

Proposed new ERA Ratings/Rankings System

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Summary

The initial and current ERA rankings systems have a number of flaws, which we can now improve on given that we have easy access to individual match scores through Tournament Software. Under the new system players will have both an overall rating and a rating for each individual sport which is a measure of their profile. In each match the winning player's overall ratings goes up and the loser's goes down. The extent by which ratings change is dependent on the difference between player's ratings at the start of the match. In addition, individual sport ratings also go up and down as a result of the individual sport scores, and for individual sports the extent to which ratings go up or down is also dependent on the score in the individual sports.

Classes have a range of 480 points and are split into sub-classes of 120 points. So class A is split into A1, A2, A3 and A4 sub-classes (from high to low). There are national classes from A-D, and a + class for world classes above this.

Everyone will only have one overall rating regardless of whether they have entered open or age-restricted events. Ratings for age groups are then just a sub-group of the overall list. Ratings for men and women will be independent.

A group of players who play frequently will be given initial ratings by the ERA committee, and then there will be formulae to determine ratings for any new players. If a class within an event consists entirely of new players, then the ERA committee will determine a rating and profile for one of the entrants by watching them play in their first event.

Principles of the new rating/ranking system

Initial ERA rankings

The initial ERA rankings had been based on the total points accumulated over the period of one year for any domestic or world tour events. Points were awarded for the final placings achieved, and placings in world tour events carried a higher level of points than the English and British national events, which in turn carried more points than the regional ERA open events. There were two main problems with this approach. Firstly there was no overlap between points awarded for A and B events, so that last place in A was given more points than first place in B, so that once you were classed as an A player, you remained as one. Secondly the rankings reflected the number of tournaments played too strongly and weren't a good reflection of ability – for example when Calum Reid started playing racketlon again, he wasn't ranked in the top 30 in the UK. What this meant was that organisers of tournaments had to make subjective judgements about who played in which class because this couldn't be based on rankings.

Current ERA ranking system

The current system is based on the average points gained per tournament, with an overlap between A and B classes (and all other classes), so that someone continually coming last in A tournaments would be classed as a B player. The current system is a much better measure of ability, and accordingly players are classified into different classes.

One of the drawbacks of using a system based on average performance is that one bad tournament has a big impact on your rating/ranking. For example, Jagdev Singh's first tournament was C class at the English Open, and his result there meant that he was ranked outside the top 20, when clearly he was a top 10 UK player.

The current system also doesn't take account of the strength of the tournament, or the luck of the draw (as generally only 2 players are seeded per draw). One of the consequences of racketlon successfully expanding to have more regional tournaments, and moving away from being London-centric, is that the strength of tournaments are more variable.

People are also playing fewer tournaments which means that in order for rankings to be more stable, we have to use a longer qualifying period. This in turn makes it difficult for rankings to reflect current form when players improve, and makes it hard for players to change their rating/ranking.

Proposed new ERA rating system

The move to using Tournament Software to run tournaments means that there is now data available about individual matches which could be used to determine ratings, rather than having a system based on finishing places in tournaments. Julian Kashdan-Brown recently made the point that he entered a vets tournament of 8 people, his first opponent didn't show up, he lost his first match before the tennis and his last opponent left before playing him, so he finished 3rd and gained a reasonable number of points.

The proposed new system would be based purely on your results against who you have played, and not on your final tournament position. In the example above, Julian would have lost rating points because he lost the only match that he played.

In time I will document the maths behind the proposed new system, but this paper will concentrate on the principles, and I will work out the maths so that it fits these assumptions.

The new system would classify players with an overall rating, and a rating in each of the component sports so that we can compare different player profiles. The basic principle is that if you beat someone overall then your overall rating goes up and if you lose to someone it goes down.

The amount by which the ratings go up and down is determined by the difference in rating points between the two players at the start of the match.

- The winner of a match gains a certain amount of points, and the loser loses the same number of points.
- If a very high rated player beats a very low rated player, neither players' rating will change much
- If a high rated player beats another high rated player, the ratings would change a reasonable amount.
- If a medium rated player beats a higher rated player, the rating change by a greater amount.

The number of ratings points that people go up or down is also determined by the size of the victory. This applies more to the component sport classifications rather than other overall rating.

