

Is a revision of the international scoring tables overdue?

By Rolf Geese

In the view of many German coaches working in top-class athletics, the current scoring tables for the decathlon are not particularly well balanced. The throwing events and the 1500 metres are seen as underrated compared to the sprints and jumps. This could lead to advantages or disadvantages for certain athletes and affect both the outcome of competitions and the world ranking list. An investigation was carried out to confirm if the perceived imbalances in the assessment of performances exists and identify a possible solution. Working from the assumption that current world record performances are at the absolute limit of human capability and thus are roughly equal, the investigation also considered the anthropomorphous, physiological and biomechanical features of decathletes in contrast to specialists. The finding was that the current scoring system has striking flaws. A more balanced system, based on the best performances of the world's 10 best decathletes and alignment with a leading event (the 100 metres), is proposed. A discussion of how the corrected system would have affected past competition results and the current world's best list is also provided.

ABSTRACT

Rolf Geese has worked as a lecturer at the Institute of Sport Sciences at the University of Göttingen, Germany, since 1973. His work centres on the fields of biomechanics, especially load analyses, training theory and sports medicine. He graduated from the Sport Institute in Mainz, holds a degree in biology and physiology from the University of Göttingen and a doctorate degree from the University of Frankfurt/Main.

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The problem

The assessment of the specialist events forms the basis of the IAAF's scoring system for the combined events. This raises the question of whether the assessment of performances by generalists, which the decathletes undoubtedly are, in accordance with the assessment of specialist performances can be sufficiently "fair". In the opinion of many German coaches involved in top-class athletics, the current scoring tables are not particularly well balanced. In particular, the throwing events and 1500 metres are seen as underrated. If serious inequalities in the allocation of points between the individual events of the decathlon do exist, they would inevitably result in an advantage or disadvantage for

athletes (and teams) and could lead to victory and defeat in a close competition. Therefore, it is right to investigate whether an imbalance exists and, if so, if it is possible to come to a more fair, well-rounded and understandable scoring system for decathlon performances.

The problem to be addressed is the comparability of performances in individual events in which equal opportunities are expressed – a principle that should be fundamental in a sport that claims to be objective. However, even with performances by specialists, comparability is a problem. Who can say if the selected performances by male athletes in Table 1 are equivalent to each other?

We chose the World Record in the 100 metres as the reference value for the events of the decathlon, as non-experts can easily relate to sprint performances. This is probably less true for other events. As long as a person has not achieved a relatively high level in an event, he/she will lack the necessary experience and knowledge that are the prerequisites for being called an “expert” on that event. It is hard to imagine, for example, how a former top-class middle distance runner, without any doubt an expert on

his/her events, could be called onto a committee tasked with assigning points scores for performances and make equally competent evaluations in both his/her own events and in completely different events such as the pole vault. However, the reality is that point values are assigned by individuals who are not experts in all events, and hence there are blatant flaws in the scoring system for some events.

An attempt to solve the problem

We worked on the assumption that the current world record performances are at the absolute limit of human capability¹ and can therefore be seen as roughly equal. Following this, one could reasonably suggest that the world's best performances should be allocated a comparable number of points. Table 1 shows that this basic principle is apparently not in effect² in the current scoring system.

We believe that there are additional aspects to be considered in the design of the scoring system of the combined events. Constitutional, particularly anthropomorphic, features play a vital role in performance. Specific body types, described by measurable

	100m [s]	Long Jump [m]	Shot Put [m]	High Jump [m]	400m [s]	110m Hurdles [s]	Discus Throw [m]	Pole Vault [m]	Javelin Throw [m]	1500m [min]
Performances equal to the point value of the 100m World Record	9.78 1151	8.35 1151	20.82 1151	2.36 1151	43.27 1151	12.69 1151	63.28 1151	5.76 1151	86.95 1151	3:34.35 1151
Current World Records and their point value	9.78 1151	8.95 1312	23.12 1298	2.45 1244	43.18 1156	12.91 1120	74.08 1383	6.14 1278	98.48 1331	3:26.00 1218
Difference between point values [%]	-	+ 14.1	+ 12.9	+ 8.2	+ 0.5	- 2.6	+ 20.3	+11.1	+15.7	+ 5.9

