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THE SECOND GENERATION  
OF PLAYING PERSONALITIES  
IN LUCASCHESS 9

## 1. LOOKING AT THE PAST: THE FIRST GENERATION

The latest release of the well known chess gui **LUCASCHESS** contains a new set of "playing personalities" that I have, maybe a bit pompously, called as "second generation". The first generation, that currently is working in v8.08 and older, has finally expired its time: I have always intended it as a first, fully functional though, attempt but I have always known that there were some not-so-little problems that needed to be fixed: I and **LUCAS MONGE** (the main author of this wonderful chess program) have always agreed that an improvement was necessary, sooner or later.

The 1gen (from now on I'll use this jargon to mean the first generation of personalities) basically has these following features:

- 1)all personalities are based on the old but effective engine **greko 7.1**, purposely (and kindly) modified by its author **VLADIMIR MEDVEDEV**, who actually has helped me a lot with his ideas on how implementing a nps limiter to a chess engine and also how handicapping an engine properly.
- 2)range of playing strength varying from 1390 (1gen "oleg") to 2120 (1gen "raul").
- 3)a common tendency to lose games on time (even in won positions), more marked when the value of nodes per second is fairly below 1000.
- 4)a common tendency to play weakly even the easiest basic endgames.
- 5)different playing styles according to these factors:

- hash tables (1-1024 MB): amount of RAM used by the engine to store various data; the larger it is this number the *faster* the engine will be, and therefore stronger too though actually this issue is much more complex and the previous sentence is really a rough oversimplification.
- multi pv (1-256): number of principal variations that the engine will calculate; the higher it is this number the more precise the engine will be but at cost of a lesser depth but once again this is an oversimplification.
- nodes per second (1-999999999): number of nodes per second; this value represents the speed of the engine to make calculations and it is absolutely independent from the hardware, therefore each playing personality will have the same strength in different computers (**LUCASCHESS** is the only gui able to ensure that)!

Naturally the higher it is this number the stronger will play the engine because it goes deeper in its analysis.

You might wonder what is a node? Chessly speaking, a node is a specific unique position that an engine has evaluated in all its aspects and, if worthy, stored.

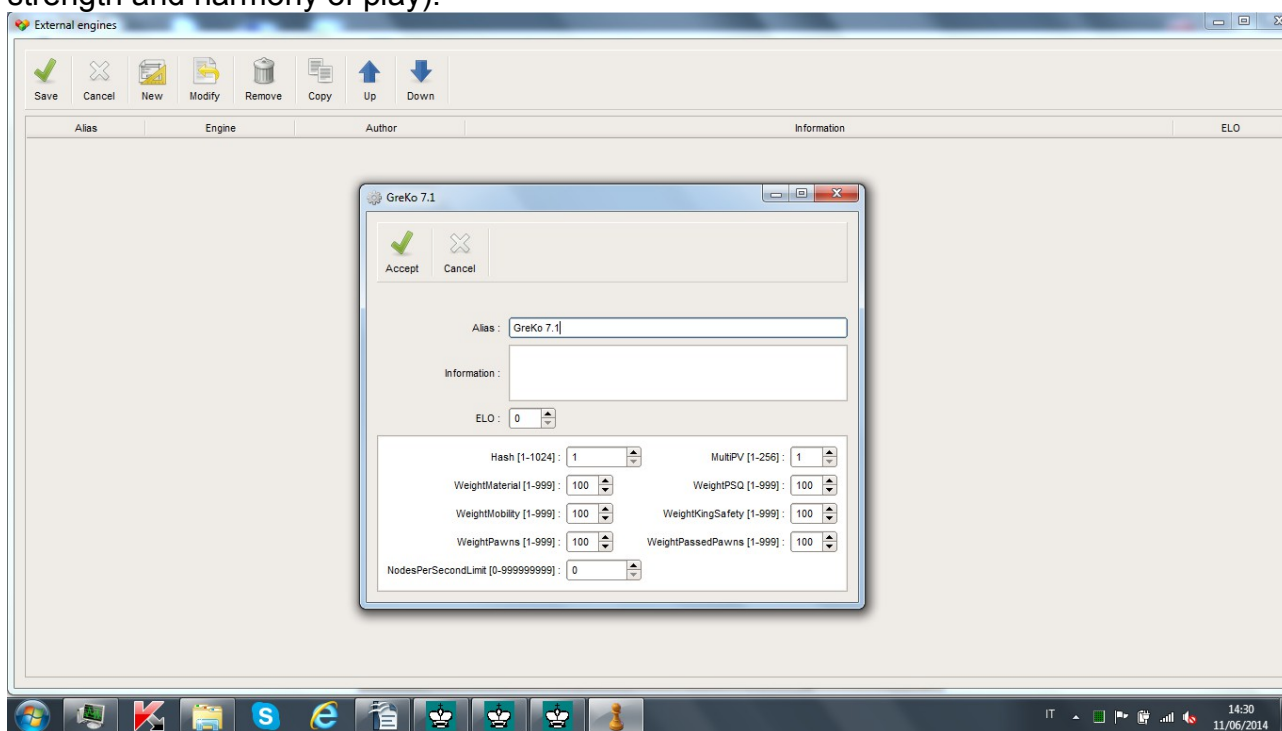
- material (1-999): a multiplier to make the engine more or less materialistic; default value is 100, therefore lower values make the engine more "speculative", higher values instead make the engine more eager to grab pawns and pieces, often neglecting positional factors.  
Materialism and strength are related in a very complex way, that I'll try to explain in a followin chapter
- positional tables (1-999): a multiplier to make the engine more or less positionally "orthodox"; most engines use internal representations of the board to assign a value to each type of piece for each square, simulating human wisdom not to put knights close to rim, to place rooks on 7th raw if possible and so on...  
As usual default is 100.
- mobility (1-999): a multiplier that affects the evaluation of the mobility (and therefore

activity) of both sides; being 100 the default value, higher values lead the engine toward positions where its pieces have large mobility while lower values make the engine's play more "static".

