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The 1985 IAAF Decathlon scoring tables: an attempt at analysis

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"This is a detailed analysis of the complex workings of the new Decathlon scoring tables. The author first examines the changes caused by the introduction of this new system in 1985 and then goes on to the consequences these changes brought about in training planning and in the determination of the winners. He concludes that the new scoring tables tend to favour the "hidden specialist" instead of the real all round athlete."

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Translated from the original German by Jürgen Schiffer.

1. Introduction

On April 1, 1985, new IAAF scoring tables for the Decathlon and Heptathlon came into force. The final decision to adopt the new tables was preceded by in-depth and sometimes heated discussions, including those at an International Scoring Table Conference which was convened in Prague in March 1983. In Helsinki in 1983, the IAAF Technical Committee was presented with three rather different scoring proposals, only one of which, naturally, could be accepted. The accepted proposal, which had been prepared under the leadership of Victor Trkal (TCH), was officially passed by the IAAF Congress in Los Angeles in 1984.

As combined event athletes have now been judged according to these tables for four competitive seasons, it would seem sensible at this point to make a provisional assessment of the new scoring system. Such an assessment is necessary, since the introduction of the new tables was by no means smooth. The purpose of this article, therefore, is to examine the new tables and to make an appraisement of their value.

2. Changes

If one were to convert the performances of top level combined event performers achieved before 1984 into points using the new scoring tables, there would be no revolutionary shifts in the rankings. However, for each of the first seven athletes on the all-time Decathlon list there would be a change of at least one place. In general, at this level, the athletes receive more points for their performances using the new tables. However, the increases are not uniform. Whereas for his best performance Uwe Freimuth (GDR) would receive 88 points more than he had before, Guido Kratschmer (FRG) would get only 18 additional points for his 1980 World Record. The causes of these changes will be dealt with in detail later. It must, however, be pointed out here that any change of rank implies the necessity for a more precise scoring system (Table 1).

Inspite of the fact that each introduction of new scoring tables (the current system is the 5th since 1912) has brought with it changes (the introduction of a new system without alterations would not make much sense), shifts of rank on the combined events lists brought about by new tables have never caused a great sensation. The general acceptance of the new tables might be the result of the logical thought that, as the lists remained more or less the same, the new tables must be as fair as the previous ones. However, completely different reactions might be evoked if the all-time lists in the sprints or Shot Put were changed, even slightly, through the later introduction of a new measurement system.

It is often overlooked that, in its creation, a scoring system can be "manipulated" or - to express it in a more neutral way -"mathematically adjusted" in such a way that the point level of a "target group" is changed relatively little while the point level of another group or groups is radically affected. In other words: without understanding the reasons for changes at different levels of performance, the real quality of scoring tables cannot be evaluated objectively.

That the changes caused by the 1985 scoring tables are by no means as insignificant at all levels as they may seem

Table 1: Changes in the point score and rank of the world's best decathletes (date: end of 1984)

Name	Diff.	Points according to 1985 table	Rank	Points according to 1964 table	Rank
THOMPSON	+50	8.847	1	8.797	2
HINGSEN	+34	8.832	2	8.798	1
FREIMUTH	+88	8.792	3	8.704	4
WENTZ	+44	8.762	4	8.718	3
APAYCHEV	+66	8.709	5	8.643	7
DEBTYAROV	+46	8.698	6	8.652	5
KRATSCHMER	+18	8.667	7	8.649	6

becomes obvious if one looks at the 7,000 point level. Here the tendency is not for an increase in points but, rather, a decrease by up to 200 points compared with the old scoring system. As a result, the range between a national level performance or an international junior level performance on the one hand and a world class performance on the other hand becomes considerably greater. The tendency towards "strict" scoring of medium level performances is even more pronounced on the 6,000 point level. This must surely have a demotivating influence on all athletes who, as yet, have not reached the top, but aspire to do so. The question must be how far is this tendency justified?

In order to give an answer to this question, it is necessary to make available a standard of comparison encompassing the whole range of performances, from beginner to top level athlete, in all the disciplines. The use of such a standard of comparison would make the assessment of "scoring fairness" possible. The main purpose of such a comparison is the identification of performances of equal standard, keeping in mind the principle that performances in different disciplines which occur with identical frequency statistical must be allocated identical point scores. From this it follows that "occurrence probability" can be used as a standard of comparison.

Thus, changes of the scoring characteristics can best be identified by contrasting the performances which the designers of the respective scoring tables think to be equivalent, at both the upper and lower ends of the scoring tables, by giving them identical point scores.

3. Lower scoring limits

At the lowest level of performance, reliable identification of performances of equal standard seems to be particularly difficult since here, one deals with the data of beginners and fitness athletes instead of with the data of experienced competitive athletes. A possible approach to answering the question of what performance in each individual decathlon discipline is worth, one point would be to just to the lower scoring limits of the 1964 scoring tables refer to. For this, it certainly would not have been much trouble to use the extensive statistical data of Jörbeck (SWE), who created the 1964 scoring tables, or those of Ulbrich (cf. Ulbrich 1950). However, if one compares the lower scoring limits of the new tables with those of the 1964 tables, it becomes obvious that this possibility has not been made use of (Table 2 on p. 48).

Generally, it can be said that - with the exception of the Hurdles - it has become easier to score one point. However, the changes are uneven rather than symmetrical. For example, compare the differences in the scores for the throws and for the 400m. From the point of view of setting equal standards, some "one point thresholds" attract attention at first sight. In the Pole Vault, for example, one point is given for clearing a height of 1.03m. In the Hurdles, on the other hand, the athlete must run over ten 1.07m high obstacles which are distributed over a distance of 110m in less than 28.09 sec in order to be given one point. In doing so, he additionally must surpass the Long Jump's one point threshold of 2.25m (even a beginner's hurdle stride is about 3m long!) as well as the minimum High Jump performance a total

of ten times (by 30 cm each time!). Thus, in hurdling, the athlete must considerably surpass the one point threshold of other events at least 30 times in order to earn only one point. Furthermore, to get that one point, he must be 3 sec faster than he needed to be with the old scoring tables. Thus, an equivalency between the one point thresholds of the various disciplines does not seem to exist.

