Handicaps in Tennis

By Geoff Trott

It is useful to be able to rank tennis players in order of their abilities for a number of reasons. In the case of players in tournaments, the ranking is determined by their results against all the other individuals playing in the same events and is done on a win/loss basis. This ranking is then used for seeding players and for allowing entry into tournaments (32 best players for example). Ranking is also used for doubles teams, although when players change their partners it becomes a bit problematic as to whether their ranking will or should be affected.

Tennis is a game against other players, where players can win more points than their opponents but lose the set. So the result of a set depends on the relative ability of the players and how each player copes with the shots from the other player. Handicaps perhaps should be applied at the point level but in practice are more often applied at the game level. The handicap is not often used to decide the result of a set but more often used to determine the final result of a match

One way to use handicaps in team tennis is to give each individual player a handicap such that when the games won by the players in each team are added up and the sum of the handicaps of each player in the team is added to or subtracted from the games won, the difference between these two results is close to zero. The handicaps are added if the better players have smaller handicaps and subtracted if the better players have larger handicaps. For example, consider the case that team A plays against team B using handicaps with the better players having smaller handicaps. Assume that team A wins a total of N_A games and the sum of the handicaps of the players in team A is L_A while team B wins a total of N_B games and the sum of the handicaps of the players in team B is L_B then ($N_A + L_A$) should equal ($N_B + L_B$) if players in both teams played to their handicaps. Similarly, using handicaps where the better players have larger handicaps, assume the sum of the handicaps of the two teams are H_A and H_B, ($N_A - H_A$) should equal ($N_B - H_B$) if players in both teams played to their handicaps. Normally, the difference in handicaps is added to the team whose handicap indicates that they are the weaker team so assuming team A is the stronger team, our examples would be rearranged to N_A should equal ($N_B + [L_B - L_A]$) or N_A should equal ($N_B + [H_A - H_B]$) if both teams played to their handicap.

Notice that this type of handicap does not change the result of any set so the better players should win most of the sets they play. If the winner of the match is determined by the number of sets won, the handicaps will not change that result as they are only applied at the end of the match and to the games won by each team. If the result is determined by a combination of sets won and games won, the handicap may allow the team winning fewer sets to win the match. Playing matches with handicaps allows teams to win points by playing better than their handicaps even if they have trouble winning a set. Giving each player a handicap helps in deciding how to group teams into divisions of approximately the same abilities by considering the minimum and maximum team handicaps for each team.

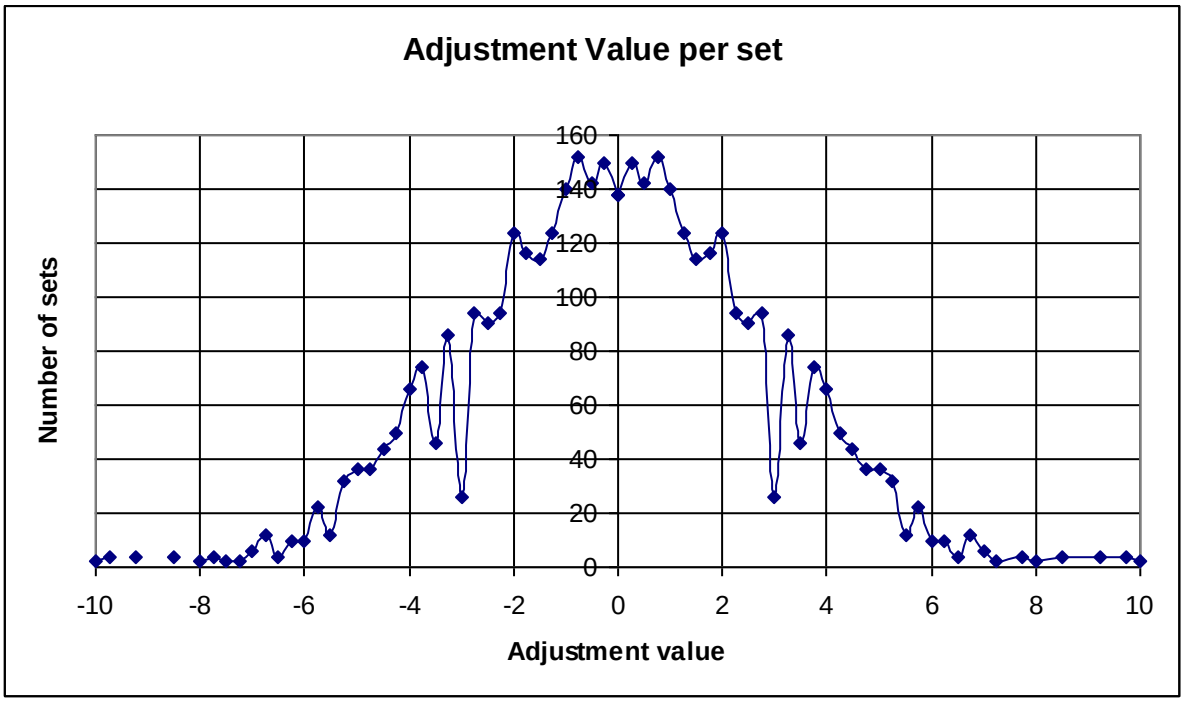
Since the handicaps are always used as differences between the handicaps of players in the match, the actual handicap of a player is only a relative value compared to the handicaps of all players that are playing in the competition and not an absolute value. The handicaps are a relative measure of the performance of a player in a competition with all the other players in the competition. That means a constant value can be added to (or subtracted from) the handicap of all players and there will be no change in the operation of the handicaps.

