

Patterns for the Game of Chess

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A pattern is a three-part rule, which expresses a relation between a certain context, a problem, and a solution. In a chess game, patterns are born from the combination of relationships between chess pieces and the concepts of attack and defense. There are winning patterns even during the first phases of the game (the opening), consisting of the first 10–12 moves from starting the game, or during the endings, where there are few pieces and pawns. There are a lot of known maneuvers in the winning patterns. This paper focuses on the most popular chess winning configurations, many of them recorded in the chess literature.

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1. INTRODUCTION

Chess is a two-player board game, played on a checkered gameboard with 64 squares, arranged in an eight-by-eight grid. Each player begins a game with 16 pieces: one king, one queen, two rooks, two knights, two bishops, and eight pawns. Each of the six piece types moves differently. The objective is to *kill* the opponent's king by placing it under an inescapable threat of capture. This is called *checkmate*. For this, a player's pieces are used to attack and capture the opponent's pieces, while supporting their own. Also, the game can be won by voluntary resignation of the opponent, which typically occurs when too much “material” (chess pieces) is lost, or if checkmate appears unavoidable. A game may as well result in a draw.

Let us consider the concept of a pattern. According to Alexander [Alexander 1979], a pattern consists of a rule that contains context, problem and solution. It is possible to think about the game of chess in those terms. To do this, it can be defined patterns that correspond to the different stages of the game, as they are **openings** (start of the game), **middlegame**, and **endings**. Similarly, a sub-classification can be made that has to do with the subject: tactical or strategical. In other words, there are chess positions that are solved through a clear sequence of moves, by tactical actions, while others are solved only by strategical or positional means. Therefore, the context of each pattern could be well defined in terms of chess positions. In any case, what is important is to clearly notice the connections among chess pieces.

Very complex chess patterns may arise. For example, let us consider the “principle of two weaknesses”, also known as “one side has two weaknesses”, one on each side of the board. This means that the opponent has more

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space in the center, so you can go from one side to another board faster than your opponent. Sooner or later, the stronger side can attack a weak position, and next, turn to the second one, and then to return to the first one. Most of the times, the opponent is not able to arrive in time to defend both weak positions. The expression of this principle is simple, but categorized as a pattern, it does not seem to be so simple.

Patterns are about design and interaction of objects, as well as providing a communication platform with reusable solutions to commonly found challenges.¹ So, patterns for the game of chess are general purpose abstractions of problems found when properly playing chess. A good collection of chess patterns may reduce complexity and solutions to problems encountered in chess, making them easier to understand, so we could have a selection of tested solutions to work with.

This paper describes some of the most well known and popular chess patterns, such as the “Tarrasch formula”, the fork of a knight, the rule of square, and so on.

2. . SOME POPULAR CHESS PATTERNS

2.1. “TARRASCH’S FORMULA”

The most popular game endings –and the more difficult to play well– are the rooks endings. They appear when all the other pieces have gone, and remains only rooks and pawns. Frequently in this type of game ending, there is an extra pawn for one of the players, and most of the time, this pawn is a passed one, that is, there is no opponent pawn along the same column. There are a lot of tips and recommendations for both players: the one with the advantage, and the one who has to deal with an inferior game. Polish grandmaster Siegbert Tarrasch (1862-1934), enunciated a very clever rule for manage these type of endings.

[Also known as] - *rooks should be placed behind passed pawns* –either yours or your opponent’s

[Example] - In the game Mecking – Korchnoi, 1974², Black has a passed pawn column “a”, in a typical rook and pawns ending. This is a clear example of the Tarrasch’s formula, in which the defender must use it to save the game (finding a draw):

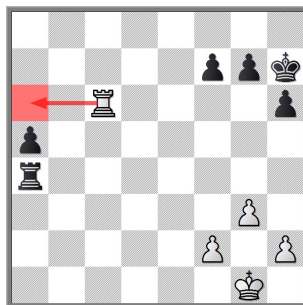


Fig. 1. Mecking–Korchnoi, 1974. An example of the “Tarrasch’s Formula”. The white rook goes behind the passed black pawn in column “a”

[Context] - In chess endings, when queens, bishops and knights are gone, the passed pawns (those who have no enemy pawns in front of them) are looking to become through promotion to a stronger chess piece.

[Problem] -The weaker player must stop the passed pawns of the opponent.