At very high values, **greko** tends to become a "grinder": it tries to maximize its mobility but also to suffocate its opponent, by limiting its mobility.

- king safety (1-999): a multiplier that modifies the behaviour of the engine about the safety of its king and opponent's too; as usual the default value is 100. Higher values force the engine to be more cautious, lower values naturally get the opposite behaviour.
- pawns (1-999): a multiplier that affects the engine's behaviour about pawns, and mainly the pawn structure; the default value is naturally 100. Naturally higher values lead to more solid pawn structures, while lower values the opposite.
- passed pawns 1-999): a multiplier that modifies the tendency of the engine to create or keep one or more passed pawns, even neglecting other factors. Once again 100 is the default value, while with higher values the engine will crave passed pawns or will avoid more and more any passed pawn in case of lower values.

Apart from any consideration about hash tables, multi pv and nodes per second, most users might believe that the following one is the best set of parameters (at least in terms of strength and harmony of play):



well, I'd say yes and no!

Sometimes the programmer simply doesn't have enough time to play thousands of test-games (with different set of values) to decide what is best.

It is not rare, not only with **greko 7.1**, that a slight change in the values might determine a certain improvement of results!

The truth is that most programmers look for the best compromise among strength, precision and harmony of play, and that means that not rarely something must be sacrificed here and there.

In our case, as **greko 7.1** has been used to generate a bunch of playing personalities, the priority is neither certainly the absolute playing strength (as most users of **LUCASCHESS**

are beginners or at most masters, so who cares to play against monsters above 2700???) nor millimetric precision (instead a certain amount of imprecision is welcome, as it simulates human blunders).

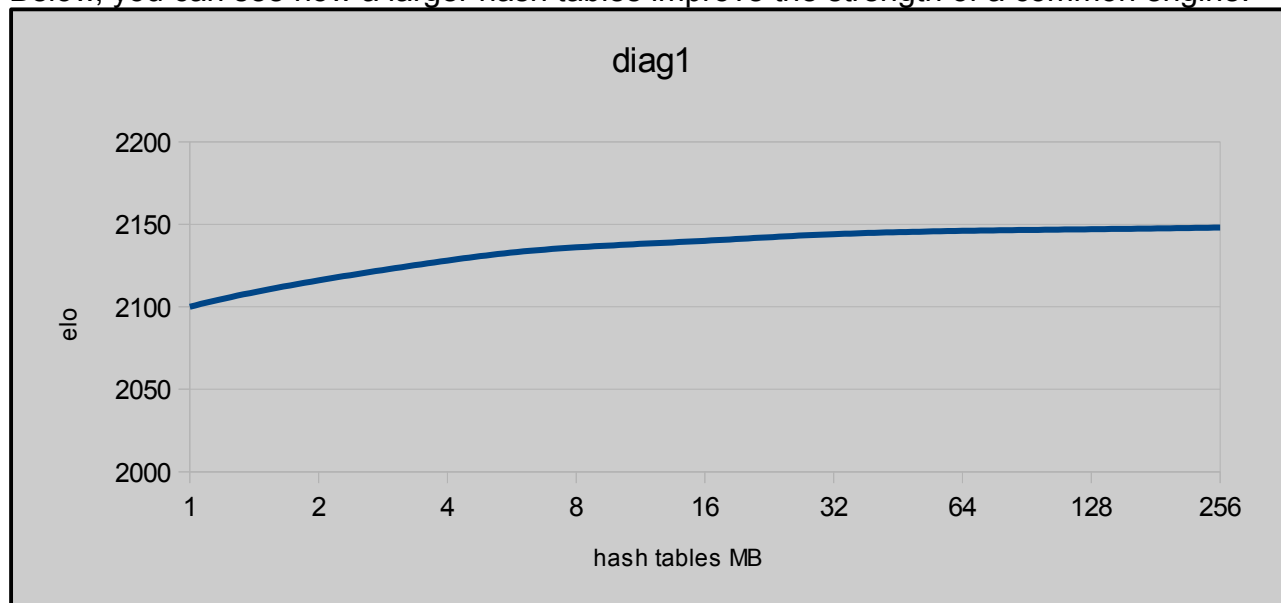
Therefore my target, when I decided to start creating 2gen, was the highest variety possible!

I felt that by **greko 7.1** I wasn't able to simulate all possible nuances of human-like play. That's why 2gen features four new more sophisticated engines: **greko 12**, **greko 9.8**, **hamsters 0.5**, **amyan 1.62**, **deep toga 1.9.6**, **fruit 1.5** and **gambitfruit 4bx** (and likely other engines will be added in the future, almost surely some **glaurung** that I haven't chosen yet, maybe the 2.1).

On this occasion, I wish to thank infinitely **ANTONIO DIEGUEZ (amyan 1.62)**, **ALESSANDRO SCOTTI (hamsters 0.5)** and **VLADIMIR MEDVEDEV** (various releases of **greko**) to let me use their engines to create more sophisticated playing personalities: their engines are not open sources' ones, so it is a great deal of kindness that they give their permission to use their creatures without earning a penny (as, after all, everyone is involved in the development of **LUCASCHESS**).