It is most unlikely that handicaps will reflect the actual result of every set played. There is too much variation in the results of a set of tennis due to circumstances on the day. The handicaps can only be such that on average they reflect the results obtained in a competition. So like all averages, they need to be based on a large number of results, in this case set scores, involving as many different players as possible. Consider a junior player who may hit the ball very well and with speed, but if his shots keep coming back from the other end, he will probably make a mistake

before winning the point and not get the results that his ability to hit the ball would appear to deserve.

Setting the handicap values

Assigning handicaps to players and keeping track of players' results requires some guidelines to follow. For example, it is desirable that most players' handicaps remain constant once they reach their "normal" performance level. However the results achieved by most players show a large variation over all the sets they play. Typically, the variation in adjustment value in each set can be as large as 10 and about 40% of all sets played have an adjustment value of 3 or more. The graph below plots data from a typical competition for all sets completed by all players in all divisions of the competition and shows the total number of sets completed that had each adjustment value. The data that are available on the performance of each player is historical, based on competitions completed and so may not be very good at predicting the future performance of players in different circumstances. However, historical data should help in deciding if a player is improving with age or getting worse with age, for example. A guiding principle should be to make changes slowly to the handicaps of players who have matured in their tennis abilities, and only change quickly the handicaps of new players and young players that have shown improvement over one competition. Given that there is an expected variation in the adjustment values for individual sets, the most reliable handicap values are obtained for players who have completed the largest number of sets in a competition.



So the committee should be presented with the historical record of all players in the most recently completed competition to help it decide whether or not to change players' handicaps. This historical record can be in two different forms: the actual handicap used by each player in each competition with the best value for the results achieved in the most recent competition; and the best value for the all the most recent competitions.

The best value for the handicap for a particular competition is calculated by adjusting the handicaps of all players in the competition to be within a range of 0.5 from the value that gets their adjustment value as close to zero as possible. If the best handicaps for the most recent competitions show a consistent adjustment value, the actual handicap of that player should be adjusted towards that consistent value. For new players, who do not have an historical record, they should be given their best handicap, as that is the best estimate of their handicap based on the results data available. For young players who have shown improvement in the most recent

competition compared to the prior one, their handicap should be changed to the best value as this is the average value over the whole competition and they will probably improve over that value, even if their rate of improvement levels off. Players who do not have a consistent best handicap value over recent competitions should have their handicap adjusted so that it is the mid range of their variation in best values.

Collecting and processing the data

The handicap adjustment process uses the data obtained from the results of the sets played by each member of all the teams in a competition. The sets are played with different partners and against different opponents. In the case of the mixed competition, the players are involved in playing mixed doubles as well as same gender doubles. Players filling in for different teams in other divisions have results that help to maintain the relativities of handicaps across the whole competition. The data collected are used in the following way.

The handicaps of each pair of players in a set are added and the difference between the sums of the handicaps is used to predict the result of the set. The expected difference in the games of the final result is calculated by dividing the difference in handicaps by the number of sets played by each contestant in a match. For example, if we assume that everyone plays 4 sets and the difference in handicaps is 4, the expected result is (6 – 5). If the better players have lower handicaps, the pair with the lower sum of handicaps is expected to win. If the better players have higher handicaps, the pair with the higher sum of handicaps is expected to win.

