Man and Machine:
Chess Engines and the Psychology and Beauty of Chess
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Introduction

Chess is boring. Or so they say. As someone who plays chess, that isn't my experience in the slightest. For me, chess is an emotionally charged, competitive outlet. It would be embarrassing to tell how many times I've yelled or broken something after an online game. (At one point, my mother felt the need to give me a talking-to about the language I was using during games—apparently, my expletives could be heard down the hall). And while I've learned to get a better grip on my emotions while playing, I still value the excitement of chess. You can imagine my horror, watching the 2018 World Chess Championship, when I realized that the critics were right. At least with the best players in the world, chess has a problem: due to computers, it's increasingly boring and predictable.

In 1997, then-world chess champion Garry Kasparov lost to the computer Deep Blue in a highly publicized match. This was a critical moment in the chess world; never before had the best human lost to a machine (Kasparov). Since then, computers programmed to play chess—known as chess "engines"—have only gotten better. Today's top engines can easily defeat the world's best players (Siegel). It should come as no surprise that players at all levels, including myself, have taken advantage of engines as a useful training tool. When studying openings, I memorize the moves the engine says are best. After a game, I analyze my performance with the help of an engine, which can point out the errors I made. When put in the hands of the world's best players, women and men who have dedicated their lives to the study of chess, this is taken to the extreme. "'For quite a number of games on the highest level, half of the game—sometimes a full game—is played out of memory'" said former world chess champion Vladimir Kramnik (Simonite). "'You don't even play your own preparation; you play your computer's preparation.'"

Engines' impact on the game was evident from the 2018 World Chess Championship. Held biannually, the World Chess Championship pits the defending champion against a challenger in a multi-game match. In 2018, the competitors were defending champion Magnus Carlsen and challenger Fabiano Caruana. All twelve games played in classical time format were drawn (i.e., ties), the first time ever that a world chess championship had no decisive games. A high frequency of draws wasn't unexpected—Carlsen and Caruana were separated by just three Elo points[1]at the start of the match, meaning they were almost identically skilled ("Top 100 Players November 2018"). Nor was it necessarily a bad thing, since not all draws are boring. For example, a drawn game where a player misses a win may keep the audience at the edge of their seats. However, most of the games were deadlocked from the beginning, with only one game featuring a missed win (Klein). Both competitors' preparation, made possible by teams of supporting players using computers, proved too strong to crack. "'I'm facing not only the analytical team of Fabiano and his helpers, but also his computer help'" remarked Carlsen after game two (McGourty). Until Caruana was out of his preparation, Carlsen wasn't playing a person so much as he was playing a computer.

Considering the volume of computer-assisted preparation Carlsen and Caruana had at their disposal during the 2018 World Chess Championship, the boringness of the games is not particularly surprising. It is merely demonstrative of a more general trend. Chess engines have caused top-level players to play more like computers, coolly calculating and memorizing with the goal of playing the best moves possible. These changes are undesirable, as the point of chess is not

always to play the "correct" move. The movement toward playing chess more like engines makes the game more boring because it ignores two key elements of chess: beauty and human psychology.

Beauty

Chess has its earliest roots as an art form. The first recorded chess game comes from a poem entitled "Scachs d'amour," Valencian for "chess of love." Likely written in 1475, the poem depicts a game of chess between the gods Mars and Venus, offering psychological explanations for each move (Negri). For example, when white attacks black's queen with his knight, the author offers this explanation for why the queen retreats: "The gracious lady returns to her place/For a Knight, mostly one of noble breed/Should not wish to stain an honest fame" (de Castellví et. al). The quality of the chess in the game is mediocre at best, but that is beside the point. For the poems' authors, chess was something beautiful, and not necessarily concerned solely with good moves.

The poetic potential of chess moves has not been lost in modern times. Take, for example, chess "compositions," or chess puzzles[2] created in part for their aesthetic value. Compositions are not derived from actual games of chess; instead, they are created by a compositionist. "'Problems are the poetry of chess,'" said Vladimir Nabokov, one of the most prolific compositionists in history (Gezari and Wimsatt 102). "'They demand from the composer the same virtues that characterize all worthwhile art: originality, invention, harmony, conciseness, complexity, and splendid insincerity.'" Compositions have instructional value, too, whether it is teaching a player a particular checkmating sequence or improving their pattern recognition. It is impossible to separate the aesthetics of chess from the other elements of the game.

Neither "Scachs d'amour" nor chess compositions are the result of human vs. human games, but beauty in chess is often born from competition. Many tournaments offer a "brilliancy prize," awarded to the player who played the tournament's most beautiful game (Humble 59). Even when there is no prize to recognize the beauty of a game, the chess world has come to collectively recognize certain performances as special. This phenomenon of finding beauty in the human element of competition is not restricted to chess. A basketball fan might romanticize Michael Jordan's "flu game" as one of the greatest performances ever, not because Jordan's stat line was the most impressive in history, but because of the circumstances of his performance. So too might a chess fan romanticize Bobby Fischer's so-called "Game of the Century," not because it was the most technically correct game ever played, but because of a sequence of moves Fischer played that I, and many other chess fans, find incredible.