## 2. CORRELATION (STRENGTH/SEARCH PARAMETERS) AND TRENDS IN GREKO 7.1 AND OTHER ENGINES

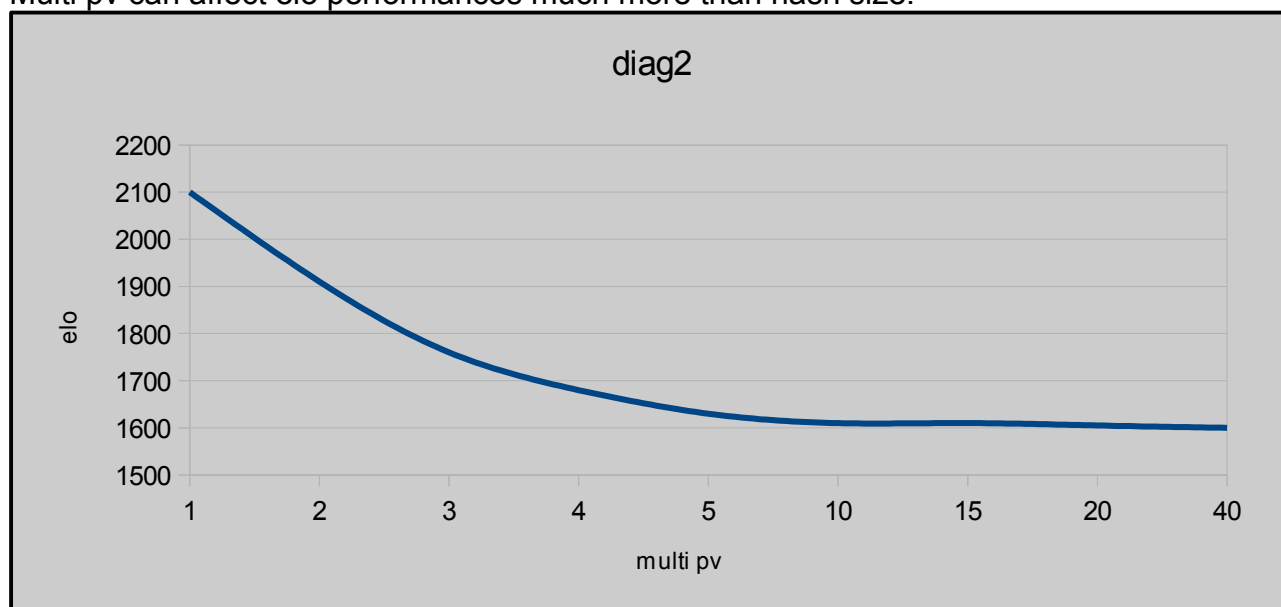
Below, you can see how a larger hash tables improve the strength of a common engine:



(based on 1200 test-games against other engines, timing 10+0, where **greko 7.1** is set at 2000 nodes per seconds and all other parameters as default).

As we might expect an increase of size of hash tables results in a increment of performances, that nevertheless becomes smaller and smaller (for other engines, it even happens that a too big value of hash tables leads to a worse performances, but I'll not discuss here about this subject).

Multi pv can affect elo performances much more than hash size:



(based on 1200 test-games against other engines, timing 10+0, where **greko 7.1** is set at 2000 nodes per seconds and all other parameters as default).

Commonly a chess engine has several "mechanisms" for discarding stupid or useless moves, that otherwise will slow it down; but as usual there is a compromise between the need for speed and the need for precision, and the more advanced are these mechanisms the less likely is that a good move gets discarded.

When we increase the number of principal variations that the engine is forced to watch, we

artificially let it to discard less; the issue is very complex and, after all, it is not the main subject of this lecture.

The problem is that, unfortunately, if the engine has to calculate with more "attention" a wider range of moves, it will at the same time be forbidden to reach an higher depth.

Precision or depth, then?

Both factors surely increase strength but they go toward opposite directions; the combination of these contrasting elements results in the diag2.

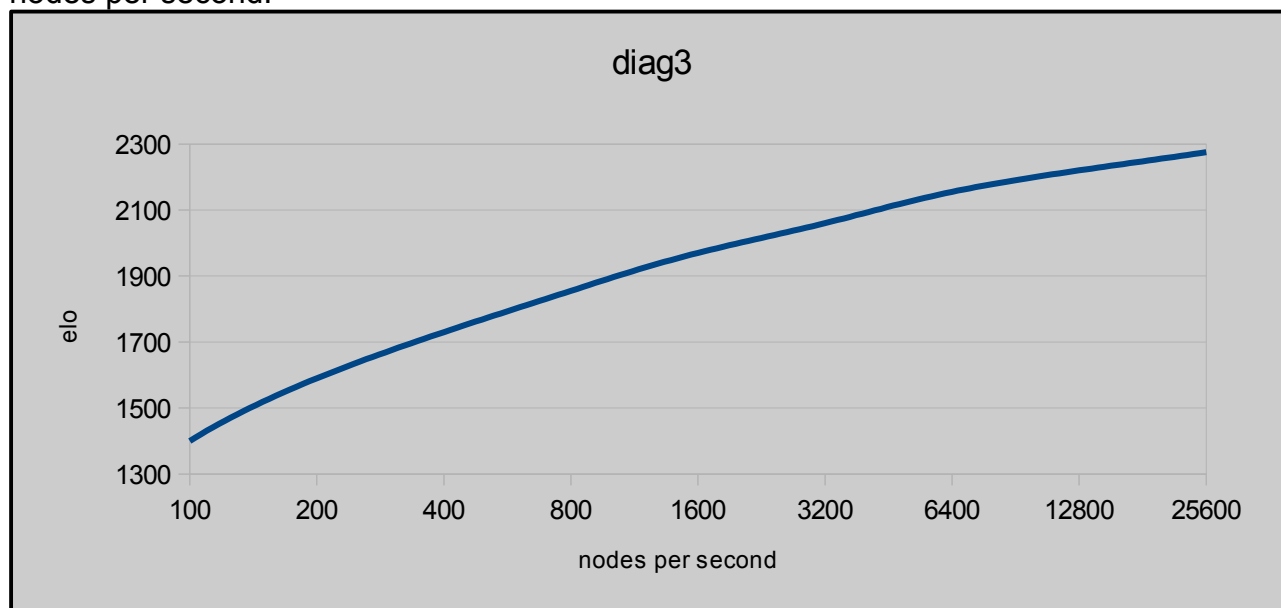
As a rule, multi pv=1 is always leading to the best elo performances because the built-in algorithms of the engines are usually more than sufficient to limit the possible mistakes due to missed hidden and difficult resources of the position.