[Solution] - Place a rook behind a passed pawn. “In complicated rook endings the most important rule is one laid

¹<http://www.dofactory.com/net/design-patterns>

²<http://www.chessgames.com/perl/chessgame?gid=1082252>

down by the author: The rook's place is behind the passed pawn; behind the enemy pawn in order to hold it up, behind one's own in order to support its advance". [Tarrasch 1988] In each case, the rook gets more squares as soon the passed pawn makes a move.

[Structure] - The participants in this pattern are rooks and pawns. Often, one of the players has an extra passed pawn.

[Dynamics] - Figure 2 shows a chess diagram with the maneuver of the defending side.

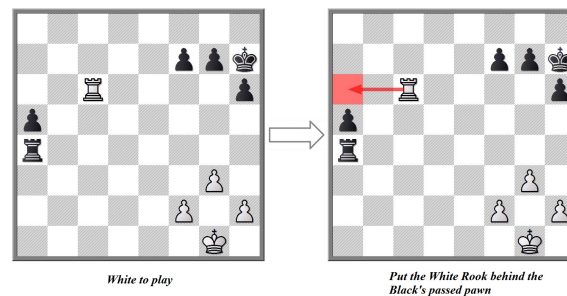


Fig. 2. Tarrasch's formula in action

[Known uses] -The Tarrasch's formula is used in some of the games as follows:

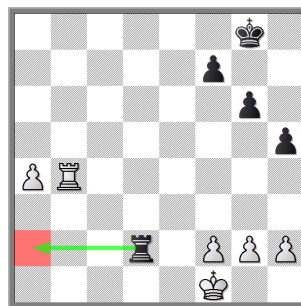


Fig. 3. In the game Unzicker-Lundin, 1954, the position was a simple draw placing the black rook behind the passed pawn.

[Consequences] - Many rooks game endings work around the minimal advantage of a passed pawn. The player with the advantage should try to put his rook behind his own passed pawn, to support its advance. The defender should attempt to do the same. A rook behind the enemy pawn is a secure way to find a draw in an inferior position. Many rooks endings can be saved using this formula³, because the defender can get more space (squares) as soon the passed move moves. On the other hand, the player with the advantage will win also more space if his/her rook is behind his own pawn, again, as soon the pawn can move.

[Variants] - Tarrasch's formula has some practical exceptions (look at *known uses*). For instance the game Kharlov – Morozevich, 1995⁴, where the suggested move by Tarrasch's formula 1. ... Rb7 is only enough for a draw (Figure

³Endings of one rook and pawns are about the most common sort of endings arising on the chess board. Yet, though they do occur so often, few have thoroughly mastered them. They are often of a very difficult nature, and sometimes while apparently very simple, they are in reality extremely intricate. - José Raúl Capablanca

⁴<http://www.chessgames.com/perl/chessgame?gid=1099966>

4).

Other games in which there are variants of the Tarrasch's formula are:

- Yuri Averbach [Averbakh 1966] indicates that the rule is correct usually when both rooks, the one who has the advantage and the defending side, are over the pawn [Nunn 1993].
- But when the pawn is blocked by the opponent's king, the rook of the same color must be usually better defending the pawn from the side.[Emms 2008]
- At the ending of rook and pawn vs. rook, if the pawn has not passed in the fourth row, the best place for the rook is in front of the pawn. [Dvoretsky 2006]
- On a similar note, Cecil Purdy says that the rook is better behind the pawn if it has reached at least the fifth row. [Purdy 2003] Again the reason was outlined before: the rook gets more squares as soon the passed pawn makes a move. According to Purdy, at the fifth row, the rook behind the pawn is getting more powerful as soon the pawn is moved.

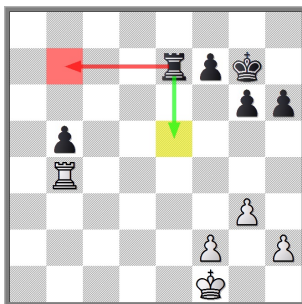


Fig. 4. Here is a wrong application of the Tarrasch's formula. Black rook behind his own pawn is not enough to win (square "b7", marked with red). The right maneuver is to place the Black rook in the square "e5" (marked with yellow). The reason behind this move takes account of the opponent King (in this case the White King), who is cutted off from the action with the Black Rook in e5.

