Neoclassical Chess: a new evolution of the game

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Summary

Due to widespread computer-assisted preparation, the possibility of memorizing opening lines has produced a strong impact in chess (which hereafter we will call "classical chess"). Many chess variants have been designed in the past to solve this problem; but they have not succeeded. They simply have resulted in essentially different games. The objective of this work is to develop a new chess variant which solves the problem of the excessive memorization of the opening phase, while modifying chess to the minimum extent that is necessary, in such a way that its rules, history and legacy are preserved.

We have made a mathematical reformulation of the problem into a "constrained optimization" problem. Admissible chess variants should be very similar to chess: they should start from a balanced position, preserve the legacy of classical chess, and reflect opening preferences of contemporary master play. The constraint of the problem is that there must be enough uncertainty in the initial position. Optimization consists of determining the admissible variant which is "closest" (most similar) to classical chess, among which those that comply with the restriction so that uncertainty about the initial position prevents memorised opening preparation.

The solution to the problem, which we have denominated "Neoclassical chess", is as follows: all rules are identical to chess; the only difference is that the game starts with the position that is obtained after the first three full moves of a game chosen at random from relevant contemporary master practice. Hence, the fourth move by White is the first one that is chosen by the players.

Separately, there is a solution (Neoclassical Black chess) where Black performs the first free move (either the fourth Black move, or the third one in an introductory version). We have developed a computer program and a free application for mobile phones and tablets. There have already been experiences with this new chess: the first Neoclassical chess tournament was held in Madrid on May 9, 2015, and was attended by elite Spanish grandmasters.

In conclusion, we have designed and developed a new variant of chess, which we have denominated Neoclassical chess, which solves the problem of the exhaustion and excessive memorisation of the opening phase in modern chess, while preserving the rules, integrity and legacy of the classical game of chess.

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For more information, please see the websites www.neoclassicalchess.com and also www.ajedrezneoclasico.es (in Spanish).
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Introduction and background

Chess from its origins has been a “quasi-infinite” game, where the combinatorial explosion of possibilities gives rise to so many different positions that playing skill and talent have been more important than memorised preparation for all possible initial courses of the game. Recently a problem has arisen: the growth of opening theory together with ready access to chess software and powerful personal computers have enabled memorised opening preparation to have a strong impact on elite competitions, as well as on competitive professional and even amateur events.

Several variants of chess have been proposed in order to solve this problem. The most relevant among them is Chess960 (“Fischer-Random” chess). Their main limitation is that most chessplayers like chess as it is. These variants are not perceived as “real” chess, as the rules or positions involved are very different from those of classical chess, with the consequence that the integrity, history and legacy of the classical game are all discarded along with opening theory. So we can state that the problem has not been solved, it has just motivated the invention of some different games. Or put differently: the problem has been solved at the cost of renouncing a good part of chess itself.

The bibliography at the end of the current paper allows the reader to verify the reality of the problem and that existing solutions are unsatisfactory, in the opinion of outstanding chessplayers and experts.

Objective

The objetive of the present paper is to develop a new variant of the game of chess that solves the issue of the excessive memorization of the opening phase while preserving the rules, history and legacy of the classical game of chess. We have defined in what follows all the requirements that such a new game should satisfy:

1) It must be a game equal to chess, except in the opening. It must start from an initial position as balanced as that of classical chess and the playing set-up must be as simple as that of chess.

2) It must include and preserve the legacy of classical chess. (2a) All master (high-skill) games of chess are possible instances of the new game (with rare exceptions due to an incorrect opening or lack of competitive relevance), a property which we denominate "backward compatibility” with classical chess. (2b) Likewise, all instances of the new game are also possible games of classical chess (“forward compatibility”).

3) It must reflect the opening preferences of contemporary high-skill human play, with the capacity to evolve and incorporate future preferences through a systematic, non-arbitrary process.

Additionally, we have aimed to modify classical chess in the least possible degree, the strict minimum needed to solve the problem, and to accomplish this in a reproducible, non-arbitrary manner. By accomplishing this objective, we would moderate the influence of the computer on the preparation of the opening phase, which has disproportionally enlarged the rote memorisation component of chess, while fully preserving its major contribution on all other aspects of modern chess.

