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### The History of Computer Games

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# The History of Computer Games

by

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## Milestones in Computer Backgammon

**1979:** BKG 9.8, the first strong backgammon player (written by Hans Berliner of Carnegie Mellon University), defeated world champion Luigi Villa in an exhibition match. However, it is widely accepted that Villa played better and that the computer got better rolls.

**1989:** Gerald Tesauro's neural network-based Neurogammon, which was trained with a database of games played by expert human players, won the backgammon championship at the 1989 International Computer Olympiad. All top backgammon programs since Neurogammon have been based on neural networks. Search-based algorithms are not currently feasible for backgammon because the game has a branching factor of several hundred.

**1991:** Gerald Tesauro's TD-Gammon debuted. Instead of being trained with a database of moves, TD-Gammon was trained by playing itself. This approach was challenging because individual moves are not rewarded: the reward is delayed until the end of the game, and credit for winning must then be distributed among the various moves. Tesauro used temporal difference learning, pioneered by Richard Sutton, to get around this obstacle.

**1992:** TD-Gammon was playing at a level nearly equal to that of the best human players. Furthermore, it influenced the play of human backgammon experts.

**1992-present:** Many programs inspired by TD-Gammon have emerged, such as Fredrik Dahl's JellyFish, Harald Wittman's mloner, and Olivier Egger's Snowie. Some programs have been developed that are not based on the temporal difference learning method, but they have not proven themselves superior.

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## Milestones in Computer Bridge

**1958:** Tom Throop, an avid chess and bridge player, wrote a bridge program on a UNIVAC computer. It could only play one round before it ran out of memory.

**1980s:** Computer bridge attracted more attention from more researchers, but Tom Throop stayed at the fore. In 1982, he finished the first version of Bridge Baron, a program that continues to be developed today.

**1990:** Zia Mahmood offered a £1,000,000 prize to any bridge program that could beat him.

**1997:** Bridge Baron won the 1<sup>st</sup> World Computer Bridge Championship.

**1998:** The program GIB, written by Matthew Ginsberg from the University of Oregon, became the strongest bridge program. In 1998, GIB not only won the Computer Bridge World Championship, it was also the only computer player invited to play in the Par Contest at the World Bridge Championships. Out of 35 competitors, GIB finished 12<sup>th</sup>.

**1998:** GIB played Zia Mahmood and Michael Rosenberg in an exhibition match. GIB lost but did well enough to make Zia Mahmood nervous: he withdrew his £1,000,000 challenge.

**2000s:** Jack, written by Hans Kuijf from the Netherlands, dominated the computer bridge world. Jack won the Computer Bridge World Championship in 2001, 2002, 2003, 2004, and 2006. In 2005, the winner was WBridge5, a program by Yves Costel from France.

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## Milestones in Computer Checkers

**1952:** Arthur Samuel wrote a checkers program, a program that he would spend two decades developing and refining. Written in assembly language, Samuel's program used both alpha-beta searching and learning.

**1962:** Arthur Samuel's checkers program won a game against Robert Nealey, a former Connecticut checkers champion who was blind.

**1966:** Arthur Samuel's checkers program lost four games each to Walter Hellman and Derek Oldbury, two players vying for the world championship.

**Late 1970s:** PAASLOW, a checkers program from Duke University (written by Eric Jensen, Tom Truscott, and Alan Bierman), beat Samuel's program in a two-game match. However, PAASLOW then lost a match to Elbert Lowder, a checkers grandmaster.

**1989:** Researchers at the University of Alberta, including chess aficionado Jonathan Schaeffer, began work on the checkers program Chinook.

**1990:** Chinook qualified to play a match for the world human championship by coming second to World Champion Marion Tinsley in the U.S. Championship. The world checker federations decided to exclude Chinook from playing for the title. A new title, the World Man-Machine Champion, was created.

**1992:** At the first World Man-Machine Championship, longtime world champion Marion Tinsley beat Chinook. In the 40-game match, Tinsley won four games, Chinook won two, and there were 34 draws.

**1994:** Tinsley and Chinook played again and drew six of six games. Tinsley then forfeited because of ill health.

**1994-1995:** Chinook defended its title in two matches against Grandmaster Don Lafferty.

**1997:** Undefeated since 1994, Chinook was retired.

**2000s:** David Fogel and Kumar Chellapilla created Blondie24, a program that used neural networks and an evolutionary algorithm to teach itself how to play checkers. Supplied with only the rules of the game and a few other basics, Blondie24 became a tournament-level checkers player.

