Biomechanical Analysis of the Discus at the 2009 IAAF World Championships in Athletics

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(Translated from the original German by Matthias Werner)

ABSTRACT

The techniques of the top eight placers in the men's and women's discus throw at the 2009 World Championships in Athletics were studied by a team of researchers from the Institute for Applied Training Science in Leipzig, Germany, with the aim of obtaining the latest data and insight into the technical condition of the world's current best throwers. The throws in both the preliminary round and finals were recorded with video cameras set up in the seating area of the stadium. The release parameters (release velocity, angle of release, etc), spatial and temporal characteristics of the throwing movement and other data were obtained from a three-dimensional photogrammetric analysis of the best throws for which suitable recordings were available. To give guidance for coaches and athletes preparing for future high-level competitions, the mean values and standard deviations were derived and compared with other parameters. Parameters describing the throwing technique were averaged for two groups of finalists in the two competitions and compared to those that explained the differences in the placings.

AUTHOR

Marko Badura holds a Diploma in Sport Science. He works at the Institute of Applied Training Science (IAT) in Leipzig, Germany. As an athlete, he placed 4th in the javelin at the 1990 IAAF World Junior Championships and held the German junior record for the javelin from 1990 until 2007.

Introduction

In the men's discus throw at the 2009 IAAF World Championships in Athletics in Berlin, local star Robert Harting (GER) threw a dramatic last round personal best of 69.43m to snatch the gold medal away from Piotr Malachowski (POL), who had led the competition from the first round and then thrown his own personal best (and national record) of 69.15m in the fifth round. Harting's win was the seventh World Championship title by a German (five by Lars Reidel and one by Jürgen Schult, who was representing the GDR). Third place went to the defending world and Olympic champion Gerd Kanter (EST) who threw 66.88m.

The women's event two days later had a surprise winner as former World Junior Champion Dani Samuels (AUS) produced two personal bests, taking the lead in the fifth round with her winning 65.44m. Both Yarelis Barrios (CUB), who was second with 65.31m, and Nicoleta Grasu (ROU), third with 65.20m, recorded their season's best throws in the final. The three medallists were only separated by 24cm.

In this report, the results of biomechanical analyses of the two competitions made by a team from the IAT (Institute for Applied Training Science) in Leipzig, Germany, are presented. The throws in both the preliminary round and the final were recorded with video cameras and then a three-dimensional photogrammetric analysis was used with the aim of obtaining the latest data and insight into the technical condition of the world's current best throwers. Specifically, we wanted to quantify key parameters of discus throwing technique and calculate correlations that could guide athletes and coaches preparing for top-level competitions in the future.

Table 1 gives the complete results of the two finals.

Table 1: Results of the discus throw at the 2009 IAAF World Championships in Athletics

Pos	Athlete (Country)	Round					
		1	2	3	4	5	6
Men's Final – 19 August – 20:10							
1	Robert Harting (GER)	68.25	67.04	67.80	x	67.80	69.43
2	Piotr Malachowski (POL)	68.77	68.05	67.00	x	69.15	67.33
3	Gerd Kanter (EST)	65.91	65.65	x	66.88	66.24	65.45
4	Virgilijus Alenkna (LTU)	66.36	66.32	65.68	64.53	66.24	x
5	Casey Malone (USA)	63.61	61.59	65.64	64.84	65.98	66.06
6	Zoltán Kövágó (HUN)	x	63.09	62.47	x	65.17	61.69
7	Bogdan Pishchalnikov (RUS)	62.03	63.29	63.18	64.26	65.02	x
8	Gehard Mayer (AUT)	62.16	60.49	63.17	x	60.83	x
9	Omar Ahmed El Gazaly (EGY)	62.13	62.83	62.76			
10	Mario Pestano (ESP)	62.76	x	62.27			
11	Jared Rome (USA	58.48	62.47	x			
12	Frantz Kruger (FIN)	x	59.77	x			
Women's Final 21 August – 21:15							
1	Dani Samuels (AUS)	x	59.05	62.71	64.76	65.44	x
2	Yarelis Barrios (CUB)	64.44	63.87	61.17	x	x	65.31
3	Nicoleta Grasu (ROU)	x	65.20	62.38	60.68	63.41	x
4	Zaneta Glanc (POL)	58.69	59.83	62.66	x	57.71	x
5	Aimin Song (CHN)	51.69	60.50	61.78	x	61.39	62.42
6	Nadine Müller (GER)	57.53	57.62	62.04	60.40	x	x
7	Natalya Sadova (RUS)	60.70	61.78	59.31	60.44	58.26	61.44
8	Mélina Robert-Michon (FRA)	59.80	60.92	60.89	x	59.90	59.69
9	Sandra Perkovic (CRO)	x	60.77	x			
10	Aretha Thurmond (USA)	x	59.89	59.88			
11	Xuejun Ma (CHN)	58.79	x	58.58			
12	Stephanie Brown Trafton (USA)	58.53	x	57.94			