Origins

Fischer-Random Chess (Chess 960) is an important reference point for the present problem, after which there has been no conclusive proposal, but abundant discussions on possible ways of solution. Bronstein chess is an earlier proposal with important similarities to Fischer-Random Chess, see Davis (2014). Our formulation of the objective of the current work has an important precedent in Pal Benko in the 70's, see Davis (2014): "*The task, then, is to find a minimal change in the rules that would retain as much of the present game as possible and yet eliminate its worst feature, the over-analyzed starting position*". Benko saw a possible solution in Bronstein's chess. In the current paper we carry out the formulation of the "minimal change" to its ultimate consequences, showing that it is possible to preserve the essence of the game and its legacy, including past games and opening theory, in contrast to Bronstein's chess or Fischer-Random chess.

Methods

In order to develop the new game, we have built a logical framework that delineates our objective from a mathematical perspective. The problem has been reformulated as a "constrained optimization" problem within the set of all variants of chess which fulfill the three requirements mentioned above: a game substantially equal to chess, which starts from a balanced position and preserves the legacy of classical chess, and that reflects the opening preferences of contemporary high-skill human play. We now further explain this framework.

In what sense do we "optimize"? Firstly we have defined a concept of "distance" between any of these admissible chess variants (i.e. that fulfill all three requirements) to classical chess, and declare that our objective is to "minimize" such distance, so that the further a certain variant is from classical chess, the lesser the quality we consider it to be.

We also establish a constraint: there must be sufficient uncertainty about the initial position in the chess variant so that the value of opening preparation based on rote memorisation is in practice greatly diminished, as it is very unlikely to be useful: such preparation is progressively forgotten over time.

Note that classical chess is an admissible variant, in fact the only one which is at zero distance from itself (as it is identical to itself), while any other variant is at a positive (larger than zero) distance from it. However classical chess does not fulfill the constraint of sufficient uncertainty: the initial position is a single one, fixed and known beforehand.

Hence the mathematical formulation includes the assessment that classical chess is the most "perfect" (highest-quality) variant among all admissible ones, while it recognises that it does not fulfill the needed uncertainty constraint. As we get "farther away" from classical chess, the uncertainty about the initial position increases, and at some point it is sufficient, so that the problem is solved. Conceptually, the "optimization" makes the departure from classical chess to be the strict minimum, as the more a chess variant resembles classical chess, the better. In our framework, the characteristics of the solution are logical consequences of the defined objective and methods, and give rise to a clearly defined standard definition of the new game.

We also explore, in a mathematical sense, the question of the "uniqueness" of the solution. Uniqueness from a mathematical viewpoint refers to the fact that there is esentially one solution under the logical framework. Only one chess variant within the framework would be the optimal one fulfilling all needed requirements.

Results

Main result

The solution to the problem, that we have called “Neoclassical chess”, is the following: all rules are identical to the rules of chess, except that the game starts on the position after the first three full moves of a game taken at random, just before the start of play, from relevant contemporary chess master practice. Hence, the fourth move by White after the usual initial position of classical chess is the first one that is freely performed in a Neoclassical chess game.

A variant of this solution is “Neoclassical Black chess”, in which the game starts with Black moving first in the position obtained after seven half-moves (i.e. after the fourth move of White in the selected master game), so that the Neoclassical Black game starts with Black’s fourth move. Additionally, we have defined an “Introductory Neoclassical Black” variant, where the game starts after five half-moves, with Black’s third move. The “optimal” number of moves after which the Neoclassical game starts is not arbitrary but obtained as a solution: the minimum number of moves that solves the problem, within the mathematical framework described above.

Note that they are two separate categories of the new game: a "traditional" solution where White performs the first move within the "Neoclassical" game, and another less familiar one, where it is Black who starts. Although it can be argued that in the latter case the game is less similar to classical chess, it has the advantage of compensating Black, who is the first to choose a move within the "Neoclassical" game.