Chess engines do not take the beauty of a move into account before playing; they simply play the "correct" move. When human players mimic engines, playing memorized, "correct" moves, something essential to the game is neglected. Grandmasters have long hypothesized that chess is a dead even draw with perfect play (Seirawan and Stefanovic 117–118). Some inaccuracy, then, is necessary for a spectacular move to be possible. "Without error there can be no brilliancy," wrote former world chess champion Emanuel Lasker. The problem is engines don't make mistakes. If the goal of chess is just to play the "correct" move, why should humans bother trying? Engines will always be better than people in that regard.

Human Psychology

There is a fundamental difference between the way a chess engine and a human approach a competitive game of chess. In a given position, an engine would play the same move every time, regardless of its opponent. A human, by contrast, plays the game against their opponent. The importance of the psychologies of the two players cannot be overstated; researcher Vadim Kulikov at the University of Oulu goes as far as to say each head-to-head chess game is actually two games happening concurrently: first, the game of chess played on the board; and second, the mental game played between the players (626). This is known as psychological interplay (622) and is critical in understanding why chess players make the moves they do.

As an example, Kulikov points to game 20 of the 1990 World Chess Championship match between Garry Kasparov and Anatoly Karpov[3]. Kasparov is playing as white. The position after move 25 (Qe8) is shown in fig.1. On move 26, Kasparov sacrificed his knight for a pawn (Nxh6). Instead of recapturing the knight (Rxh6), Karpov decided not to accept the sacrifice, (continuing with c3) allowing Kasparov's knight to escape. From Kasparov's interview after the game, it is clear that the psychological battle between the two competitors was the reason Karpov decided not to recapture: "According to Kasparov, the reason for Karpov not to take the knight was not (entirely) a matter of his own (Karpov's) calculation, his sophisticated understanding of the combinatorics of chess, not of his own feeling, and not even of his confidence in his opponent's (Kasparov's) calculations, but it was (at least partially) a matter of Karpov's confidence *in*

Fig. 1: Kasparov - Karpov World Championship
Match (1990), Lyon FRA, rd 20, Dec-15
Position after 25...Qe8

Kasparov's feelings (Kulikov 620; emphasis original).

Psychological interplay is evident from my own games. When in a losing position, I will often make a threatening move that I know is terrible on the off chance that my opponent will miss its refutation—I recognize that my opponent must make a mistake for me to have a chance in the game. Similarly, I frequently play moves designed to trick my opponent. For example, if my opponent has a move that "looks good" but I know to be a blunder, I may play a few "waiting" moves to see if my opponent falls into the trap.

Top-level players' extensive, computer-assisted preparation does not lessen the importance of human psychology in the game. Rather, it changes the nature of human psychology in chess. In today's game, much of the psychological interplay occurs before the game begins, during preparation. Players try to guess which openings or ideas their opponents will throw at them, all the while trying to find openings or ideas their opponent may have overlooked. "The truth is, I'm more attracted to [positions] where the (computer) evaluation is going against me, so that it's less likely

that my opponent has checked it," remarked Fabiano Caruana while commentating a recent chess game. To me, this feels less organic or interesting than watching psychological interplay occur over the board, especially in the case of a dynamic player such as Mikhail Tal.

Mikhail Tal: The Intersection of Beauty and Psychology

The distinction between beauty and human psychology might strike some readers as arbitrary. After all, the beauty of a move is determined by humans, rather than some sort of objective criteria. Though I have discussed both separately in this essay, it is true that the two are connected, and it is worth exploring this connection. The playing style of former world chess champion Mikhail Tal serves as an excellent case study in how beauty and psychology can combine to create incredible, exciting chess.

Tal was briefly world chess champion from 1960–1961 (Hartson). However, Tal is not remembered for his dominance in the game. Instead, he is remembered for his aggressive, attacking play (Hartson). "Chess, first of all, is art," he is quoted as saying. If beauty was the basis for Tal's understanding of chess, psychological warfare was a close second. "You must take your opponent into a deep dark forest where 2+2=5, and the path leading out is only wide enough for one," he once wrote. This embrace of the beauty and psychology of chess is evident from Tal's games. He is most famous for his sacrifices, many of which were later shown to be inaccurate by computers. By playing these surprising moves, Tal was often able to unsettle his opponent, damaging their ability to play the game.

Fig. 2: Isaak Birbrager vs Mikhail Tal
Team Championship of USSR, juniors (1953), Kharkov
Position after 28. Nd2

One of Tal's most incredible moves came in the 1953 Soviet juniors Team Championship against Isaak Birbrager. Tal had the black pieces. The position after Birbrager's 28th move (Nd2) is shown in fig. 2. In this position, Tal made the extraordinary decision to capture a pawn with his bishop (Bxg4), allowing Birbrager to capture his queen with his knight (Nxf3). Chess engines evaluate this move as a blunder, but an uneasy and pressured Birbrager was unable to find the "correct" moves, and Tal won the game (Copeland). "This is the perfect example of a Tal move," writes chess national master Sam Copeland in his analysis of the game. "There is not a clear idea for [Tal] to regain the material, but Tal's pieces are alive and crackling with energy while White's pieces struggle to find meaning in the position."