That applies to all engines, in all conditions (long or short time controls, with or without increment).

But there is a region of the diagram where, when the speed of the engine for each principal variation is so low that doesn't considerably affect the depth reached, then the precision becomes the dominant factor and the engine doesn't lose strength when multi pv is increasing, instead it starts gaining elo again!

A typical chess position may have from 30 to 50 legal moves (sometimes much less, sometimes even more); practically, when multi pv=50 or more, it happens that no "extra precision" is artificially added to the search (compared to multi pv=1) and the graph gets horizontal (stable elo performances).

As a rule, the dominant factor to strengthen or weaken a chess engine remains its speed, and in case of **greko 7.1** included in **LUCACHESS** I am referring clearly to the number of nodes per second:



(based on 1200 test-games against other engines, timing 10+0, where **greko 7.1** is set at variable nodes per seconds and all other parameters as default).

The reason of this trend is simple and obvious: the higher is the speed of an engine the deeper it will go in the search, and the likelihood to discover better resources in the position becomes higher and higher.

Though I have not run specific tests about, I can also assert that in all engines when involved in games against human players, a little dose of materialism often increases performances; but incredibly the same phenomenon can be observed if we let the opposite (values of material slightly below 100, for **greko 7.1**).

I may try to give empiric explanation of that: generally, engines are better than humans of comparable strength in defending worse positions but also they are more ruthless in

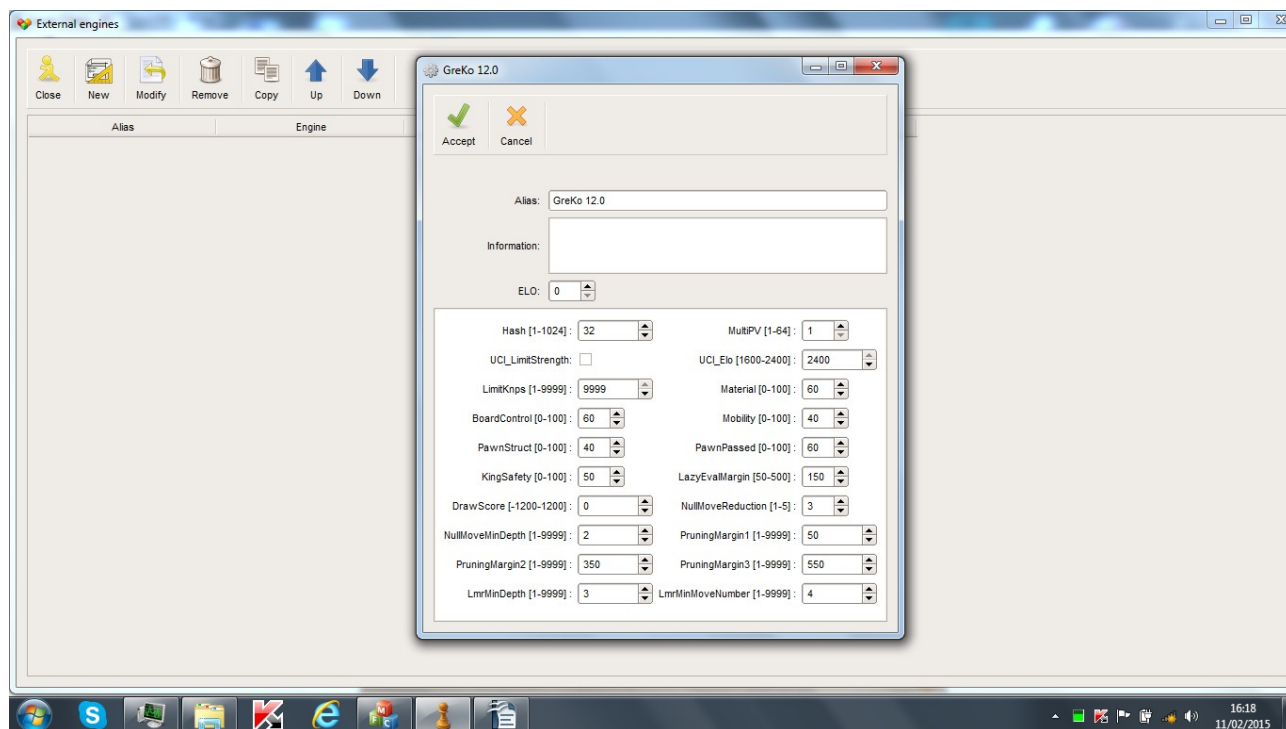
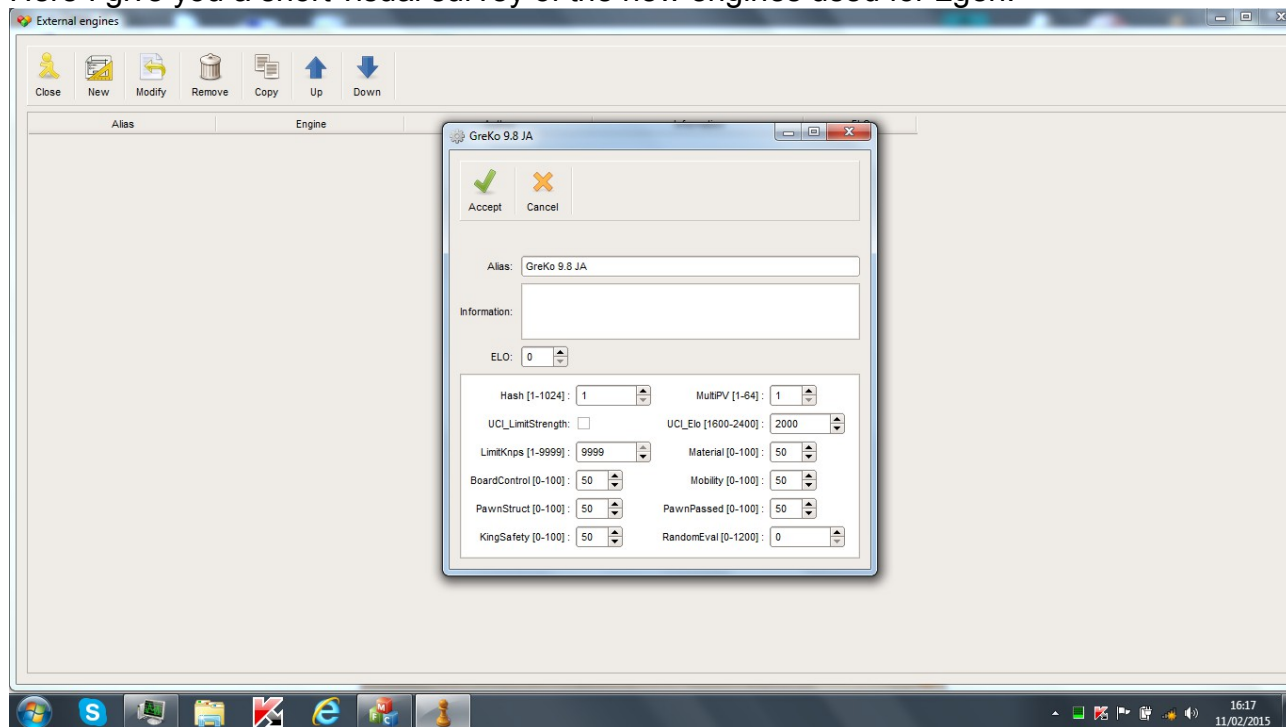
punishing blunders.

