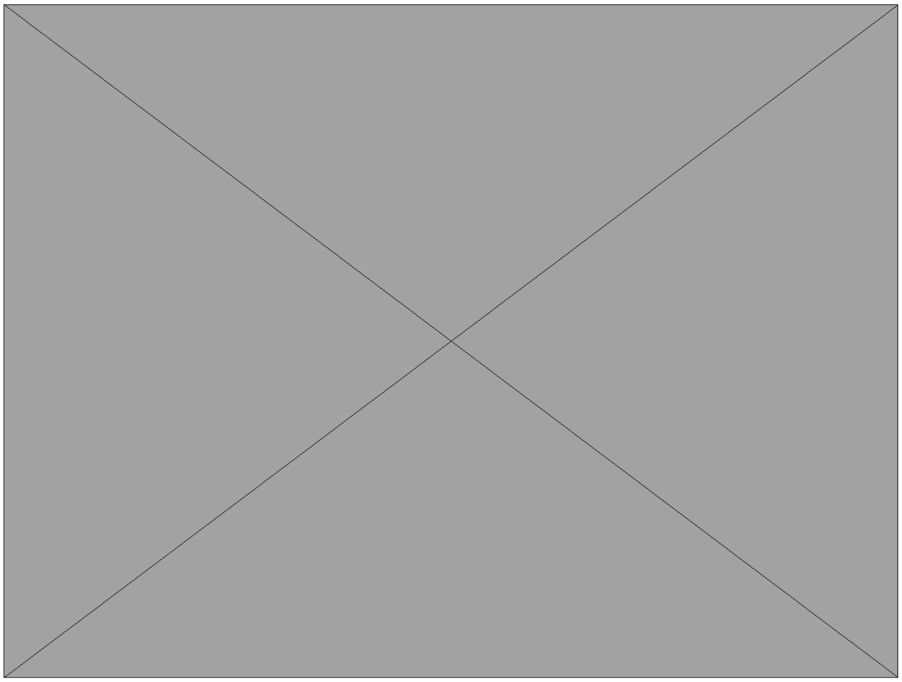
Hydra is famous for its relentless assault on the enemy king. "It's the Rottweiler of computer chess," Donninger says proudly. "It floats like a butterfly, stings like a hornet." He says that he has tried to endow the program with the slashing, sacrificial style of the former world champion Mikhail Tal. Yet Hydra's fighting spirit is as much Donninger's as Tal's. As a boy, Donninger fought constantly in school, analyzed each of Muhammad Ali's matches, and taught his younger sister an Ali-inspired uppercut to ward off bullies. In his twenties, he fought as a junior welterweight in a top Vienna gym. Occasionally, he pulls on a worn pair of boxing gloves and hammers away at a heavy bag that hangs from a beam on the side of his house.

Hydra, Shredder, Junior, and Fritz—another top program—routinely defeat leading grand masters, each playing with a distinctive personality that reflects not only its inventor's particular approach to chess and programming, but also moves and tactics that seem to arise spontaneously from intricacies of the computer code, which the programmer himself often cannot explain. Over the past decade, these programs, which typically sell for about sixty dollars and run on a P.C., have become essential tools for grand masters to analyze past games, test opening lines, and generate new ideas. (Hydra is not commercially available, in part because of its specialized hardware; some programs, including versions of the reigning world champion, Zappa, can be downloaded, free, from the Internet.) In the past several years, these programs have begun to play the kind of elegant, creative chess once thought to be the exclusive province of humans. Computers are allowing people to look more deeply into the game than ever before. They are even helping people to play more like machines.

The first chess automaton was, like Hydra, created as a diversion for royalty. In 1769, the engineer Wolfgang von Kempelen built "the Turk" for the Hapsburg ruler Maria Theresa. A robed and turbaned mannequin seated at a large desk, the Turk toured Europe and America for decades, trouncing all but the best players; according to one story, it beat Napoleon so badly that he swept the pieces from the board in disgust. Though the Turk's mechanical components were impressive—it had elaborate, whirring gears and could nod, roll its eyes, and lean over the board as if in concentration—its human component was decisive: it was secretly operated by a skilled chess player curled up inside the desk.