Methods

Recording and Camera Set-up

The DV camera and analogous camera used were hardware-synchronised. The frame rate of the video recordings was 50 Hz (25 full frames, 50 half frames). An IAT-developed capture-program enabled synchronised recording of the movements onto a notebook computer. This required the use of an A/D-converter for the analogous camera.

The cameras had to be positioned in the seating area of the stadium, as the research team could not access the infield during the event. This meant that the cameras were about 20-25m above the infield and there were very large distances between their positions and the competition site (between 70 and 100m), making the use of telephoto lenses necessary. There was also a reduction of image quality due to complicated and changing lighting conditions. This was aggravated by the fact that the installation and calibration of the cameras had to be completed before commencement of the afternoon competitions (daylight conditions) and the camera settings could not be changed during the competitions, which ended in the evening (partly floodlight conditions).

Calibration

Due to the difference in height between the camera positions and the infield, increased requirements for calibration were demanded. The process applied was developed at IAT (Figure 1). It is based on a selective entry of spatial co-ordinates, i.e. each point in the calibrated space is allocated to a three-dimensional co-ordinate. The origin of this co-ordinate system (zero point, x, y, and z each 0.00) was a point at the front side of the throwing circle, which lies on an ordinate running through the centre of the throwing circle and the middle of the landing sector. As the cameras were fixed, the analysis of the competition movement could be started immediately after calibration.

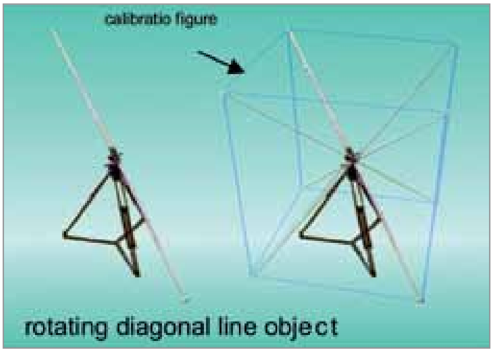

Figure 1: Diagonal rotating object for calibration of spatial co-ordinates

The differences in height between the camera positions and the infield also made verification of angles of the spatial co-ordinates in the release area especially important for the evaluation of the calculated angles (angle of release, etc.). Hence, after calibration, the angle of inclination was determined for a fixed pole by calculating the spatial co-ordinates of six small balls (centres) attached to the pole and comparing them with the actual value, measured by a digital spirit level, also attached to the pole (Figure 2). This was done for three different measurements, each time varying the angle of inclination in the x- and z-axis (side view), as well as the angles of turn in the x-y-level (view from behind). On average the deviations ranged between 0.9 and 1.05%. This means that at an angle of release of 40° the error rate amounted to 0.4°.

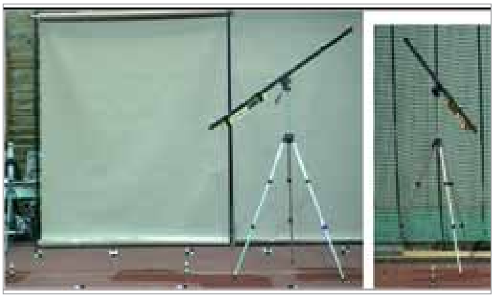

Figure 2: Verification of spatial angles on the basis of a previously realised calibration

Data Analysed

Our plan was to extensively analyse the best attempt by each of the top eight placers in both the men's and women's finals. If this was not possible due to recording problems – quite often judges, photographers or others on the infield obstruct the camera view – we planned to analyse the thrower's second best attempt. Unfortunately, in the women's final kinematic analysis was not possible, as for most of the attempts either the view of the throwers was partially blocked, strong vibrations distorted the video recording or inexplicable problems in synchronising were detected after the competition. In most cases, we were able to fall back on the recording of a very good attempt in the qualification round. However, in one case, Zaneta Glanc (POL), our only chance was to analyse her relatively poor attempt in the fifth round of the final (57.71m)

For the analysed attempts the main performance determining factors (release velocity, angle of release, etc.) were calculated. The analysis also included a number of biomechanical factors related to the throwing technique. A selection of these has been addressed in this report.