A look at the throwing disciplines adds to this impression. In the Shot Put, for example, the athlete gets one point for a distance which is below the release height. Given the relationship between height of release, speed of release and the throwing distance, a one point performance of 1.53m requires only about 17% of the release velocity that a specialist will produce. In the 100m, the decathlete must achieve 56% of a world class sprinter's velocity in order to be given one point.

From the point of view of an equal standard of performance, the scoring of the lower limits of performance is so unbalanced that the only conclusions possible are that the statisitics used as a basis for the tables were from different populations or that they were "constructed". From the point of view of correct statistical procedure, neither of these possibilities are permissable.

4. Upper limits of performance

In contrast to the one point thresholds, the assessment of the upper performance levels is not very difficult. National and international statistics in all combined event disciplines make direct comparisons possible. Furthermore, it does not take much calculating to find rather meaningful and sound data of central tendencies via arithmetical mean values. Since the new scoring tables were introduced in 1985, it seems appropriate to use corresponding performance data from the period immediately before they come into effect for comparison. This the very material which must have been used for developing the new tables.

4.1 Comparison of top level performances

Figure 1 gives an overview of the performance data in the decathlon disciplines of three different groups: first, the World Records as they stood in 1984; second, the respective average values for 1984' top 30 specialists in

Table 2: Comparison of performance levels at the lower scoring limits

Scoring tables	100m	Long Jump	Shot Put	High Jump	400m
1985	17.83	2.25m	1.53m	0.77m	81.21
1964	15.69	3.60m	4.71m	1.13m	78.05
	110m H.	**Discus Throw**	**Pole Vault**	**Javelin Throw**	**1500m**
1985	28.09	4.10m	1.03m	7.12m	7:54.11
1964	31.95	12.82m	1.50m	14.03m	6:39.6

each discipline; and third, the average values of the marks in the respective discipline for the 100 all-time best decathletes (date: 1984).

Each performance or average is converted into points using the new scoring tables and is graphically presented in the form of an "antenna" (WR), or as a white (x 30 'S') or black column (x 100 'D').

At a glance, the very different heights of the "antennae" show that (from a statistical point of view) World Records are suitable for such a comparison in only a limited way. They vary extremely, are correspondingly of a unique character and do not express anything universally valid about the real performance standards of the respective events. However, the sometimes considerable extent of the deviations, together with the fact that all sprint World Records seem to be 'worth" less than the corresponding jumping and throwing records, creates confusion.

A comparison of the white columns confirms this statement to a high degree, although performances of almost identical standard are compared with each other. The fact that columns of approximately identical height are to be postulated does not prevent the average performances of

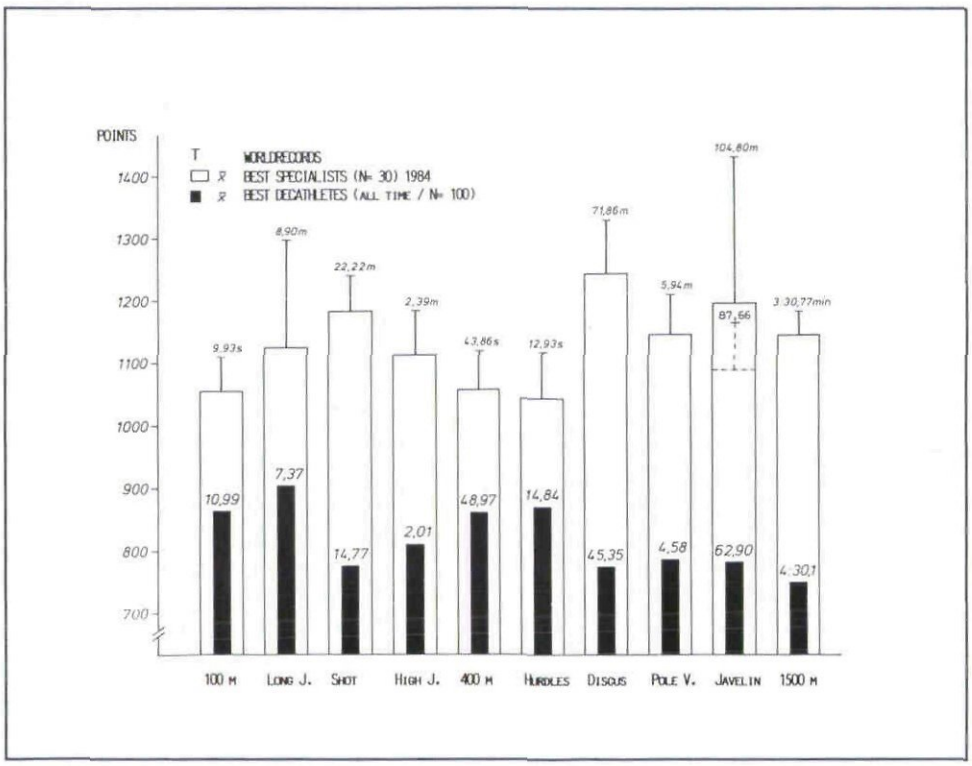

Figure 1: Comparative presentation of the level of World Records (date: end of 1984/new javelin: 1987, broken line), the average of the best performances of the world's 30 best specialists and the mean of the best performances of the world's 100 best decathletes in the disciplines of the Decathlon. Basis of calculation: 1985 tables

the world's best specialists to diverge from each other by more than 200 points!

