

An Addendum

to a LittleChessEvaluationCompendium,

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For abbreviations, ps will mean pawns, cps – centipawns, mps - millipawns, if the number is not indicated it will be centipawns; b – bishop, n – knight, k- king, q – queen and r –rook. Also b will mean black and w – white.

We will assume that the bishop value is 3ps, knight value – 3ps, rook value – 4.5 ps and queen value – 9ps.

X-ray attacks

X-ray attacks (x-raying, or indirect attacks) are possibly the single most important tactical weapon on the board. Pins are actually only a particular case of x-ray attacks. An x-ray attack would be an attack by a piece with a ray of action on a file, rank or along a diagonal; that is to say a queen, rook or a bishop. Knights are excluded from x-raying. The difference from ordinary attacks is that the attack may not be directly upon a piece or pawn, but indirectly, i.e. between the attacking piece and the piece being attacked there are one more own or enemy pieces or pawns along the ray. When there is only one piece or pawn in between the x-ray attack will be once removed and will be scored 1/2 the usual value for a direct attack (let's say that the usual value for a direct attack upon a queen is 9cps, then an indirect attack once removed will give 4.5 cps, upon a pawn 0.5 cps, etc.). When there are 2 pieces or pawns in between (an x-ray attack twice removed), the indirect attack will be scored by 1/4 the value usually assigned to a direct attack. Thus, attacking the q by a rook or bishop will give 2.25cps. An attack thrice removed will carry a bonus of 1/8 the usual value and an attack four times removed a bonus of 1/16.

When attacking the king along an x-ray, the value for the king may be 2 times that of a queen, in the specific case carrying with it a bonus of 18 and divided according to the number of removals.

X-raying has 2 major advantages in that it gives a fuller picture of almost any existing tactical interaction on the board; and at the same time engines might be aware of events that are to happen a couple of moves further down the tree. For humans, being aware of such possibilities means that their tactical ability would rise sharply in a very short time, of course after some decent practicing.

Of course, engines are tactically very strong and usually aware of such possibilities, but I honestly think they could do even better.

Passer status

An easy way to check the potentiality for creating a passer would be the following:

Neutrality

If for each own p on the board on a given file there is also an enemy p on the same file, the position will be passer-wise neutral, i.e. it is impossible to create a passer for one of the sides. If one of the sides has a p more on a given file, then we shall check if there is an enemy p on an adjacent file that could block the forward movement of the own p. If there is one, then the position is also neutral. The p on the adjacent file might well be a double one.

A candidate, prospective or a potential passer

When the above condition is not fulfilled and we have a p that does not have a counterpart on the same file, or whose forward movement can not be blocked by a p on an adjacent file, but which is still not a passer (the enemy groups of pawns are removed from one another), then we have a potential passer for one of the sides. Potential passers should be scored for something like 20 cps in the middlegame and 35 cps in the endgame. A rising bonus 1/2 the value for a fully-fledged passer might be given for the decreasing distance to a promotion square, in the way it is usually assigned to a passer.

Connectedness of pawns

A group of pawns will be defined as a structure of pawns when each p of the structure has at least one own p on an adjacent square horizontally, vertically or diagonally. Thus a2, b2 or a2, b3 would be groups of 2 ps, but a2, b4 would not. The larger the group, the better - +3cps for each member of the group. A bonus of +5cps for a p being defended by another p is also indicated; thus structures of the type a2,b3,c4 are a positive development.

Scoring of groups of pawns

For the number of groups of pawns on the board -3 for each group should be subtracted. In this case isolated pawns, be it vertically or horizontally, should be counted as a group.

Potential member of a group

When a p is just one square apart from fulfilling the conditions for being a member of a group, then it will be a potential member and will be assigned a negative value of -1. (eg. ps on b4, c5 and a2; the a2 p is just one square apart from a3 and it can span that distance; therefore, just -1). If, however, a p is just one square apart, but it can not span the distance itself, then -6 should be given. (eg. ps on b2,c2 and a4 - -6 for a4).

General positioning of pawns

A more central pawn would carry a higher value as its potential for growth and influence along its way forward spanning the left and right corners of the board is bigger than a less central pawn's. Thus an a p would be inferior to a b p by -7, a b p inferior to a c pawn by -7 and a c pawn inferior to a d pawn by the same value. It is irrelevant if the p is double, isolated, in the own or enemy half of the board. But please note that the ratio might be fully reversed in simple endgames when an a p could be preferable to a d p.

Positioning of pawns vertically

+2 cps for a p on the 3rd rank (a p on the second rank would carry no bonus)

+4 cps for a p on the fourth rank

But this would not apply to pawns of the pawn shelter, of course.

Double pawns

Double pawns, be it isolated vertically, a group in itself or part of a group, shall be assigned a penalty of -10 for each p.

In the endgame, the value should be double.

Isolated pawns

Isolated pawns represent the case when a pawn is severed from other ps by one or more files (horizontal isolation) or by one or more ranks (vertical isolation).

For isolated ps a penalty of -10 for each p should be given, both for a vertical isolation, as well as for horizontal one.

Degrees of isolation

Isolation might be measured by degrees.

2 cps for each rank or file separating the isolated p from other ps shall be given.

Values for isolation should be double in the endgame.

Backwardness

Backwardness is a very important concept in chess.

A p could be not only backward, but also semi-backward and backward-fated.

