

MasterMind Chess: Design and Implementation of Classic, Capablanca and Fischer Modes with Real Time Match Observation

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Abstract

Chess is one of the most famous and played games of the world. The development of chess computer games follows the history of computers itself, and until nowadays it is still adapted to new platforms and gameplays. This paper describes the design and implementation of MasterMind Chess, an online computer chess game with innovative design and three distinct game modes, where users interact in a competitive environment and are able to watch ongoing matches in real time. The interface elements and layout of the game are compared with the ones from similar games of various platforms, along with its game modes and features, and the ideas behind the visual and gameplay innovations are discussed.

Keywords: design, interface, chess, online game, multiplayer game.

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1. Introduction

The game of Chess is, roughly, one of, if not the most played game in the world. Early versions of the modern game are dated to 280 to 550 CE, in India, during the Gupta dynasty [Jain, 2014]. Due to its importance and popularity, Chess is even considered an Olympic sport, with annual tournaments and competitions all over the world. With the development of modern computers came the creation of the first Chess softwares, such as the Deep Blue, which became the first computer to win against a Chess world champion [Russel and Norvig, 2009]. Later, with the advent of the internet and more powerful computers, more intelligent Chess programs were developed, and people could play against each other without the need to be physically present in the same space.

As the internet became more popular and accessible to almost everyone, more Chess games were developed and the online Chess community began to grow in population. Even FIDE, the global organization that commands Chess rules, uses an online database to store the rating of official players.

With the creation of new operational systems, such as the Mac OS, and the popularization of other UNIX based operational systems such as Linux, new games

of Chess began to appear for those platforms and many of the existing were adapted to also run in these new systems. This affected the design and development of the game, which has to be adapted to handle another keyboard, for example, or a limited and small screen, in the case of a portable device, such as an Android smartphone. These design issues can be a real challenge to overcome, especially if the game has an innovative proposal.

MasterMind Chess is a multiplayer, online Chess game that supports, aside the classic, two other famous game modes, created by Chess champions and officially recognized by the international Chess organization. The design of the game was created to differ from other Chess softwares, as it tries to immerse the player in a real life environment, with interface elements that resembles objects that the player uses in a real match. The users can play competitive matches to increase their rating and achieve higher ranks, being rewarded with badges, trophies and medals to represent this progress. They can also improve their gameplay by watching ongoing matches in real time, where they can study higher rating players playing and see their strategies, or be watched by other curious players.

This paper is organized as follows: Section 2 presents some related games; Section 3 presents a brief introduction to the chess game; Section 4 presents the developed game; Section 5 presents a discussion; and Section 6 concludes the paper.

2. Related Games

In order to compare the chosen design and resources with existing ones, some of the related games were chosen to a quick analysis of its layout and interface elements. The games were chosen based on their popularity (number of players, or rating and number of comments/downloads, in case of mobile games) and their design, in order to compare the disposition of its elements, their features and other outstanding details. Figure 1 shows some of the related games.

Chess.com¹ (Figure 1a) live game interface, the board is shown along the users' name, their ELO, title, a flag representing their nationality, an diamond icon which represents if the player is premium (has paid for full access of the features) and the game clocks. Its propose is to have a quick match with a random online

¹ <http://www.chess.com>.

player in the web platform. There is no move history and no log of the captured pieces, only the necessary

information to the match: the board and the clock.



Figure 1: Chess related games (a) Chess.com (b) gameknot.com (c) Internet Xadrez Clube (d) Chess Hotel (e) Chess Friends (f) instantchess.com (g) multiplayerchess.com (h) Chess Online Expert (i) ChessJam.

In gameknot.com² (Figure 1b), is also a web interface, and like (Figure 1a), it is shown the board, the players' name, the clock, their ELO and a representative picture of the players. Along with these elements, there is a box containing three tabs, where the player can alternate between the move history, the chat and the notes – a place reserved for private annotations of the player, probably about the match. Internet Xadrez Clube's interface³, a PC desktop game, in (Figure 1c), has all those elements showed at the same time, along with a list of users that are watching the match, a button to activate or deactivate the chat, and three top tabs: game options, preferences and Board and Pieces, where is possible to personalize the images of the game.