- If a match is close in an individual sport, say 21-18, then ratings don't change much
- If a match is a relatively comfortable victory in an individual sport 21-13, then there the number of rating points won or lost is higher.
- If a match is very one sided in an individual sport, say 21-6, then there is a much greater difference in the number of points won or lost.
- As long as at least 11 points have been played in tennis, the tennis is scaled up to the equivalent of the leading player having 21 points. For example, if the match is stopped at 7-5, the overall score for changing ratings is scaled up to 21-15.
- For the overall rating, the margin of victory is not taken into account.

Classes are defined as currently from A to D, and there is an international elite class above Class A. The attributes of the class in the new ratings system are as follows:

- Classes have a range of 480 points.
- Each class is divided into 4 sub-classes, such that class A is divided from high to low into A1, A2, A3, A4 each with a range of 120 points.
- The underlying assumption behind creating the points difference for an individual sport is that a 120 point difference in rating in Class A (ie one sub class) equates to on average a 21-15 victory in an individual sport for the higher ranked player.
- There is a graded differential between Class A and Class B, such that a 21-15 victory in an individual sport in Class A is considered equivalent to a 21-13 victory in Class B, and equivalent to a 21-11 victory in Class C.
- The logic behind this is that when the standard of players is greater there tends to be more consistency in individual sport match scores.
- There is not a graded differential for the overall rating.

Each player would have an overall rating, and a rating for each individual sport. So for example, my rating would be something like B1 overall, then B1 for table tennis, A4 for badminton, B2 for squash and B1 for tennis (or something like that). Note that my overall rating changes when I win or lose a whole match, whereas my individual sport ratings change according to the result of the match in that sport.

So assume I played Fabien Mauroy, lost the TT, won the other 3 sports and won overall. My overall rating would increase, as would my badminton, squash and tennis ratings, and my table tennis rating would go down. The amount that my TT rating would go down would be a combination of the difference in mine and Fabien's ratings, and the score in the match. Given that Fabien's TT rating is likely to be significantly higher than mine in the first place, he would need to win by a very large margin to increase his TT rating by a significant amount.

Ratings are recalculated after each match, although in practice any changes will be calculated after each tournament.

Rating new players

If two people are playing each other and they both have ratings, then the number of points won or lost can be calculated using the assumptions above.

However if one person is unrated, and the other is rated, then a temporary rating is calculated as follows:

- For each sport, the temporary rating is calculated relative to their opponent's rating.
- If their opponent has an A4 TT rating and they beat them 21-15, then their temporary TT rating will be set around 120 points higher than their opponent's. If they lose 21-15, their temporary rating will be set around 120 points lower.
- If a new player plays only one rated opponent in a tournament, then (assuming that they play all 4 sports), they would have temporary ratings for all 4 individual sports. Their temporary overall rating is then calculated as the average of the temporary individual sport ratings.
- If a new player plays more than one rated opponent, then their temporary individual sport ratings for TT are set at the average of the temporary ratings calculated against each opponent, and are set similarly for the other sports. As before the overall temporary rating is set as the average of the individual sport ratings.

Following a tournament, there is an initial set of calculations to determine temporary ratings for all new players. Then there is a second set of calculations which moves everyone's ratings up or down depending on the result of all their individual matches.

Initial ranking of UK players

As currently no-one has a rating based on the new system we will have to generate new ratings for all players. The way that we will do this is to select a small group of seed players (probably those who play most frequently) and the ERA committee will set some initial ratings for those players. We will then retrospectively work out other people's ratings based on tournaments starting from the 2014 Yorkshire Open (as that's the first one recorded in Tournament Software), and use results from the 2014 ERA and World Tours to generate ratings for all UK players. Note that in order to do this we will actually have to create and maintain unofficial ratings for all players who have played on the ERA or World Tour.

Open, U16, U21, 45+, 55+ and Men v Women ratings

The disadvantage of the current system is that lots of players have two sets of ratings, for example a vets rating and an open rating. Currently people only have a 45+ rating and ranking if they have played in a 45+ tournament, and that ranking only change when they play 45+ events, and not if they play open events. There are currently no 50+, or 55+ UK ranking, because there aren't enough events played to make the rankings statistically robust.

With this new system, people will only have one overall rating (and a set of ratings for each individual sport), and anyone that they play will affect their rating. This means that it is feasible to create sub-lists of U16, U21, 45+ 55+ etc as long as we know people's year of birth. Anyone wanting to be ranked in any of the non-open age categories will need to supply their year of birth. Year of birth will never be published.