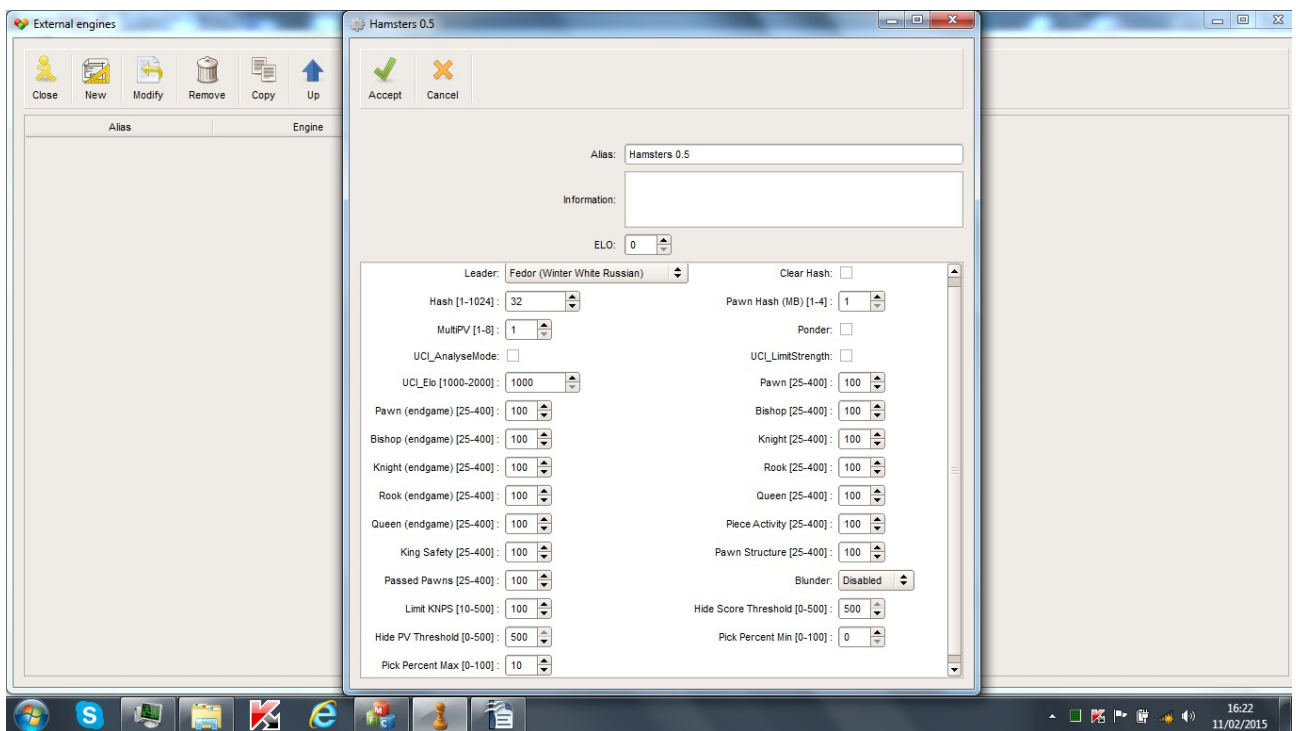
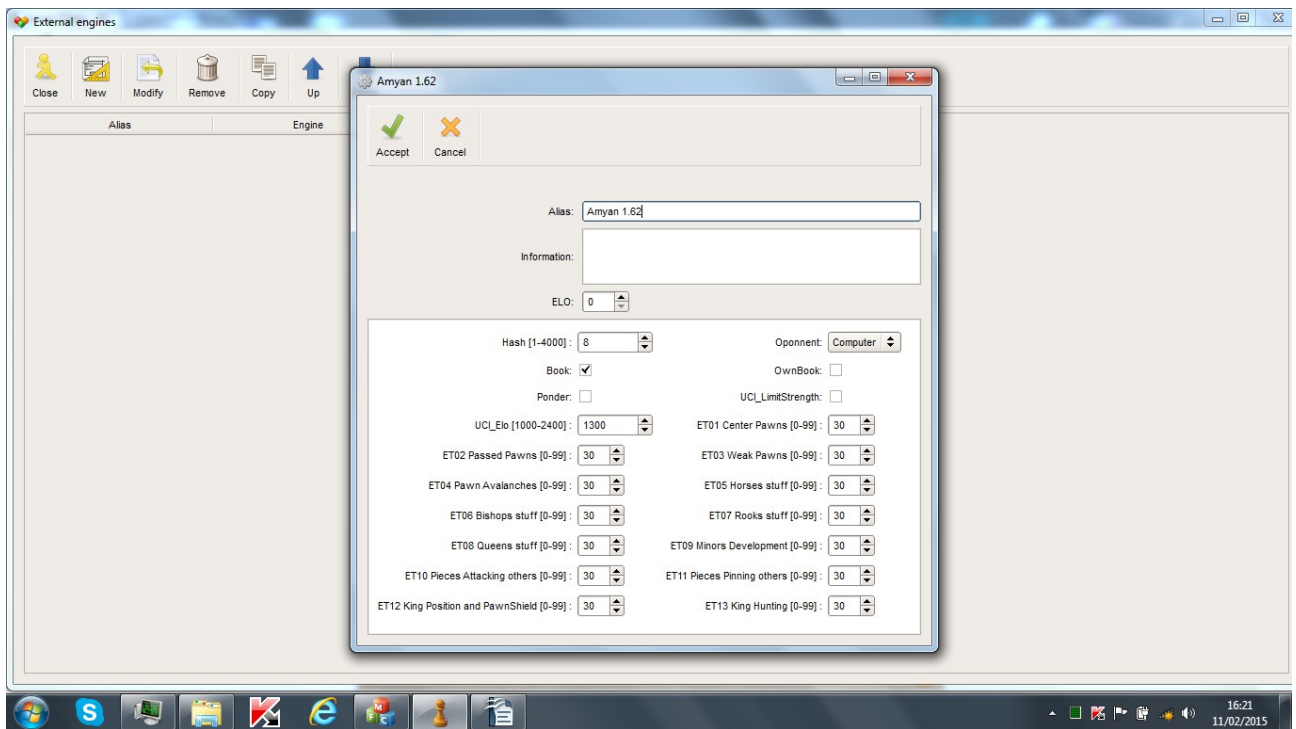
That's why an engine generally is able to capture a pawn or piece that we humans might call "poisoned": engines have no fear at all, and if they succeed to survive to the manoeuvres of the human player after a "brave" capture then they will win the game. But also an engine with little materialism (not too little obviously) is often more inclined than normal to sacrifice material for semi-speculative reasons: again they have no fear and it is not easy to defend for human players.