In (Figure 1f), there is the simplest layout, instantchess.com⁴. Like (Figure 1a), there is only the clock, the players name and their ELO. As the name of the site suggests, it is an instant chess match, where the

player do not even need to register in order to play. The same occurs in (Figure 1d), (Figure 1e) and (Figure 1g), Chess Hotel⁵, ChessFriends⁶ and multiplayerchess.com⁷, respectively, where there is no need to register before playing. All the games shares almost all the functionalities, with only minor differences or extra, visual features, such as (Figure 1e), where the player can use a picture to represent his profile in the game.

Three dimensional layouts are also very common, as they appear in (Figure 1h) and (Figure 1i). Usually, the player sees the board in a diagonal view, as if they were in an actual physical space. Some games even allow the player to rotate and move around the board in the 3D view. Generally, these 3D games are designed for desktop applications, as it is easier to have the processor power to run a 3D engine.

Between platforms, one can see that, as the games turns more portable, their interfaces tends to be as

² <http://www.gameknot.com>.

³ <http://www.ixc.com.br>.

⁴ <http://www.instantchess.com>.

⁵ <http://www.chesshotel.com>.

⁶ <http://www.chessfriends.com>.

⁷ <http://www.multiplayerchess.com>.

simple as possible, in contrast with desktop games, which tends to explore the more feature as possible in their interface. In mobile versions, with the limited space, it is common that only the board is shown and the other options are hidden, being the user capable of seeing those features if he chooses to. In web applications, it is common that the interface is still simple, but with tabs to access other features. The user must alternate between the chat and the history, for example. This type of layout saves spaces, as it joins multiple features in just one spot, but generally the user cannot access those multiple features at just one time, if he desires.

Some games have a great number of features, options for personalization and multiple versions for different platforms, but most of them are paid or have limited access (the player has access to some features, but have to pay to liberate access to the others). The main difference between MasterMind Chess and the other games is that, in addition to being totally free, with no limited features, it also has all the three game modes, the social interaction between the players, a complex ELO-based ranking system and a reward system for the player to always feel motivated to achieve higher ranks. The design of MasterMind Chess is also a differential, as few games tries to give a theme to the game, other than the basic board layout.

Table 1: Chess related games.

Game name	Platform	OS	Single/ Multi	Spectator	Game modes	Classification	Access
Chess.com	Web	-	Single Multi	Yes	Classic, 960	Multiple	Limited
multiplayerchess.com	Web	-	Single Multi	No	Classic	None	Free
gameknot.com	Web	-	Single Multi	No	Classic	ELO Competition	Limited
Internet Xadrez Clube	PC	Windows	Multi	Yes	Classic	ELO	Limited
Instantchess.com	Web, Mobile	iOS	Multi	Yes	Classic	ELO	Limited
Spark Chess	PC, Web, Mobile	Windows, MAC, iOS, Android	Single Multi	Yes	Classic	Score Competition	Paid
Internet Chess Club	PC, Web, Mobile	Windows, MAC, iOS, Android	Single Multi	Yes	Classic	ELO Competition	Paid
ChessFriends	Web, Mobile	-	Single Multi	Yes	Classic	ELO Competition	Limited
Chess Hotel	Web	-	Multi	No	Classic, 960	ELO	Free
Chess Online Expert	Mobile	iOS	Single Multi	No	Classic	ELO	Paid
ChessJam	Web, PC	Windows, Linux, MAC	Single Multi	Yes	Classic	ELO	Free
Playchess.com	Web	-	Multi	Yes	Classic	ELO	Limited
Shredder Computer Chess	Web, PC, Mobile	Windows, MAC, iOS, Android, Windows Phone	Single	Yes	Classic, 960	ELO	Paid
Chesslive.com	Web	-	Multi	Yes	Classic	ELO	Limited
Chessworld.net	Web	-	Multi	Yes	Classic	ELO	Limited
ChessAnyTime	Web, Mobile	iOS Android	Multi	Yes	Classic	ELO	Paid

3. Chess Game

Chess is a board game which consists of an 8x8 square board, containing two sets of 16 pieces, being one white and the other black. The white pieces occupy the first two rows of the board, while the black pieces occupy the last two rows. There are six types of pieces - i.e. Pawn, Rook, Bishop, Knight, Queen, and King -, each having its own way to move and capture other pieces across the board.