The first real chess-playing machine was designed in the late nineteen-forties by the British mathematician Alan Turing, who, in 1950, in the paper in which he proposed the famous Turing Test, identified chess as an ideal proving ground for machine intelligence. Since computers were not yet widely available, Turing acted as his own central processing unit, laboriously working out each move on paper. With the advent of computers a few years later, chess became the darling of the A.I. community. The game was enormously complex, had simple rules, and, unlike many objects of scientific research, provided an unambiguous way to measure results: the more a program won, the smarter it was thought to be. In broad terms, the early programs of the nineteen-fifties and sixties worked the way Hydra and its peers do today. They consisted of a search function, which sifted through the tree of possible moves, and an evaluation function, which applied a score to positions that arose along the way, awarding bonuses for good characteristics and penalties for bad. The move leading to the highest-scoring position would be selected.

The first chess programmers attempted to use the same intuitive strategies in search and evaluation that people employed when playing chess. However, their translations of human rules of thumb—control the center, don't move your queen too early—into programming language proved too crude to produce good chess. Worse, the more



"I'm like most people, I guess—a mixture of good and bad."

knowledge the programmers built into the search function, the slower the search became, which limited how deeply the program could see into a position—its "search horizon." The first programs were characterized by nonexistent strategy, embarrassing endgame technique, and a remarkable gift for blunders. In 1956, the MANIAC, a nuclear-weapons computer at Los Alamos, lost to a human opponent, even though the rules had been simplified and it had been spotted a queen. Mikhail Botvinnik, a former world champion, tried to write a program that thought the way he did, but it never won a game in tournament play.

A breakthrough came in the late nineteen-seventies, with the advent of "brute force" programming, which traded selectivity for speed. By paring back chess knowledge, emphasizing search algorithms like alpha-beta pruning, and exploiting faster hardware, programmers were able to consider a far broader search tree. Computers began to beat master players in the early eighties, and in 1988 Deep Thought became the first program to defeat a grand master. The brute-force approach culminated in 1997, when Deep Thought's successor, Deep Blue, a multimillion-dollar I.B.M. supercomputer that could evaluate two hundred million positions per second, won a six-game match against Garry Kasparov, the world champion.

Computers had triumphed at chess not by aping human thought, as most A.I. experts had expected, but by playing like machines. The analogy with flight is instructive: as long as people tried to fly by imitating birds, attaching diaphanous wings to their arms and flapping madly, they were doomed to failure; once they escaped the paradigm of the familiar, however, they were soon flying much faster than birds. Yet something still seemed to be missing. Programmers had made the most of computers' computational superiority, but many experts agreed that humans retained the edge in strategy. After Deep Blue's victory, A.I. researchers lost interest in chess, largely because brute-force methods seemed too crude and mechanical to shed much light on the nature of intelligence. "'Brute force' was a derogatory term," recalls Jonathan Schaeffer, a computer scientist who is the author of several chess programs and the world-champion checkers program Chinook. "You were considered a heretic if you didn't try to emulate the human brain."

By the late nineties, most chess programming was done not for mainframes but for much slower microcomputers and, subsequently, for P.C.s. Even today, the fastest P.C. programs can analyze only about four million positions per second, a fraction of Deep Blue's capacity. In order to achieve world-class results at these speeds, programmers needed to find ways of searching more selectively and evaluating more precisely. Over the past several years, the most gifted programmers have learned how to distill the more arcane principles of grand-master play into computer language. Some have identified principles that grand masters never imagined.

Donninger reviews Hydra's errors alone or with Christopher Lutz, trying to define each problematic position in twelve bits' worth of questions, which he can incorporate into Hydra's code. "Sometimes it would be nice to have more questions to work with," Donninger says. "But then you'd risk diluting the essential characteristics of the position with less vital information. Twelve bits is good discipline." Because these questions determine how Hydra will play, Donninger won't reveal most of them; a few, however, are more or less the same for all programs. The questions that Hydra uses to assess the value of a passed pawn are: "Is this a passed pawn?" (1 bit); "Is the square in front of it blocked?" (1 bit); "Which row is it on?" (3 bits); "Is it supported by a neighboring pawn?" (1 bit); "Is it supported by a neighboring pawn that is itself a passed pawn?" (1 bit); "Is it an advanced passed pawn?" (1 bit); "Is the enemy king inside the pawn's square?" (1 bit); and "Which phase of the game are we in?" (3 bits).