There are very few instances of women playing men at racketlon, so it is likely that mens' and womens' ratings will be entirely independent and that the #1 in the world for each gender is likely to have a very similar rating overall.

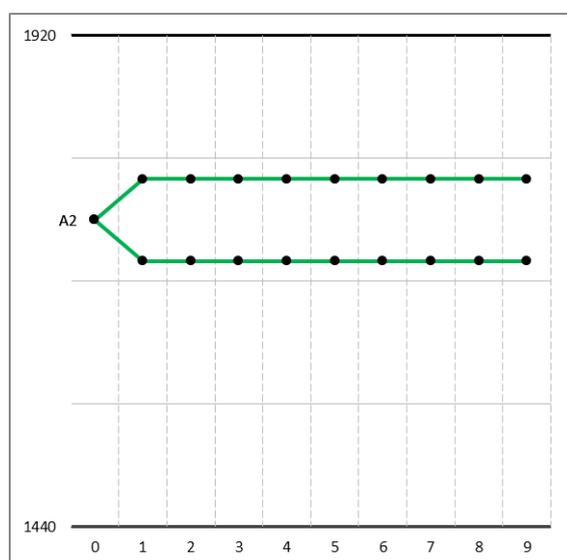
Maths

The rest of the document sets out the maths behind the ranking system. However, this section is mainly illustrated with charts, so you may be able to ignore the formulae and look at the charts and read the accompanying commentary. The formulae are included for transparency and documentation of the ratings system.

Changes to the overall rating when the equal players or the stronger player wins

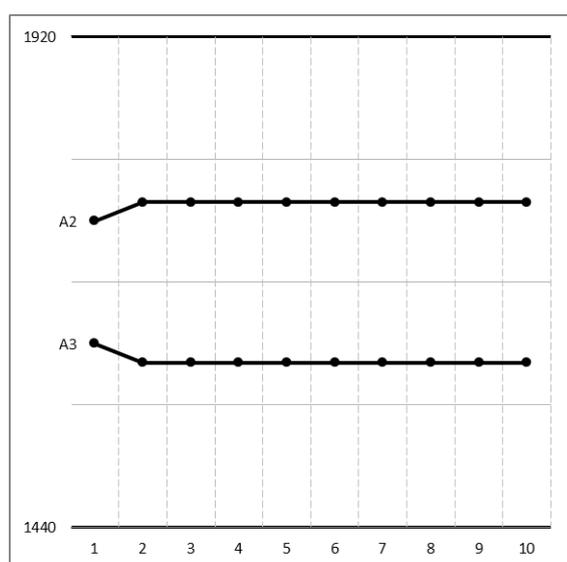
Each class is 480 points and is split into 4 categories. For example class A consists of A1, A2, A3, A4 sub-classes each of which has a range of 120 points. A formula is used to calculate the number of points exchanged between players. The formula has been designed so that changes are minimal if the winning player is two sub-classes above the losing player before a match, but that if players were the same level before a match, there will be 80 points difference between them afterwards (two-thirds of a class).

The following examples illustrate what would happen to a mid-A2 player, but the same formula and number of points exchanged apply to all levels.



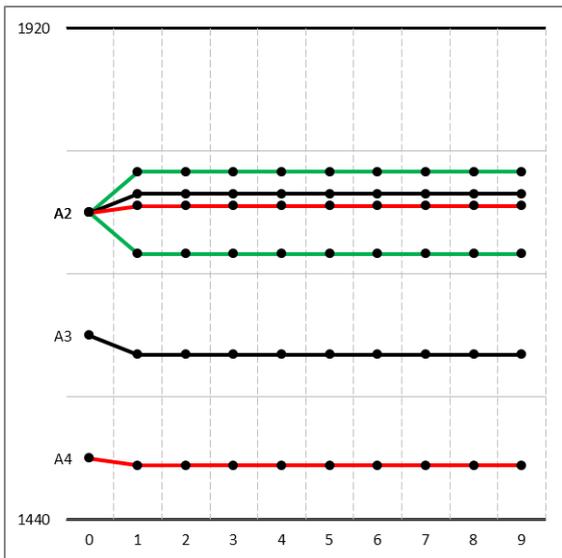
If both players were ranked in the middle of the A2 band before playing, the winner will be rated at the top of the A2 band after playing, and the loser at the bottom of the A2 band. The winner gains 40 points and the loser loses 40 points.

