

Handicap Tables

by David Lane

The coincidence between Bill Lavender's letter in the February/March issue and the announcement in the January News from the Centre that a new set of Handicap Tables have been distributed for comment may have set a lot of people wondering exactly what is going on.

Let me say at once that there is no conflict between Bill Lavender and myself. I am now in correspondence with him and have sent him a set of my Tables together with detailed notes on the way in which they were produced. They are based on exactly the Principles he outlined in his letter to you. I believe that the only difference between us is that having spent the whole of my professional life in research, design and assessment of weapon systems, including both guided and ballistic missiles, I am perhaps a little more cautious about making assumptions and had to justify each one of them before I built them into Handicap Tables.

In the end I used the same assumptions as Bill Lavender, but it is as well to be aware that none of them (except of course his second) are strictly true. However, the ways in which actual shooting differs from these theoretical assumptions do not produce significant differences in Handicap Tables but the knowledge can be put to good use.

It is in the hope therefore that I can put people's minds at rest about what is going on, and at the same time provide some information which will help to improve scores, that I offer these notes on the whys and wherefores of the proposed new Tables.

My interest in Handicap Tables started in 1976, when I found it difficult to answer apparently simple questions like "How many extra points can I pick up by using thicker arrows? and from juniors "which is my worst range — I want to practice it?"

Having set out to answer questions like these, the idea of a Comprehensive set of Tables which could be used as a working tool to help archers improve their shooting, began to take shape. This led me to wondering whether the assumptions built in to the existing Tables were still valid in the light of the advances in scores which have taken place so dramatically over the last few years. Further, with greater availability of better equipment, more and more juniors are shooting the York, Hereford and FITA rounds by the time they are 14 or 15 years old and separate handicap ratings with a drastic change when they are 18 is becoming unrealistic.

Finally, new rounds may be required, such as the Junior National round recently introduced, and we need a way of generating the appropriate figures quickly to keep Handicap Tables up to date.

The first question which had to be answered was the effect of arrow size. If the size of arrow makes a significant difference, then it would be almost impossible to provide comprehensive tables. Calculations were therefore done for 16/64, 18/64 and 20/64 arrows at accuracies of shooting which would cover the range from over 1400 on a men's FITA right down to 117 points from a St. Nicholas. The result was that the maximum difference between 16/64 and 20/64 arrows was only 2 points on a double FITA 1 and the same on a full outdoor FITA.

I do not know whether the average archer uses 18/64 arrows, but I am content that I can use this size without invalidating the results for other sizes by more than a point or two either way. I can also confidently assure archers that it is much more important to use arrows

which match the bow and give clean arrow flight than worry about the extra line cutter decisions you might get by using thicker arrows.

Next came a fairly fundamental question. The sums that I had been doing had assumed circular, normal distributions of errors, centred on the pin hole. The reason for this is that the statistical properties of such distributions are well known and calculations with them are simple. Experience has taught me however, that while they are very convenient, they are not always representative of real life.

A limited study of patterns of shots of individual archers tended to confirm my worst fears. It appears that only the top archers shoot circular, central patterns. With most archers there tends to be a dominant error which produces an elliptical distribution of shots. Also, most regrettably, the majority of archers do not manage to centralise the pattern round the pin hole, even when you look at the results of a complete days shooting. In fact I came to the conclusion that the ability to shoot a circular pattern and centralise it is probably one of the signs of a really good archer.

Previous experience with elliptical distributions (which are not very easy to handle even with the aid of computers) had taught me that for the same average miss from the point of aim, reasonable amounts of ellipticity do not produce very large differences in the score. However, off setting the distribution from the centre can cause a fairly rapid reduction in score.

So a decision had to be made — should I build in to the tables some allowance for the apparent fact that the average archer doesn't bother to centralise the pattern of shots on the target? After consideration it was decided not to. This is an error which any archer ought to be able to recognise and correct. If not, the archer will pay the penalty of a lower score and a poorer handicap rating.

Once again, however, the practical advice is very clear. First and of major importance, read the target and adjust your sight to centralise the groups. Don't go to the extreme of becoming a sight twiddler and trying to adjust on each arrow, but watch particularly to see whether your shots are distributed evenly round the pin hole. Secondly, look to see whether your spread of shots is about the same vertically and horizontally. If not get your instructor or coach to help you identify the cause of the dominant error and work to reduce it. Both of these are absolutely standard bits of coaching advice — I can only repeat that I am surprised at how many archers don't seem to bother.

Next came the question of how exactly does accuracy (measured in terms of average angular dispersion) vary with the range to the target? It is fairly well known that accuracy decreases as range increases. Bill Lavender doesn't mention this effect, but it is a fundamental characteristic which must be built into Handicap Tables, otherwise you get unrealistically high scores demanded at long range. Further, I needed to know whether advances in equipment or technique had modified the law which Cmdr. B. Mc C. Smith built in to the 1973 tables and also whether the same law applies to both sexes and all age groups, bearing in mind the wide range of bow weights which are used. Rather than rely on theoretical estimates, I decided to analyse actual tournament results so as to keep the findings tied firmly to reality.