A backward p is the case when on its way forward a p passes through a square where it can be captured by an enemy pawn and no other own p supports its movement forward. (eg. wpa5, bps b7,a6 - b7 is backward)

A semi-backward p is the case when on its way forward a p passes through a square where it can be captured by an enemy p, but an own p supports its movement forward. (eg. wpa5, bps a6, b7,c7 - b7 is semi-backward as c7 supports the b6 square)

Backward-fatedness is the concept when on its way forward a p passes through a square where it can be captured by 2 enemy ps with no own ps supporting its forward movement. (eg. wps a5,c5, bps b7, a6,c6 - b7 is backward-fated)

All three forms of backwardness can be measured according to the rank upon which the backward p is placed.

Backward p on the 7th rank - a penalty of -25 cps is given

Backward p on the 6th rank - 1/2 the penalty for a p on the 7th rank (eg. wpa4, bps a5,b6)

Backward p on the 5th rank - 1/2 the penalty for a p on the 6th rank (eg. wpa3, bps a4,b5 - a penalty for b5)

Backward p on the 4th rank - 1/2 the penalty for a p on the 5th rank (eg. wpa2, bps a3,b4 - a penalty for b4)

Semi-backward p on the 7th rank - a penalty of -15 cps is given

Semi-backward p on the 6th rank - 1/2 the penalty of a p on the 7th rank (eg. wpa4, bps a5,b6,c6 - a penalty for b6)

Semi-backward ps are not penalised when on the 5th or 4th ranks

Backward-fated p on the 7th rank - a penalty of -35 cps is given

Backward-fated p on the 6th rank - $2/3$ the penalty of a p on the 7th rank (eg. wps a4,c4, bps a5,b6 - a penalty for b6)

Backward-fated p on the 5th rank - $2/3$ the penalty of a p on the 6th rank (eg. wps a3,b2,c3, bps a4,b5 - the wp on b2 is, of course, backward, but bpb5 is penalised for backward-fatedness)

Backward-fated p on the 4th rank - $2/3$ the penalty of a p on the 5th rank (eg. wpa2, bps a3,b4 - a penalty for b4 is indicated)

The values for all types of backward ps should be double in the endgame.

Intersections of pawns and pieces

$1/500$ the sum of the values of the pawn and the piece for the square upon which the rays of action of the pawn and the piece intersect (for the p diagonal-wise representing its capturing ability).

Weighting of different factors in middlegame and endgame

If the value of the q in my view is 9 ps, the value of a r - 4.5 ps, that of the n and b - 3 ps, then the total material on the board in the initial position will be 38 ps each side. For the purposes of this project a middlegame position will be one with a material exceeding 15 ps (i.e. half of the initial total material of pieces) and an endgame position one with a material less than 15 ps.

The following rules for middlegame and endgame would apply:

In middlegame the following evaluation factors should be weighted higher:

- mobility - by about $1/10$ to $1/5$ the usual value
- attacks and x-ray attacks - the same as above
- intensity of interaction - same
- space advantage - by about $1/8$ higher than the usual value for pawns and pieces alike

In endgame the following evaluation factors should be weighted higher:

- passed pawns - by about $1/3$ the usual value
- double pawns - by about $1/2$ the usual value, if there is such when the pawn is part of a group; if not, then a penalty of at least 20 is indicated, steeply increasing with the decreasing material on the board.
- isolated pawns - by about $1/3$ the usual value

Precision scaling

The above factors could be weighted more precisely by introducing additional intervals for available piece material: 30-25, 25-20 and 20-15 brackets for the middlegame; and 15-10, 10-5 and 5-0 brackets for the endgame. With decreasing material on the board for the middlegame the above mentioned factors would be scaled down, while with decreasing material on the board for the endgame the above mentioned factors would be scaled up.

Cutting the tree

Harmonious (smart) mobility

Smart mobility means that the overall percentual differences in quantitative mobility between the pieces on the board are the lowest possible. The proposition is that a group of pieces with better smart mobility will be more harmoniously positioned than a group of pieces with a worse one. Thus, if we have a group of 2 pieces, one of which has a very low mobility, and the other one a very high mobility, and another one for which quantitative mobility numbers

are more evenly split, the group with the more even split should be favoured. In the case of 5 pieces, a q, a r, 2 bs and a n, a variation with mobility numbers for the pieces of 12, 7, 6, 5 and 4 respectively should be chosen, and a variation with mobility numbers of 14, 7, 6, 5 and 2 respectively left out. The general rule shall be that a variation is chosen for which the sum of the percentual differences between the pieces in rising order of mobility scores is the lowest possible (the sum of the differences between the piece with highest mobility score and the piece with second highest; the second highest and the third highest, etc.). I would even go as far as to suggest that a group of pieces with 20 percent better smart mobility is to be favoured instead of a group of pieces that has 20 percent higher mobility measured in an ordinary way.

Complementarity (Optimal spread)

Complementarity is a very important factor in chess. The concept refers to control of free squares on the board by the pieces. For each free square on the board controlled by a piece a bonus of 3 millipawns (mps; this should mean one thousandth of a pawn) is given (and maybe even much higher). For a second piece controlling the same square the bonus should be only 2 mps; and for a third piece - 1 mp. Thus, it would be preferable for a square to be controlled by as few pieces as possible, which would guarantee even distribution of control of free squares on the board by the pieces (optimal spread). The higher complementarity is, the better the general welfare of a position.