Table 1: Comparison of performances in the events of the decathlon

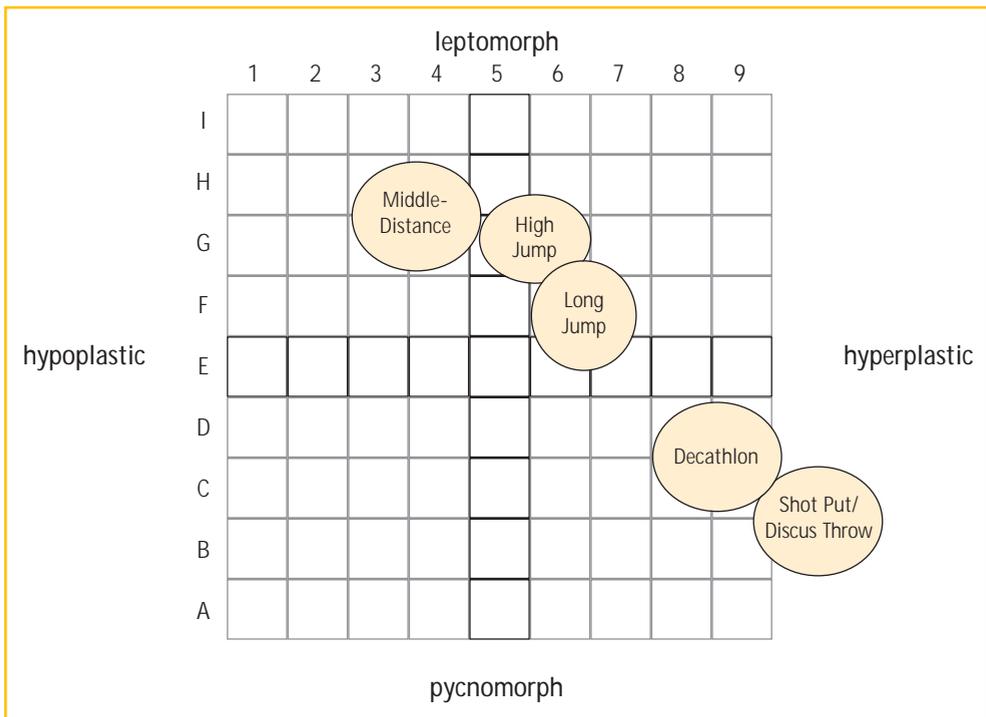


Figure 1: Body types ideal for different athletics events (following the system of coordinates by CONRAD)

features, can be assigned as ideal for each athletics discipline. This is made clear by the model published by CONRAD (1941), which was developed for the definition of body types and was applied to sports by TITTEL/WUTSCHERK (1972).

The positions of the events in Figure 1 suggest the assumption that they reflect an event-specific aptitude related to the body type. In a way, there is a selection process. Those who are equipped with the prerequisites for achieving top-class performances (including a suitable body type and physique) in an event turn to (or are pushed towards) that event. This selection process can be explained from the point of view of both physiology and biomechanics (compare HOERLER (1974), HALDANE (1981), GEESE (1981)).

However, the combined events are different and here the body type must be adapted through training within the individual's genetic limits. The mix of events, with very clearly

varying motor-physical demands, calls for a specific combined events body type, which is a mix or balance of the different body types. Extreme body types are not suitable: the light and relatively small (leptomorph-hypoplasic) body type of long-distance runners is as little suited for shot putting or discus throwing as the big and heavy (pycnomorph-hyperplastic) type is for endurance performances. Following this, one could expect that the individual events be assessed comparably by the scoring system so as not to favour one body type over another but such is not the case in the decathlon. This can be substantiated by a comparison of the average point scores of decathletes in the 10 events.