4.2 The effects of the new javelin

In general it can be said that, according to the new tables, throwing performances are given the most points. However, since the introduction of the new javelin in 1986, this statement is only valid as far as the Shot Put and Discus Throw are concerned. The reduction in the mean throwing performance of the world's 30 best javelin throwers by about 8m in 1987 leads to a reduction of about 120 points. Because of this, the Javelin Throw drops behind the 1500m and all the jumping disciplines (see broken line: WR or $\bar{x}$ 30 'S' with the new javelin).

This remarkable difference, which was caused exclusively by the change of implement, has in no way been taken account of as far as scoring is concerned. Consequently, Decathlon results achieved in 1985 (using the new scoring tables and the old javelin) must be statistically dealt with in a completely different way than the results from the following years. The fact that Decathlon performance lists, record lists included, ignore this is evidence of a lack of sensitivity to the problems of the combined events. Whereas javelin specialists, who have comparatively homogeneous results, must accept similar reductions in distance, the situation for decathletes, who can have very heterogeneous javelin performances, is often completely different. Analogously, there would certainly have been different reactions if decathletes as good in the javelin throw as Raimo Pihl or Lennart Hedmark (both SWE) had still been active between 1984 and 1986.

For example, if, under the old tables, the total point score of a decathlete having a talent for the Javelin Throw was identical with the total point score of a competitor having a talent for the 100m, the javelin specialist would gain about 130 points when the new tables were applied! In 1986, however, the new javelin caused a reduction in the average throwing distance for a "good-decathlete" javelin thrower from about 85m to about 77m, whereas in the 50m range (an "average" decathlete's "average" mark) no reductions worth mentioning can be noticed. Accordingly, the advantage gained by a strong thrower in 1985 was reduced by about 120 points so that the equal point score for our two decathletes in 1984 was almost re-established again in 1986. Furthermore, since 1986, the relationship between the requirements in the Shot Put and the Discus Throw on the one hand and the Javelin Throw on the other has obviously been changed to the disadvantage of decathletes having a talent for the Javelin Throw.

The person responsible for the new scoring tables cannot be charged with a premature introduction of "his scoring system" nor the late introduction of the new javelin. Nevertheless, the simultaneous change of the conditions both in the Decathlon and the Javelin Throw would have been more desirable.

Not to increase the confusion more, but for reasons of correctness, it may be added here that, depending on the respective athlete's javelin performance, the Decathlon World Record will have been equalled, in theory, when a competitor scores within 45 points of the present record: with the new javelin, Daley Thompson's (GBR) 65.24m

would be worth about 3m less, which is equivalent to 45 points (Julin, 1988).

4.3 Reasons for the unequal scoring of the disciplines

Let us now turn back to the white columns. As already mentioned, they are particularly high for the throws, medium heights are achieved in the case of the jumps and the lowest point scores can be noticed in the sprints.

The main reason for this unequal treatment of performances which are actually of equal standard is the fact that, when making up the 1985 tables the objective, as implied in the preface to the 1985 Scoring Tables book, was to develop them according to relative instead of absolute criteria. Relative means that, in the case of the upper scoring limit, the standard of comparison was not the absolute performance capacity of the specialists, but that of the best decathletes. Thus, more points are given in those disciplines where the decathletes (as compared with the specialists) are weakest, i.e. in the throws and in the 1500m. Fewer points are awarded in those disciplines where decathletes are almost as strong as the specialists, namely in the sprints.

The Long Jump however, at least partially, contradicts this interpretation. Although here, decathletes achieve their best performances compared with the specialists, the Long Jump ranks ahead of the sprints as far as the height of the column is concerned (the cause of this will be dealt with later).

In order to check whether the new scoring tables meet the objective of being constructed along relative lines, the black combined event columns have been integrated into the white specialist columns. (The sample of the world's top 100 decathletes which had been taken as a basis meets strict statistical requirements.) Consequently, the mean values of 100 100m performances, 100 Long Jump performances etc. from the same 100 decathletes are contrasted with each other after having been converted into new scoring points. Analogous to the results of the specialists, it can be assumed that, relative to each other, these performances are more or less of equal standard. Correspondingly, they should be allocated approximately identical point scores.

However, a look at the height of the black columns shows that even here there are sometimes very great differences. This contradicts the objective to construct "relative" scoring tables.

A verification of the cause of this obviously unequal treatment of combined event performances of equal standard shows that, on this level of performance, points are apparently given on an absolute basis! If the points being given in the individual disciplines were put into a points ranking list, there would be conspicuously high correlations between this list and both a"velocity ranking" list and a ranking list of "best performances in combined event competitions".

A "velocity ranking" list is a table of the average running, release (throws) or take-off (jumps) velocities of the best decathletes in the world arranged according to the respective degree of approximation to the velocities achieved by the specialists in the respective disciplines (= 100 %). According to this table, the best degree of approximation is achieved in the Long Jump (95 % of the specialists' take-off velocity). This is followed by the

sprints (91 to 92 %), the Pole Vault and HighJump (about 87 %) and finally the throws and the 1500m (80 to 82%) (cf. Tidow 1981).

The "best performances in combined event competitions" list is the order which is created if the mean value of the ten best results of each of the individual Decathlon disciplines (independent of the total number of points in the respective Decathlon) is calculated and then converted into points using the new tables. The resulting ranking list of best performances according to points shows a highly significant correspondence with that ranking order which can be derived by having a mere look at the different heights of the black columns.

To sum up what has been said in this section, the conclusion must be that the objective, of creating relative tables has not been realised. Although the current mean performance standards of world's best decathletes are scored approximately correctly, this scoring (with the exception of the 1500m) is based on an absolute system.