The reason Tal's queen sacrifice is remembered today is because it is beautiful. The reason it was effective was because of its psychology. But if Tal had played like an engine, it never would've happened, and he wouldn't have won.[4] Chess engines evaluate the position in fig. 2 as drawn.

Limitations

I've talked a lot about top-level chess in this essay. That's because this phenomenon—players playing chess like engines—is only found in top-level chess. As I stated earlier, my games are exciting and action-packed. This is mostly because my games have a much higher frequency of mistakes than those of top-level players. Neither myself nor my opponent has even a fraction of the preparation that the best chess players do, nor are we anywhere near their skill level.[5] But there is another reason for these mistakes: I exclusively play speed chess. In the 2018 World Chess Championship, both players had 100 minutes to make their first 40 moves, with an additional 50 minutes added to their clock after move 40, another 15 minutes added after move 60, and 30 seconds added every time they made a move ("Rules and Regulations for the FIDE World Championship Match [FWCM] 2018"). By contrast, I normally play on a time control that only allows three minutes to make *all* my moves. Unsurprisingly, there is research to indicate that putting players under time pressure leads to more exciting games. Even amongst top-level players, skill level becomes less predictive of game result when players are under time pressure (Harreveld et. al). The faster the game, the less predictable the result, probably due to a higher frequency of mistakes (Harreveld et. al). Consequently, implementing faster time controls has been proposed as a way to make top-level games more exciting (Tisdall).

It is also important to acknowledge that despite widespread use of engines, there is no evidence the frequency of draws has increased. One analysis of 78,458 high-level games from 1970 to 2017 found the draw rate has remained fairly static (Zhou). Again, players playing like chess engines is not a widespread phenomenon. Most grandmasters do not have teams of other players on computers helping them memorize and study thousands of computer moves. The world's most elite tournaments (such as the World Chess Championship) are unusual because their stakes are so high; with so much on the line, the competitors do much more to prepare than a grandmaster in a typical match. Even if playing like a chess engine is limited to the highest levels, that's still problematic. Elite tournaments are the most visible, generating the largest audiences.

What Can Be Done?

Due to coronavirus, the 2020 World Chess Championship was delayed until 2021. As I write this in December 2021, Magnus Carlsen is in the middle of a 14-game match to retain his title against challenger Ian Nepomniachtchi. For the first time in five years, a decisive World Chess Championship game was played, with Carlsen defeating Nepomniachtchi in game six (Colodro). The clues for how to fix chess can be found from this game, which was recognized by many as a classic immediately after its conclusion (Colodro).

Carlsen and Nepomniachtchi were out of their preparation soon into the game, after an unusual series of moves left both in an unfamiliar position. "'I couldn't remember the lines

properly [after move 10], so from there on I had to kind of invent things over the board'" reflected Carlsen (Doggers). Likewise, Nepomniachtchi found himself burning time early on.

Despite the World Chess Championship's long time control, both players ran into time pressure. Carlsen was especially in trouble, with only three minutes left at move 30, and ten moves until time control[6] (Doggers). As a result, both players made several key mistakes, which contributed to the excitement of the game. After time control was reached, and the dust settled, engines evaluated the position as drawn (Doggers). However, Carlsen would slowly grind away at Nepomniachtchi's position, and after a record-setting 136 moves, Carlsen came away with the win.

Game six was undeniably exciting, and key to its excitement was a reduced influence of computer engines on the game. This was due to the game's early departure from the competitors' preparation, unusual positions, and time pressure, all combining to lessen the importance of preparation and increase the frequency of error. If we want to change the way that top-level chess players play, the events of game six point toward solutions that would make the game more exciting. We could implement faster time controls, or make players start with a randomized position, negating all preparation.[7] Though many top-level chess games have a problem with boringness, game six of the 2021 World Chess Championship shows that there is still the potential for beauty in chess.

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[1]Elo systems are used in chess as well as other competitive activities to measure differences in skill.

[2]Chess puzzles are positions where players are challenged to find the best move.

[3]This essay utilizes algebraic notation. For readers unfamiliar with algebraic notation, feel free to skip the parenthesis.

[4]This position had already repeated itself twice (with Qe3, Nf1, Qf3, Nd2, etc.). In chess, three repetitions of a position is a draw. If Tal had played the "correct" move, the game would've ended by threefold repetition.

[5]Typically, in online chess, competitors are paired by Elo. I tend to be at the same skill level as my opponents.

[6]As was the case in the 2018 World Chess Championship, players receive extra time once they reach 40 moves played. This is known as "reaching time control."

[7]Known as Fisher Random or Chess 960, this chess variant starts with all pieces on the back rank in a randomized (but symmetrical and fair) starting position. With 960 possible starting configurations, it would be impossible for players to memorize opening moves.

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