Analysis of the Men's Competition

General

The average age of the top eight finalists was 29.5 years, which was slightly above the average at the previous year's Olympic final in Beijing (28.8 years). As five of the finalists in Berlin had been among the best eight in Beijing, there really is no change in the age structure. The oldest of the eight was the former champion Virgilijus Alenkna (LTU) at 37 years. As he remained without a medal this year, the average age of the medal winners dropped by three years to 27 years.

Six of the eight finalists used a jump (supportless) release. Alekna used the brace leg (single-supported) release and Harting used the double-supported release style. Additional personal data for the top eight throwers is given in Table 2.

Table 2: Personal data for the top men discus throwers at the 2009 IAAF World Championships in Athletics

Name	Weight [kg]	Height [m]	Style of release
Harting	126	2.01	Double-support
Malachowski	122	1.92	Support-less
Kanter	120	1.96	Support-less
Alekna	130	2.00	Single-support
Malone	120	1.98	Support-less
Kövago	105	2.09	Support-less
Pishchalnikov	111	1.97	Support-less
Mayer	105	1.91	Support-less
Average	**117** ± 9	**1.98** ± 0.05	-

Performance-determining Parameters

Overall, there was no significant connection in this homogenous random sample between throwing distance and release velocity, although 25% of the throwing distance can be explained by it (r = 0.5).

This is similar to the situation with the calculated angles of release, where we can see there was considerable deviation from the postulated ideal (35-37° with no wind). The angle of release does not help to clarify the differences in throwing distance.

The maximum tangential performance Pmax clarifies this connection to the throwing distance by 50 % (r = 0.72 sig.). This parameter has a high (proportional) correlation to the maximum acceleration of the discus. In other words, it describes the ability of the thrower to maximise the acceleration of the discus.

The average of the aerodynamic quality for the top eight throwers was 9.3%. With 15.2%, Alekna achieved the highest while Zoltan Kövago

(HUN) at 4.4% had the lowest degree of utilisation. This has to do with these two throwers' extreme angles of release (32.4° and 38.9°, respectively) as well as with the corresponding angles of attack and attitude (Table 3).

Table 3: Performance-determining parameters of the analysed attempts of the top men discus throwers at the 2009 IAAF World Championships in Athletics (v0 = release velocity, α0 = angle of release, P_{max} = maximum tangential performance, aerodynamic quality = difference between measured distance and theoretical distance according to the parabolic equation)

Name	Distance	v0	α0	Pmax	aerod. quality
	[m]	[m/s]	[deg.]	[kW]	[%]
Harting	69.43	24.9	37.3	5.27	9.5
Malachowski	69.15	24.9	35.4	5.82	10.7
Kanter	66.88	24.4	37.5	5.13	9.0
Alekna	66.36	24.2	32.4	4.63	15.2
Malone	66.06	23.9	36.5	5.09	12.6
Kövago	65.17	24.6	38.9	4.03	4.4
Pishchalnikov	65.02	24.4	38.3	5.00	7.0
Mayer	63.17	24.5	34.5	4.59	5.8
Average	**66.41**	**24.5**	**36.4**	**4.95**	**9.3**
	± 1.97	± 0.3	± 2.0	± 0.50	± 3.3