**2005:** A checkers opening called the White Doctor was solved — it is a draw. Since then, four more openings have been solved. Checkers will be a solved game (presumably a draw) within two years.

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## **Milestones in Computer Chess**

**1770:** “The Turk,” a mechanical device with cogs, wheels, and a skilled human chess player inside a box, was developed by Baron von Kempelen.

**1890:** The Spanish inventor Leonardo Torres y Quevedo developed an algorithmic mechanical device to win endgames with a king and a rook against a king.

**1948:** Alan Turing and Claude Shannon independently developed the basic algorithms still used in chess programs.

**1957:** Herbert Simon, future Nobel laureate in Economics, predicted that a computer would be world champion within 10 years.

**1958:** Alex Bernstein and his colleagues developed the first full working chess program.

**1959:** Allen Newell, Herbert Simon, and J. C. Shaw developed the first alpha-beta chess-playing program.

**1967:** Richard Greenblatt's MacHack program played club-level chess.

**1968:** International Master (IM) David Levy made a now famous bet with four computer science professors that a computer program wouldn't beat him in a serious chess match.

**1970:** Monty Newborn initiated the U.S. Computer Chess Championships, which later became the North American Computer Chess Championships.

**1973:** CHESS 4.0, a program from Northwestern University, won its fourth U.S. Computer Chess Championship. The only program that it didn't beat in the tournament was a program from Dartmouth, with which it drew.

**1974:** The program Kaissa from the Soviet Union (written by Adelson-Velsky, Arlazarov, and Donskoy) won the first World Computer Chess Championship in Stockholm.

**1975:** CHESS 4.5 of Northwestern University became the first program to achieve the United States Chess Federation (USCF) expert rating.

**1978:** IM David Levy easily beat CHESS 4.7 by a score of 3.5 to 1.5.

**1980:** The Northwestern University CHESS 3.x and 4.x series of programs (written by David Slate, Larry Atkin, and Keith Gorlen) dominated the North American Computer Chess Championship.

**1983:** Ken Thompson's Belle was the first program to officially break the USCF master (2200) barrier.

**1983:** IM David Levy defeated the fourth World Computer Chess Champion, Cray Blitz (written by Robert Hyatt, Albert Gower, and Harry Nelson), 4-0 in London.

**1987:** Fidelity Electronics (Kathe and Dan Spracklen) and German chess manufacturer Hegener & Glaser (Richard Lang) developed the first officially rated USCF master-level microcomputer chess programs.

**1985-88:** Hitech (written by Hans Berliner and colleagues at Carnegie-Mellon University) quickly became the dominant program and in 1988 broke the USCF 2400 barrier.

**1988:** Deep Thought (written by Feng-hsiung Hsu, Thomas Anantharaman, Murray Campbell, and Andreas Nowatzyk) tied for first at the Software Toolworks Championship with Grandmaster (GM) Tony Miles, defeating GM Ben Larsen along the way.

**1989:** Garry Kasparov, World Chess Champion, defeated Deep Thought 2-0 in an exhibition match in New York City.

**1989:** Deep Thought became the sixth World Computer Chess Champion in Edmonton, Alberta.

**1990:** Deep Thought defeated IM David Levy 4-0 in London.

**1993:** Deep Thought defeated Judith Polgar, the world's youngest grandmaster, 1.5 to 0.5 in an exhibition match.

**1994:** In games limited to 25 minutes for each player, WCHES (written by Dave Kittinger) scored 5-1 against grandmasters at the Fifth Harvard Cup in Boston.

**1996:** World Champion Garry Kasparov defeated Deep Blue 4-2 in Philadelphia.

**1997:** Garry Kasparov and Deep Blue played another match. Deep Blue won two games, Kasparov won one, and they drew three — making Deep Blue the overall winner.

**March 2002:** Former World Championship Candidate, GM Boris Gulko (Elo rating 2605), played a series of two-game matches against four of the world's best computer chess programs (described below):

- **Deep Junior:** Reigning computer world champion (by Amir Ban and Shay Bushinsky of Israel).
- **Deep Fritz:** former world champion (by Frans Morsch of the Netherlands and Mathias Feist of Germany).
- **Hiarcs:** A program (by Mark Uniacke of England) best known for its strong positional play.