An adjustment value is calculated by finding the difference between the actual score in the set and the expected result. If one pair is expected to win (6 – 4) and they win (6 – 2), the adjustment value for the winners is (-2) if the better players have lower handicaps and (+2) if the better players have higher handicaps. That is, if the actual result indicates that the pair played better than their handicaps predicted, the sign of the adjustment value is such that it would take their handicap towards the better player values. The other pair would have the same adjustment value with the opposite sign. Similarly, if one pair were expected to win (6 – 4) and they lose (6 – 4), they have played 4 games worse than the handicaps predicted and their opponents have played 4 games better than the handicaps predicted. The adjustment values for the set are given to both players in the pair. So every player has an adjustment value for each set played, and these are added together for all sets played over the competition to give a total adjustment value for the competition for every player. Incomplete sets are ignored in this process.

That describes the process that is used to assemble the data that are then used to adjust all players' handicaps. The data consist of one record of data for each player who has played one or more sets for a team in the competition. Players who only played for their own team will have one record of values. Players who have been borrowed by other teams will have a record of data for each team that they played for. The data record for each player in each team consists of many fields that include their current handicap, the total adjustment value, number of sets played, number of sets won, number of sets lost, number of games won and number of games lost. There are also data to identify in which division, team and the player's computer number in each team the sets were played. The computer number is less than 20 for players who belong in a team; 20 and above for pool players; and above 39 for players borrowed from other teams or other Tennis Wollongong competitions. During the handicap adjustment process, players who played in more than 1 team have the values in the key fields of total adjustment value, total sets and matches played in each record summed to give total values for these three parameters for all sets played by these players.

The Adjustment Process

The handicap adjustment process starts by adjusting the handicaps of the players who have the largest total adjustment value. When talking about the adjustment value, I mean the absolute value of the number, as the sign of the number only indicates which way to adjust the handicap, up (+) or down (-). The players with the largest adjustment value have normally played a large

number of sets and have a handicap that does not match their results. In an extreme case, it is possible to have an adjustment value of 48 for a match where everyone plays 4 sets (expected 6 – 0, actual 0 – 6 for 4 sets, for example). Changing the handicap of one player will change his/her adjustment value as well as the adjustment value of every player that he/she played with and against. So changing the handicaps of the players with large adjustment values first will affect many other players and may mean that other players' adjustment values will become closer to zero with no change in their own handicap. Handicaps are always integers so the changes to handicaps are made in steps of 1 each time. To perform the process of adjusting the handicaps of several hundred players playing 30 or 40 sets each is beyond the ability of pencil and paper calculations and is done by a program on a computer. The results are all entered into a database on the computer system and a program works on the numbers stored in this database.

The program used to adjust handicaps is given an adjustment value range in the program and finds all players whose adjustment value is outside that range and increments or decrements their handicap to move their adjustment value closer to zero and looping around the process until all adjustment values are inside the range. Changing a player's handicap by 1 causes a change in their adjustment value equal to the total number of matches they have played. If more than one player's handicap is adjusted at the same time and they have played with or against each other, their adjustment values will change by a slightly different value than the one just mentioned. Let me list some observations about the process so far.

1. The adjustment value for each set is distributed equally to both members of the pairs who played the set (one pair receives a positive value and the other pair receives a negative value) so the sum of all adjustment values for all players in the competition is zero. There are two questions raised by this. Firstly, it may be that one member of the pair was the dominant player and the other one the weaker player so why should they both get the same value? The answer to this is that it is too complicated to determine a fraction for sharing the adjustment value that makes sense in all cases and as long as everyone plays many sets with a number of different partners, hopefully the potential errors of giving both members of the pair the same adjustment value will be averaged out. Secondly, why not divide the adjustment value by 4 so that it is spread amongst the 4 players? Since we are trying to change the handicaps to move the total adjustment value closer to zero, this is not really necessary. Giving all four players the full value simply makes the total adjustment values for all players bigger than perhaps they should be and it makes hand calculations a bit easier. Also the handicaps will work with results of singles sets if all players get the same adjustment value that is not modified by the number of players involved in the set.
2. The expected result sometimes cannot be achieved. For example, if the sums of the handicaps for both pairs are the same, the expected result is (6 – 6) and the closest actual result to this is (6 – 5) by one of the pairs. This just has to be tolerated and a 1 game adjustment value for a set is quite reasonable (see previous graph). If all players win their serves, the result will be (6 – 5) to the pair serving first while if there is one break of serve the result could be (6 – 5), (6 – 4) or (6 – 3) to the pair getting the break of serve. This case is a balanced one in that either team can do better or worse than expected. In another scenario, if the difference in the sums of the handicaps of the two pairs is greater than six multiplied the number of sets played by everyone in the match, a (6 – 0) result would be a better than handicap result for the weaker pair and a worse than handicap result for the better pair. This case is an unbalanced one, in that the better team can only do worse and the weaker team can only do better than predicted. The problem of the difference being greater than this number is addressed by not using the adjustment value from any sets where the difference in handicaps predicts a result greater than or equal to (6 - -1). That is, if the expected result is (6 - -1) or worse, the adjustment value for that set is set to zero. This makes sure that the adjustment values are not distorted