For complementarity relating to the quadrant (a square shape of the board consisting of 4 board squares each side when evenly splitting the entire board to 4 such shapes) where the enemy king has found refuge values for optimal spread can be weighted by, say, 1/3 higher.

With other factors being equal, complementarity may very well make the big difference.

You can develop the idea further by introducing a split ratio for control of black and white squares. If control as measured above for one of the colours is represented by a ratio in the interval of 50-50 split to 55-45 split, then a bonus of 50 cps would be indicated. If the split is in the interval from 55-45 to 60-40, then the bonus would be lowered to 30 cps. If the split is in the interval from 60-40 to 70-30, then no bonus or penalty points are given. When the split exceeds the 70-30 ratio, variations are left out.

Complementarity in the defence of the king shelter

This might be very important. Complementarity will be calculated in the usual way (and taking into account the control exercised by own pawns), but not only for the free squares of the king shelter, but also for the squares occupied by own pawns or pieces. The value for complementarity might be multiplied by 2 or 3. The higher the value for complementarity of the king shelter, the more solid the defence of the shelter should be.

Additionally, one might also calculate the split ratio for control of black and white squares of the shelter and assign bonus points. Bonus points could be assigned in the usual way for split ratio in intervals (from 50-50 to 55-45; from 55-45 to 60-40 and from 60-40 to 70-30, while for values exceeding the 70-30 threshold variations might be left out), and then multiplied by 2.

X-ray intensity of interaction

For each square on the board whereupon the rays of interaction of a queen, rook or bishop intersect, be it horizontally, vertically or diagonally, and regardless the number of own or enemy pawns and pieces in between (that is the x-ray quality), a certain bonus is given (it might be equal to one hundredth the sum of the values of both pieces, divided by the number of own or enemy pawns and pieces along both rays of action to the point of intersection).

For x-ray intersections on squares of the enemy king shelter the value might be double.
Knights could also be included into the equation when interacting with a piece along its x-ray.

Cutting the tree (mobility)

In this way you can cut not only branches, but entire boughs from the search tree.

For the purpose the game is divided into different phases in respect of the available piece material on the board. For the middlegame those phases would be in intervals of 5 pawns difference: 30-25; 25-20 and 20-15.

30-25 interval: leave out, do not consider any variations where even a single piece has a mobility lower than:

- 4 free squares for the q
- 2 free squares for the n or b
- and 1 free square for the r

25-20 interval: leave out, do not consider any variations where even a single piece has a mobility lower than:

- 6 free squares for the q
- 3 free squares for the n or b
- and 2 free squares for the r

20-15 interval: leave out, do not consider any variations where even a single piece has a mobility lower than:

- 8 free squares for the q
- 4 free squares for the n or b
- and 3 free squares for the r

General positioning of pieces

General positioning of pieces in terms of space advantage

For a piece positioned on the first rank a penalty of -15 mps will be given

For a piece positioned on the second rank a bonus of 15 mps will be given

Positioning on the third rank will carry +30 mps

The fourth rank +45, the fifth +60, the sixth +75, the seventh +60 and the last, eighth rank will carry a bonus of 30mps.

General positioning of pieces in terms of centralisation

For the purpose the entire board will be divided into 4 square shapes:

- the central squares of e4, d4, e5, d5
- the board squares of the square shape with borders on the f3-f6-c6-c3 squares, excluding the squares of the above shape
- the board squares of the square shape with borders on b2-g2-g7-b7, excluding the squares of the above 2 shapes
- the board squares of the square shape a1-h1-h8-a8, excluding the squares of the above 3 shapes.

The first shape, first in degree of centralisation, will carry a bonus of 100 mps for all pieces.

The second shape, second in degree of centralisation, will carry a bonus of 75 mps for all pieces.

The third shape will give a bonus of 50, and the fourth 25.

General holistic positioning of pieces

General holistic positioning of pieces will be the average value of positioning in terms of space advantage and centralisation.

Smart positioning of pieces

For the purpose at least 3 factors must be taken into account: let's say these will be mobility, attack and general holistic positioning. The proposition is that variations should be considered displaying the lowest cumulative sum of the percentual differences between the three factors, i.e. the sum of the values of the differences in percentage points between the highest scoring factor and the second highest, and the second highest scoring factor and the third highest, should be the lowest possible. Thus, if we have a variation with scores for mobility of 20, attack of 15 and holistic positioning of 10, this should be chosen instead of a variation displaying for the piece scores of 22, 15 and 8 respectively. I would even go as far as to assert that a 10 percent lower score for smart positioning of pieces would compensate for 10 percent higher score of the sum of the three factors measured in the ordinary way. Thus, variations will lower smart positioning could be left out early in the search.

Stepping-stones for attack

+5 for each square of intersection of an own pawn and own piece into the quadrant where the enemy king has found refuge

Calculating mobility

When calculating mobility, not only the free squares, where the piece could go, but also the squares, where it can be captured for nothing or just for a pawn by an enemy pawn, should be taken into account.

If a certain number is assigned for each free square the piece could go, then for a square where it can be captured by an enemy pawn for just a pawn a value a portion of the value for the free square should be assigned. That portion will be the ratio between the value of a p and the value of the relevant piece.