Once Donninger is satisfied that he has the right questions, he enters them into Hydra's evaluation function as a new heuristic, or chess rule. Hydra, like all other chess software, has hundreds of heuristics woven into its code, where they behave like DNA, shaping the program's personality. The Hydra code for evaluating a passed pawn, written in the computer language Verilog, looks like this:

```
if(iwPA7) begin
    wBlocked_A<=!iEmptyA8;
    wPassed_A<=1'b1;
    wSupported_A<= iwPB6;
    wDuo_A<=(iwPB7);
    wBack_A<=1'b0;
    wMaxRow_A<= 3'h6;
    wPRow_A<=3'h6;
    wLever_A<=1'b0;
end
```

How the heuristics interact, reinforcing and overriding one another, is mysterious; even a slight adjustment to a single rule can produce side effects that the programmer cannot predict. After Donninger adds a new rule, he runs a long series of test matches to determine whether it works, pitting the new version of Hydra against other programs. If the new Hydra wins more often than its predecessor, the new heuristic stays. Donninger says that for each new rule he needs about three months to work out unexpected kinks. (By contrast, Ban and Bushinsky sometimes tweak Junior's code right up to the start of a game. "We like to change things, take risks, improvise," Bushinsky says. "Maybe this is not so smart sometimes—it's considered a real no-no in computer science. But that's how we work. Maybe we do have an instinct for the program, sense something about how it feels.")

Today, the best programs blend knowledge and speed so effectively that even the most talented human players have little chance of defeating them. In 2003, Fritz and Junior fought Garry Kasparov to a draw in tense multi-game matches. A round-robin event in October, 2004, pitting Hydra, Fritz, and Junior against three leading grand masters, ended in an 8½–3½ victory for the computers. The machines' superiority was most obvious during the Hydra-Adams match in London. "Adams was simply pushed off the board by a much stronger opponent," says David Levy, an international master who watched the event.

Donninger is no longer interested in man-versus-machine matches. "I see the same pattern in each game," he says. "I call it Chrilly's Law: every ten moves, at the most, in complicated positions, even the strongest player will commit a slight inaccuracy—the second-best move when only the best will do. He doesn't even notice it, but Hydra does. Its evaluation bars start growing, a little taller with every move. By the time the grand master realizes the problem, it's already Game Over." Many chess players and programmers would like to see a match between Hydra and Kasparov, who has officially retired from chess to pursue a career as a politician in Russia but is still considered the ultimate opponent. "The world's greatest-ever human player against the world's greatest-ever computer player—we would all love to see it," Levy says. Donninger is indifferent to the idea. "I'm much more interested in beating Shredder, Fritz, and the other programs," he says. "I learn more from those matches."

In February, I watched Hydra play Shredder in one of the most sophisticated chess games in history, during the fourteenth International Computer Chess Championship. The tournament was held in Paderborn, Germany, in a shabby, fluorescent-lit conference room whose boisterous disarray often suggested a tailgate party more than a competition. Sixteen contestants sat chatting in pairs at small tables laden with computers, chess sets, beer, coffee, and half-eaten hunks of strudel. The programs reflected their authors' whims: one sounded a gong with every move, others displayed photos—of a pet falcon in one case, a scantily clad starlet in another. "They're extensions of our egos," Vincent Diepeveen, the author of Diep, a Dutch program, said.

Donninger and Hydra sat at a table in the middle of the room, the laptop draped with a U.A.E. flag and Donninger in his game-day outfit, which he wore on all five days of the tournament: black jeans, dirty white clogs, and a gray cardigan with deerhorn buttons. Across from him was Shredder and its inventor, Meyer-Kahlen, a round-faced man with a melodious tenor voice who is the only professional chess programmer not affiliated with a larger organization, and is widely admired by his peers. "He does everything himself—the program, the user interface, sales, technical support," Donninger says. "No one knows how he manages to stay at the top."