To a large extent, I can say that values of materialism from 85 to 115 (in **greko 7.1**) don't cause a loss of playing strength, instead it is even possible to observe some gain.

Similar considerations can be said about other parameters like mobility, king safety...

Here I give you a short visual survey of the new engines used for 2gen:





most items are self-explanatory...



### 3. THE FUTURE IS HERE: THE SECOND GENERATION

As I have already said, my main target when I started working on 2gen was to obtain:

- more variety in playing styles and also some individual nuances
- more human-like play
- wider range of strength
- higher number of personalities

First of all, I needed a semi-quantitative test to prove that the desired targets will be reached so I imagined this kind of test-game:

- I play white, the engine will play black
- I will play, no matter what the engine does, 1.h3 as my first move, 2.d3 as second move and 3.c3 as third moves so that all personalities will play according to their style and knowledge (provided that any opening book gets "bypassed" very early)
- time control 10+0

I have considered seven personalities for each "generation", with very comparable strength; the results are listed below:

engines 1gen	moves	used time	engines 2gen	moves	used time
oleg (1390)	1.h3 Nf6 2.d3 Nc6 3.c3 e6	1:05	hellen (1350)	1.h3 d5 2.d3 c6 3.c3 a5	2:08
umberto (1510)	1.h3 Nf6 2.d3 Nc6 3.c3 e6	1:04	ferenc (1510)	1.h3 d5 2.d3 e5 3.c3 Nf6	0:40
ferenc (1630)	1.h3 Nf6 2.d3 Nc6 3.c3 e6	1:22	zoran (1600)	1.h3 d5 2.d3 e5 3.c3 Nd7	0:29
goran (1760)	1.h3 Nf6 2.d3 Nc6 3.c3 e5	1:19	boris (1750)	1.h3 d5 2.d3 Nf6 3.c3 e5	0:20
lars (1860)	1.h3 Nf6 2.d3 e6 3.c3 Nc6	1:17	adam (1870)	1.h3 d5 2.d3 e5 3.c3 Nc6	0:32
diana (1970)	1.h3 Nf6 2.d3 Nc6 3.c3 e6	1:15	lajos (1990)	1.h3 d5 2.d3 Nf6 3.c3 Nc6	0:40
raul (2120)	1.h3 Nf6 2.d3 Nc6 3.c3 e6	1:18	greta (2130)	1.h3 d5 2.d3 Nc6 3.c3 e5	0:40

As you see, 1gen always answer 1..Nf6 and as a second move there is only a choice between 1...e6 and 1...Nc6; naturally, if we extend this test to further moves, we will notice increasing differences but it is a proven fact that 1gen doesn't have great variety in the approach to most positions.