Table 4: Average values of selected biometric parameters of two groups the top men discus throwers and selected kinematic parameters of their analysed attempts at the 2009 IAAF World Championships in Athletics

	dist.	height	weight	v0	α0	γ0	P_{max}	foott -drl_t3	tsata _t3	finp blt4_t5	mavha t1_t5	mavta t4_t5	vstdbl _t4
	[m]	[m]	[kg]	[m/s]	[deg]	[deg]	[kW]	[deg]	[deg]	[m]	[deg/s]	[deg/s]	[m/s]
g1	67.96	1.97	125	24.60	35.7	33.9	5.21	235	30	2.79	626	1290	1.85
g2	64.86	1.99	110	24.35	37.1	32.9	4.68	245	19	2.84	668	1228	1.30

v0	release velocity
α0	angle of release
γ0	angle of attack
Pmax	maximum tangential performance
foottdrl_t3	angle of foot at touchdown of right leg
tsata_t3	torque between shoulder axis and throwing arm at touchdown of right leg
finpblt4_t5	length of final acceleration path from touchdown of brace leg to discus release
mavhat1_t5	mean angular velocity of hip axis between right leg lift off and discus release
mavtat4_t5	mean angular velocity of throwing arm between touchdown of brace leg and discus release
vstdblt4	linear velocity of shoulder at touchdown of brace leg

Selected Additional Results

The comprehensive analysis was preceded by the allocation of the top eight throwers into the following groups (table 4):

- Group 1 (g1) includes places 1-4;
- Group 2 (g2) includes places 5-8.

The average values of selected kinematic parameters for the two groups were then found and these are given together with biometric parameters of the athletes in Table 4

The average throwing distance for g1 was 3.10m greater than g2. The differences in body height are, on average, marginal but the difference in average weight is obviously relevant and shows statistical correlation to the throwing distance ($r=0.79$, $p<.05$).

The throwers in g1 achieved an average release velocity that was only slightly higher than that of g2, but they delivered their throws at an almost optimal angle of release (no wind 36°). However, on average, the g2 throwers apparently chose a more favourable angle of attack and hence angle of attitude of the discus (g1: -1.8° / g2: -4.2 °).

At the touchdown after the flight phase of the throwing movement, the foot of the right leg was hardly turned forwards. Except for Harting (195°), all the throwers touched down the right foot at almost a right angle to the throwing direction (Ø 240°). An analysis of the foot touchdown in all the finalists (men and women) allows the conclusion that double-supported releases are executed with the foot turned further forwards at touchdown of the right leg than the support-less releases (double-support: Ø 214°, n = 7; support-less: Ø 238°, n = 9).

The best throwers tend to hold their throwing arms further back in the flight phase. This leads to the observed pronounced difference in the torque between the shoulder axis and the axis of the throwing arm at touchdown of the right leg of - 11° in favour of g1 (tsata_t3).

The average length of the final acceleration path of the discus after touchdown of the brace leg was nearly equal for the two groups. The difference of 5cm is within the range of the measuring mistake and is not interpretable.

A higher angular velocity of the throwing arm in the final phase (mavtat4_t5) for the g1 throwers indicates that this is a performance-determining factor. However, although a clear trend can be

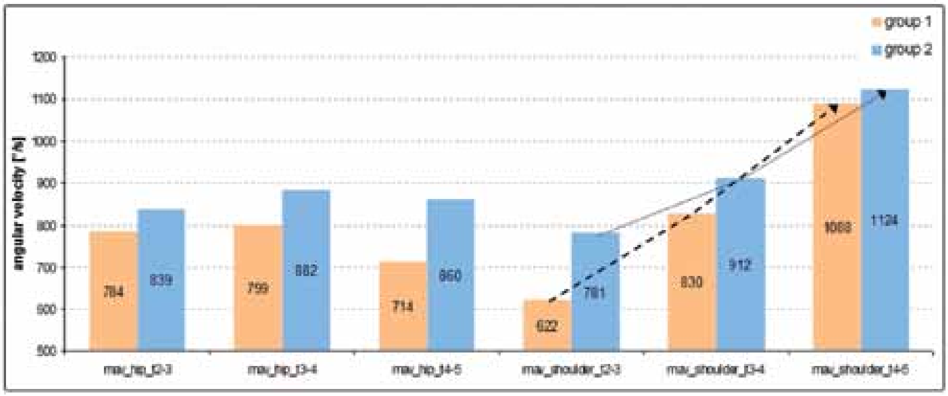

Figure 3: Differences in maximum angular velocities of the hip and shoulder axes in three vital phases of the throwing movement of the analysed attempts of two groups of the top men discus throwers at the 2009 IAAF World Championships in Athletics (t2-3: flight phase; t3-4: amortisation/single support, t4-5: delivery phase)

seen, this correlation was not significant in the given sample. The reason for this high angular velocity in the final and decisive phase of the throwing movement is apparently the high orbital velocity of the shoulder at the point of touchdown of the brace leg (vsbl). The correlation of this parameter to throwing distance was significant ($p<.05$) and clearly distinguishes the two groups. With an average of 1.85 m/s, the g1 throwers had 30% higher shoulder velocity at touchdown of the brace leg than g2 (1.30 m/s). This points to the fact that the better throwers started the final acceleration of the discus slightly earlier, which was only possible because of a greater torque in the torso.