by these results too much. Hopefully, this situation will not occur too often and teams should be encouraged to not play their lowest handicap players against the weak teams and the weak team should be encouraged to play their best players against the stronger teams.

There are limits to the accuracy of the handicaps due in part to the items above and to the difficulty of players being consistent in their performance when playing with different partners and against different opponents. When the results of teams are analysed, a standard deviation of about 10 in the games plus handicap difference values remains for all matches played that indicates there is a substantial variation in the prediction of results when playing a variety of teams even if the teams' handicaps are optimized. So the question arises: What criteria should be used to make a change to a player's handicap for future competitions based on the processing of the results of the last competition? Perhaps a handicap value can be found for all players that gives the players a total adjustment value that changes sign reasonably often over consecutive competitions to give an average adjustment value of zero over time or is close to zero all the time.

Players can be placed into groups according to how their adjustment values behave in successive competitions. There is a group of players (group A) whose adjustment value remains close to zero so they get results that agree with their handicap consistently with their various partners. There is another group of players (group B) whose adjustment value keeps showing an improvement in ability. This group mainly consists of younger players who can improve their play by quite a few handicap values in one competition. There is another group (group C) whose adjustment value shows a lessening of ability. This group contains players who have an injury or perhaps have lost some mobility with age or injury. And there also seems to be a group (group D) whose adjustment value keeps changing in sign with each competition or does not settle down to a steady value. New players can also be a problem when their initial handicap 'guess' generates results that lead to a large adjustment value.

The Adjustment Algorithm

The handicaps are adjusted based on the results of the previous competition just completed. The results of each set are compared with the expected result, determined by the handicaps of the players on the court. The sum of handicaps of the pairs of players at each end of the court are subtracted to get a difference in handicaps between the pairs and this difference is divided by the number of sets played by each player in the team (usually 4). This scaled difference is used to determine who should win and the score in games by which they are expected to win. The difference between the expected result and the actual result for each set is called the adjustment value and each player in each pair is allocated the same adjustment value for each set that they play. For example (assuming that the better players have lower handicaps), if the sum of the handicaps of pair A is 30 (e.g. 10 and 20) and the sum of the handicaps of pair B is 36 (e.g. 17 and 19), pair A should win the set by a score of 6-4.5. If pair A were to win 6-3 and so get a result better than the handicaps predict, both players in pair A would get an adjustment value of -1.5 and both players in pair B would get an adjustment value of +1.5. On the other hand, if pair A were to win the set 6-5, both players in pair A would get an adjustment value of +0.5 and both players in pair B would get an adjustment value of -0.5 (pair B played better than the handicaps predicted). The adjustment value does not indicate who won the set; it is only a measure of how close the pairs came to achieving the expected margin in games.

Once the minor rounds of the competition are complete, it should be possible to adjust the handicap of each player so that the sum of all their total adjustment values is as close to zero as possible. These adjusted handicaps are arguably the best objective measure of how good each player's results were for that competition relative to all other players in the competition and in particular, the players in their division of the competition.

The process of adjusting the handicaps follows an algorithm that treats every player by the same set of rules. The only inputs from the operator are to enter the number of iterations before a

pause in the process and to observe the number of changes made each step and the changes in the extreme values of variation and delhc (calculated by dividing the variation by the number of matches played) and hit return to continue the process. As the process nears the final steps, it can enter a stage where handicaps of several players start to oscillate between two values. This can be because the players only play with the same partners and so the handicap of the two players on the court changes by 2 when they both change by 1. Manually changing one player's handicap will solve this problem. At the end of the process, there may be a number of players who are on +0.5 or -0.5 away from the ideal handicap. If any one of these have their handicap changed by 1, their delhc value would simply change to the other 0.5 value, positive to negative or negative to positive.