A way of solution

The performances of the world's ten highest scoring decathletes under the present system serve as an empirical basis for our study and proposal. Only the best decathlon performance of each athlete is documented. The events of decathlon are subdivided into four groups:

Table 2: Sprints and jumping events

	performance	points
100m	10.61s	952
400m	47.86s	917
Long Jump	7.79m	1009
High Jump	2.07m	867
Mean value		936

- ◆ Sprints and jumping events
- ◆ Throwing events
- ◆ Technical-coordinative events
- ◆ The 1500m

Each group is marked by a high affinity concerning the constitutional performance prerequisites and physical conditioning requirements (Tables 2 to 5).

The variation of scoring between the event groups illustrate these differences once again.

Table 3: Throwing events

	performance	points
Shot Put	15.68m	831
Discus Throw	47.47m	814
Javelin Throw	66.09m	830
Mean value		825

Relations of scoring in the event groups

Sprints/Jumps	1.00
Hurdles/Pole Vault	1.00
Throws	0.88
1500m	0.77

Table 6: Relations of scoring in the event groups

The tables clearly show that for the world's best decathletes:

- ◆ The sprinting/jumping/technical-coordinative events are assessed comparably.
- ◆ The scores for the throwing events average of about 11% fewer points than for the sprinting/jumping/technical-coordinative events
- ◆ The score for the 1500m is about 22% fewer points than for the sprinting/jumping/technical-coordinative events

Table 4: Technical-coordinative events

	performance	points
Hurdles	13.96s	980
Pole Vault	4.96m	898
Mean value		939

Table 5: 1500m

	performance	points
1500m	04:34.12	718
Mean value		718

Tables 2 to 5: Average performances in the individual events by the 10 best decathletes of all time (point in time: 31 December 2003) separated by event groups

Hence, a comparable assessment is not the case. The current scoring system entirely ignores the effects of highly decisive anthropomorphic, physiological and biomechanical prerequisites. To achieve the same number of points given for their mean performance in the 100m, the 10 best decathletes would have to run 4:02.1 in the 1500m, a time that can hardly be achieved with a physique typical of decathletes.

To adapt to exactly these circumstances we proceeded as follows:

1. Optimal performance ability

The average performances in the individual events (Tables 2-5) are seen as the present maximal performance ability of decathletes, which will be improved only marginally³.

2. Comparability between the individual events

Establishing comparability between the individual events can be rationally carried out by reference to a "leading" event. For our purposes, the 100m was chosen as the leading event and the remaining events are compared and adapted to it. An adaptation is carried out if the point difference amounts to >3%. For a reassessment the exponent c in the equation $P=a(M-b)^c$ (for the throws) and $P=a(b-M)^c$ (for the 1500m) is changed.

Line 6 in Table 7 shows the events where the point scores have to be increased or

reduced from the current scoring system, and by how many points, in order to create a balance. However, the 100m, which is already scored highly relative to the throws and the 1500m, causes a considerable increase in the final score. The correction of the calculation formula leads to the intended levelling of the 9 events with an average point value of 940 points, as can be seen in the last line of Table 7. The deviations of the individual events are abolished now, the only exception being the 1500m. In this case, statistics⁴ justify the assumption that the rate of development in this event has fallen behind the others. The statistics of the 10 best 1500m performances by 8000-point decathletes (x = 8143 pts.) show an average performance of 4:10.24, which is about 22 sec. faster than average of the 10 best decathletes of all time. (This also reflects a trend, namely that the 1500m performance decreases as the total point score increases.) A deficit of development has to be acknowledged here but it can only be estimated. For our purpose, we have set it at 10 seconds. This means that the average number of points, namely 940, is achieved by a performance of 4:22.0.