4.4 The individual decathlete versus the "average" decathlete

Much more serious is the irrefutable fact that an individual decathlete, because of his specific talents and weaknesses, cannot be identical with the fictitious statistical "average decathlete", who is the artificial product of the calculation of the mean values of performance in the ten disciplines for the 100 best decathletes in the world. Depending on their individual performance structures, decathletes can deviate considerably from the "standard" in some disciplines or event groups. The problem with this is that, under the new tables, decathletes who are more talented at the running disciplines are at a disadvantage compared with decathletes who are more talented at the jumps or throws. Furthermore, such a method of scoring contradicts, to a large degree, the ideal of the all-round combined event competitor.

The main reasons that, up to now, this has not caused a sensation on an international level are the fact that the introduction of the new javelin was made without a corresponding adaptation of the scoring system and the fact that decathletes are at a disadvantage as far as the Discus Throw and Shot Put are concerned (because they are forced to keep a "normal" weight in order not to reduce their level of performance in the other events), thus preventing their penetration into spectacular "progression zones".

5. Basis for scoring: absolute or relative?

The question whether a scoring system should be developed exclusively on the basis of performances achieved in the combined event competitions (relative) or on the basis of all competition results (absolute) has always led to conflicting views.

The supporters of a relative system point out the injustice of judging the performance of combinded event athletes, who throughout their competition become more and more tired, on the basis of top marks achieved by athletes who are completely rested. They further state that the physical prerequisites which are needed for certain disciplines are much too varied to make possible a fair comparison between a single event specialist and a decathlete, who does 10 events. Irrespective of the

fact that many combined event performers do not surpass their best event performances when they are in a fresh state - i.e. when taking part in individual competitions - a close look shows that there is some misunderstanding on the part of supporters of relative tables.

If one proceeds from the assumption that the Decathlon is a test of all-round ability, the respective level of performance achieved in the individual disciplines can only be judged by means of an outside criterion. Thus, approximation to the specialists' level of performance in as many disciplines as possible becomes the objective measure of the degree to which the ideal of the all-round athlete has been realised.

Otherwise, one can only find out to what degree a combined event athlete has approximated the current level of performance of other athletes having the same goal. It can therefore be concluded that a relative scoring system does not permit a valid statement on the "all-round ideal". Furthermore, when using a relative scoring system, one disassociates oneself from the performance standard and performance development of the specialists.

In addition, since one can hardly keep single event specialists from taking part in combined event competitions, their participation would soon make a statistical revision of the upper relative scoring limit(s) necessary. There would be no "gain in fairness" if, in certain disciplines - such as the 1500m, significantly more points were to be given when using a relative scoring system. As long as the tables follow the principle of equality, all combined event participants would then be given respectively higher scoring points.

6. Principle of scoring: progressive, linear or regressive?

Apart from the shortcomings of the lower and upper scoring limits, the main reason for the preferential treatment of the athletes having a talent for the Discus Throw and Shot Put, compared with the athletes having a talent for the jumps, and the preferential treatment of the jumpers, compared with the sprinters, was the pushing through of the principle of (performance) progressive scoring.

Although the implementation of the obviously progressive "Sparks Scoring System", which had already been agreed upon, was prevented in 1982, the person responsible for designing the system were not prepared to give up the principle of a progressive point allocation rate.

Since, up to the present, no concrete information on the underlying basis of the 1985 scoring tables has been available (it is only known that this system is not based on velocity as was the case with the 1964 scoring tables), the performances in Figures 2, 3 and 4 (pp. 54-55) are linearly represented on the abscissa, and the corresponding point allocation curves for the new scoring system (bold) and, by way of comparison, for the old scoring system have been drawn.

The presented 100m, Long Jump and Javelin curves, which serve as examples of all the disciplines clearly show that points are allocated in a performance progressive way. However, in doing so, the progression in the 100m is so slight that the curve from the old tables, which are based on a linear velocity, turns out to be steeper! If one uses the jumps and throws curves as a comparison (see Figures 3 and 4), the

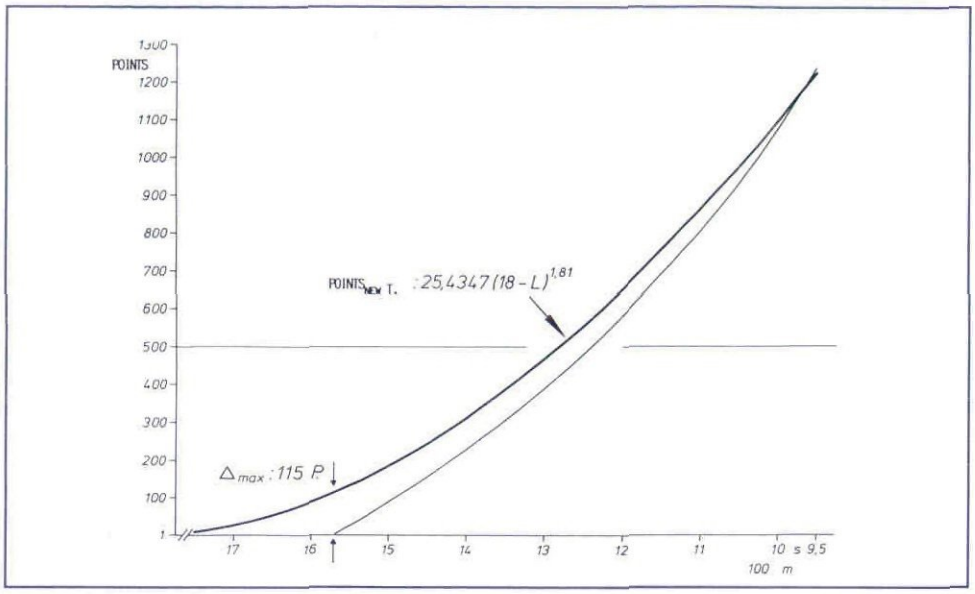

Figure 2: Point allocation curves for linear increases in 100m performance. The bold curve symbolises the 1985 scoring tables. The thin curve symbolises the 1964 scoring tables. The formula for the calculation of the point score is presented ("L" =performance)