Time usage is quite homogenous too.

On the contrary, 2gen always answer 1...d5 but already from the second move onwards they show a much superior variety; also time usage is more varied (compare the superfast 2gen-boris with the very slow 2gen-hellen ).

Both in terms of mistakes and highly deep "manoeuvres" and "plans", 2gen shows a more advanced and human-like behaviour, even in low-rated personalities.

I have tried to obtain:

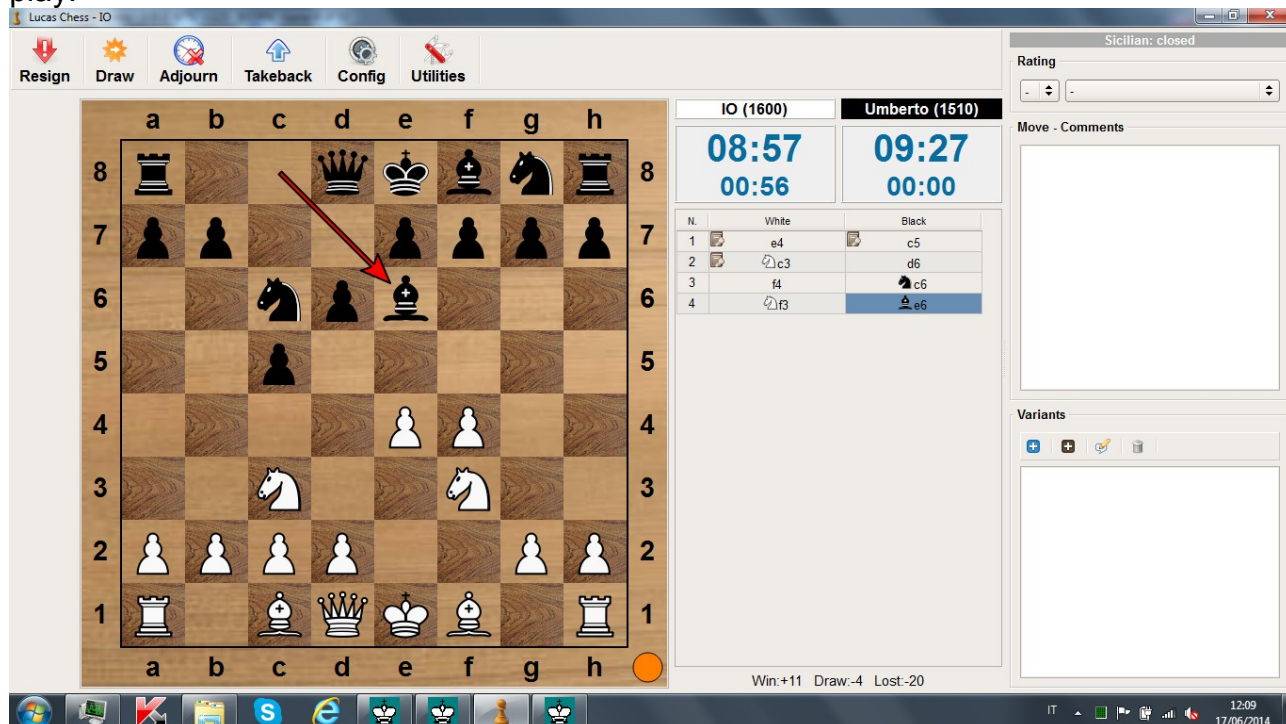
- a substantial reduction of the frequency of stupid and absolutely non human-like moves
- a substantial improvement on the quality of play, independently from elo rating

While the second issue was not too difficult, provided that the new engines used for 2gen are clearly superior in all their aspects to **greko 7.1** (and therefore their play too), the first one was instead a very difficult task.

After several thousands of test games, I have learnt the behaviour of 2gen's engines (yes, every chess engine has its own soul!).

I believe the result is very fine and, immodestly, likely the closest "thing" to the actual human play you can get with a playing software; naturally everything can be perfected and 2gen is no exception but once again **LUCASCHESS** overtakes all its rivals, commercial ones included...

Let's see now some test-games; to start, let's consider what has been improved in opening play:



4th move of 1gen-umberto is really odd and I seriously doubt that any 1510-rated player will ever play it (for several reasons: the semi-threat 5.f5, the fact that 4...Be6 attacks nothing and pin nothing, the fact it decreases black elasticity as his dark-squared bishop must fianchetto forcedly to develop decently quick but then the f5 advance becomes even stronger and so on...).

The problem is that **greko 7.1** uses some piece-square tables where the development of the bishops on third ranks is somehow overvalued (actually newer **grekos** have a better understanding of the position and these moves never occur or almost never).

Let's see how a 2gen with 1500ish elo (2gen-ferenc) instead behaves:



4...g6 is a much better choice, maybe the best in this position (though most players will

play 4...Nf6 here).