	100m		400m		Long Jump		High Jump		Hurdles	
Minimum	10.43		46.23		7.26		2.03		13.73	
Maximum	10.89		48.97		8.11		2.17		14.66	
Mean values	10.65	940	47.73	922	7.80	1010	2.07	868	14.10	980
Relation to 100m score	1.00		0.98		1.07		0.92		1.02	
Difference from 940 pts.(100m)	0		18		57		72		22	
Corrected mean value	940		942		940		944		939	

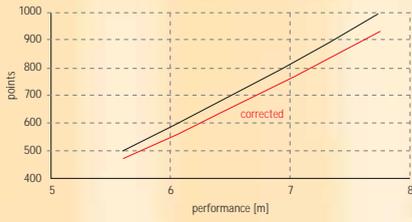
	Pole Vault		Shot Put		Discus Throw		Javelin Throw		1500m		Total
Minimum	4.80		14.90		43.40		59.86		4.19.75		
Maximum	5.40		16.78		49.70		72.42		4.45.89		
Mean values	5.01	913	15.98	850	47.32	815	66.14	831	4.31.89	732	8830
Relation to 100m score	0.97		0.9		0.87		0.88		0.78		
Difference from 940 pts.(100m)	27		90		125		109		208		
Corrected mean value	940		940		941		939		861		9326

Table 7: Statistics of the 10 best decathlons

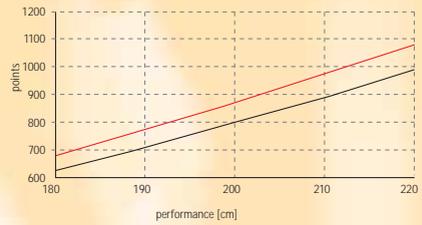
Table 8 provides an overview of the current (steps) and information on the basis of calculation and corrected scoring systems (in 100-point calculation).

Long Jump			High Jump			400m		
target: - 70 pts at 7.80m			target: + 72 pts at 2.07m			target: + 18 pts at 47.73s		
a=0.14354 b=220 cm c=1.40		a=0.14354 b=220cm c=1.389	a=0.8465 b=75 cm c=1.42		a=0.8465 b=75 cm c=1.437	a=1.53775 b=82 s c=1.81		a=1.53775 b=82 s c=1.818
performance [m]	current scoring [pts]	corrected scoring [pts]	performance [m]	current scoring [pts]	corrected scoring [pts]	performance [m]	current scoring [pts]	corrected scoring [pts]
7.76	1000	933	221	1000	1091	46.17	1000	1022
7.36	900	841	211	900	985	48.19	900	919
6.94	800	748	200	800	873	50.32	800	816
6.51	700	655	189	700	765	52.58	700	713
6.06	600	562	177	600	652	54.98	600	610
5.59	500	469	165	500	544	57.57	500	508
$P=a(M-b)^c$			$P=a(M-b)^c$			$P=a(b-(M+0,14))^c$		
110m Hurdles			Pole Vault			Discus Throw		
target: - 22 pts at 14.10s			target: - 27 pts at 5.01m			target: + 126 pts at 47.32m		
a=5.74352 b=28.50 c=1.92		a=5.74352 b=28.50 c=1.923	a=0.2797 b=100 cm c=1.35		a=0.2797 b=100cm c=1.3547	a=12.91 b=4.0 c=1.10		a=12.91 b=4.0 c=1.138
performance [m]	current scoring [pts]	corrected scoring [pts]	performance [m]	current scoring [pts]	corrected scoring [pts]	performance [m]	current scoring [pts]	corrected scoring [pts]
13.80	1000	978	529	1000	1030	56.18	1000	1163
14.59	900	868	497	900	927	51.40	900	1042
15.42	800	774	463	800	821	46.60	800	923
16.29	700	676	429	700	719	41.72	700	804
17.23	600	578	394	600	617	36.80	600	685
18.25	500	480	357	500	515	31.78	500	567
$P=a(b-(M+0,24))^c$			$P=a(M-b)^c$			$P=a(M-b)^c$		
Long Jump			Javelin Throw			1500m		
target: - 70 pts at 7.80m			target: + 109 pts at 66.14m			target: 940 pts at 4:22min		
a=0.14354 b=220 cm c=1.40		a=0.14354 b=220cm c=1.389	a=10.14 b=7.0 c=1.08		a=10.14 b=7.0 c=1.11	a=0.03768 b=480 c=1.85		a=0.03768 b=480 c=1.8803
performance [m]	current scoring [pts]	corrected scoring [pts]	performance [m]	current scoring [pts]	corrected scoring [pts]	performance [m]	current scoring [pts]	corrected scoring [pts]
7.76	1000	933	77.20	1000	1136	3.53.79	1000	1182
7.36	900	841	70.68	900	1020	4.07.42	900	1062
6.94	800	748	64.10	800	903	4.21.77	800	942
6.51	700	655	57.46	700	788	4.36.96	700	822
6.06	600	562	50.74	600	672	4.53.20	600	703
5.59	500	469	43.96	500	557	5.10.73	500	584
$P=a(M-b)^c$			$P=a(M-b)^c$			$P=a(b-M)^c$		