Note also that the solution obtained depends on the definition of distance used. With an alternative definition, a more complex solution is obtained, a “Neoclassical variable-depth chess", which we consider to be merely of theoretical interest[**].

Statistical Analysis

We have obtained the reference collection (database) of master games, with appropriate filters to ensure that they are relevant competitive games with a balanced start, which defines the universe of relevant "contemporary master practice".

For each number of full moves made from the initial position ("depth"), we have obtained the *probability density function* of resulting positions, taking into account transpositions (different move orders arriving at the same position), both in the cases of integer depth (Neoclassical chess) and fractional depth (Neoclassical Black chess). The latter case arises from an odd number of half-moves (equivalent to fractional numbers of full moves). For example, depth 1.5 means that the positions are obtained after the second White move, with Black starting play on its second move right afterwards. Note that depth 0 corresponds precisely to classical chess.

For each depth, we order all positions in decreasing frequency. With this ordering, we have built the *cumulative probability distribution function* ***F***, a statistical term that allows us to state that, for example, after Black’s second move, the 7 most frequent positions cover 50% or more of the games in the reference database. In our formal framework,

[**] This solution significantly increases the complexity of the method without bringing about practical improvements and causes the loss of an important property: the independence of the method with respect to changes in the probability distribution of openings. Similarly, previous depth randomization does not bring about improvements of interest, given the narrow margin with which uncertainty constraints are met as we will see.

the "optimization restrictions" are precisely the conditions that such function ***F*** must satisfy. From the results in the database, we construct the following table (using a concrete, representative database for illustration):

		Cumulative probability distribution function ***F*** (positions sorted from most to least frequent)			
Depth	Position with max. probability	50.0%	66.6%	75.0%	90.0%
0	100%	1	1	1	1
1	24.0%	3	5	6	13
2	11.9%	7	13	19	58
3	6.2%	19	50	78	247
4	5.3%	62	151	244	798

Neoclassical chess: Cumulative distribution function for different depths

The table shows for different depths:

a) In the second column, the probability of the most frequent position (“max. probability”), among those that would be obtained as initial positions for Neoclassical chess,

b) In the third to last columns, how many positions (in order of decreasing frequency) a player should prepare to be assured, with a certain probability, that the initial position obtained is among those he/she has prepared.

For example, at depth 2 a player must have studied 7 initial positions to have at least a chance of 50% that his/her preparation has been useful, 13 for 66.6% probability and 19 for 75% probability. In statistical terms, the formulation of the “restriction” on the uncertainty is expressed as: ***F*** (7) ≥ 0.50 where 7 is the smallest integer that satisfies the equation. Additionally, the most frequent position at depth 2 appears with a 11.9% probability, being the one obtained after the following sequence of moves in algebraic chess notation 1. d4 Nf6 2. c4 e6 (where N stands for “knight”). This number 11.9% includes less frequent move-orders leading by transposition to the same position.

In practice the minimum number of positions, and the degree of assurance of being prepared that players wish to reach depend on the dedication of the players and therefore the level of chess competition. While at this point, an empirical investigation and corresponding experimentation in real play would finally validate the results, note that the jump in the number of positions to be prepared when going from depth 2 to depth 3 is explosive and notable at all probability levels, especially at the most relevant between 66.6% and 75%, arriving at sufficiently high values (more than 50 positions). Also the probability of the most frequent position decreases rapidly (in relative terms) until depth 3, reaching an adequate value around 6%, and stabilizes thereafter. Depth 2 seems to be insufficient for high-dedication amateurs, given the breadth of current preparation. It is clearly insufficient at professional and top-level competition. However, note that depth 3 demands study of no less than 78 initial positions just to get a 75% chance of being prepared for the start of the game. Therefore, we conclude that depth 3 is optimal: the minimum which guarantees that the uncertainty about the initial position is such that makes preparation for a concrete opponent useless in the days or weeks leading up to the game. This depth discourages mechanical memorization, which becomes not only a very difficult feat, but also impossible to maintain, given the ease with which what is memorised mechanically is forgotten, and the

continuous emergence of opening novelties. Note that at depth 4, preparation becomes simply hopeless, but this is achieved at an excessive “cost”, reflected in the unnecessary imposition of style to the players mandated by an additional complete move.