When the movement of a piece causes it to attack the enemy king, it is said that the king is in check. The next movement must be done in a way to prevent the king to stay in check. If there are no available square for which the king can move without being attacked, nor an allied piece can block the attack or capture the attacking enemy piece, it is said that the king is in checkmate and the game is over.

There are some special movements that can be performed in the game in special situations. The En Passant, for example, is a special capturing condition

of the Pawn, that can only be performed when the said Pawn is on its fifth rank (the rank of a piece is its position regarding the first row of the player's side), an enemy Pawn has just performed a two-square start movement, and its ending position is the square to the side of the Pawn. Being so, the enemy Pawn can be captured diagonally. This is the only Chess capturing movement that the piece's end position is not where the captured piece was. This rule was proposed on the XV century, along with the two-square start of the Pawn, to prevent a Pawn to escape from its capture by an enemy Pawn by moving two squares.

The castling is another special movement, and the only one that two pieces are moved at the same time. It involves the King and one of the Rooks. There are six conditions that have to hold before the player is able to perform a castling movement: (i) The king and the chosen rook are on the player's first rank; (ii) Neither the king nor the chosen rook have previously moved; (iii) There are no pieces between the king and the chosen rook; (iv) The king is not currently in check; (v) The king does not pass through a square that is attacked by an enemy piece and (vi) The king does not end up in check (this holds true from any legal move). Being these conditions checked, the player can move the King by two squares to the right (or three to the left), and the Rook by three squares to the left (or four squared to the right).

Upon reaching the 8th rank, a pawn shall be promoted to another piece of the same color. The player decides which piece the pawn will turn between the Rook, the Knight, the Bishop and the Queen, and the new piece replaces the pawn at the same square. The choice of the new piece is not limited by the pieces that the opponent has captured, i.e., the player can have more than one queen in the board, for example, if he already has one in the event of promoting a pawn to another.

In recognized competitions, all moves of a match are recorded, in order to prevent illegal moves and cheating. It is also a good practice to record one's matches, as it can later be reproduced for learning purposes. There are several ways to describe and record a chess match. The most famous and used notation is the algebraic notation. In the algebraic notation, the board's squares are identified by coordinates, being the horizontal axis labeled from *a* to *h* and the vertical axis from 1 to 8 starting from the first square from left to right in the white player's side. Each piece, excluding the pawn, is identified by its first letter: B for Bishop, R for Rook, K for King, Q for Queen and N for Knight (K is already used by the King). Thus, for the notation of a move, it is indicated the type of the piece plus its destination square. The pawn is the only piece that does not require identification, as only one pawn can move to a specific square at a time. For example, "Be5" indicates that the Bishop moved to the square e5. If a piece captures another, it is used an "x" right after the piece type: In the previous example, it would be "Bxe5" (Bishop captures at e5). When more than one of the same piece can move to the same square, the move is

disambiguated by, in order of preference, the file of origin (the column), the rank of origin and, if not enough, both of them. Special moves also are represented in the algebraic notation. The castling is represented by "O-O", when it is made on the King's side and by "O-O-O" when it is made on the Queen's side. The pawn promotion is indicated by the piece to which it was promoted at the end of the notation. For example, "g8Q" indicates that the pawn moved to the square g8 and was promoted to a Queen. The check is indicated by a "+" on the end of the move and a checkmate by "#". The end of the game is represented by "1-0" if white's player won, "0-1" if black's player won and "1/2-1/2" indicates a draw. This notation is also the official notation recognized by FIDE.