The game started with a handshake, a custom in matches between grand masters, and continued for about twenty minutes with a chatty congeniality unthinkable in competitive chess. Once a game begins, programmers are not permitted to adjust their programs, but there is no rule against sharing information. Donninger and Meyer-Kahlen turned their screens so that each could see from the scrolling numbers and colored bars what the other's program was thinking, and speculated aloud about their programs' prospects. When Donninger recorded the wrong move on the board, Meyer-Kahlen politely corrected it. However, as the position became complicated both men grew quiet and stone-faced, their eyes fixed on the screens. Other programmers drifted away from their matches and gathered in a tight circle around the table.

"What a stupid sport!" Donninger snapped, as the programs jockeyed for infinitesimal advantages. "We're completely helpless. It's like riding shotgun in a Formula One race car."

Ninety minutes into the game, most of the pieces were still on the board, arranged in an intricate logjam. Shredder was happy with the position, but so was Hydra; evidently one of the programs was mistaken. Then Shredder attacked Hydra's kingside, with a risky pawn advance that seemed to expose Shredder's own king. "*Scheisse!*" Meyer-Kahlen exclaimed. "What the devil is Shredder doing?"

The situation was critical, but neither programmer knew who was winning. Nor did anyone in the crowd around the table, which included the two grand masters on the Hydra team, Christopher Lutz and Talib Mousa.

"*Unklar*," Lutz murmured, when I asked him what he thought of the position.

Donninger's face brightened for a moment. "'Unclear' is a grand master's way of saying, 'Who the hell knows?'"

The uncertainty persisted for several more moves. Then, suddenly, it became obvious that Shredder was on the verge of being checkmated. Nevertheless, the program made a queenside pawn push, just as Hydra was cornering its king on the other side of the board.

"Oh, Shredder, what kind of a crap move is that?" Meyer-Kahlen said. Eight moves later, he reached abruptly across the board to shake Donninger's hand, resigning the game. Then he stalked away from the table.

Afterward, while Mousa recounted the match to Sheikh Tahnoon on a cell phone, Lutz and Donninger reviewed the game at the chessboard. "We're trying to understand what happened and why," Donninger said wearily.

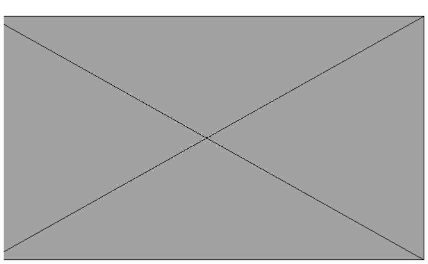
It is now plausible to argue that computers are playing subtler, more imaginative chess than the humans they have been designed to emulate. "They make a lot of counterintuitive, even absurd-looking, moves that on closer inspection can turn out to be outrageously creative," says John Watson, an international master who has written more than twenty-five books on advanced chess theory and strategy. "By generating countless new ideas, they are expanding the boundaries of chess, enabling top players to study the game more deeply, play more subtly." Viswanathan Anand, a thirty-five-year-old Indian who is currently rated the world's top active player, often uses several chess programs simultaneously when he trains. "I have Shredder, Fritz, Junior, and HIARCS"—another popular program—"running all the time so I can see their various opinions, which are often very different," he says. "When a position catches my fancy, we compare notes." In some cases, computers are rewriting the game's ground rules. "Certain endgames that for centuries were unanimously thought to be draws have actually proved to be clear wins," says John Nunn, a player formerly ranked in the top ten whose groundbreaking books on endgames were the first to be written using extensive computer analysis. "Computers helped me to discover a number of fundamentally new positions that no one had ever expected, some of which were outstandingly beautiful," he says.