There is no relationship between the margin of victory (shown on the x-axis) and the number of ranking points won or lost (y-axis).



If a mid-A2 player beats a mid-A3 player, then the number of ranking points won or lost is lower.

In this instance rather than gaining or losing 40 points, the winning player gains 19 points and the losing player loses 19 points.



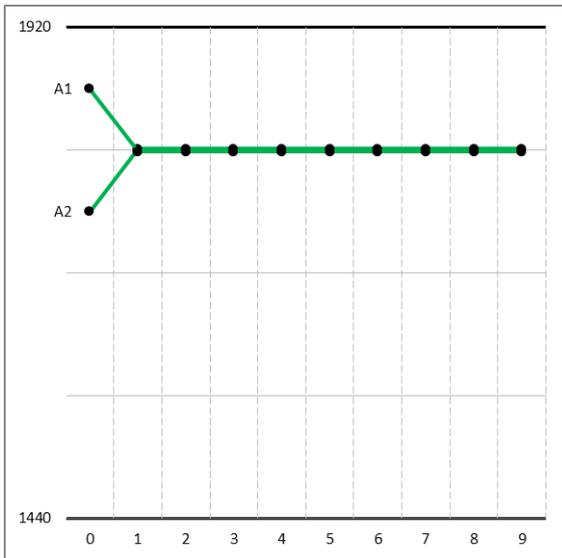
If a mid-A2 player beats a mid-A4 player, then only 7 points are exchanged.

The chart on the left shows all 3 scenarios of a mid-A2 player beating a mid-A2, a mid-A3 and a mid-A4 player.

The system is set up so that there is a law of diminishing returns, otherwise if someone continually won all their matches their rating would continue to go up indefinitely.

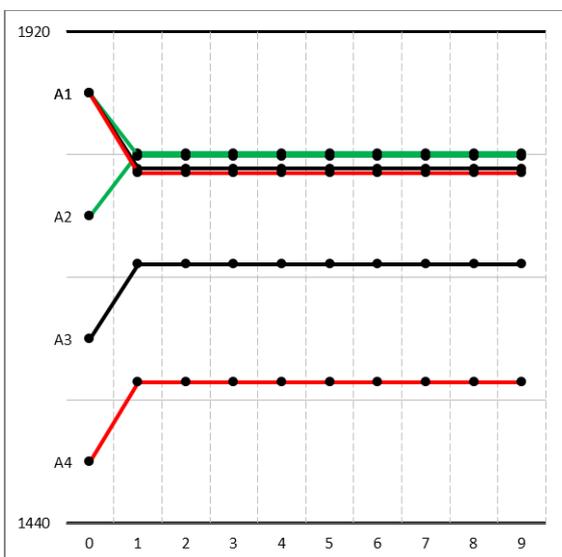
Changes to the overall rating when the weaker player wins

The formula also rewards players more when they beat someone who is higher ranked than them.



If a mid-A2 player beats a mid-A1 player, then 61 points are exchanged, so that the winner ends up 2 points higher ranked than the loser.

This compares to the 40 points exchanged when two players of equal rank play.



If a mid-A3 player beats a mid-A1 player, then 73 points are exchanged (black lines). If a mid-A4 player beats a mid-A1 player, then 78 points are exchanged (red lines).

As you will normally play a minimum of 3 matches in a tournament, if you win the class then your overall rating will increase for each of the 3 matches.

Formula for overall rating

The formula for determining the number of points exchanged for the overall rating is

$$\text{Points} = 80 * (1 - (1 / (1 + \text{EXP}(0.01 * (R_{tL} - R_{tW}))))).$$

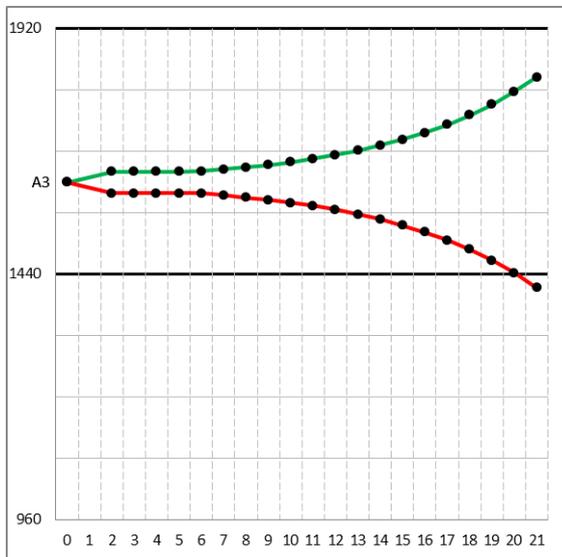
Where

R_{tL} = Rating of the loser before the match was played

R_{tW} = Rating of the winner before the match was played

Changes to individual sport ratings – margin of victory and dampening effect

Changes to the ratings for individual sports follow the same sort of formula as for the overall rating with two additional factors. The formula takes into account the level of the victory and the overall skill level of both players.