2.2. DEFENDER REMOVAL

Chess master, very often, accommodate their forces (pieces), in such a way most of the pieces defend each other. A very common tactical trick against this strategic idea is to eliminate a defender of another piece (could be even a pawn). As soon the defender is taken, the new undefended piece can be taken easily. This is a way to ensure material advantage.

[Example] In the next position (see next figure), Black Bishop defends the Black rook in "f5". The procedure to win a piece is to remove the defender to take the piece defended.

[Context] -Pieces under attack that are defended by other pieces as well.

[Problem] - One of the player is attacking an opponent piece who is defended another piece too.

[Solution] - Remove the defender of the attacked piece to take it (the defended piece) the next move.

[Structure] - This is a general pattern in which many of the chess pieces could be involved. Frequently pieces are defending with each other, so the removal of a defender is a common tactical procedure.

[Dynamics] - The next diagram shows the maneuver of the defender removal pattern.

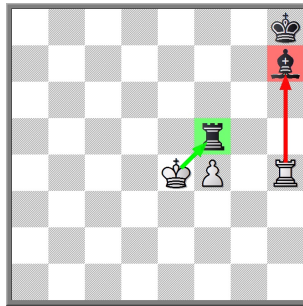


Fig. 5. In this case, the bishop of *h7* protects the rook in *f5*. The maneuver implies to sacrifice the white rook with 1. *Rxh7!* and continue with 2. *Kxf5*, winning the ending.

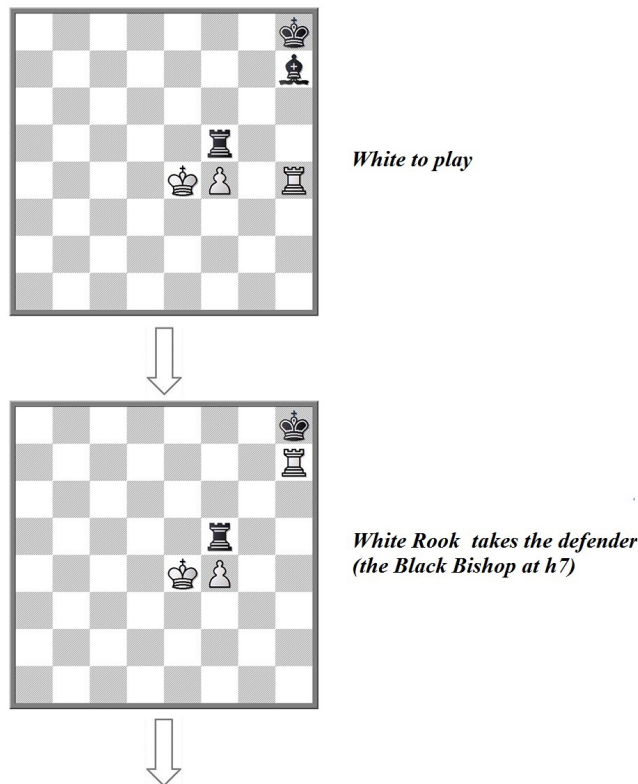


Fig. 6. First part: Defender removal.

[Variants] - There are a lot of variants of this pattern, but the principle is the same: remove the defender to take the piece defended.

[Known uses] - This is a very common maneuver and there are lots and lots of examples in the master chess practice.

[Consequences] - Applying this pattern frequently takes the advantage or at least, gives a better chance to the