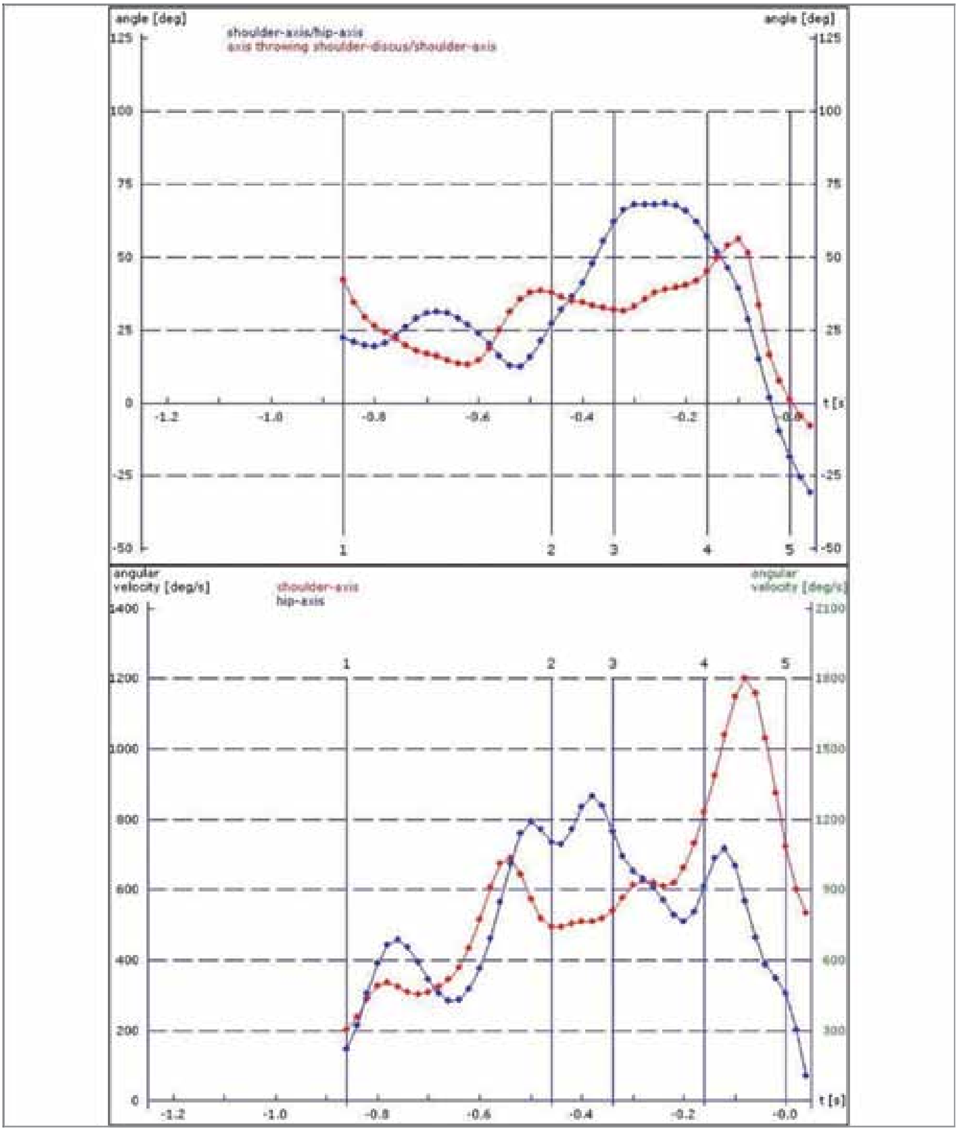

Figure 4: Build-up of torque (top) and course of angular velocities of hip and shoulder axes (bottom) in the 69.43m discus throw of Robert Harting (GER) at the 2009 IAAF World Championships in Athletics

The character of the change in velocity from phase to phase represents a decisive influencing factor. The increase in velocity from phases 3-4 to phases 4-5 was 50% for g1 but only 30% for g2. Hence the increase was steeper. Also, it is not effective when the shoulder axis has a higher velocity than the hip axis in the active phase of the right leg (phase 3-4), as was seen in g2 (Figure 3).