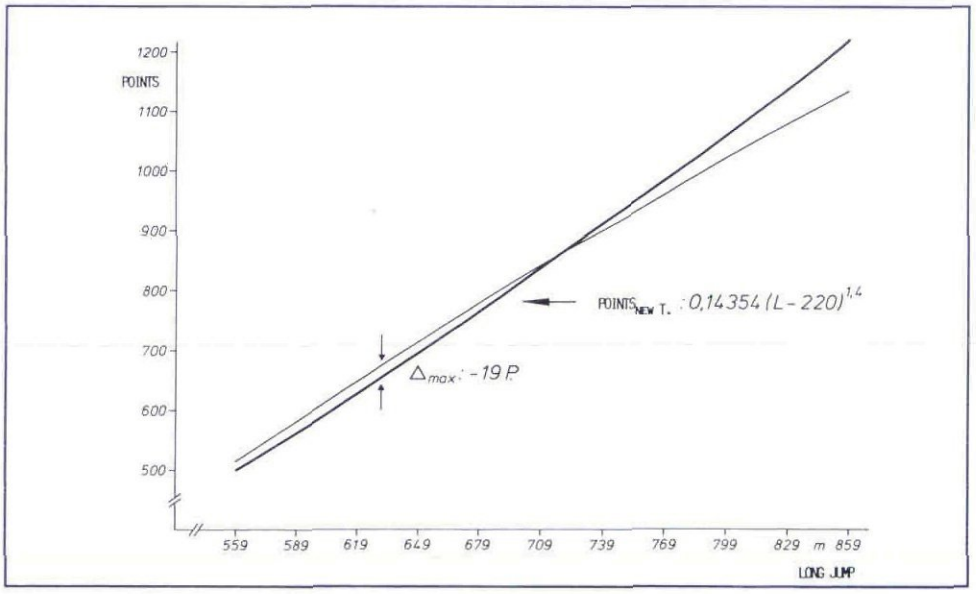

Figure 3: Point allocation curves for linear increases inperformance in the Long Jump. The bold curve symbolizes the allocation of the 1985 tables. The thin curve refers to the 1964 scoring tables. On the left of the point of intersection fewer points are given; on the right of the intersection increasingly more points are allocated. This shows the progressive orientation of the new tables in contrast to the slightly regressive orientation of the 1964 tables

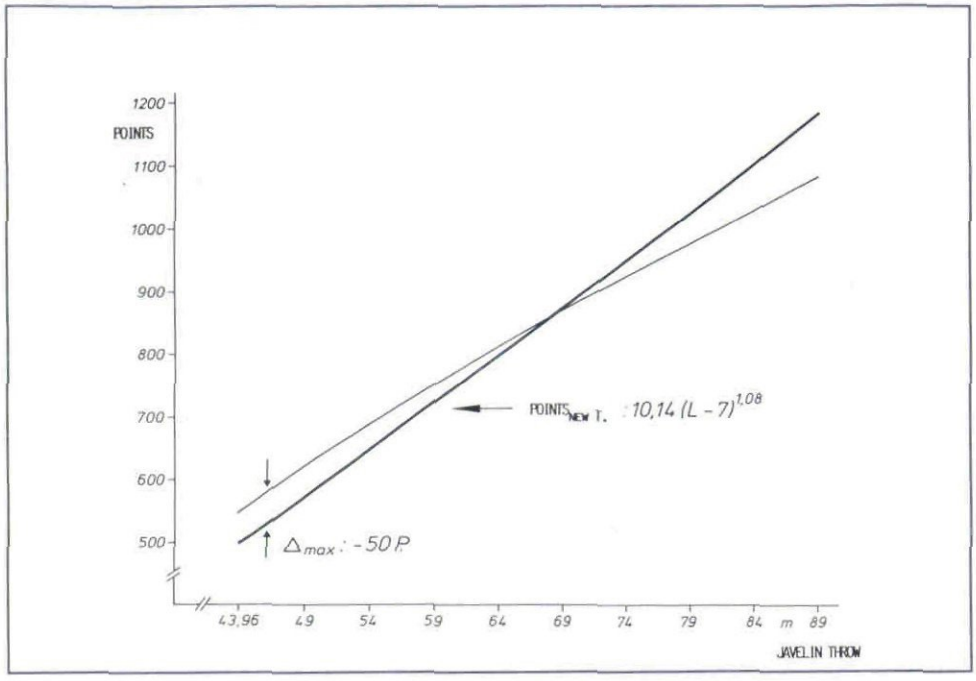

Figure 4: Curves with 1985 (bold line) and 1964 (thin line)scoring tables in the Javelin Throw. The negative maximum ofdifferences has been entered on the left side. If there is a linear increase in performance, the curves intersect at about 68m, so that, from this distance on, increasingly more points are given when using the 1985 tables. Thus, the curve sections make clear the progressive awarding of points in the throwing events with the new scoring system as compared with the regressive awarding of points when using the old tables

causes of the obvious disadvantage for decathletes who are strong in the sprints and hurdles is revealed. Whereas, in both the Long Jump and in the Javelin Throw, the progression rate chosen causes a rise of the curves, the curves fall when using the old scoring system. As a result, there is in the 100m a point advantage, caused by the lowered lower scoring limit, which becomes increasingly smaller. At approximately 9.55 sec, the old and new scoring curves intersect. In other words: on the 1985 scoring tables, when compared with the 1964 tables, the higher the athlete's level of performance, the fewer the points given for each improvement.

Since the situation in the Long Jump and the Javelin Throw is exactly inverse - a small performance progression according to the new tables as compared to a small performance regression in the old velocity-linear scoring system - after the points of intersection (at 7.21 or 67.45m, respectively) the gap between the two lines becomes greater and greater, which means that an increase in performance on a higher level is rewarded with growing rates of increase.