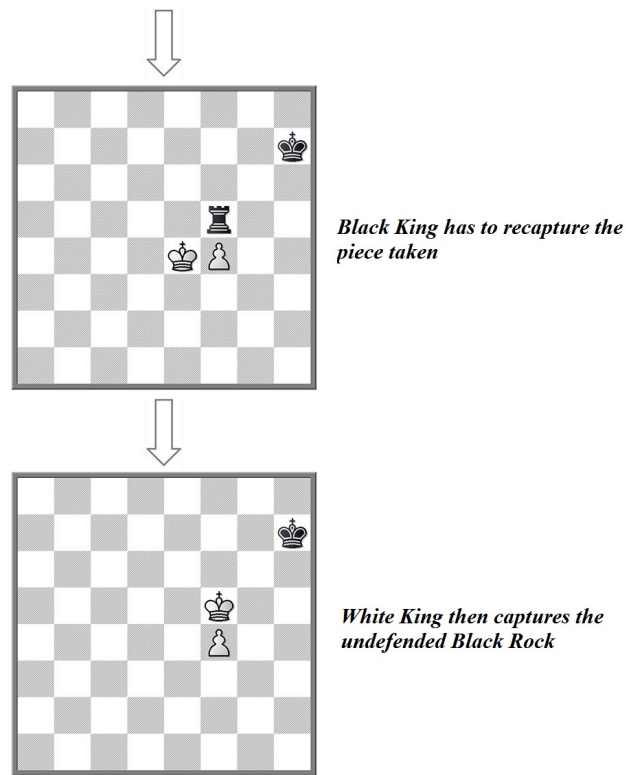


Fig. 7. Second part: Capture the second piece already not defended.

player who executes it. There is a drawback: this maneuver often simplifies the chess position so that sometimes there is not enough material to win.

[Solved example] In the game Lukin – Timoshenko, Spartakiad, URS 1979, (see Figure 8), White defined the game removing the Black defenders in a very effective way: 19. Rxd8! First, get rid of the best defender of the Black side. 19. ... Qxd8 20. Qh4 Bc4 21. Rxf6! 21. ... Bxe2 Now remove the second best defender of Black position. 22. Rh6! f6 23. Bxf6! gxf6 24. Rxh7+ Kg8 25. Qh6 Rc7 26. Qg6+ Kf8 27. Rh8+ Ke7 28. Nd5+ 1-0

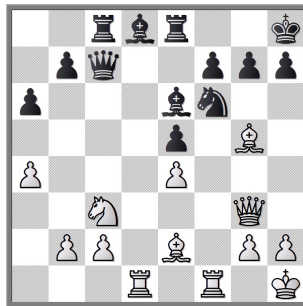


Fig. 8. White to play. Lukin – Timoshenko, Spartakiad, URS 1979: A good example of removing the best defenders of Black position.

2.3. THE GREEK GIFT

This tactical theme was inspired in the *Horse tale*, from the Trojan War about the subterfuge that the Greeks used to enter the city of Troy and win the war. In chess the player who is attacking sometimes can find a very subtle configuration of pieces that may start a strong attack with a sacrifice of a bishop against the opponent King. The sequence of movements of the attacking side are really easy to follow and the defender side many times are unable to deal with the aggressive sacrifice.

[Also known as] - Sacrifice in *h7/h2*

[Example] - The next position has the fundamental elements of the *greek gift*:

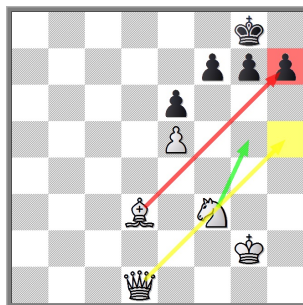


Fig. 9. Greek gift example.

[Context] -The fundamental elements are (for white pieces) a bishop attacking h7, queen on d1 or e2 (to have the chance to translate it to h5), and a knight on f3. Sometimes a white pawn in e5 is necessary to avoid a black knight defending the castled opponent king.

[Problem] - Destroy the black fortress to begin a strong attack against the opponent king.

[Solution] - In the diagram position, 1. Bxh7+ starts the attack. After 1. ... Kxh7 2. Ng5+ followed by 3. Qh5 builds a very strong attack against a undefended king.

[Structure] - This patterns occurs often when the opponent king is short-castled and the attackers pieces are against the king: a Bishop attacking the pawn in "h7", a Knight dominating the "g5" square and a Queen ready to be translated to the king's flank to help the attack.

[Dynamics] - The next diagram shows the sequence to make.

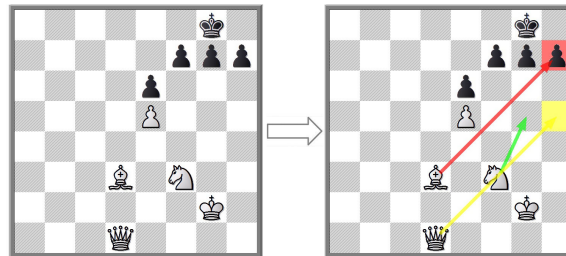


Fig. 10. Dynamics of the greek gift: 1. Bxh7+! Kxh7 2. Ng5+ Kg8 3. Qh5 with a very strong attack.