For a square where the piece can be captured for nothing by an enemy pawn the value should be 1/2 the above value.

Exotic pawns

Semi-passers

This is a p that goes behind an own passer and fulfills the conditions for being a passer (that is, there are no enemy ps that could capture it along its way forward) if it were not for the more advanced passer. A semi-passer should be assigned some bonus, for example 1/2 the value of a fully-fledged passer. Sometimes semi-passers in complex double-edged positions could be a valuable asset if the more advanced passer perishes.

Treble pawns

Treble ps occur when there are 3 own ps on the same file. Of course, a big penalty is indicated, maybe -60 cps.

Quadruple pawns

This will occur only extremely rarely. 4 own ps on the same file should be heavily penalised, at least 1.5 ps.

Immobilised double pawns

Immobilised double ps is the case when 2 double ps are definitely stopped in their movement by an enemy pawn. (eg. wpe4, bps e5,e6) This is certainly a big disadvantage since it will be almost impossible for the ps to correct their deficient structure. Twice the value of a penalty for double ps is indicated. The penalty might be somewhat decreased if there is an own p on an adjacent file less advanced than the more advanced pawn of the 2 double ps. (by 10)

Material imbalances

Material imbalances will be the case when one of the sides has superior material strength, but certain positional factors make up for the material inferiority of the other side, or even place it in a better situation. This is a very tricky concept, especially for engines, simply because usually they do not have the code for it.

Powerful central passers

Central passers (especially when they are into the enemy camp), when there are at least 2 of them and are connected (i.e. they are on adjacent squares of the board horizontally or diagonally), should get some bonus points apart from bonus points for passer status and for being connected passers (which is a huge advantage; +50 for the tandem and additional bonus for a third p). The third bonus is associated with their centralised position, paralysing the activity of enemy pieces. I would assign +30 for a p on an e or d file and +20 for a p on a c or f file. This is especially true for the middlegame and might compensate for the exchange or other disadvantageous material imbalances.

Endgame

Q and passer versus (vs) a r and minor piece, or q and passer vs 3 minor pieces: the position on the board is drawn (provided all other ps are on the same side and placed in a way not largely detrimental to the defending side) when the r and n or b control simultaneously a square along the way forward of the enemy passer; or when 2 of the minor pieces control the same type of square. Engines often do not understand this.

Grading of pieces and pawns

Pieces and pawns will be graded throughout the game

Pieces will be graded in relation to the overall number of pawns on the board, while pawns the other way round - in relation to the overall material strength of pieces on the board, reflecting the fact that pawns and pieces complement each other.

Grading of pieces

There are 4 types of positions bearing in mind the ps left on the board:

closed positions - 13-16 ps left

semi-closed positions - 9-12 ps left

semi-open positions - 5-8 ps

open positions - 0-4 ps

Those 4 types should not be mistaken for closed and semi-closed pawn structures, reflecting the fact of positioning of ps on central and semi-central files, as well as space advantage, with due assignment of certain bonus points.

Grading of pieces for closed positions:

queen -10% of real standard value
rook - 15% of standard value
bishop will have no change, standard value
knight +10% of standard value

Grading of pieces for semi-closed positions

q -5% of standard value
r -10%
b +5%
n +10%

Grading of pieces for semi-open positions

q +20%
r +10%
b +15%
n -10%

Grading of pieces for open positions

q +30%
r +10%
b +20%
n -15%

The grading of pieces reflects the fact that pieces have changing degrees of mobility when there are different number of ps on the board, and that has a direct impact on their power. Therefore they should be graded. It is evident that the queen gains the most from the decreasing number of ps, while the knight is the big loser, with rs and bs in between.

Grading of pawns

Pawns will be graded in relation to the pieces left on the board (defining middlegame or endgame; if 60 is the overall piece strength, then middlegame starts from 30 piece strength upwards, and endgame downwards). It is obvious that with decreasing piece strength left ps become gradually more powerful, in respect to their structure, passer status and influence on the board.

Pawns might be graded in four categories in decreasing order:

Piece strength 60-45 - no change from standard value
Piece strength 45-30 - +5% standard value
Piece strength 30-15 - +10% standard value
Piece strength 15-0 - +15%

Backward pawns are extremely important in chess. They could partially determine the passer status, if a p could move forward or not, they could bode ill or well for the general welfare of a position and help in assessing other factors. Backward ps occur 2 or 3 times more frequently than double and isolated ps do as a whole. So if you are doing backward ps just for the 7th

rank, and skip semi-backward ps, backward-fated ps and their varieties, not definitively backward ps, partially backward ps, potentially backward ps, backward ps when part of a fixed structure, and backward ps when connecting to a more advanced own p, and if you do not do backward ps across ranks, then most probably you are skipping half of the existing positional factors on the board and a big portion of what chess actually is all about.

Not definitively backward pawns

A not definitively backward pawn is one that has more than 1 free square until it reaches the square where it can be captured by an enemy p. (eg. wpe4, bpse5, d7 - the d6 square is free for other pieces to pass through so that backwardness is not that compulsive) Such a p might be penalised a bit lower, let's say 1/2 of standard penalty. For me semi-backward ps should not be penalised, but backward-fated should, and depending on the rank where the p is placed. (eg. wps c3,a3, bps c4,b6 - b6 is such type of p)

This concept might be developed for the number of squares the backward p is away from the enemy pawn's capturing square.