In conclusion, the analysis of this and similar tables constructed with other definitions of "relevant contemporary master practice" convincingly indicates that depth 3 is optimal in Neoclassical chess in the case of the “traditional” category, with initial choice by white.

Statistical analysis of Neoclassical Black chess

In order to study what is the optimal number of moves if Black starts play in the neoclassical game, we construct a similar table for positions that have emerged after a fractional number of full moves (therefore positions after a White move). It would suffice to study the depths 2.5 and 3.5, given that 3 is optimal when White starts. The full table is:

		Cumulative probability distribution function ***F*** (positions sorted from most to least frequent)			
Depth	Position with max. probability	50.0%	66.6%	75.0%	90.0%
0.5	41.7%	2	2	2	3
1.5	19.7%	4	7	9	24
2.5	7.3%	13	27	43	125
3.5	5.4%	33	85	140	437

Neoclassical Black chess: Cumulative distribution function for different depths

In this case, the optimal depth is less obvious than in the traditional case. We believe that depth 2.5 is not sufficient for elite chess and in particular for the level of the Candidates Tournament and the World Championship, given the large scope of current preparation: less than 50 positions at probability levels between 66.6% and 75% are necessary. However up to the level of amateur and non-professional masters, it is most likely sufficient, since their preparation time is much more limited. As we pursue a single standard of play for traditional Neoclassical chess and another one for Neoclassical Black chess, that leads us to propose in the latter case depth 3.5 as the optimal unified standard for all levels of play, including top-level chess, and depth 2.5 for “Introductory Neoclassical Black” chess.

Obtaining the position after the third move (along with the two adjacent Black variants mentioned) relies on the existence of a robust characteristic of the distribution of openings in high-skill practice, found in the course of the present investigation. "Robustness" means that the optimal number of movements (optimal depth) is independent of how we define a master game (the minimum "rating" level of both players) or how we define "contemporary" practice (the last five or twenty years, for example), or which games will be excluded as non-relevant ("blitz", "rapid", “blindfold") within a wide range of reasonable definitions. As we have verified, the phenomenon of the significant "jump" between depths 2 and 3, and similarly between depths 2.5 and 3.5 (as well as 1.5 and 2.5) is also observed irrespective of the parameters that define the reference database of master games, within very wide ranges.

Consequences of the result

One of the most important advantages of Neoclassical chess is that, when preparing a game against a certain opponent specific opening preparation is not useful, or even possible. The only possible preparation is to be aware of the opening preferences of the opponent in classical chess and act accordingly taking into account his style.

The issue is that the probability that a given position appears on the game we are about to play is very low. Even for the most frequent position it is just around 6% and we would have to wait to have played on average more than 30 games to get such a position with appropriate colour. However, if sufficient games are played, the more likely positions will appear, so that it is worth understanding plans, pawn structures, themes and tactical ideas in important opening lines.

In Neoclassical chess, when the number of positions to prepare increases sufficiently, the value of preparation based on rote memorization decreases very rapidly. The surprise is that at very small depths (3 or 3.5 full moves), the reduction in value is so extreme. This is a crucial outcome of the present work.

Another important finding is that the initial positions of Neoclassical chess are mostly those that define today's important openings (Slav, Spanish, Nimzo-Indian), or in other cases one or two moves after them (subsystems within the French and Sicilian). None of those positions excessively conditions a player's style or makes the player finding him/herself carrying out a very specific plan or tactical idea. This is very important for the practical appeal of Neoclassical chess.

Uniqueness of the result

We have explored and established the uniqueness of the proposed solution in a formal mathematical sense. We have shown that Neoclassical chess is essentially the unique solution of the problem in the proposed mathematical framework, understanding that there is uniqueness on the one hand for Neoclassical chess with the usual start by White, and separately on the other hand, for the Black variant. As there are no alternatives that meet the requirements specified in the "objective" described above, Neoclassical chess is shown to be the only alternative to classical chess which, while preserving the integrity and legacy of chess, solves the problem of the exhaustion and excessive memorisation of the opening.