In Figure 4 we can see that Harting succeeded in realising a temporal succession in the velocity maxima of the axes in the main phases of the throwing movement. The course of the angular velocity of the shoulder axis after the high point of the discus orbit is exemplary and only second place Malachowski showed a similar course. All the other throwers had either an arrhythmic pattern or an earlier increase in acceleration. The early maximum in the angular velocity of the hip axis can be explained by the right leg being turned far forwards at touchdown (293°), making it possible to put pressure on the right hip early.

The analysis of the acceleration path of the discus shows that, except for Harting, all the throwers studied had a discontinuity in the acceleration at the time of the touchdown of the left leg (Figure 5). For all the top eight, the average shows that this interruption is slightly diminished, as the different time structures balance it.

The next key position is the low point of the discus orbit. Here all throwers had to overcome a clear "wave trough", with Harting having the largest drop in acceleration. Afterwards he achieved roughly the same increase as Malachowski, but does not come up to his maximum. It is assumed that this "slump" is less pronounced with the athletes who perform the support-less release, as they can already make favourable use of the vertical acceleration from the legs at this point in time. On the other hand these athletes then have the problem of not being able to exert force on the discus any more once they have left the ground. This explains the strong negative course of the right flank (after the maximum) in the acceleration graph. Accordingly, Harting reached the maximum of acceleration only shortly before the discus left his hand.

Analysis of the Women's Competition

General

In contrast to the men's final, the double-supported release was the generally preferred style, with six of the top eight placers using it. Additional personal data for the top eight throwers is given in Table 5.

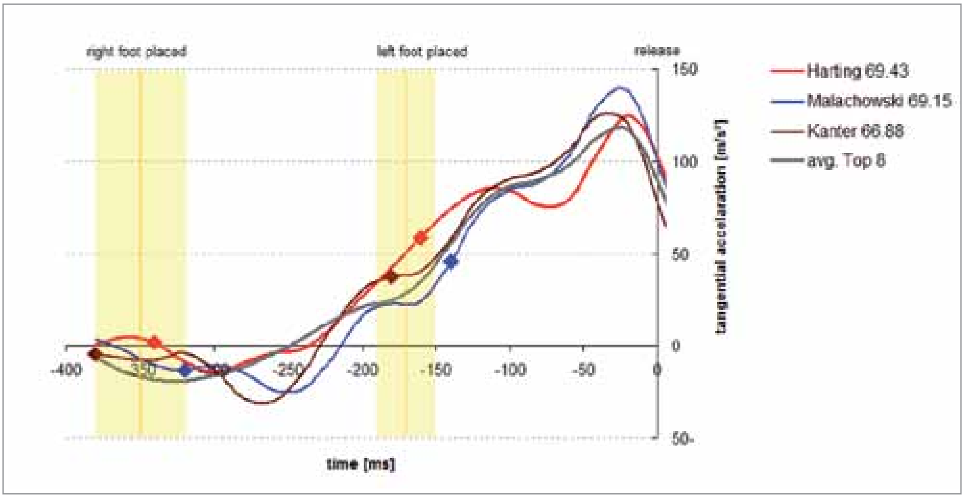

Figure 5: Acceleration of the discus in the main phases of the throw in the analysed attempts of the top men discus throwers at the 2009 IAAF World Championships in Athletics

Table 5: Personal data for the top women discus throwers at the 2009 IAAF World Championships in Athletics

Name	Weight [kg]	Height [m]	Style of release
Samuels	82	1.82	Double-support
Barrios	89	1.72	Support-less
Grasu	88	1.76	Double-support
Glanc	94	1.86	Double-support
Song	85	1.75	Support-less
Müller	95	1.93	Double-support
Sadova	83	1.78	Double-support
Robert-Michon	80	1.76	Double-support
Average	**87** ± 5	**1.80** ± 0.06	-