Handicaps are integers so that it is not possible to get all the total adjustment values for all players to zero at the same time. Since a change in one player's handicap will change the adjustment value of every other player that was on the court with that player, the algorithm progresses by changing handicaps by one each iteration through the program. The number of players whose handicaps are changed at each step is limited by only changing the handicaps of those players whose adjustment values are the furthest from zero. This is done by finding the extreme value of delhc and setting the delhc range to be 0.2 less than the extreme value. This means that only a few handicaps will be outside the range at any iteration.

The parameter delhc (short for delta handicap or change in handicap) is the one that we are trying to get to be no more than 0.5 away from zero. Initially some players who have only played a few matches will have a large delhc while those players who have played a large number of matches will have a small delhc as their adjustment values have been reduced in the previous processing. It is an important part of the process to change the handicaps of players who have only played a few matches so that their results do not influence the handicaps of the players they played with or against, even if their assigned handicap does not end up being changed in spite of their best handicap for this competition being different from their actual handicap.

At the end of the process when no delhc values are outside the -0.5 to 0.5 range, the adjustment value of any player must be in the range of 0.5 times the number of matches played. Also, at any time the sum of all adjustment values of all players is zero. For players who have played for more than one team, the process adds the adjustment values, the number of matches and sets played for all teams to calculate their overall delhc and also changes the handicap for such players for all teams at the same time when required. The final handicaps are an indication of how all players performed in the competition that generated the results relative to all other players in the competition. They provide an objective basis for deciding whether handicaps of players should be changed for the next competition. They do not necessarily predict the actual handicap to use for players in the next competition.

The steps in the process of adjusting handicaps that have been used recently on all senior competitions are listed below. At each step, the adjusted data are stored in a excel file for further processing. The process is started by going to Tennis Activities > Reporting > Handicaps and selecting the desired competition. I suggest that you choose to Print Work Sheet for the runs during the competition before starting the adjustment process and when the adjustment process has reached its conclusion. Otherwise just choose to sequence by name and report by team. Then fill in the file name as suggested below.

1. A handicap report is run for the selected competition (GO) and the results are stored in a file that identifies the competition type, year and number. For example **sax-101000** shows the first mixed competition in 2010. Once the adjustment process starts, the file name would be initially set to a name of **sax-101nnn**, where nnn is the iteration number when the pause is reached. This step also sets up the temporary database table that is used for the handicap adjustment process. The extreme adjustment value and delhc value are displayed for information.

2. Click on Update H/Cs. This will proceed to iterate around the process until the extreme variation value is inside a range of 40.
3. When the iteration involves using the delhc range, two windows will appear in each iteration. The first will allow the delhc range to be changed. If you want to force a pause, put a large value in here so there are no changes and the process will pause and generate an output file. The second window will give information about how many changes have been made. Just hit *Enter* on each window.
4. Step 3 is carried out until the extreme value for delhc is either 0.5 or -0.5. This then has all players with their best handicap for the competition based on the results of the competition.
5. The historical data are updated and examined by a committee to decide if any players should have their handicap adjusted on the basis of their performance over several consecutive competitions and if any handicaps have changed during the process that now look as if they should not have changed. Using the best handicaps for a number of recent competitions as a guide, a handicap can be chosen for all the groups of players that caters for group D players by using the average of their best handicaps. Group B players can have their handicaps changed to be closer to the best handicap of their most recent competition and group C players can have a slow change to their handicaps start more quickly than for group A players. With group A players and indeed group D players, the aim would be to not change their handicaps unless there was a sustained change in their best handicaps for a few consecutive competitions and then the change would only be by 1 at a time. New players should be given their best handicap or close to their best handicap. Players who only fill in for up to 3 matches, should have a handicap that reflects their best handicap but unless they are young improving players, changes to their handicap should be slow.
8. The changes decided by the committee are entered manually into the teams of the most recently completed competition and a final run is made to get the final adjustment value and delhc for all the players.
9. The final handicaps and adjustment values are entered into the historical record.

This completes the handicap adjustment process.