Software applications

We have implemented the solution as a computer program and free application for mobiles and tablets, which can be downloaded from the three major platforms (Apple, Android/Google and Windows), with the name “Neoclassical Chess: Basic”, as well as an application for education and training, which is also free: “Neoclassical Chess: Schools”[††]. Finally, we have also developed a more elaborate application, containing richer data and the Black variants: “Neoclassical Chess: The Suite”. The application provides the initial moves and the initial position for the players to place on a physical Board and start play. The chess pieces are placed on the board in the initial position indicated by the application and play begins. Therefore, the requirement of operational simplicity is also satisfied. See the attached figure as an

[††] The current version of the "Neoclassical Chess: Schools” app contains a smaller number of opening lines than the main app, the better-known openings in school chess and only the most important chess master openings. We believe that the most appropriate methodology is to combine this in the future with small depths in the initial levels of "Neoclassical" school training.

example. Also, we are developing a Neoclassical Chess Manager software, now in its last stages of development, which allows organizers and arbiters to easily conduct neoclassical chess tournaments.

Experiences

Neoclassical chess has already been put into practice in several tournaments. The first was held in Madrid on May 9, 2015, and was attended by the Spanish chess elite. It was won by Grandmaster (GM) Iván Salgado, followed by GM David Antón and GM Francisco Vallejo-Pons. Simultaneously an amateur tournament was held with FIDE rating over 2000. The third one was an Open tournament held in Madrid on 19 July 2015. Grandmasters and masters who have played Neoclassical chess have highlighted the interest of this new game and many believe that it can help revitalize chess. Many amateurs find it fun and instructive. Most have had the opportunity to play positions they had never played before. Neoclassical chess games where chessplayers have faced new positions have been particularly instructive for them.

Discussion

Precedents of Neoclassical chess

We have analyzed the most important chess variants that have been proposed to date and which share a motivation similar to ours, including Chess960, which happens to be the main reference with which to compare Neoclassical chess. We have performed this analysis in relation to our objective and methodology. We have thus found that all other variants are burdened by some crucial limitation, and that they do not achieve the proposed objective.

Schiller (2011) writes a critique of Chess 960 as a solution to the problem, and makes a suggestion that is valid for tactical training and as an alternative form of chess (based on sharp balanced positions and gambits), but which is insufficient as a general method of play or evolution of chess. Also Lakeland (2013), with a proposal aimed at the computer and allowing handicaps. There is a lack of a general conceptual framework and criteria to choose the proposed depth.

Dvoretsky, in Kasparov (2007, p.380) makes a tentative proposal where a pawn from each side would be chosen at random and both would be advanced one step. This suggestion is put forward without too much conviction ("half seriously, half-jokingly"), but shows both the extent of the concern by its author and the direction in which Chess 960 should be improved and has the merit of specifying unambiguously the mechanics of play, which is unusual in other contributions.

In Giddins (2012), in a Chessbase online debate, he brings forward a successful debate on the exhaustion of chess (initially in relation to the excess of draws) with reader feedback, where some participants suggest opening randomization as a possible solution. This has also been suggested in the past on informal or unpublished reviews, although there has been no conclusive progress due to the apparent arbitrary nature of how to perform this randomisation[‡‡]. While this does not specify the method of play, it is very similar to an element of the Neoclassical

[‡‡] The identification of the problem of the exhaustion of the opening has been made by many publications and players in the past. Some authors have gone somewhat further, considering the possibility of "drawing lots" on the opening. As a result of the celebration of the first Neoclassical tournament in May 2015, also several participants, including several elite players or strong amateurs mentioned to the authors that they had considered already "drawing lots on the opening" as a solution. Although they had not published it, the fact that players that had not been involved in the project had this idea, as well as many other players

chess, although the randomisation of the opening is in fact only a means; the adequate method turns out to be, as we have seen, to randomise over a representative collection of high-skill (master) chess games.