Gulko won one game, lost three, and drew four. The results were:

	<b>Junior</b>		<b>Fritz</b>		<b>Hiarcs</b>		<b>Shredder</b>		<b>Total</b>
<b>Computers</b>	1/2	1/2	1	1/2	1/2	1	1	0	<b>5.0</b>
<b>Boris Gulko</b>	1/2	1/2	0	1/2	1/2	0	0	1	<b>3.0</b>

**April 2002:** Like Gulko, GM Ilya Smirin (Elo rating 2702) played two-game matches against four of the best computer programs. Instead of playing against Deep Fritz, though, he played against Chess Tiger, a program (by Christophe Theron of France) that had achieved an Elo rating of 2788. Unlike Gulko, he lost no games. The results were:

	<b>Shredder</b>		<b>Hiarcs</b>		<b>Junior</b>		<b>Tiger</b>		<b>Total</b>
<b>Computers</b>	0	1/2	1/2	1/2	1/2	1/2	1/2	0	<b>3.0</b>
<b>Ilya Smirin</b>	1	1/2	1/2	1/2	1/2	1/2	1/2	1	<b>5.0</b>

**May 2002:** GM Alexey Dreev (Elo rating 2690) played one game against Deep Junior at tournament time controls (each player had two hours to make the first 40 moves). The game was a draw.

**May 2002:** A match between Deep Junior and GM Mikhail Gurevich (Elo rating 3641) was played with a time control of 60 minutes per player. Junior was run on a Pentium 4 with 2.0 GHz and 1GB RAM and won 3.5 to 0.5.

**October 2002:** World Champion Vladimir Kramnik played an eight-game match against Deep Fritz. Kramnik lost his two-game lead, and the match ended in a 4-4 tie.

	1	2	3	4	5	6	7	8	Final
<b>Vladimir Kramnik</b>	1/2	1	1	1/2	0	0	1/2	1/2	<b>4.0</b>
<b>Deep Fritz</b>	1/2	0	0	1/2	1	1	1/2	1/2	<b>4.0</b>

**January 2003:** Garry Kasparov and Deep Junior tied in a six-game match in New York. Most chess authorities felt Kasparov had the edge in the final position of the sixth game.

	1	2	3	4	5	6	Total
<b>Garry Kasparov</b>	1	1/2	0	1/2	1/2	1/2	<b>3.0</b>
<b>Deep Junior</b>	0	1/2	1	1/2	1/2	1/2	<b>3.0</b>

**July 2003 and July 2004:** The program Shredder 7 dominated three South American round-robin tournaments with human players rated between 2300 and 2500.

**October 2004:** At the Man vs. Machine World Team Championship in Bilbao, the programs Hydra, Fritz, and Deep Junior played Veselin Topalov, Ruslan Ponomariov, and Sergey Karjakin. The computers prevailed, totaling 8.5 to the humans' 3.5.

**June 2005:** The first "freestyle" chess tournament, a tournament in which players are allowed to use computers and external help, was held. A pair of human amateurs won, beating out a number of teams that had grandmasters.

**July 2005:** Shredder 9.0 dominated an 11-player round-robin tournament with humans, scoring 8.5 (out of a possible 10) with players rated between 2207 and 2513.

**July 2005:** The program Hydra (from the United Arab Emirates) defeated Michael Adams, the seventh-ranked player in the world, in a six-game match. Hydra totaled 5.5 points, Adams only 0.5.

**November 2005:** The programs Hydra, Deep Junior, and Deep Fritz dominated a six-player human-computer event including Ruslan Ponomariov, Rustam Kasimdzhanov, and Alexander Khalifman. Once again, the computers won, totaling 8 to the humans' 4.

**March 2006 (preliminaries) and April 2006 (finals):** The second freestyle tournament was won by Hydra with its creator, Chrilly Donniger.

**June 2006:** The preliminaries of the third freestyle tournament were held, featuring an extended time control. Teams of grandmasters and computers dominated over both computers playing alone and teams of computers and lesser players. Not one pure computer program qualified for the finals.

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## **Milestones in Computer Go**

**1970:** Al Zobrist wrote the first computer go program as part of his dissertation.

**1972:** Walter Reitman and Bruce Wilcox began years of research on go programs. They wrote the program Interim.2 and published several influential articles on computer go.