[Solved example] The next game Colle – O' Hanlon, Nice 1930⁵, arrived to this position (see next figure). Here White gave the greek gift to mount a very strong attack.

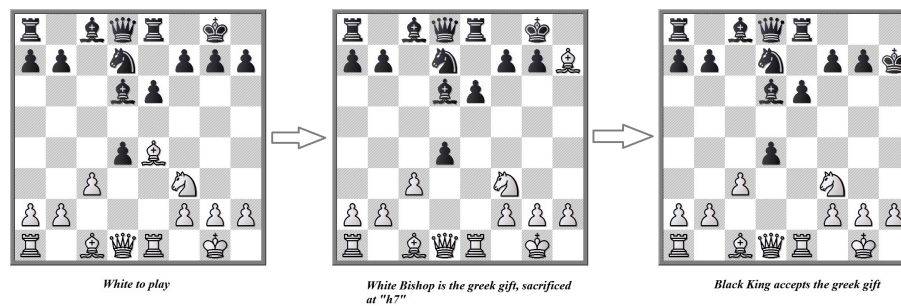


Fig. 11. Dynamics of the greek gift: 1. Bxh7+! Kxh7

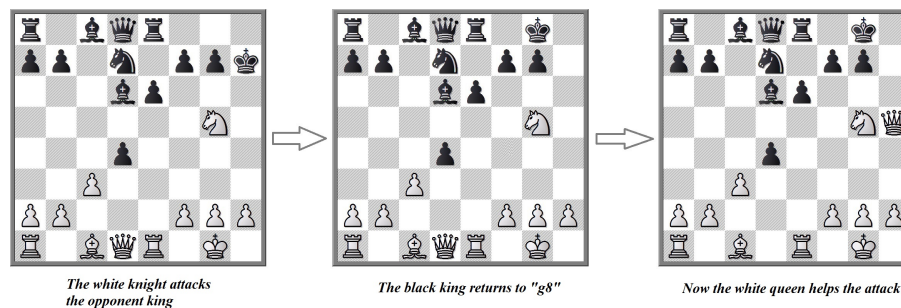


Fig. 12. Dynamics of the greek gift: 2. Ng5+ Kg8 3. Qh5 with a killing attack.

⁵<http://www.chessgames.com/perl/chessgame?gid=1316498>

[Variants] - There is variations of the greek gift, but in any case, the position should have the fundamental elements outlined for success in the attack.

[Known uses] - There are many master games with this pattern. One of the most impressive is **Wells, P. – Dumitrache, Dragos**, Balatonbereny 1997. 1. d4 d5 2. c4 e6 3. Nc3 c6 4. Nf3 Nf6 5. e3 Nbd7 6. Bd3 Bd6 7. O-O O-O 8. e4 dxe4 9. Nxe4 Nxe4 10. Bxe4 Re8 11. Re1 c5 12. Bxh7+! (played after 40 minutes of thinking -see Figure 13) 12. ... Kxh7 13. Ng5+ Kg6 (13... Kg8 14. Qh5 Qf6 15. Qh7+ Kf8 16. Ne4 Qxd4 (16... Qf5 17. Qh8+ Ke7 18. Qxe8+ Kxe8 19. Nxd6+) 17. Qh8+ Ke7 18. Bg5+) 14. g4 (14. h4 f5 (14... Rh8 15. Rxe6+ fxe6 16. Qd3+ Kf6 17. Qf3+ Kg6 18. Qf7+ Kh6 19. Nxe6+) 14... Nf8 (14... Rf8 15. Qd3+ Kf6 16. Qh7 (16. Qe2 Nb8 17. dxc5)) 15. Qd3+ f5 16. Qh3 f4 (16... fxg4 17. Qxg4 Kf6 18. Qf3+) 17. Qh5+ Kf6 18. Re5 (18. Ne4+ Ke7 19. dxc5) 18... Qd7 (18... Bxe5 19. dxe5+) 19. Bxf4 Bxe5 20. Bxe5+ Ke7 21. Nf7 (21. dxc5) 21... Qa4 22. Bd6+ Kd7 23. Qxc5 e5 24. d5 Ne6 25. Nxe5+ Kd8 26. Bc7+ Nxc7 27. Nf7+ Kd7 28. Qd6 checkmate 1-0



Fig. 13. Greek gift in Wells P. - Dumitrache D, 1997r

[Consequences] - Generally this pattern is very well known and builds a strong attack frequently. You must notice all the elements involved. In the game Salgado, I. - Svidler, P. Gibraltar, 2015 ⁶ Salgado didn't have all the elements needed to build a winning attack, so Black defended successfully. In fact, Salgado missed a *zwischenzug* ⁷ from Svidler.