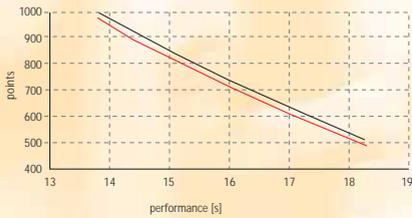
Long Jump



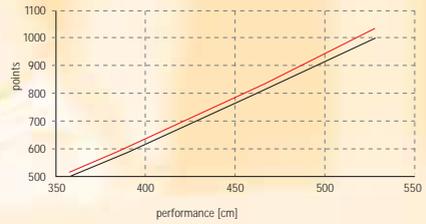
High Jump



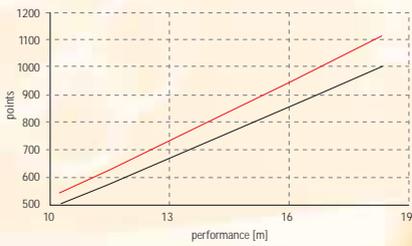
110m Hurdles



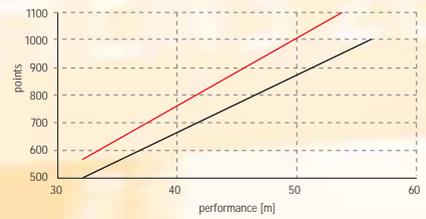
Pole Vault



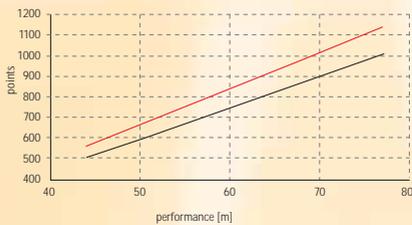
Short Put



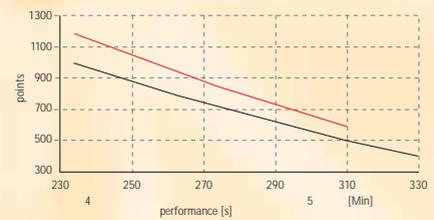
Discus Throw



Javelin Throw



1500m



400m

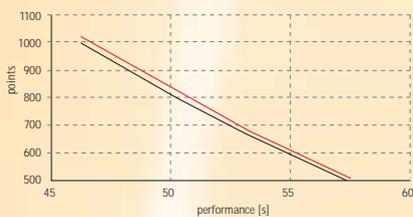


Fig. 2: Graphic representation of current and scoring systems.