The World Chess Federation, FIDE (Fédération Internationale des Échecs), is an international organization that regularizes and connects national chess federations all over the world. It is the supreme governing body that is responsible for the most important and visible chess competitions of the planet, such as the World Chess Championship and the Chess Olympiad, aside of regional and national competitions. The FIDE defines the rules for all chess game modes, from individual matches to international tournaments, and classify the players according to their performance in the tournaments, using the called FIDE rating, an ELO-based rating.

3.1 Modes

There are a lot of game modes that chess can be played. Each mode has its own rules, and was created as an alternative to the conventional chess game. Apart of the high number of chess game modes, some of them gain special attention, as they were created by famous world grandmasters. Some of them include the Capablanca Chess and the Fischer Chess, both recognized and having their rules supported by the FIDE organization.

The **Classic Chess game** mode is the original chess game, with an 8x8 board and a pre-determined time.

The **960 Chess** - also known as Fischer Random Chess - is a regular Chess game (with an 8x8 size board and the same pieces), with the difference that the initial position of each piece is chosen randomly for the white's player, and then reflected to the black's player. The "960" is referred as the total number of possible initial setups in which a game can start. The motivation in its creation lies in the fact that, for a regular chess game, an experienced player can predict almost all (if not for all) possible first opening moves, to a certain degree [Glicoric 2003]. It was proposed by the world Chess champion Bobby Fischer, in 1996. Figure 2 show a possible initial configuration for a regular 960 Chess game.

The castling rule is also modified for this type of game [Lewis, 2014]. In live matches, the random positions of the pieces are decided by a coin or a dice, individually. The only restrictions for the positions are that the king must be between the two rooks and each bishop occupies a square of different colors - that is,

one bishop must be in a white square and the other on a black square.

The **Capablanca chess** is a game mode where two more pieces are added - i.e. Chancellor and Archbishop - and, thus, increasing the normal size of 8x8 to a bigger 8x10 board [Pritchard, 2001]. The Chancellor is positioned between the King's Bishop and Knight, and its movement is the combination of the movement of a Tower and a Knight. The Archbishop, on the other hand, is positioned between the Queen's Bishop and Knight, and its movement is the combination of the movement of a Bishop and a Knight. Figure 3 shows the match configuration of a Capablanca Chess game.

Another difference from the Classic game mode is the castling rule, as the King now has to move three squares to castling to the right and four to the left. This type of orthodox Chess was proposed by the world Chess champion José Raúl Capablanca. Worried that in some decades the grandmasters of Chess would dominate the game in such a way that all the games would always end in a draw, he proposed this new variant, which allow new possible outcomes. The Archbishop, for example, can, alone, checkmate a lone King.

3.2 ELO

The ELO rating is a mathematical method to calculate the relative skill of a player in competitive games. It was created by the Hungarian physics professor Arpad Elo, and adapted to be used in many multiplayer different games and sports. In this method, each player is rated with a number (the ELO) representing his level of skill [Elo, 1978]. If a player has a higher ELO than his opponent, it is expected, with a certain percentage, that he has a higher chance to win the match. After every match, the ELO of each player is recalculated. The winning player gains a quantity of points based on the difference of ELO between his opponent: if the player with higher ELO won against the player with the lower ELO, a small quantity of points will be awarded, as it was expected that he or her win the match, and also a small quantity would be lost by the losing player. However, if the player with lower ELO won the game, he or she would be awarded with a higher quantity of points, and the losing player would also lost a higher quantity. Therefore, this system is self-correcting, as the player's ELO will be updated until it reaches the point where the player wins and loses 50% of the matches, if he plays with opponents with the same ELO as his.

4. MasterMind Chess

The MasterMind Chess⁸ is an online, multiplayer chess game. The game software was implemented using the C++ programming language, using the SFML library⁹

⁸ Available for free download at <http://www.mastermind.pairg.dimap.ufrn.br>.

⁹ <http://www.sfm-dev.org>.

as base for the network, the sound and graphical user interface.