2.4. RULE OF THE SQUARE

“pawns are the soul of chess”. ⁸ In many pawn endgames (Kings and pawns only, all the other pieces were exchanged), the concrete calculation of moves is the main concern of the chessplayers, because they have to be very precise in their calculations. Any miscalculations often means the defeat. The rule of the square is a very clever shortcut to eliminate the need for exact calculations. This maneuver works most of the time in simple pawns endgames.

[Example] In the next position:

[Context] -pawns endings, passed pawns and promotions.

[Problem] - Every pawn has its square when it going to be promoted. The opponent King want to catch the enemy pawn.

[Solution] - If the King is inside the area defined by the pawn, he will catch this pawn. If a King is outside this area he will not catch it. The pawn square is made by drawing a diagonal from the pawn to the eighth rank. Now

⁶<http://www.chessgames.com/perl/chessgame?gid=1783557>

⁷an intermediate move

⁸With this sentence, Danican André Philidor (1726-1795), put the basics of chess strategy.

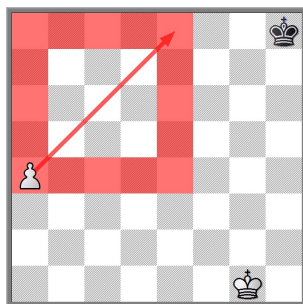


Fig. 14. If the black king stays outside the square of the pawn, the pawn to move is guaranteed to promote without being immediately captured by the opponent king.

imagine a square that encloses the pawn, the queening square and the diagonal (see figure 10).

[Structure] - This pattern occurs in most pawns endings in which all the other pieces are not anymore at the chessboard. It involves kings and pawns only.

[Dynamics] Instead of counting moves if a King can catch an opponent passed pawn, the player can only check if his King is inside the pawn's square. In fact this is a shortcut to calculations at the chessboard.

[Solved example] - During the ACM Computer Championship 1984, last round 4, in Nuchess (2/3) versus Cray Blitz (3/3)⁹, it seemed as if Nuchess would win, forcing a massive tie for first place. In the diagram position, Nuchess played 45. Rxg6?? This is the move which turned a win into a loss, and allowed Cray to clinch its undisputed first. White wins a second pawn, but in the coming pawn ending its material edge is worthless as the white King is too far removed to cope with Black's lone, but distant passed a-pawn (the square rule). William Blanchard of the Nuchess team dejectedly confirmed that this program failed to include the principle of the King having to be inside the square of the pawn to catch it. Of course, Nuchess's search did not extend so deeply that it could see the a-pawn queening. Hyatt said that Cray knew about the square of the pawn rule, but that this was the first time he was aware the principle was relevant to the computer's move choice...¹⁰

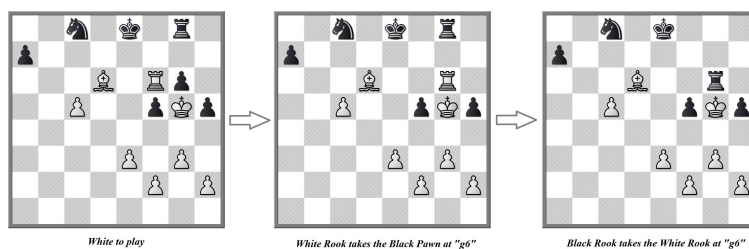


Fig. 15. Sequence of the game Nuchess vs Cray, 1984, After 45.Rxg6?? Rxg6+.

[Variants] - There are a lot of variants of this pattern, but basically encountered in the pawns endings.

[Known uses] - This is a very common maneuver and there are lots of examples in the master chess practice.