There is no reason for the respective degrees of the progression or for the form of the curves. However, it is obvious that, particularly in the 100m, a velocity-linear increase of running

speed brings about a superproportional increase in the corresponding energy expenditure since the air resistance which must be overcome does not increase in a linear but in an exponential way. Consequently, a rate of increase which is below the performance progression of the 1964 tables cannot be accepted from a physical point of view, either.

Thus, the original intention of the new tables to compensate decathletes in a correspondingly progressive way for the indisputably higher energy output it takes to improve one's performance if one has already achieved a high level of performance, has been turned into the exact opposite in the case of the running events!

The previously discussed asymmetry between the physical requirements in the running, jumping and throwing events at the specialists' level of performance is thereby explained. It can also be understood why, particularly in the jumps and throws, the lower performance limits had to be so extremely low. In using this quasi performance linear principle of scoring, the numerically rising or failing performance marks (c.g. 11m, 12m, 13m, or 12 sec., 11 sec., 10 sec.) prevent the determination of equally correct requirement relations, firstly at the one point threshold, secondly on the level of international decathlon performance standard and thirdly on the level international class specialists.

It should be mentioned here that the reason for the uncertainty regarding the rate to be chosen in each events the fact that, up to the present, there has been no scientific basis for the correct determination of the respective rates.

The same would hold true for tables in which a regressive principle of allocation was favoured. Although any tendency towards specialisation in a particular discipline within the Decathlon would be nipped in the bud by such a system (weaknesses are sanctioned while strengths are not rewarded), the statement that the choice of the respective degree of a decrease in allocation would have to be arbitrary holds true here as well.

From this it follows that a linear principle of scoring, reflecting the measuring processes, should be preferred. Unfortunately, a performance linear construction of the tables must to be ruled out since distance and time are different physical dimensions. For example, in performance linear tables the running disciplines would always be put at a disadvantage compared to the jumps and throws. This applies to the 1985 tables as well because the comparatively moderate rate of progression which was chosen leads to quasi performance linear effects.

7 Consequences

7.1 Training planning

What can be derived from what has been said above for both the daily training of decathletes and the planning of decathlon training in general? Of course, the fundamental principle of decathlon preparation, namely the optimization of the relationship between training effort and training effect is still valid. However, the 1985 scoring tables have made certain shifts of emphasis necessary. These shifts are primarily dependent on the individual athlete's performance structure. In order to illustrate this, the diagram in Figure 5 has been made.

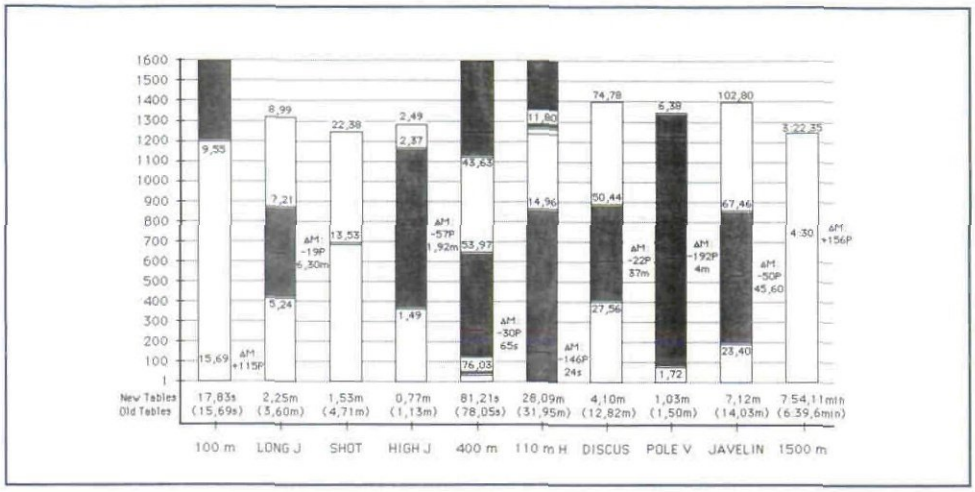

Figure 5: Point allocation characteristics of the 1964 and 1985 scoring tables. The white sections symbolise an increase in points. The shaded areas stand for a decrease in points. The difference maximum is symbolised by a plus or minus sign in each case, signifying the most conspicuous changes from the 1964 tables

The object of the diagram is to show visually, both to athletes and coaches, the peculiarities of the new tables. This would certainly have also been possible by the presentation of ten separate performance curves (see Figures 2 to 4). In this case, however, the synoptic clearness of the illustration would have been lost (see Figure 5).

The reference points for Figure 5 are the 1964 and 1985 scoring tables. The point column constructed above each decathlon discipline shows whether, according to the new scoring system, an identical number of points, more points or even fewer points are given compared to the old scoring system. To complete the picture, the new or old lower scoring limits are shown at the foot of the column.

The respective white column sections imply that more points are given for an identical performance. The shaded sections symbolize point reductions. The minus signs drawn at certain places within these shaded column sections mark the respective negative "delta maximum" (= difference maximum), i.e. that level of performance at which the most points are deducted.

The following four examples serve to illustrate this:

— In the 100m, up to a performance of 9.55 sec, more points are given than was the case with the old scoring tables. For a 9.55sec performance an identical number of points is given (shown by the double line) and the athlete who runs even faster gets fewer extra points. It is important to see from this "allocation dynamics" that, with increasing performance, regressively more points are given: the positive "delta-maximum" is at the bottom of the column.

- In the Long Jump there are two positive zones. From 2.25m to 5.24m regressively more and from 7.21m onwards progressively more points are given. Within the shaded negative zone

the situation is exactly the other way around: The closer one gets to the negative delta-maximum (minus sign at 6.30m), the fewer points are given; after this, the deduction of points is reduced again until "it draws level" at 7.21m. If one jumps further, one gets increasingly more points than according to the 1964 scoring tables (as has been said above). The situation is similar in the High Jump, Discus and Javelin Throw. In these disciplines, according to the individual athlete's performance capacity up to 57 points (High Jump: 1.92m), 22 points (Discus: 37m) or 50 points (Javelin: 45.60m) fewer are given.