It allows players to invite others to play against them, as well as to play with random opponents in order to progress in the online ranking. There are a total of nine ranks, each representing a game mode and the duration of a match. The available game modes are the Classic Chess game, the 960 Chess (Fischer Chess) game and the Capablanca Chess game, and the times of a match are 5, 15 or 30 minutes. By winning or losing ranked matches, the player is allocated into the according rank and awarded with a badge, a medal or a trophy that represents his skills accordingly.

4.1 Design Process

To create an innovative design to one of the most played games of the world is not an easy task. To start this process, many popular Chess softwares were selected to have their main features and design investigated, in order to make a deep analysis of what was important to have, what was just decorative elements and create something that was (at least almost) entirely new. The idea of creating a design that remember a real world environment came as a result of this previous investigation, where it was noticed that almost every game have a digital design, making the game much more technical and giving it some kind of dark atmosphere. So, the main idea was that MasterMind Chess resembles a real life Chess match, as if the player were actually in a table, playing with his opponent.

After having a solid idea, the key features that compose the game were chosen and a process of sorting out the layout began. The initial layout had the board on the center, some interface elements on its left side and some on its right side. The chat would be under the board and only the opponent player's name was displayed. This layout was changed to a more compact one, where the chat would be on the center of the board, transparent, being shown only after a message was received or the player wanted to type a new message, and would slowly disappear after a while. This would leave space to more elements, that otherwise would be unutilized, in the case the player does not wanted to send or receive messages. This space was used, in the final design, to have a similar display of the opponent name, but for the user itself. The clock, which was on the right side of the board, seemed to be a little displaced on the design, so it was moved to inside the name's display, on the right side of the names. The idea of having the board not centered, but on the side, was chosen because it concentrates all the interface elements on just one side and leaves more space to the Capablanca Chess mode, where the board occupies a larger lateral area. In this way, the name's display wood was set to be of the same size in both Capablanca and Classic/Fischer modes, to set a standard.

The placeholder for the pieces was chosen to be a box because it looks like a real match, where the pieces are stored for transportation along with the board itself.

At first, there was two boxes, one for each set of pieces, but only one box made more sense. The paper holder that contains the chat and the move history were once two separated elements, the paper holder itself and a little notepad. It was chosen to compact these two elements in just one, giving a different color to the paper to indicate each active option and a button to change. This was because in this way, less space was consumed without taking the metaphor of the user handwriting on the paper to annotate the moves or chat with the opponent.

The layout itself, the position of each element, was set and decided using a paper prototype, being each paper piece an interface element. This is a very important step in the game design, as it gives a more objective perspective to the designer [Filho et al., 2013]. The current layout was chosen in a way that, aside being simple and compact, instead of throwing a lot of information to the user, it does not waste any space that could be used to another feature.

4.2 Lobby Interface

As a naturally competitive game, the interface of MasterMind Chess was designed such to have this competitive element highlighted, like the rank, the rewards for winning, the option to play ranked games, the ELO of the player and from the others.

The option to play ranked games - the ones that will modify the player's ELO based on the result of the match and the ELO of the opponent - is centered to be of easy access and allow a fast start of a ranked game, to stimulate the player to play competitively.

The lobby is the main screen, where the user remains after a successful login. From there, he can enter a match or observe ongoing matches in real time. The MasterMind lobby interface is divided into five separated areas, being two in the left and the other three in the center-right. The upper-left area is a profile display showing the main status of the user, as his ELOs, nickname and rank. The lower left area is a list of users, and allows the player to invite others to casual matches through a "challenge" button, with a sword icon. The upper right of the lobby contains, in its center, a big "Play" button. This button separates other six buttons, being the right ones the game mode – classic, Capablanca and Fischer – and the left ones being the times of a match – 5, 15 and 30 minutes. Upon selection of a game mode or a time, the rank of that particular combination is updated on the center-right area, showing the players with the highest ELO in that rank. The Play button also sends the player to the specified mode-time combination queue, where he will remain until the server finds another player to be his opponent, based on his ELO and his MMR, or he chooses to leave. In the lower-right area, it is shown a list of ongoing matches, where the player can choose to watch a particular game.