2 squares away - 1/2 of standard penalty

3 squares away - 1/4 of penalty (eg. wpb2, bpsb3, a6)

4 squares away - 1/8 of penalty (eg. wpb2, bpsb3, a7 - a7 is penalised very low)

Taking into consideration this type of ps would make it possible to recognize early enough detrimental pawn moves, for example wp b3, bps a6,b5,c5 - b5b4 would be a bad move from this viewpoint.

Not definitively semi-backward pawn

A not definitively semi-backward p is a semi-backward p more than one square away to where it would be captured by an enemy p. (wpb4, bpsb5,c7,d6 - c7 is such a type of pawn)

In distinction to backward ps, the penalty is not decreased, but increased, as enemy pieces could potentially control the square in front of the p. The increase should be small, however, maybe by 1/3 the standard value for a semi-backward p on the 6th rank.

Partially semi-backward pawns

A partially semi-backward p is a semi-backward p that could become both fully backward, and semi-backward, and sometimes also backward-fated. (eg. wpsb4,d4, bpsb5,c6,d6 - if the d4 p falls, c6 becomes semi-backward, if the d6 p falls, c6 becomes backward-fated, and if both d4 and d6 were to fall, c6 becomes fully backward p) In that case this type of p should be assigned some penalty, maybe 1/3 the cumulative values for the three types of ps, as it might evolve into all of them.

The concept might be developed across ranks, with lower values when the partially semi-backward p advances forward.

Not definitively partially semi-backward pawn

This is a partially semi-backward p more than one square away from the square where it could be captured by an enemy p. (eg. wpsb4,d4, bpsb5,c7,d6 - c7 is such type of p) In this case the penalty for c7 should be increased somewhat in respect to a partially semi-backward p, as the enemy side could take control of the square in front of the p, including, if d5 square is not guarded by black, by advancing own d p.

The concept could be developed across ranks with decreasing penalties for the advancing semi-backward p.

Potentially backward pawns

A potentially backward pawn is one of a bigger pawn structure that could evolve into both a fully backward p, and a semi-backward one. (eg. wpd4, bpsd5,c6,b7 - c6 is a potentially backward p, if black moves b7b6, c6 will become semi-backward, if black moves b7b5, c6 will become fully backward) A penalty is indicated for these possibilities, but not big as the structure could endure for a long time, let's say 1/4 the cumulative penalties for both types of possible evolutions.

The concept could be developed across ranks with decreasing values when the p moves forward.

Double backward-fated pawn

That would be the very rare case of a backward-fated p that is double (eg. wps a4,c4, bps b6,b7). As the backward-fated p restricts the forward movement of the b7 p, the penalty should be higher, say 1.5 times.

Fixed horizontally isolated pawn

If an isolated p is fixed (blocked in its movement) by an enemy p, then the penalty for the isolated p should be increased significantly, maybe 1.5 times, as it is restricted in its movement and may fall easy prey to the enemy pieces.

Backward pawn connecting to a more advanced own p

Eg. wpc5, bps a6,b7,c6

The penalty for b7 should be somewhat increased, by 1/4, as if it moves forward the more advanced p it connects to would become isolated.

Backward p when part of a fixed chain

When a backward p is a part of a fixed chain (eg. wps d3,e4,f5, bps f6,e5), the penalty for backwardness should be increased steeply, by 2/3, as if it moves forward, it would not correct things, but instead another backward p on its place could appear (e4), if the enemy side decides to capture.

The concept could be developed for ranks with steeply decreasing penalties as the backward p moves forward, as soon a passer might appear.

Backward pawn when part of a pair of double ps

If a backward p is part of a pair of double ps (eg. wpc4, bpsc5,d6,d7), then the penalty for the backward p should be decreased by 2/3, as its forward movement will force the undoubling of the pawns.

+3cps for each piece controlling the square in front of the backward pawn as on this will depend if the ps are undoubled or stay as a weakness.

Backward p when part of a fixed structure with diagonally connected own ps and double

In this case (eg. wps d3,e4,f5,e2, bps d4,e5,f6), if the double p is behind a p that is not the least advanced (d3 in this case), the penalty for a backward p should be retained, and that for double p removed, because the forward movement of the less advanced double p will force the undoubling of the ps, while at the same time another backward p will appear in its place.

Semi-backward p with adjacent double ps

This type of semi-backward p deserves at least 1/4 higher penalty than standard semi-backward ps, because the adjacent double ps would render very difficult any coherent advance of the members of the group. (eg. wpsb2,b3,c2,d3, bpd4 - c2 is such a p)

If a pawn makes 2 enemy ps backward simultaneously (eg. wpb5, bpsa6, c6), then the penalty for backwardness should be decreased, maybe one half the value. This applies also to not definitively backward ps.

Pieces amplifying the backwardness of a pawn

Some bonus points should be assigned to own pieces controlling the square in front of an enemy backward p (only relating to fully backward ps, and not to not definitively backward ones). Let's say 1/5 the penalty for the backward p. The concept is very difficult to apply to semi-backward ps, and useless for backward-fated.

Piece-pawn positioning in relation to the enemy camp

It would be preferable to have pieces in front of ps pawns in relation to the enemy camp.