**1981:** David Fotland began writing the program that is now known as The Many Faces of Go.

**1983:** Michael Reiss began writing the program that is now known as Go++. Despite its name, Go++ is written in C, not C++.

**1984:** Computer go tournaments began to be held. Recurring tournaments included the Ing Cup, which was held from 1985 to 2000, and the FOST Cup (sponsored by the Japanese Foundation for the Fusion of Science and Technology), which was held from 1995 to 1999.

**1990s:** Chen Zhixing, a retired professor of chemistry, wrote the go program Handtalk, which went on to win the Ing Cup and FOST Cup in 1995, 1996, and 1997. In the late 1990s, when Handtalk was being reworked, Go4++ (now called Go++) and The Many Faces of Go rose to prominence.

**2000:** Goemate, the successor to Handtalk, won the go competition in the 5<sup>th</sup> Computer Olympiad.

**2000:** The Ing Prize expired without having been won. Offered by Acer Incorporated and the Ing Chang-Ki Wei-Chi Educational Foundation, the Ing Prize would have awarded about \$1,500,000 to the developers of a go program that could beat a junior champion.

**2000s:** Computer go programs proliferated. Among the strongest programs now are Go Intellect (written by Ken Chen, University of North Carolina at Charlotte) and the open-source program GNU Go.

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## Milestones in Computer Othello

**1971:** Othello as we now know it was created when Goro Hasegawa modified the rules of Reversi, a game from the late 1880s.

**1980:** The Othello program The Moor (written by Mike Reeve and David Levy) won one game in a six-game match against world champion Hiroshi Inoue.

**Early 1980s:** Paul Rosenbloom developed the Othello program IAGO. When IAGO played The Moor, IAGO was better at capturing pieces permanently and limiting its opponent's mobility.

**Late 1980s:** Kai-Fu Lee and Sanjoy Mahajan created the Othello program BILL, which was similar to IAGO but incorporated Bayesian learning. BILL reliably beat IAGO.

**1992:** Michael Buro began work on the Othello program Logistello. Logistello's search techniques, evaluation function, and knowledge base of patterns were better than those in earlier programs. Logistello perfected its game by playing over 100,000 games against itself.

**1997:** Logistello won every game in a six-game match against world champion Takeshi Murakami. Though there had not been much doubt that Othello programs were stronger than humans, it had been 17 years since the last match between a computer and a reigning world champion. After the 1997 match, there was no longer any doubt: Logistello was significantly better than any human player.

**1998:** Michael Buro retired Logistello. Research interest in Othello waned somewhat, but some programs, including Hannibal (by Martin Piotte and Louis Geoffrey) and Zebra (by Gunnar Andersson), continued to be developed.

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## Milestones in Computer Poker

**1970s:** Nicolas Findler wrote a poker program that played five-card draw. His program was not especially strong, but his aim was to model the thought processes of human players, not to make the best possible player.

**1984:** Professional poker player Mike Caro wrote the program Orac on an Apple II computer. Orac played Texas Hold'em, a popular and computationally interesting type of poker. Unfortunately, Caro kept the program secret, so it's not known how strong or weak the program was.

**1990s:** A commercial poker program called Turbo Texas Hold'em was developed. A rule-based program, it has sold more copies than any other commercial poker program, and it is still sold today.

**1997:** University of Alberta researchers, led by Jonathan Schaeffer, wrote Loki, a Texas Hold'em program.

**1999:** The University of Alberta team rewrote Loki and called the new program Poki. Poki plays ring game Texas Hold'em, which has up to 10 players.

**2001:** The growing University of Alberta team wrote PsOpti (which stands for "pseudo-optimal"), which used game theory. PsOpti plays heads-up (two-player) Texas Hold'em.

**2000s:** Online gambling sites proliferated. Because these sites involve real money, poker programs, or "pokerbots," are not allowed to play.

**2000s:** The University of Alberta team continued to develop new technology. Their research included the creation of Vexbot, a learning-based program that adapts according to models it makes of its opponents.

**2005:** The first World Poker Robot Championship was held. The winner of the amateur competition (which did not include programs from the University of Alberta), PokerProBot, won \$100,000.

**2006:** Later in July, the American Association for Artificial Intelligence (AAAI) will host the first AAAI Computer Poker Competition, organized by the Poker Research Group at the University of Alberta. Who will win?!

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