4.3 Matches Interface

The interface elements present in the game represents important features that should be presented to the player: the board, the clocks (Figure 2A), the move history (Figure 2C), the captured pieces (Figure 3B), the player's information (Figure 3A) - i.e. name, ELO and a representative image, a configuration button (Figure 2B) and a chat (Figure 3C), to enable communication. The game design was made to give the impression that the player is sitting by a table and playing with the opponent as in the real life. The chess board is put on the table, and the other interface elements on its side. That includes the box, where the captured pieces will remain, to give the idea that the players are storing them; a notepad, which will contain the history of the last moves and which will simulate the chat and a configuration/options button, represented by a lone gear. The decision to use one box to hold the captured pieces was made based on the principle that the player should always be capable of seeing which pieces were already captured by each player. This is important to give a quick reference towards the state of the game, like who has the material advantage. Another possibility was to use the box as containments, like drawers, in the table or in the board itself, as it is in the most table chess boards, and the player having the option to close or open them as he desires, but this would require additional lateral space and, in the closed state, this space would be unutilized. A notepad was chosen to represent the move history inspired by the idea that, in real tournaments or official matches, the players should always write down on a paper the moves, to avoid conflicts. As the player should be able to see the last moves, but is not required to see all the moves all the time, a five-last-moves history showed to be a reasonable choice. The notepad positioned closest to the player was also imagined thinking in the real life, as the player could easily write the last move in that manner. The clock is placed on the right side of the player's nickname, and is also used to indicate which player moves next, by changing its color. If the player's time fall below 20 seconds, the clock turns red, to get his attention to the remaining time.

The board is on the left for two reasons: first, it forces all the other elements to be on just one side of the board. This makes the interface cleaner, as the player can focus only on the game, on the left, and the other elements, on the right, instead of some elements on the left, the board on the center and the other elements in the right. The second reason is the Capablanca chess: as the board gains two additional columns, additional lateral space is required. As the board is on the left, this space is obtained adding one column on the left side of the board and one in the right side, filling the gaps between the border of the table and the other elements.