+20mps for own piece placed vertically in front of own p (files will be checked)

-10mps for own piece placed behind an own p

+20mps for own piece placed diagonally in front of own p (diagonals will be checked)

-10mps for own piece placed behind an own p

Optimal spread for pawns

The optimal spread of ps on the board might bode well for the general welfare of the position.

For the purpose, positions of pawns within the rectangle a2-a7-h7-h2 will be checked.

A penalty of -5cps is due for each p controlling an additional square (apart from the first) along the same file.

Same penalty of -5 for each p controlling an additional square along one and the same rank.

-7 would be due for each square within the rectangle controlled by a second p

Potential of advancing forward

For each p on the board the number of own ps on adjacent files will be checked.

+10mps for each p on adjacent file

+5 mps if this p is placed behind the pawn we are measuring the potential for vertically

+3mps if this p is placed in front of the pawn vertically

+7mps if this p is on the same rank

This should be repeated for all pawns.

Potential of connectedness

This will apply to positions with double or isolated ps, but may also be applied to perfect structures as groups of ps can easily disconnect and reassemble again. The proposition is that the more centrally vertically and horizontally a p is placed, the better the chances for connecting with the help of own and enemy pawns and pieces. For the purpose we will use a rectangle shape of the board, consisting of the squares within the shape a2-a7-h7-h2.

For vertical placements on the 2nd and 7th ranks - a bonus of +3cps is given

If p is on the 3rd and 6th rank - bonus will be +6

4th or 5th rank - +9

For horizontal placements, the bonus points will be as follows:

d and e files - +8cps

c and f files - +6

b and g files - +4

a and h files - +2

Potential of bridging the gap of disconnectedness

Placements of ps more to the back of the board will carry a bigger bonus than those to the fore.

P on 2nd rank - +7.5 cps

P on 3rd rank - +6; 4th rank +4.5; 5th +3; and 6th rank +1.5

Penalties for root pawns

Root pawns are the last of a group of ps. This concerns only groups of ps connected diagonally. With the perishing of the root p of such a group, all other ps become more vulnerable. Penalties will increase with ranks increasing.

no penalty for root p on second rank

-5 for root p on 3rd rank

-7 for root p on 4th rank

- 9 for 5th and -11 for 6th rank

If a root p is the mainstay of a group of ps along 2 diagonals (eg. wps e3, d4, c5, f4), then the penalty should be somewhat increased, maybe double.

Double penalties are indicated if a root pawn is a part of a fixed or semi-fixed structure, since much more depends on its well-being than if the structure was not fixed.

Double ps when part of a group and closing the ranks

When double ps are part of a group with the more advanced of the pair connecting diagonally to a even more advanced own p, a big penalty would be indicated for the double ps, because it is impossible for members of such a group to advance coherently. 1/3 higher value for the doubling. (eg. bpsb7,b6,c5) Such a structure is not only deficient, it is ugly.

Bonus points for double ps when part of a group in relation to the size of the group

When part of a group, double ps should be weighted in respect of the size of the group. The smaller the group, the better, because an advance of the ps will create less deficiencies.

+5 cps for a group of 3 in relation to a group of 4

+5 cps for a group of 4 in relation to a group of 5

Pawn Shelter

The pawn shelter will consist of all pawns within the shelter zone.

Shelter zone

The shelter zone will comprise the squares, adjacent to where the king is placed, as well as the squares, 2 squares apart vertically, horizontally, diagonally or along a sinuous route (eg. wkg1, wph3 or e2, i.e. the move of a knight). The adjacent squares will build the immediate shelter zone (with squares behind the king excluded), while the squares 2 squares apart will build the wider shelter zone.

Scores for ps of the pawn shelter

Ps of the pawn shelter will be scored in relation to which part of the shelter zone they belong to, as well as in relation to the route to the king, for the wider zone.

Each pawn of the immediate shelter zone will get a bonus of +50.

Each pawn of the wider shelter zone vertically, horizontally or diagonally removed from the king will get a bonus 1/2 of the above value.

Each pawn of the wider shelter removed along a sinuous route will get a bonus 1/3 of the bonus for the ps of the immediate shelter zone.

Spatial mobility

Spatial mobility will be defined in relation to the number of directions a piece can go to.

Directions for the knight will be the existence of free squares in front of it, behind it, as well as to the left and right of it. +3cps for each existing direction with available mobility. For the rook directions will be defined in the same way, giving the same bonus. For the bishop, directions will be defined in the same way, but along diagonals. For all three pieces the maximum number of existing directions will be, of course, 4. The queen has maximum 8 existing directions with available mobility, defined as those for the r and the b, and receiving a bonus of +3 each.

The bigger the number of available mobility directions, the higher the probability a piece could do well in its different functions, while a smaller number, even if the overall value for mobility is good, would mean that the piece has certain limitations to do satisfactorily in all its functions. That would have some repercussions on its strength.

Moves freeing squares for own pieces

+2mps for each square a piece frees on its move for occupation by another own piece. That would have some impact on future developments, of course.

Weak spots

Weak spots are squares on the 3rd rank of the board (6th for the black pieces) not guarded by own pawns.

-10 for each such square

-20 for squares belonging to the shelter zone

Unguarded squares on the 4th rank

For squares on the 4th rank unguarded by own ps a penalty of -2 will be assigned, -4 in the case of existing immediately in front of the shelter zone.