⁹1.c4 e5 2.Nc3 Bb4 3.a3 Bxc3 4.dxc3 Ne7 5.g3 d5 6.cxd5 Qxd5 7.Qxd5 Nxd5 8.Bg2 Nb6 9.a4 O-O 10.a5 Nc4 11.Ra4 Nd6 12.a6 Nd7 13.Be3 Nb6 14.Rh4 Rd8 15.axb7 Bxb7 16.Bxb7 Nxb7 17.Nf3 Rd5 18.c4 Ra5 19.O-O Ra2 20.Rd1 Rxb2 21.c5 Nc8 22.Rd7 f6 23.Rg4 g6 24.Rh4 h5 25.Rxc7 Nd8 26.Ra4 Rb7 27.Rxb7 Nxb7 28.Ra6 Kf7 29.Nd2 Nd8 30.Ne4 f5 31.Ng5+ Kg7 32.Nf3 Nf7 33.Nxe5 Nxe5 34.Bd4 Kg8 35.Bxe5 Ne7 36.e3 Kf7 37.Rf6+ Kg8 38.Kg2 Rc8 39.Kf3 Re8 40.Ra6 Ra8 41.Kf4 Kf7 42.Kg5 Rg8 43.Rf6+ Ke8 44.Bd6 Nc8 45.Rxg6 Rxg6+ 46.Kxg6 Nxd6 47.cxd6 a5 48.g4 hxg4 49.Kxf5 a4 50.e4 a3 1.Kxg4 a2 52.e5 a1=Q 53.f4 Qg1+ 54.Kf5 Qxh2 55.e6 Qc2+ 0-1

¹⁰<https://chessprogramming.wikispaces.com/Rule+of+the+Square>

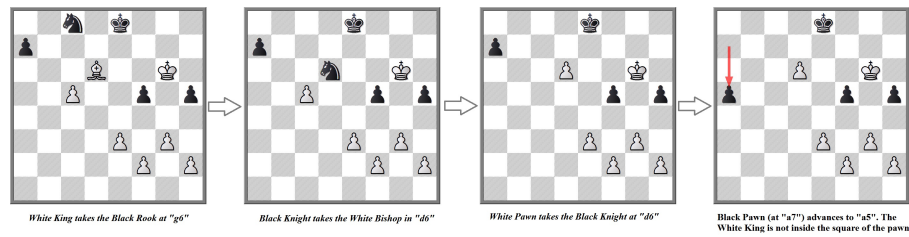


Fig. 16. 46.Kxg6 Nxd6 47.cxd6 a5! and White King cannot catch the black pawn.

[Consequences] - Applying this pattern can save calculations time over the chessboard. Many pawns endings depends on very accurate calculations of future moves and in fact, this pattern si also applied in knights endings. The most simple benefit for a chess player is that he/she doesn' need to calculate long variations in the pawns ending.

2.5. FORK WITH A KNIGHT

There are countless similar patterns, which in many cases represent positions that can be treated in the same way, although superficially seem different positions. In the language of design patterns we can make this generalization. The following position shows a double attack with a knight:

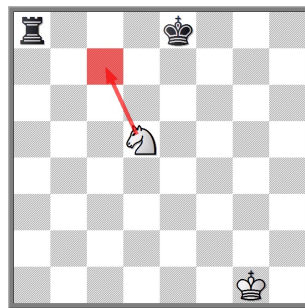


Fig. 17. A typical knight fork.

But this position could be appear in another part of the board (see figure 16):

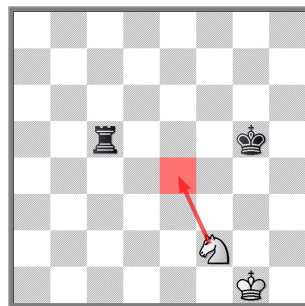


Fig. 18. A different position with the same fork pattern.

2.6. A COMBINATION OF CHESS PATTERNS

Many chess patterns appears in different stages of a very same game. We can illustrate the combinations of them. The diagram shows the different patterns that arise in the game Larsen, Bent–López Michelone, M., *circa* 1973.:¹³.