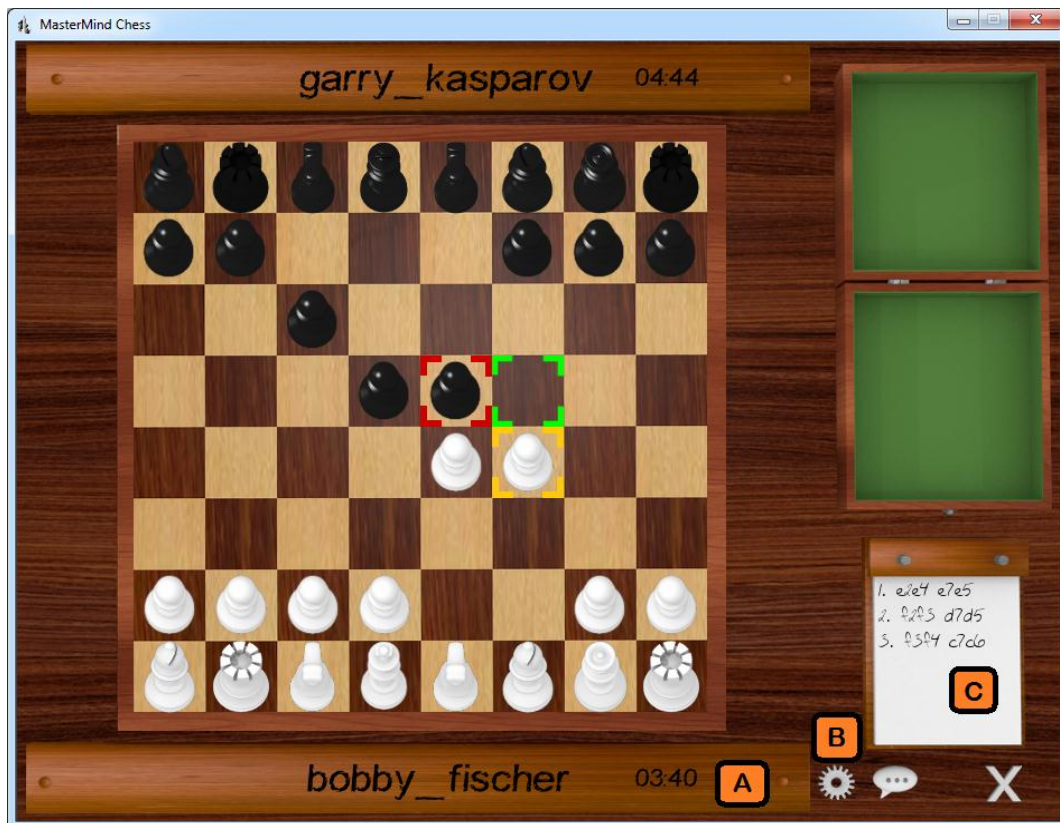


Figure 2: MasterMind Chess in Fischer mode.



Figure 3: MasterMind Chess in Capablanca mode.

4.4 Rank, Badges and Achievements

The MasterMind Chess ranks are calculated using the ELO rating system. Each player starts unranked and

with a default (hidden) 950 ELO. After five matches with random opponents, the player is ranked according to its performance in those matches. To calculate the ELO of a player according to a match, it is necessary to

know his actual rating, the rating of his opponent and the expected score that he has on the match.

The expected score of a player is his probability of winning the match plus half the probability that the match ends in draw. The following formula is used to calculate the expected score of a player:

$$E_a = \frac{1}{1 + 10^{\frac{R_b - R_a}{400}}}$$

Where R_b is the ELO rating of player B (in this case, the opponent) and R_a is the ELO rating of player A. The formula to update the player's ELO is given by:

$$R'_a = R_a + K(S_a - E_a)$$










Where R'_a is the updated player's ELO, R_a is the actual player's ELO, K is an updating factor, S_a is the actual score of the player and E_a is the expected score of the player. The actual score can be either 0 (lose), 0.5 (draw) and 1 (win). The K-Factor is an updating constant that indicates the sensitivity in which the ELO rating is updated. The higher is the K-Factor, the more rapid is the change in the player's ELO in each game. MasterMind Chess uses almost the same principle of FIDE's rating to choose the K-Factor: $K = 30$, for new players until its 30th match; $K = 15$, for players with ELO always below 2400, and $K = 10$, for players that had reached 2300 ELO and has more than 30 matches, being then K fixed permanently at 10 (in FIDE's rating, this value is fixed at 2400 ELO, not 2300).

In addition to the ELO, the player also has a hidden variable called the Match Making Rating (MMR), which determines the range of ELO of the opponents he can get matches in the queue. This number can either help or difficult the player to achieve higher ranks, as it can be negative or positive. If a player wins a lot of consecutive matches, his MMR will be high, meaning that he will be matched with stronger opponents and gain more ELO in the case of a winning, and lose less in a loss. On the other hand, if a player loses a lot of matches in comparison to the number of times he wins, his MMR will be low, meaning that he will get weaker opponents and lose more ELO, in the case of a loss, and gain less ELO, in the case of a win. In other words, if a player loses too much, the system "believes" that he does not have the proper skill to be in that level, and tries to lower his ELO so that he plays with opponents of same skill. Thus, to get to higher ranks, he needs to win more matches, to prove that he has improved his skills and deserves to gain more points. The opposite is true to a player who has a high MMR: as he demonstrate to have a higher skill level to the ELO he is, the system tries to match him with higher ELO players. If he wins, he will gain more ELO, and if he loses, he will lose less ELO. To avoid a player losing too much ELO to a player with high MMR, that is believed to have more skills than its actual rank, half of his MMR is summed with his ELO in the formula for the losing player. The same occurs with the opposite: upon winning a match

to a player with a low MMR and higher ELO, the winning player gain fewer points than normal, as half of the losing player MMR will be subtracted from his ELO.