Own pieces controlling weak spots

+5 for own piece controlling a weak spot

+2 for own piece controlling an unguarded square on the 4th rank

Double those values for squares of the shelter zone

Enemy pieces occupying weak spots

+5 for enemy piece occupying a weak spot

+2 for enemy piece occupying an unguarded square on the 4th rank

Imminence of attack (piece reserve strength; overall distance from the enemy king)

For the purpose the distance in squares from where a piece is placed to where the enemy king is placed along the shortest route is measured. Both the square where the piece is placed, and

the square where the enemy king is placed, are counted, and the measurement is done supposing there were not any other pieces on the board. For bishop opposite the colour of the square where the king is placed the reference square will be that immediately in front of the king vertically.

Naturally, rooks go by 2 consecutive moves along a file and a rank; bishops will use diagonals of different directions; while the queen will choose a route consisting of a diagonal movement and a movement along a file or rank (eg. wkg1, bqd6 - the q will go to d4 and then to g1, 7 squares in all, instead of going to d1 and then g1 - 9 squares in all). For the knight, the first move spans 4 squares, and the rest of the moves span 3 squares.

When we get a value for all pieces, we calculate the sum total, which number will be the overall distance in squares from the enemy king. The lower the number is, the better. The overall distance from the enemy king is useful in that it is often indicative of whether an attack could be completed successfully or not. By taking into consideration the distance for all pieces, we have an idea about how many pieces are well prepared to reinforce the attack once the pieces immediately attacking the king are not able to do the job. Besides, the sum total is often a number much less homogeneous in different variations than that for, say, mobility, and could be used for efficiently cutting the tree. Variations above a certain threshold could be discarded very early into the search.

Blocking

Best blockers are obviously the knight and bishop, as it is difficult to remove them from their position. Rooks could be removed and forced to retreat by enemy ns and bs, while the queen is not suited for blocking at all, as it could be expelled from its position by all other enemy pieces. What concerns the king, blocking should not be considered at all, except in the late endgame.

Blockade could be measured more precisely by referring to the rank on which the blocker is placed. Obviously, the earlier a passer is stopped in its movement forward, the better.

If blocker is on 3rd rank (wp on 2nd), then the bonus for a blocker should be increased by, say, $2/5$.

Blocker on 4th rank - increase of $1/5$ standard value

Blockers on 5th and 6th ranks - standard value

Blocker on 7th rank - decrease bonus by $1/5$ standard value

Blocker on 8th rank - decrease bonus by $2/5$ standard value

Blocking from afar

Blocking from afar would signify giving certain bonus points for pieces that are not immediately blocking the passer, but are nevertheless staying in its way one or more squares apart. The passer could move forward, but only to a certain point.

If blocker 1 square away - $1/2$ the standard value

Blocker 2 squares away - $1/3$ the standard value

Changing blockers

A bonus for own pieces controlling the square occupied by an own blocker is due, as those could take its place in the course of the game, depending on the requirements of the position.

$1/2$ the standard value for a blocker for a second (apart from the main blocker) piece controlling such square, and $1/3$ the standard value for a third piece controlling it.

For 2 blockers blocking 2 separate passers the bonus for the second blocker should be decreased by 1/3 as the pressure is not easily handled.

If 2 blockers block 2 passers diagonally connected, then the bonus for the second blocker might be decreased by 2/3 as this type of blocking is usually inefficient.

Blocking a double p

+2mps as this stops the forward movement of the double ps

Blocking a horizontally isolated p

+3mps as when the p is blocked it is easier to prey on it

Blocking double horizontally isolated ps

At least +15mps, as this is an excellent position for the blockers, they cannot be attacked by ps

Blocking a double backward p

At least +5cps. Eg. bpd5, wpsd4,c3,c2 - the c4 square is a perfect square for transferring black's pieces.

Blocking a p that is not passed but has entered your own camp

If a p is not a passer, but has moved into your own camp (eg. wpf2, bpf4 - f4 is such a pawn), then blocking it would be useful as it stops its dangerous movement forward. +4cps for a piece blocking such a p (in the above example a piece on f3). However, rooks should not be considered because of some mobility limitations.

If the p is stopped in its movement forward by an enemy p that is not on the same file, but controls the square in front of the advanced p from an adjacent file (eg. bpf4, wpe2), then the bonus should be somewhat diminished, maybe by 1/2, because the p that has entered your camp cannot advance a square further without being captured by p. Still, the threat of advancing exists. +2cps would suit all white pieces on f3

Blocking double pawns when part of the king shelter

When double ps are part of the king shelter, blocking them would be quite useful.

+7 cps for a piece blocking such ps (eg. wps f2,g2,g3 - a black piece on g4). However, bishops are excluded from this.

+5 cps for enemy p fixing (blocking) them

Blocking the root p

Blocking the root pawn can be quite efficient, because of different reasons. On the one hand, its forward movement is stopped. On the other, even if such a p connects to only one own p diagonally, the blocking piece, because of its proximity, exerts some pressure on the ps of the chain. Besides, as the root p is a backward p, the blocking piece is placed on an ideal position, because it cannot be attacked by ps. (eg. wpsd4,e5, bpe6 - d5 would be an ideal square for all pieces) +25 if the blocker is a knight, +20 if bishop, +15 for the rook, and +10 for the queen. In distinction to the usual points for blocking, the q is not penalised, but gets a bonus instead.

Fixed pawn structures

Fixed pawn structures is the case when own and enemy ps are on adjacent squares vertically, i.e. they stop (block) their movement forward.