Chess programs are even having a psychological impact. Because computers feel neither nervousness nor fear, they are able to defend apparently hopeless positions, which has encouraged human opponents to persevere even when defeat seems inevitable. The seventeen-year-old American champion Hikaru Nakamura recently told the *Times* that he plays with the courage of a computer. "I'll play some of these really crazy moves that people are not going to be expecting," he said. "The way I play is not like most people. The moves are more computeresque."

Shay Bushinsky and Amir Ban believe that computeresque is better. "Many people don't like it when I say this, but I think Junior plays more creatively than humans," Bushinsky says. Ban goes further, insisting that Junior's creativity is a symptom of its inherent intelligence. "This is an emergent phenomenon of the program, not something I put into it," he says. "It's like Junior is the child and I'm the father. I may think I've taught my child everything, but it's constantly dreaming up things that surprise me."

Such claims to creativity and intelligence are not that far-fetched. In the last few decades, scholars of emergent phenomena have revealed how simple rules at work in termite mounds, traffic jams, quantum mechanics, and the structure of galaxies can give rise to sophisticated and unanticipated behavior, just as the few basic rules of chess yield the endlessly subtle game played by grand masters and chess programs. Scientists have found that the best way to understand these complex systems is often not to theorize but to build a computer model and see how it behaves, in the same way that a chess programmer writes a new version of his program and then watches it play. As the model exhibits patterns and behaviors whose existence its programmer never suspected, it is, in some real sense, creating. And while this may not constitute true machine intelligence, a growing number of cognitive scientists and philosophers see no fundamental distinction between computers and human brains. "Sure, I think the brain is a machine," Mark Greenberg, a philosopher of mind at U.C.L.A., says. "And, likewise, that there's no reason in principle that a computer couldn't think, have beliefs and other mental states, be intelligent. Many mainstream philosophers would agree."

Some, of course, do not. John Searle has tried to disprove the notion of machine intelligence with his "Chinese Room" thought experiment, and Roger Penrose has used Gödel's ideas to the same end. The philosopher Colin McGinn argues that consciousness itself, a crucial part of intelligence, is cognitively closed to us. Yet for those who view intelligence as something essentially and almost mystically human, the analogy with flight may provide a salutary warning. In October, 1903, just two months before the Wright brothers completed their first successful powered flight, the astronomer Simon Newcomb published an essay attempting to prove that airplanes would never fly. He got nearly everything right, identifying the intricate ratios of size, weight, and wing surface in birds which proved that a man-size bird could never get airborne. Yet he overlooked one key detail—the lift effect of an airfoil—and the larger point that an airplane was not a bird. Might those who appear to require a human brain for intelligence be overlooking a broader but no less valid definition of the term?



In any event, such metaphysical matters can be neatly sidestepped with the Turing Test, which merely asks whether a machine can imitate intelligence well enough to fool a human observer. In 2000 and 2001, the leading British grand master Nigel Short played a number of speed-chess games on the Internet, against an anonymous opponent. In most games, this player put himself at a disadvantage with several bizarre opening moves, yet went on to trounce Short, who is among the world's best speed-chess players. Short became convinced that his quirky, brilliant opponent was the reclusive chess genius Bobby Fischer—who else could beat him with such superhuman ease? "I am ninety-nine per cent sure that I have been playing against the chess legend," he told the London *Sunday Telegraph*. "It's tremendously exciting." He said that he treasured these games as products of Fischer's rare art. "To me, they are what an undiscovered Mozart symphony would be to a music lover."

In fact, Short's opponent was probably a computer. "It's fairly clear that the phantom Fischer was an experienced chess-program user playing a practical joke," Frederic Friedel, a founder of ChessBase, a software company that publishes Fritz, Junior, and several other programs, says. "He made the first few absurd moves by hand to throw people off the scent, then unleashed the machine." When Friedel played through several of the games with Fritz, the program's moves were virtually identical to those of Short's mystery opponent. So a computer duped one of the world's top chess players into believing that it was a human. Friedel says that the converse also happens. "Raffael," one of the strongest players at his company's popular chess server Playchess.com, was originally thought to be a powerful computer, but was later observed making all-too-human errors. "Raffael" is now believed by many to be Garry Kasparov. ♦