- In the Pole Vault one gets more points for performances between 1.03 and 1.72m because of the extremely low one point threshold. Then, however, an extended negative progression zone begins. This zone reaches its maximum at a height of 4m; where it is minus 192 points! The higher one vaults over this negative delta-max, the smaller the deduction in points becomes. For example, for his excellent performance in Seoul, Tim Bright (USA), received 1,132 points which is only 78 points less than the 1,210 he would have scored under the 1964 tables.

- In the 1500m one always gets more points, the delta-max being plus 156 points at 4:30 min. When compared with the absolutely constructed 1964 tables, the lower performance capacity of the decathletes is judged considerably more "leniently". However this does not hide the fact that the respective point allocation rate for an increase in performance on a higher level is less than according to the old scoring tables! This means that the significance of the 1500m, like the other running events (the Decathon) for the decathlon diminishes!

7.2 What is the practical use of this diagram (Figure 5) for coaches and athletes?

If an athlete's individual point performance profile (after having converted the individual performances of the athlete's best decathlon competition) is entered into the respective columns, it can almost automatically be seen whether the athletes is in the negative or positive "progression zone" of the respective disciplines. It is obvious that such information can have a significant influence on the choice of where to put the emphasis in the individual training process. At any rate, the previous "scoring neutrality" was abolished by the introduction of the 1985 scoring tables. Thus, it is necessary to optimize the relationship between "training effort and training effect", which has already been mentioned, not only as far as talent, but also as far as scoring is concerned.

8. Determining the winner

The well publicised cheating incident in the Men's Long Jump at the II World Championships in Athletics in 1987 has unjustly brought the excellent measuring methods which are used in today's athletics into discredit. Through the use of these methods identically strict standards are applied all over the world. All result lists contain «relation scaled» data only. There can be no doubt that, in future, the IAAF will be able to prevent such manipulations (which are extremely rare anyway) by means of suitable measures. These were already evident

in Seoul at the Games of the XXIVth Olympiad.

However - if I might put it in an exaggerated fashion - in Seoul there was a case that was similar to what happened in Rome, although hardly anybody noticed it. It happened quite publicly and with the approval of the IAAF. It happened in the Decathlon. As far as timing and measuring is concerned everything was absolutely correct. However, even athletics experts are not aware that, because of the fact that, in the combined events, times and distances cannot be converted into directly comparable numbers, a second measuring system must be "put onto" the first one in order to determine the winner and the placed athletes.

From this it follows that the integrity and accuracy of the first measuring system can be maintained only to the degree of the quality and precision of the second system.

As shown above, the 1985 tables do not fulfill this demand. Completely contrary to this, the 1964 tables proved to be very good over a period of many years. During the time they were in force they were not criticized by combined event athletes. Almost all combined event experts agree that the so-called "Belgrade Scoring Tables"(adopted on the occasion of the 1962 European Championships in Belgrade) have been the best IAAF scoring tables ever. Only because of asymmetric performance development, after 20 years of use, could the compliance with the most important principle of scoring (according to which, performances of identical statistical value must be given an identical number of points) no longer be guaranteed.

As long as there is no definitely and convincingly better scoring system reflecting the linear measuring process with tape measure and stopwatch in a physically correct way available, there is no acceptable alternative to a revision of the 1964 Belgrade Scoring Tables. In other words, the tables that replaced the 1964 tables should have also been an absolute and velocity-linear scoring system developed on a broad statistical basis. Such a scoring system, made topical and revised, was officially presented to the IAAF in 1983. However, it was not accepted in favour of the present tables.

If this type of system had been used for determining the number of points given in the Decathlon at the Olympic Games in Seoul, the result would have been that Daley Thompson (GBR) would have been awarded the Bronze Medal!

9. Stability of the scoring system

It is beyond question that a scoring system once introduced should be valid as long as possible (provided that one is convinced of its usefulness). After all, the training of decathletes is not separated from, but oriented to the scoring system. The asymmetrical development of performances or the leaps in performance mentioned above are therefore sufficient reasons to check occasionally whether a revision might be necessary. In doing so, particular care should be taken that the most important scoring principle is kept to. Based on the present dynamics of performance development in athletics, future scoring tables must be adapted to reflect the greater progress in performance in the throws and jumps and the lesser progress in the running events.

Column Event	1 P 1964	2 P 1982	3 Points T.64	4 VA 82-64	5 P 2000	6 83 T.	7 85 T.
100m	10.253	9.921	1097 → 1.097 ×	3.7101m/s =	9.58	1189	1141
Long Jump	7.90m	8.185m	1054	0.9635	8.49m	1144	1188
Shop Put	18.75m	20.80m	1107	2.3923	23.20m	1200	1300
High Jump	2.17m	2.278m	1090	0.5832	2.41m	1184	1202
400m	46.00	44.95	1057	3.7771	43.89	1146	1110
110mH.	13.70	13.32	1050	4.3662	12.97	1139	1079
Discus	57.50m	66.39m	1141	4.5702	77.31m	1238	1454
Pole Vault	4.78m	5.562m	1183	1.2435	6.63m	1283	1440
Javelin	81m	88.04m	1072	5.6410	95.82m	1163	1289
1500m	3:40.2	3:35.6	1047	3.2073	3:3103	1136	1177

Table 3: Comparison of levels of performance of 1964, 1982 and 2000 (P: Performance; 64 T.: scoring tables of 1964; 83 T.: revised velocity-linear tables submitted to the IAAF in 1983; 85T.: scoring tables currently valid; VA: velocity amplitude in metres/sec between the 0 point and 1,000 point levels). Note: all clockings are hand times

How is it possible to predict how long a scoring system just introduced or about to be introduced will exist?