Each of the nine ranks has a bottom cap of 700 ELO, and can go up as much as the player can achieve. Each 200 ELO obtained by the player, he receives a new representative image to be displayed in his profile and beside his nickname, if the player is in a match. Each of these 200 ELO intervals receives a name that represents its position, starting in Bronze III, the lowest, and going up to Gold I, the highest. In the III-tier, the representative image is a badge; in the II-tier, the image is a medal and, in the I-tier, the image is a trophy. The color of each image is given according to the position in the rank, e.g., in Silver II the player receives a silver medal, and in Bronze I the player receive a bronze trophy. Table 2 shows each obtainable prize according to each rank achieved by the player.

Table 2: Achievements of the MasterMind Chess.

Symbol	Rank	ELO
	Bronze III	700 – 899
	Bronze II	900 – 1099
	Bronze I	1100 – 1299
	Silver III	1300 – 1499
	Silver II	1500 – 1699
	Silver I	1700 – 1899
	Gold III	1900 – 2099
	Gold II	2100 – 2299
	Gold I	2300+

The number in the center of the badges and medals represents the time of the match. For example, a 5-gold medal represents a player that has an ELO rating

between 2100 and 2299, inclusive, in the 5-minutes match rank. These are the initial design proposal for the images.

4.5 Current Limitations

There are some features that were intended to have in the game, but are not fully implemented yet. The game still does not have an engine to record and play past matches, for a player to watch other player's past games or study his own. The login and the profile screen are also not fully designed, and there is still no integration with social networks. Another limitation is that the interface is only available in English, and it is pretended that other languages are added in the future. It is also intended to have some sounds during the match, such as when the player moves a piece or sends a message.

5. Discussion

As it was highlighted in Section 2, the main difference between MasterMind Chess and the other Chess games is that it is totally free, includes three distinct game modes and has a unique, thematized design. The closest game to the MasterMind proposal is the ChessJam, which has a design theme based on a castle. The player navigates within the various rooms, the garden and other ambients. The game time is chosen by entering the specific door of that time, e.g., for a 5 minutes game, the player enters the door numbered with 5 minutes. Then, he is moved to a room with a top view of many chess board tables, where he can either watch ongoing games, play with someone who is already sit on a table or sit on a table of his own and wait for another player (or play with the computer).

This proposal is similar to the one of MasterMind Chess, where the design was made to give the impression that the player entered a tournament room, with records showing the information of the opponents and being able to sit on a table to play against others. The match layouts also are similar, as it was made to give the impression that the player is actually sitting on a real table. What outstands MasterMind Chess is that it has the three game modes – usually, other games just offer the option to play the Fischer Chess, not Capablanca. Also, in MasterMind Chess, all the details of the game were made as a real life metaphor, so that almost all the interface elements are made to be represented by a real life object, like the move history and the piece's box, to immerse the player in a non-digital environment. Most of the other games tries to give a real-life impression only on the actual board and pieces, with a wood-like texture.

The rewards for get to higher ranks also are a differential, as it stimulates the player to stay in the game and have progress in his gameplay and skills, over just playing some matches casually and abandon the game after some time.

6. Conclusion

This paper introduced the MasterMind Chess, an online, multiplayer chess software with three distinct game modes, the option to watch ongoing matches in real time and a design that resembles a real life environment. This design and the layout of the game are analyzed and compared with other related softwares that are famous among chess players.

One can see that, even if the software differs, some key features remain, as they are vital in the flow of the game, such as the clock. Improve these elements is a challenge, as they can even affect the gameplay of the user, such as to drive his attention towards a less important feature or element, while he should be focusing on an important move or strategy. In this way, having a simple and direct design with smooth interface elements are crucial. Rewarding the player with social features, such as to have his name highlighted or to display his trophy to the overall community is also very important, as it increases the desire of the players to stay in the game and progress through it.

As future works, the MasterMind Chess could handle new interactions inputs, such as gestural, voice and brain-computer interfaces. The user could be able, for example, to move the pieces in its turn by only moving his hand, in the case of gestural interfaces, or via its brain waves, using a brain-computer interface input, such as P300 waves or imagined movement.

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