The following diagram also shows the current and the corrected scoring systems

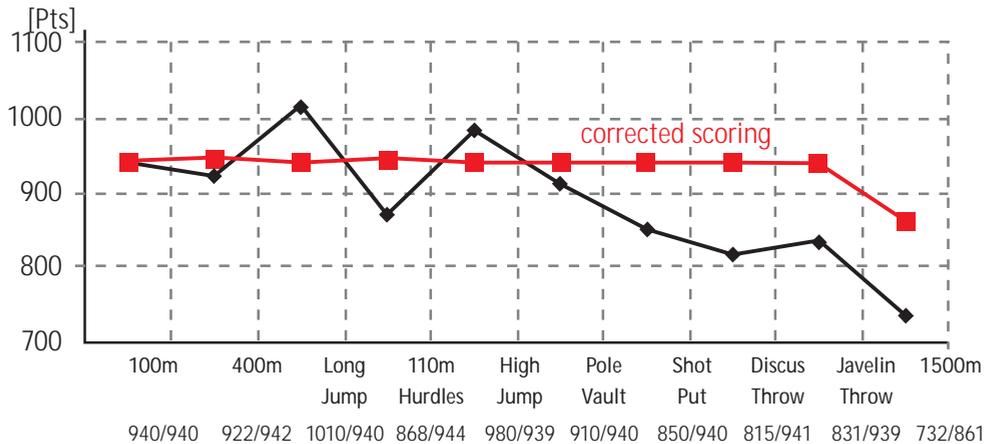


Fig. 3: Current and corrected scoring

Table 9: Individual Comparisons

	100m		Long Jump		High Jump		400m		110m Hurdles	
Sebrle (2001)	10.64	942	8.11	1089	2.12	915	47.79	934	13.92	1003
corrected scoring	10.64	942	8.11	1016	2.12	996	47.79	939	13.92	962
Dvorak (1999)	10.54	966	7.90	1035	2.04	840	48.08	905	13.73	1010
corrected scoring	10.54	966	7.90	966	2.04	913	48.08	925	13.73	987
O'Brien (1992)	10.43	992	8.08	1081	2.07	868	48.51	885	13.98	977
corrected scoring	10.43	992	8.08	1008	2.07	944	48.51	903	13.98	954
Thompson (1984)	10.44	989	8.01	1063	2.03	831	46.97	863	14.34	931
corrected scoring	10.44	989	8.01	992	2.03	903	48.97	881	14.34	909
Hingsen (1984)	10.70	929	7.76	1000	2.07	868	48.05	907	14.07	965
corrected scoring	10.70	929	7.76	933	2.07	944	48.05	926	14.07	943
Nool (2001)	10.60	952	7.63	967	2.03	831	46.23	997	14.40	924
corrected scoring	10.60	952	7.63	903	2.03	903	46.23	1019	14.40	901
Freimuth (1984)	11.06	847	7.79	1007	2.03	831	48.43	888	14.66	891
corrected scoring	11.06	847	7.79	940	2.03	903	48.43	907	14.66	869
Pappas (2003)	10.78	910	7.96	1050	2.17	963	48.22	899	14.13	958
corrected scoring	10.78	910	7.96	980	2.17	1048	48.22	918	14.13	935
Wentz (1983)	10.89	885	7.49	932	2.09	887	47.38	939	14.00	975
corrected scoring	10.89	885	7.49	871	2.09	964	47.38	960	14.00	952
Hämäläinen (1994)	10.50	975	7.26	876	2.11	906	47.63	927	13.82	998
corrected scoring	10.50	975	7.26	819	2.11	985	47.63	947	13.82	975
O'Brien (1996)	10.50	975	7.57	952	2.07	868	46.82	967	13.87	991
corrected scoring	10.50	975	7.57	889	2.07	944	46.82	988	13.87	969
Busemann (1996)	10.60	952	8.07	1079	2.04	840	48.34	893	13.47	1044
corrected scoring	10.60	952	8.07	1006	2.04	913	48.34	912	13.47	1021
Thompson (1984)	10.44	989	8.01	1063	2.03	831	46.97	863	14.34	931
corrected scoring	10.44	989	8.01	992	2.03	903	48.97	881	14.34	909
Hingsen (1984)	10.91	881	7.80	1010	2.12	915	47.69	924	14.29	937
corrected scoring	10.91	881	7.80	942	2.12	996	47.69	944	14.29	915

What impact would the corrected scoring system have?