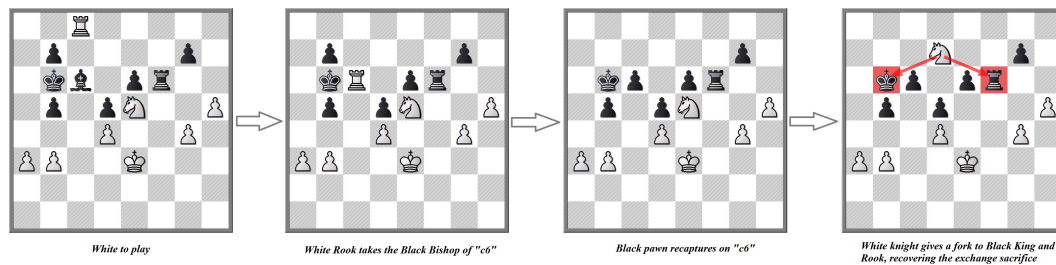


Fig. 20. First pattern (left diagram): removal of a defender (White rook takes the black bishop and square “d7” is no longer defended); Second pattern: A White Knight forks Black King and Black Rook.

The final position shows in fact, another pattern: *The Rule of the square*. Black is unable to stop the advance of the White passed pawn at column “h”.

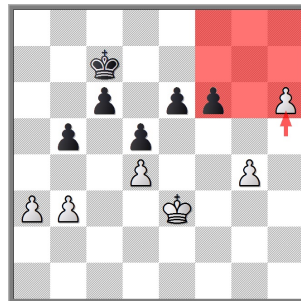


Fig. 21. Last pattern: *The Rule of the square*. In this case, Black can’t stop the advance of the White passed pawn at column “h”.

3. SUMMARY

This article shows how patterns can be applied to the game of chess. We only described some of the most common or popular patterns of chess, but we can add more and more patterns, even some of them who are very complex to use. Also, we didn’t categorize the patterns in any chess or another type of classification. In fact, there are many possibilities to categorize the patterns defined.

Many patterns have been implemented in different forms in the chess engines. For instance, the rule of the square, is also known as the Chebyshev distance (or Tchebychev distance) [Cantrell 2000] or maximum metric,

¹³Larsen, Bent–López Michelone, M., simultaneous exhibition *circa* 1973. 1. d4 e6 2. e4 d5 3. Nd2 Nf6 4. e5 Ne4 5. Bd3 Nxd2 6. Bxd2 c5 7. c3 Nc6 8. Nf3 Qb6 9. Qa4 Bd7 10. Qb3 cxd4 11. Qxb6 axb6 12. cxd4 Bb4 13. Ke2 Bxd2 14. Kxd2 Nb4 15. a3 Nxd3 16. Kxd3 Bb5+ 17. Kd2 Rc8 18. Rhc1 Ke7 19. Ne1 Ba4 20. Nd3 f6 21. Rxc8 Rxc8 22. Rc1 Bc6 23. h4 h5 24. Nf4 fxe5 25. Ng6+ Kd6 26. Nxe5 Rf8 27. Ke3 Rf6 28. b3 b5 29. f3 Kc7 30. g4 hxg4 31. fxg4 Kb6 32. h5? (Grandmaster Larsen missed 32. Rxc6! and Ne7+ winning easily) 32. ... Be8 33. Rc8 Bc6 34. Rxc6+! 34. ... bxc6 35. Nd7+ Kc7 36. Nxf6 Kd8 37. g5 Ke7 38. Ng4 Kf7 39. Ne5+ 1-0

defined on a vector space where the distance between two vectors is the greatest of their differences along any coordinate dimension.

¹⁴.

REFERENCES

- ALEXANDER, C. 1979. The Timeless Way of Building. Oxford University Press.
- AVERBAKH, Y. 1966. Chess Endings: Essential Knowledge. Pergamon Press.
- CANTRELL, C. D. 2000. Modern Mathematical Methods for Physicists and Engineers. Cambridge University Press.
- DVORETSKY, M. 2006. Dvoretsky's Endgame Manual. Russell Enterprises.
- EMMS, J. 2008. The Survival Guide to Rook Endings. Gambit Publications.
- NUNN, J. 1993. Secrets of Rook Endings. Batsford.
- PURDY, C. 2003. C.J.S. Purdy on the Endgame. Thinker's Press.
- TARRASCH, S. 1988. The Game of Chess. Dover.

¹⁴It is also known as the *chessboard distance*, since in the game of chess the minimum number of moves needed by a king to go from one square on a chessboard to another equals the Chebyshev distance between the centers of the squares, if the squares have side length one, as represented in 2-D spatial coordinates with axes aligned to the edges of the board. For example, the Chebyshev distance between f6 and e2 equals 4

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