This analysis is tedious to say the least of it. You have to turn the problem round and work back from the score to the equivalent angular accuracy and then sort out how this accuracy varies with range. You then have to compare the results for the different age groups and decide whether they are significantly different. The analysis of course needs the scores at each range to be kept separate and regrettably most tournament organizers publish only the

total score. As perhaps one would expect there are pretty big variations from one tournament to another even when a lot of the same archers are competing, and so the results have to be averaged over as many tournaments as possible to average out the differing tournament conditions.

With the detailed results list available to me at the time it became apparent that the variations between one tournament and another were just as great as the differences between ladies, gentlemen, girls and boys — the results all overlapped one another with one important exception. In some tournaments, particularly in the youngest age groups, it is clear that there are effects due to tiredness or loss of concentration so that accuracy actually gets worse as the target gets nearer.

It was at this stage that I approached National Council and discussed the whole problem with the National Handicap Advisory Officer. The problem we were faced with was that if allowances were made for fatigue effects, then it would mean different scores per dozen depending on whether it was the third, sixth, eighth or twelfth dozen which was being shot! Otherwise a single law was reasonably applicable to all archers including those youngsters who had learnt or trained to take the full twelve dozen. So we decided not to include any allowance for tiredness.

This is the fundamental result on which Comprehensive Tables depend. Excluding tiredness, the average way in which accuracy decreases with range is independent of age, sex, bow weight or ability. Stated simply it says that whatever accuracy is achieved at 30m will progressively worsen by about 4.3% for every additional 10m in range.

At this stage it also appeared that the same law was applicable to both the 122cm and the 80cm faces, but I will return to this aspect later.

The law that I arrived at is slightly different to the one that was built in to the 1973 tables, but the differences in equivalent scores which result are quite small.

This preparatory work was completed in 1977 and the whole lot was programmed into the computer. A few preliminary runs were done to discover what range of angular accuracies had to be covered to cope with the required range of scores on all of the recognised rounds.

It was found that by starting at an accuracy which would result in a near maximum score on the men's FITA and making each handicap step equivalent to a precise 4% decrease in accuracy, the necessary range could be covered with 100 steps as in the present tables.

And so, a complete set of Tables finally rolled out of the computer. All of the recognised rounds, all the Junior Rounds, the Indoor Rounds (except the PAA/Worcester), tables of allowances, scores for 3 dozen at all the metric ranges (122 and 80cm faces) right down to 10m, and scores for 2 dozen at all the imperial ranges down to 20 yards.

Further discussion with the Handicap Advisory Officer produced a few minor changes in the presentation which were easily accommodated in the computer programme and a re-run produced the Tables as they are being circulated now. Unfortunately, there was insufficient time to allow adequate consideration and discussion, take a decision whether to adopt them or not, and if they were accepted, print and distribute in time for 1978.

This is the phase which is now going on. Copies have been sent out to all Regional Records Officers with a request that they go out to selected clubs for comment. So if you are interested, get to see the Tables and send in the comments to your

Regional Records Officer. If there are any detailed queries, or any further explanation required, mathematical or otherwise, I will do my best to supply the answers.

One aspect of the tables may cause some consternation particularly among the Ladies. Since the Handicap Rating is simply a measure of accuracy and the same laws apply to both sexes and all age groups, there is only one column of Handicap Rating Numbers and we had to decide where to put the Scratch level. I will doubtless be accused of being a male chauvinistic pig when I say it has been set at 800 on the York. I hasten to add that it can easily be moved down to coincide with 800 on the Hereford but it can't be set equal to both because 800 on a Hereford only requires 74% of the accuracy needed to shoot 800 on the York.

In the meantime the work goes on. The figures for the Junior National round were available a couple of weeks after the decision to adopt it was announced. The PAA/Worcester round has been added.

The same principles have been applied to the Field Rounds and a similar set of Tables for Field Archers have been prepared and are being discussed.

With a lot more tournament results made available to me by National Council, the Tournament analysis is also going ahead and some further results are taking shape. Earlier, I referred to the same law of degradation of accuracy with range applying to both the 122cm and 80cm faces. Now it is becoming clear that this is not quite true. It will probably surprise many archers to know that in general there is a slight *improvement* in accuracy when shooting on the smaller 80cm face.

All of the data, together with any comments which have been received, will be reviewed immediately after the middle of the year so that if the Tables are adopted, a final version including the additional rounds can be run on the computer, printed and distributed ready for 1980.

So once again, if you are interested, get your comments or criticisms in early so that they can be considered adequately.

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