A quite practical method is to project the progress of development of performance in the individual combined event disciplines during the period of validity of the 1964 scoring system into the future. The development of performance during this period was primarily determined by the event specialists, but it was "imitated" especially in the sprints and jumps by decathletes. The time intervals between 1964 and 1982 and between 1982 and 2000 may serve as useful periods. 1982 has been chosen because the statistical data of all scoring proposals presented to the IAAF in the summer of 1983 go back to this year. The underlying process of calculation can be briefly described as follows (see Table 3).

The starting point is the 1,000 point level of the 1964 scoring system, which is constructed along absolute lines (as mentioned above). This means that it takes into account all competition results (column 1 'P 64'). These performance requirements are compared with the average values of the world's 100 best specialists in each decathlon discipline in 1982 (column 2 'P 82').

Each of the new performance equivalents is allocated the points given according to the 1964 tables (see column 3 'Points 64 Tables'). Since the 1964 tables are velocity-linear, the respective performance amplitudes which follow from the velocity differ-

ences between the average performances of the world's 100 best athletes in 1982 and the zero point thresholds of the 1964 tables (see column 4: 'VA 82-64') can be multiplied by exactly that factor which can be determined as improvement rate in the form of one thousandth points (1964 tables) from 1964 to 1982.

The result of this multiplication is shown in column 5 ('P2000'). The following example may illustrate this: In the 100m the performance level of the 100 best athletes from the 1982 all-time list surpasses that of the sprinters of 1964 by 97 points, i.e. the factor 1.097. If the velocity value of 'VA 82-64' is multiplied by that number, the result is the projected rate of increase in the 100m for the year 2000, provided that performance development is congruent.

The average performances of the year 2000 (see column 5 'P 2000') can now be converted into new scoring points. In column 6, the revised 1964 scoring system already mentioned has been used (see column 6 'T 83'), whereas in column 7 the 1985 tables, which are currently valid, have been used.

A comparison between the 'worst' and the 'best' events in the year 2000 shows that in the case of the revised 1964 tables, there is a difference of 147 points between the Pole Vault (1,283 points) and the 1500m (1,136 points). As far as the 1985 tables are concerned, the 'worst' and the 'best' events are the Discus Throw (1,454 points) and the Hurdles (1,078 points) between which there is a difference of 376 points.

This model calculation clearly shows that a velocity-linear and absolute scoring system can much better compensate for the diverging rates of improvement of individual events than the 1985 tables. Without being able to give an exact limit of tolerance for the most important scoring principle, which has already been mentioned several times, it is quite obvious that differences greater than 350 points between performances which are actually of equal standard lead to distortions and injustice as far as scoring is concerned. The reason for this is that a 'special talent' at certain discplines is favoured by over-proportionally high point allocations in such a way that 'all-around training' with special emphasis on the respective athletes's weak disciplines does not seem to make sense any longer.

For example, a decathlete highly talented at the Pole Vault and throws, i.e. a hidden specialist, would get 5,487 points in these four events in the year 2000, whereas according to the 1964 revision model he would only get 4,884 points. On the other hand, a decathlete equally talented at the 100m, Long and High Jumps, with performances of internationally equal standard, would have no chance at all if the 1985 tables were applied, even if his standard of performance in the other events was identical.

Thus, as far as future performance dynamics in athletics is concerned, two extremely diverging points of view are possible:

1) As a supporter of the 1985 tables, one must fear any asynchronous of progress in performance. Correspondingly, either a far-reaching performance stagnation or symmetrical progress in all events would be the prerequisite for a long period of validity for these tables.

2) As an opponent of the new scoring system, one can only hope that the scoring errors that I have demostrated will be increased to such an extent by rapid performance development in various events that a correction will become absolutely necessary. This would be the only way of preventing the combined events being dominated by 'interested' specialists some day.

For me, it is a little disturbing that, with the 1985 tables, a scoring system has been introduced in which those disciplines which are scored in a progressive way, are the events where the most significant rates of increase are to be expected - namely in the technical events.

10. Summary and conclusions

The 1985 tables are a "hybrid scoring system" lacking a standard of comparison equally valid for times and distances. At the upper level of performance this scoring system is relative, at the medium level it is absolute and at the lower level it is necessarily "compensatory-fictitious". From a statistical point of view this is unacceptable. In the running disciplines, performance increases are judged in a velocity-regressive way, whereas in the jumping and throwing events they are assessed in a velocity-progressive way. This means that the original intention of the IAAF, which was to give correspondingly more points for comparatively more difficult increases in performance, is perverted in the running events, even though it is here that the air resistance to be overcome increases in a non-linear, exponential way.

Thus, in the combined events, the IAAF applies a second measuring system which is clearly inferior to the high quality, precision and objectivity of electronic timing and distance measurement systems.

Up to now, only a middle zone which is almost correctly oriented to the current standard of performance has "covered" the weaknesses demonstrated in this article. However, this does not give much hope regarding the future of Decathlon. On the contrary, it is to be feared that, as the asymmetry of performance development in the combined event disciplines increases, it will no longer be the all-rounder who will be the 'King of Athletes', but rather the hidden specialist, whose individual performance structure in the throws and the jumps gives him the chance of penetrating deeply into progressive point allocation zones. In comparison with this, decathletes equally talented at the sprints and hurdles and the Javelin Throw as well as real all-round decathletes will have no chance at all. They have already been at a clear disadvantage since the introduction of the new tables and the new javelin on April 1, 1985 and 1986 respectively.

Based on these conclusions, it is my opinion that there is now an urgent need for the IAAF to establish a combined events subcommittee or commission to provide competent support to the Technical Committee, especially in regard to questions on combined event scoring systems.

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