These various proposals fulfill conditions only partially (except condition 3, which is not verified by any of them except Neoclassical chess, while other conditions, the objective and the restriction are fulfilled by several among the proposals). This also strongly suggests that Neoclassical chess, which verifies all of them is the solution: it meets all conditions, the desired objective and the restriction. The following table summarizes how all proposals comply with conditions, objectives and constraints, (compliance is signalled with an "X" mark).

	0	1	2a	2b	3	4	5
Bronstein's chess, Chess 960	X	X	X				X
Schiller (2011) and Lakeland (2013)		X		X			X
Dvoretsky (2007)	X	¿?		X		X	¿?
Giddins (2012) and readers "Drawing lots on the opening"	¿?	X	X	X			X
Neoclassical chess (2015)	X	X	X	X	X	X	X

Compliance by several chess variants of desirable conditions, objective and constraints

Meaning of columns:
0: Detailed specification is provided; 1: Equal to chess except in the opening, and with a balanced initial position; 2a: Backward compatibility: all master games of chess are possible instances of the new game (with rare exceptions);
2b: Forward compatibility: all instances of the new game are also possible games of classical chess; 3: It reflects the collective preferences in the opening of contemporary human high-skill practice; 4: Optimization or minimization (designed to be as similar to classical chess as possible); 5: Constraint: enough uncertainty in the initial position.

participating in Giddins (2012), confirms that it has probably been considered by many chess players. Thus the key question to answer becomes how to actually perform this process, and what is its claim of superiority over all other methods, so that a single standard of play can be developed. Also, the authors have known from Löffler (2015) that this possibility was also considered by the former world champion Kramnik. Subsequently he suggested other changes to chess of different nature (forbidding castling before a certain move), although it is not clear if with full conviction. This confirms that the approach of Neoclassical chess is correct, in particular giving answer to the problem of how to draw lots on the opening in the most satisfactory manner. The fact that is grounded on a principled logical foundation and it is the unique solution that fulfills desirable conditions, objectives and constraints is also key.

Neoclassical chess for amateurs, professionals and elite players: an "Over-The-Board" game

The most important impact of Neoclassical chess and the root cause of its beneficial consequences is that it reinstates chess as a game to be played over the board. That is, as a real-time intellectual and sporting challenge that is "non-predictable": its character as a "quasi-infinite" game is restored. As a result of this, a radical impact occurs on the study of the opening, with multiple benefits for the chess world. Among them, an increase in the proportion of the game that is played "over-the-board" (OTB), therefore increasing public interest on elite chess competitions. Our analysis indicates that Neoclassical chess can improve the quality of life of a substantial number of professional and elite players, and also the enjoyment of many amateurs during the limited time they have available to devote to the game. As short-term rote memorization of opening variants becomes a sterile exercise, valuable time is saved that can be dedicated to playing chess instead of studying it, or to other activities.

Neoclassical chess in schools

Neoclassical chess may increase the already well-established benefits of chess in schools once the initial learning phase is completed, after which the opening naturally becomes a subject of study. The reason is that Neoclassical chess rewards much more the skill and talent for pattern-recognition, which has a positive impact on intellectual youth development, rather than rote memorisation, whose usefulness is increasingly questioned in the digital era.

Classical versus Neoclassical chess

While Neoclassical chess is an alternative for the competitive chess of the future, both Neoclassical and classical chess can coexist, complement and reinforce each other, enriching the world of chess.

Conclusions

In conclusion, we have designed and developed a new variant of chess, which we have denominated Neoclassical chess, which solves the problem of the exhaustion and excessive memorisation of the opening phase in modern chess, while preserving the rules, integrity and legacy of the classical game of chess.

I will conclude by saying that Neoclassical chess is not designed to replace classical chess, or to be a better game. It does not even pretend to be a different game. On the contrary, I am convinced that there is no better intellectual game and sport than chess, and that with this small modification to the way the game of chess starts, we can escape the exhaustion of the opening phase without renouncing chess itself.

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