The corrected scoring system presented here results in a 5.6% average increase in the point scores of the world's ten best decathletes. At first sight, this may at seem strange and it might take a while to get used to the idea, but it is merely the result of an adaptation to these athletes' average 100m result (which we decided to use as the lead event or the basis for comparison). With any change to the scoring system the question naturally arises as to how the scores of previous competitions might be affected and if results or the ranking lists would be changed. Our initial exploration of

the latter issue can be seen in Tab. 9. In addition, we carried out direct comparisons of selected performers.

The comparison between the three most recent world records by O'Brien (8891 points in 1992), Dvorak (8994 points in 1999) and Sebrle (9026 points in 2001), does not produce a change in the all-time ranking; Sebrle remains number one. The point difference between Dvorak and Sebrle changes only marginally, from 32 points in the current scoring to 36 points in the corrected scoring. Sebrle's improved score is largely the result of a higher score for his performance in the 1500m, which clearly overcompensates for

Pole Vault		Shot Put		Discus Throw		Javelin Throw		1500m		point total	ranking
4.80	849	15.33	809	47.92	827	70.16	892	4.21.98	668	9026	1
4.80	874	15.33	894	47.92	956	70.16	1010	4.21.98	940	9529	1
4.90	880	16.78	899	48.33	835	72.32	925	4.37.20	698	8994	2
4.90	905	16.78	997	48.33	966	72.32	1049	4.37.20	821	9495	2
5.00	910	16.69	894	48.56	840	62.58	777	4.42.10	667	8891	3
5.00	937	16.69	990	48.56	971	62.58	877	4.42.10	784	9360	3
5.00	910	15.82	840	46.56	799	65.24	817	4.35.00	712	8832	4
5.00	937	15.82	929	46.56	971	65.24	923	4.35.00	837	9171	10
4.90	880	16.42	877	49.36	857	59.86	736	4.19.75	813	8673	5
4.90	905	16.42	971	49.36	991	59.86	829	4.19.75	958	9329	4
5.40	1035	14.90	784	43.40	734	67.01	844	4.29.58	747	8815	6
5.40	1066	14.90	864	43.40	845	67.01	955	4.29.58	879	9287	6
5.15	957	16.30	870	46.58	799	72.42	926	4.25.19	776	8792	7
5.15	985	16.30	963	46.58	922	72.42	1051	4.25.19	914	9301	5
5.20	972	16.28	869	45.84	784	60.77	749	4.48.12	630	8784	8
5.20	1001	16.28	961	45.84	904	60.77	845	4.48.12	739	9241	8
4.80	849	15.35	811	46.90	806	70.68	900	4.24.90	778	8762	9
4.80	874	15.35	896	46.90	930	70.68	1020	4.24.90	917	9269	7
4.90	880	16.05	854	49.70	864	60.32	743	4.35.09	712	8735	10
4.90	905	16.05	945	49.70	1000	60.32	837	4.35.09	837	9205	9
X = 8830											
X = 9318											
5.00	910	15.66	830	48.78	845	66.90	842	4.45.89	644	8824	
5.00	937	15.66	918	48.78	977	66.90	953	4.45.89	756	9306	
4.80	849	13.60	704	45.04	768	66.86	842	4.31.41	736	8706	
4.80	874	13.60	773	45.04	885	66.86	952	4.31.41	865	9153	
5.00	910	15.82	840	46.56	799	65.24	817	4.35.00	712	8832	
5.00	937	15.82	929	46.56	971	65.24	923	4.35.00	837	9171	
4.50	760	15.87	843	50.82	887	60.44	744	4.22.60	794	8695	
4.50	782	15.87	932	50.82	936	60.44	839	4.22.60	935	9102	