The simplest case is of a pair of fixed ps (eg. wpc4, bpc5).

Semi-fixed structures is the case when for one of the pairs of the fixed structure there are 2 free squares in between, but their movement forward is almost completely stopped as they are backward-fated ps. (eg. wps d3,c4,e4, bps d5,c5,e5)

Parts of a fixed structure is the case when one or more of the own or enemy ps do not have counterparts along the files they are placed on or when their counterpart is severed from the own pawn group. (eg. wpsd3,e4,f5,g4, bps e5,f6) Parts of a semi-fixed structure is the same, but with semi-fixed structures. Although parts of fixed and semi-fixed pawn structures seem more mobile than fully fixed and semi-fixed structures, the inherent mobility restrictions are retained because the surplus ps are backward in nature.

A chain usually refers to fixed and semi-fixed structures, but might also denote just a group of own ps.

Weighting of factors with fixed and semi-fixed closed structures

When we have fixed or semi-fixed closed structures (eg. wpsc4,d3,e4,f5, bpsc5,d4,e5,f6) placements for own pieces on squares on a more advanced rank behind the own ps would carry a certain bonus in relation to mobility, 15% higher values for minors and 5% higher for heavy pieces, as the possible disintegration of the closed structure could suddenly increase their mobility, while placing the pieces on a more backward rank behind the ps, even with higher mobility, would not help much as they could not easily penetrate the enemy position.

Drawing possibilities with bigger fixed pawn chains on the board

When we have bigger fixed or semi-fixed (of the type wpsf4,g3,h4, bpsf5,g6,h5, with two backward-fated ps opposite each other) structures, the drawing possibilities of the weaker side would increase the bigger the chain gets. This is often misunderstood by engines.

If we have 8 ps each side on the board, then the game is automatically a draw, if the weaker side does not lag behind by more than 2 pawns in evaluation, when sacrifices would become possible.

If we have 7 ps each side on the board, then a bonus of +50 cps is indicated for the weaker side as possibilities for penetration are rather low.

If we have 6 ps each side, then the bonus should be decreased to 30.

With 5 ps, +10 could be assigned.

This rule could help avoid fixing more pairs of ps, even when this could mean gaining space advantage. So when you are up in evaluation and there are already 4 pairs of fixed or semi-fixed ps, it would be wise not to fix additional ps, especially when their number grows significantly. For the purpose of measuring the number of ps of that type, a p one square away from becoming backward-fated would be counted as a backward-fated (wpg2 in the above example).

Bonus for space advantage of bigger fixed chains

With bigger fixed chains, consisting of 5 or 6 ps each side, but not more, the bonus for space advantage for the ps should be weighted higher by maybe 10%. This is because those are structures with most advanced ps not placed on central or semi-central squares, and while the increase is justified by higher mobility values for own pieces, this is not of such a vital importance because of the less central placements of the ps.

Queen on the board - score space advantage +20% higher

For the half of the board (divided vertically) where the enemy king is placed space advantage shall be scored by 30% higher.

-1 for each rank a group of ps spans

A pair of bishops on the board, pawn structure irrelevant (especially endgame), but not if there are more than one intrinsic weaknesses (eg. 2 pairs of double ps or a pair of double ps and an isolated p). In that case, the second weakness might score a portion of its due penalty, the third much bigger portion, etc.

5mps for pieces controlling the square in front of a semi-backward pawn.

5 mps for each square separating a pair of double ps (thus wpsb2,b5 would be preferable to wpsb2,b4 or wpsb2,b3)

Own piece blocking a fully backward enemy p - +10mps

Weighting of penalties for pawns in relation to enemy piece configurations

If queen on the board, weight enemy double and isolated ps by 1/3 lower

If rooks on the board, weight enemy double, isolated and backward (all types) ps by 1/5 higher for each rook

If bishop on the board, weight fully backward and fully backward-fated ps by 1/3 higher, but only if the ps are on a square the same colour as the bishop.

Bonus for relatively lower power of a piece defending own p

A bonus is indicated for the relatively lower power of a piece defending own p in relation to an enemy piece attacking the p. The bonus could be 50mps x the difference in power between the attacking and the defending piece. Thus, it would be preferable to defend the p with minors when rooks or a queen attack it. This could free up some potential for developing activity at other vital points.

For a pair of connected passers, +10 if the passers are connected diagonally and not horizontally

Do not consider positions with more than 1 fully backward pawn (i.e., just one square away from the capturing square of the enemy p) on the 7th rank. That would certainly compromise the position significantly.

Do not consider positions with more than 2 fully backward ps on the 6th rank.

Do not consider positions with more than 1 backward-fated p on the 7th rank.

Do not consider positions with more than two pairs of double ps. This could hardly be called a decent position anyway.

Do not consider positions for which the sum total of the mobility values for the two enemy pieces with highest scores exceeds by more than 50% the sum total of the mobility values for the two own pieces with highest scores.

Do not consider variations with enemy potential of connectedness exceeding own by more than 60%. (only middlegame)

Do not consider variations with enemy potential of bridging the gap of disconnectedness exceeding own more than 2 times. (middlegame)

Do not consider positions for which penalty for optimal spread of own ps is more than twice bigger than penalty for enemy ps.

Do not consider positions with more than 2 fixed isolated own ps.