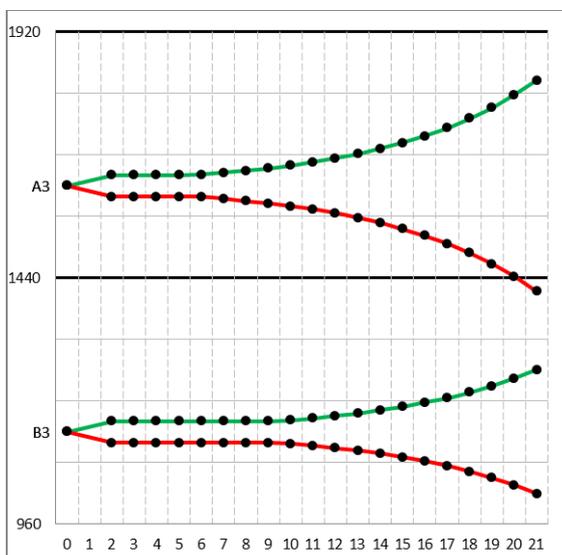


The chart shows the number of individual points won or lost when two equally ranked mid-A3 players play each other.

If one player wins by two points (21-19), then 21 ranking points are won/lost, and the same number of points are won/lost for victories between 21-19 and 21-16. At 21-15 the 22 points are won/lost and the number of points won/lost then increases on a shallow exponential curve.

If the victory is by 13 points (21-8), then 62 points are won/lost, with the result that after the match the players are 120 points or one sub-class apart.

A victory by 17 points (21-4) results in 113 points being won/lost, so that after the match, the players are almost two sub-classes apart.

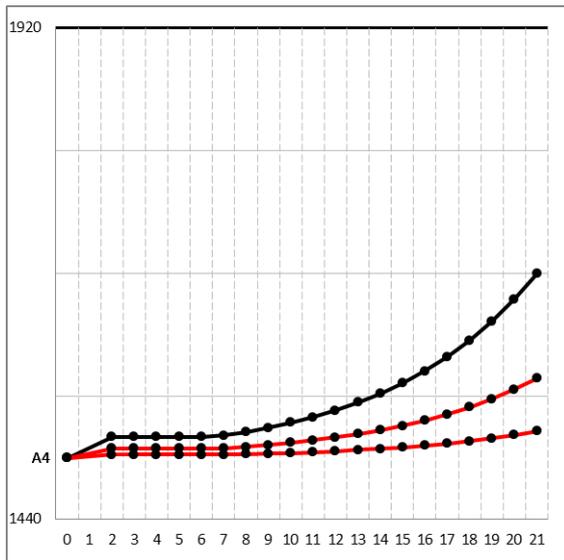


There is also a dampening effect built into the formula to take account of the fact that the greater the skill level of the players, the less variation there tends to be in the margin of victory.

The chart on the left compares the points exchanged between two mid-A3 players playing and two mid-B3 players playing. You can see by eye that the graph at the lower class is shallower than the higher class.

So a 21-8 victory for the mid-A3 players is equivalent in terms of the number of points won/lost to a 21-5 victory for mid-B3 players.

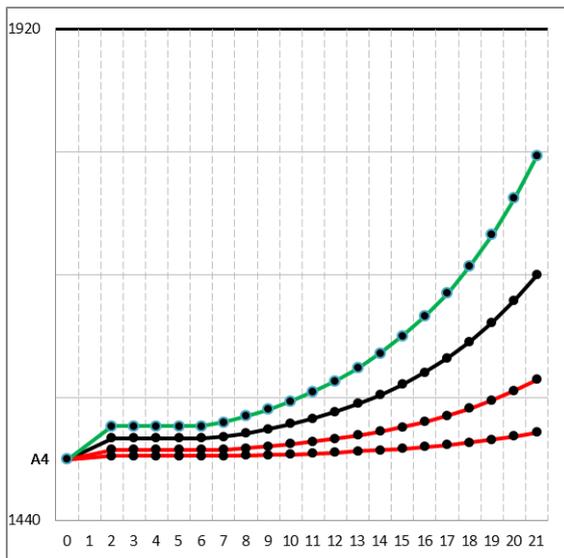
These graphs show the ranking points won or lost for an individual match, and in most tournaments you will play a minimum of 3 matches. So if you win at a sport in all 3 of your matches, your ranking for that sport will increase 3 times.