Athlete	Score		World Ranking	
	current	corrected	current	corrected
Sebrle (CZE)	9026	9529	1	1
Dvorak (CZE)	8994	9495	2	2
O'Brien (USA)	8891	9360	3	3
Thompson (GBR)	8832	9171	4	10
Hingsen (GER)	8673	9329	5	4
Nool (EST)	8815	9287	6	6
Freimuth (GDR)	8792	9301	7	5
Pappas (USA)	8784	9241	8	8
Wentz (GER)	8762	9269	9	7
Hämäläinen (BLR)	8735	9205	10	9

the points he loses in shot put. Under the corrected system, O'Brien loses ground to both Dvorak (32 points) and Sebrle (34 points). A more dramatic change in ranking would take place in the case of Thompson, who would fall from 4th to 10th in the all time list. The Germans on the list would tend to profit; Hingsen would move up from 5th to 4th while Freimuth and Wentz would be promoted by two places, passing Nool and Pappas respectively in addition to Thompson.

We also looked at the results of the Olympic decathlons in Atlanta 1996 and Los Angeles 1984. Corrected scores for the Atlanta Olympics do not help the German Busemann as the point difference between him and the winner O'Brien increases from 118 to 153, rewarding O'Brien for his better throwing performances. In the case of Los Angeles Thompson's lead of 137 points over his great rival Hingsen would be reduced to 69, as a result of increased points for Hingsen in the throws and the 1500m.

Conclusion

It has been shown that the current IAAF scoring system in the combined events is not fair – at least not in the case of the decathlon for senior men (but it is probably also true in the case of the heptathlon for senior women as well as junior combined events for males and females). Performances in the throws and in the 1500m are scored lower than in the sprinting and jumping events. Athletes who perform above average in the lower scoring events are clearly disadvantaged compared to those who record above average marks in the higher scoring events. This striking inequality is not consistent with the principle of equal opportunity. A comparison of the ten best decathletes of all time shows that their ranking under the current scoring system is greatly influenced by their relative strength in the higher scoring events.

It is a central aim of serious sport is to find out who is the best in a competition that is not designed to favour one participant, or type of participant, over another. A prerequisite for achieving this aim in the combined events is a scoring system that is marked by a high degree of comparability between the events. This means that corrected calculation

formulas and scoring tables are now required. The model for a corrected scoring system presented here is a feasible and acceptable solution based on the principle of equal opportu-

nities. In the modern era of computers, completing the work started with the models should not be a problem.

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Calculation Formulas			
Event	Formula	c current	c corrected
400m	$P=a(b-(M+0,14))^c$	1.81	1.823
Long Jump	$P=a(M-b)^c$	1.40	1.391
High Jump	$P=a(M-b)^c$	1.42	1.439
110m Hurdles	$P=a(b-(M+0,24))^c$	1.92	1.921
Pole Vault	$P=a(M-b)^c$	1.35	1.3596
Shot Put	$P=a(M-b)^c$	1.05	1.100
Discus Throw	$P=a(M-b)^c$	1.10	1.140
Javelin Throw	$P=a(M-b)^c$	1.08	1.113
1500m	$P=a(b-M)^c$	1.85	1.946

Annotations

- 1 This is supported by the fact that the performances in all but the new events for women have presently reached a plateau and that the further development is likely to be in only small increments.
- 2 It is possible that those responsible for the current scoring system have come to the opinion that human performance capability has in some events fallen behind others. But in this case, the degree of the potential difference seems to have been set quite arbitrarily. In my view, both the opinion and the degree of difference between the events are not sustainable. Flaws in the scoring system are, of course, unavoidable, but their degree depends on the compo-

sition of the group setting the scoring tables. One can assume that flaws in scoring could be minimised by the inclusion of experts with combined events-experience in such a group.

- 3 The current scoring system for males and females has remained unchanged since 1985, but performances by combined events athletes in certain events have clearly improved. For example, the average mark in the pole vault by the 10 best decathletes has improved by 14 cm (circa 40 points) in the last 15 years. For this reason alone a review and update of the scoring system is justified but the opportunity could also be used to reduce the existing disproportions.
- 4 Data provided by Jens Schulze, Paderborn.