Now let's migrate to the middlegame; here I face 1gen-*albert* (1840):

French: Tarrasch, Leningrad variation

Rating: -

Move - Comments

Albert (1840) 03:21 00:00

IO (1600) 03:19 00:12

N.	White	Black
1	e4	e6
2	d4	d5
3	c4	f6
4	e5	fd7
5	d3	c5
6	c3	c6
7	e2	cx4
8	cx4	b6
9	O-O	b4
10	b1	e7
11	a3	e6
12	d3	O-O
13	c2	h6
14	f3	d7
15	d2	c7
16	h7+	h8
17	b4	

Win:+25 Draw:+9 Lost:-6

14:16 17/06/2014

1gen-*albert* is supposed to be a decently strong player (about 1840) but Bb4 is a very ugly move that no good club player would ever play: it ruins queenside pawn structure and moreover the resulting b4 pawn is likely to be doomed sooner or later; there is a bitter combination of both positional and tactical misconceptions by 1gen-*albert*.

1gen-*albert* actually can perform (more or less) 1840 in a fide competition against human players, due mainly to its ability to play without fear and tiredness for hours but its play is somehow weaker than we might expect from a human player with such an elo.

Ok, beginners could not understand those nuances and so they could consider 17.Bb4 as perfectly acceptable; and indeed we might tolerate 17.Bb4 from a 1500-rated player, but certainly not from a 1840!



In the same position 2gen-*bill* (about 1840) chooses:



the much more reasonable b4, conquering space on queenside and inviting black to enclose the bishop in h7 (17...g6?? 18.Bxg6 fxe6 19.Qxe6 with devastating attack).

To end our discussion, let's consider a very basic endgame that even the worst beginner knows how to win:



1gen-*carlos* still has 17 seconds to deliver checkmate but has no idea how to do it (promotion occurred at move 59 and after 20 moves white is still struggling): clearly unacceptable for a player supposed to be a 1770.

Even sadder situations happen when a 1gen personality plays with only a rook or the two bishops.

Instead all 2gen personalities stronger than 1500 (and most of them below too) can win basic endgames, even with one minute left remaining or less; you can try it by yourself.

## 4. 2GEN IN ACTION

Let's watch a bit of action now: as a test I have played a game (hundreds to be sincere) where I just replay the moves of an android app against a 2gen, in order to feel what was going well and what was going wrong in my project.

Here I show a game, with 15+0 timings, where white is 2gen-*violeta* (approx elo 1780) while black is a well known free chess app (set at strength 50%).

Let's follow the game (the scoresheet helps a lot):

The screenshot shows a chess game in progress. The chessboard is displayed with files h-a and ranks 1-8. White is to move. A red arrow points to the square b6, indicating a capture. The move list on the right shows the following moves:

N.	White	Black
1	1f3(+0.12)	1f6
2	c4	c6
3	g3	d5
4	g2	f5
5	cx d5	cx d5
6	b3	b6(-0.01)
7	xb6	axb6
8	c3	e6
9	d4	g4
10	db5	d7
11	h3	f5
12	d4	g6
13	d3	c6
14	b3	b4
15	d1	d6
16	e3	c7
17	d2	hc8
18	f3	e8
19	a3	c6
20	b5	b8
21	xb6	f8

The timer shows White at 02:09 and Black at 01:01. The status bar indicates the opponent is violeta.

though all engines like enough 6...Qb6, I think that no human player would allow to get his pawn doubled here, without any clear compensation.

The screenshot shows the chess game after White has captured the Black pawn on b6. The chessboard is displayed with files h-a and ranks 1-8. White is to move. The move list on the right shows the following moves:

N.	White	Black
5	cx d5	cx d5
6	b3	b6(-0.01)
7	xb6	axb6
8	c3	e6
9	d4	g4
10	db5	d7
11	h3	f5
12	d4	g6
13	d3	c6
14	b3	b4
15	d1	d6
16	e3	c7
17	d2	hc8
18	f3	e8
19	a3	c6
20	b5	b8
21	xb6	f8
22	c5+	e7
23	d4	c6
24	ac1	g8
25	c5	d7

The timer shows White at 02:09 and Black at 01:01. The status bar indicates the opponent is violeta.

black coarse play has been punished by white, that is going to grab a pawn and moreover a keep a good grip on the position.





after a long sequence of exchanges white has improved her position, getting a concrete target (pawn in c6), a passed pawn (the one in a3) and an enemy bishop completely paralyzed: all these good things without doing anything special, just reasonable moves.



the whole manoeuvre to lead the knight in c4 is rather elegant and involves even a trap (Bxh3?? leads to immediate loss for black).



black allows further exchanges that make white's life even happier; the outcome is not hard to imagine.

The most impressive feature of this game is that, though black has not been demolished in few moves, we can notice a really big difference between the two players: white has always been in control, and has played in a way I am tempted to define "strategical". I think that, if you make a comparison between 2gen-violeta and a playing personality from other well known gui..., well you will notice a certain difference. At the end of this discussion I can say that all four targets that I had listed at the start of unit 3 have been reached.

## 5. CONCLUSIONS

The 2gen personalities are a great plus of **LUCASCHESS**, as no other chess software features a system which might be hardly comparable.

My hope is that you can play a lot of training games, with a very high degree of realism, so that when you will face actual human players during a tourney, with long time controls, for example in your very first tourney, the impact will be softer.

My personal advice is to challenge some personalities about 100/200 elo points stronger than you: this has the maximum training effect, because you need to give your best to survive in most games but sometimes you can even win; if you challenge weaker or too strong personalities you will win too easily or will lose without having understood when and where you went wrong.

Current version of **LUCASCHESS** features more than 100 new 2gen personalities but I am still working on new ones (there is no upper limit actually).

After a long thinking, I have decided to abandon the idea that each personality use an individual book: all 2gen share a single book, so that "everyone plays everything" but only up to 9th move (sometime less, in case of rare lines) so that the users may train all their openings against all different possible approaches of the opponent.

After that, I'll try to create again some simulations of the great champions of the past and present time too, hopefully before 2015 ends.