As with the overall ratings, the number of points won/lost decreases if the winning player was higher ranked than the losing player to start with.

The chart on the left shows how the points won/lost vary by the margin of victory for a mid-A4 player playing against a similar mid-A4 player in black and against a mid-B1 player in red (upper line) and against a mid-B2 player (lower red line).

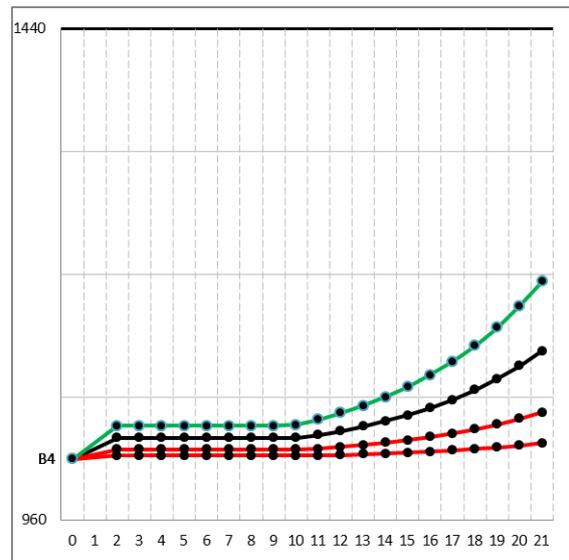
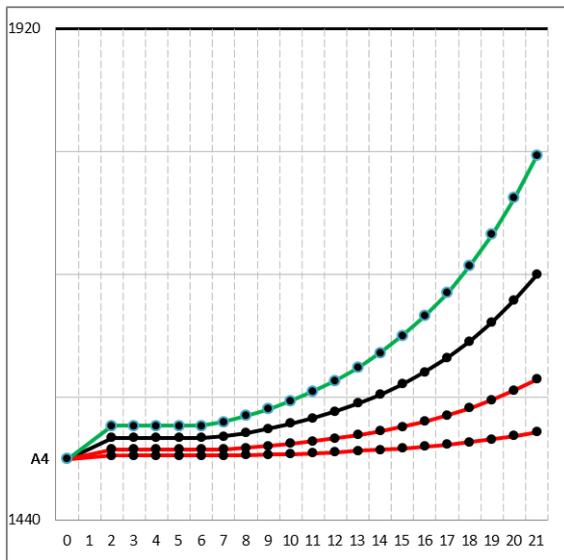
So for example beating another mid-A4 player 21-7 results in a 63 point gain, whereas the same victory against a mid-B4 player gains 27 points, and gains only 9 points against a mid-B3 player.



In contrast, if a mid-A4 player beats a mid-A3 player then the points that they gain is greater than beating a mid-A3 player (green line).

The same 21-7 victory that resulted in a 63 point gain against the same mid-A4 ranked player, gains 104 points against a mid-A3 ranked player.

The two charts below show the dampening built into the formula, one based on a mid-A4 player, the other on a mid-B4 player. You can see that the fewer points are won or lost at the lower class than at the higher class for the same margin of victory.



Formula for individual sports rating change

The formula for the number of points won/lost in individual sports is more complex than for the overall ratings because it takes account of the margin of victory and the dampening effect. Remember that for tennis matches the score is scaled up to a 21-x victory provided that at least 11 points have been played.

$$\text{Points} = 120 * 0.35 * \text{EXP}(0.15 * \text{MIN}(0, \text{Pt}_w - \text{Pt}_l - (\text{MEAN}(\text{Rt}_l, \text{Rt}_w) / 135))) * (1 - (1 / (1 + \text{EXP}(0.01 * (\text{Rt}_l - \text{Rt}_w))))).$$

Where

- Rt_l = Rating of the loser before the match was played
- Rt_w = Rating of the winner before the match was played
- Pt_w = Points of the winner (21)
- Pt_l = Points of the loser