Table 6: Performance-determining parameters of the analysed attempts of the top women discus throwers at the 2009 IAAF World Championships in Athletics (v0 = release velocity, α0 = angle of release, Pmax = maximum tangential performance, aerodynamic quality = difference between measured distance and theoretical distance according to the parabolic equation)

Name	Distance [m]	v0 [m/s]	α0 [deg.]	P_{max} [kW]	aerod. quality [%]
Samuels	65.44	24.2	36.6	2.63	10.0
Barrios	65.31	23.9	38.6	2.90	10.2
Grasu	63.41*	23.1	35.8	2.36	16.2
Glanc	57.71*	23.5	31.6	2.43	8.4
Song	62.42	23.3	33.0	2.84	16.0
Müller	61.63**	23.2	34.2	2.16	14.4
Sadova	61.94**	23.7	36.9	2.25	8.4
Robert-Michon	61.53**	23.9	30.8	2.81	13.3
Average	**62.42** ± 2.30	**23.6** ± 0.4	**34.7** ± 2.6	**2.55** ± 0.27	**12.1** ± 3.1
Dietzsch	58.44**	23.0	30.5	2.62	15.0

* next best attempt in the final feasible for analysis ** attempt in the qualification

Performance-determining Parameters

In Table 6 the performance-determining parameters for the analysed throws are compiled (including the average of the analysed throws the top eight placers and the standard deviation).

Neither release velocity nor maximum tangential performance seem to have an important statistical connection with the throwing distance in this sample. After all, despite a standard deviation in the throwing distances of 2.30m, the range of differences in the two parameters is extremely low (0.4 m/s for release velocity and 0.27 kW for maximum tangential performance).

Only the angle of release explains the difference in throwing distance with a clear statistical correlation ($p<0.05$; r2 = 0.56; see Figure 6). Hence, the angle of release has a greater importance in this sample than release velocity and it would seem that among top-level female performers the ability to achieve release velocity has converged to the point where it is not the dominating factor deciding victory or defeat.

Selected Additional Results

It is only possible to make limited statistical statements about the small sample at hand. What we can say that there was a high correlation to throwing distance ($p<.05$) between the parameters hip velocity and shoulder velocity at touchdown of the brace leg. This underlines that even before touchdown of the brace leg, the hip and shoulder of the side of the throwing arm need to be accelerated effectively.

By separating the eight finalists into two groups additional quantitative and qualitative statements can be made in respect to throwing distance. The first group (g1) comprises places 1-3, the second group (g2) places 6-8, hence the two groups each consist of three throwers[1].

[1] As the analysed throw of Glanc in place four would not allow this group comparison, it was decided to do without places 4 and 5 in respect to the allocation of groups and hence to obtain groups of equal size.

The average values of selected kinematic parameters for the two groups were found and these are given together with biometric parameters in Table 7.

The mean throwing distance for g1 was 64.72 m, and for g2 it was 61.70 m. There is no difference between the groups in respect to body weight while average g1 is a little shorter (5 cm).

In terms of release velocity, the averages for two groups differ from each other only by very little (0.13 m/s). On the other hand, the averages for the angle of release differ by 3°, which underlines the importance of this influence as already mentioned. In this context, the difference in the average angle of attitude (2.4°) is also important.

In addition, the average angle of attack for g1 is 8.8° but only 3.3° for g2, a 60% difference. This means that the angle of attack contributes substantially to explaining the difference in throwing distance.

In the comparison of additional parameters, more informative differences between both groups arise. In g1 the average phase time between the touchdown of the right leg and the touchdown of the brace leg is 0.16 s while it is 0.20 s in g2. With a high probability, the reason for that is the foot turned further forwards at touchdown of the right leg (foottdbl_t3). This parameter is stated as an angular value in Table and indicates a difference of 67°.

In respect to the angular velocity of the hip axis and the shoulder axis (see Figure 7), the characteristics of the two groups differ and reveal differences in performance.

It becomes obvious that in the flight phase the better throwers are able to reach an essentially higher angular velocity in the hip axis (amongst other things caused by a smaller radius of the free leg) and hold back the shoulder axis as demanded. In g2 the shoulder axis even precedes slightly (mav_shoulder_t23 > mav_hip_t2-3). Consequently the velocity of the hip naturally needs to be increased to get

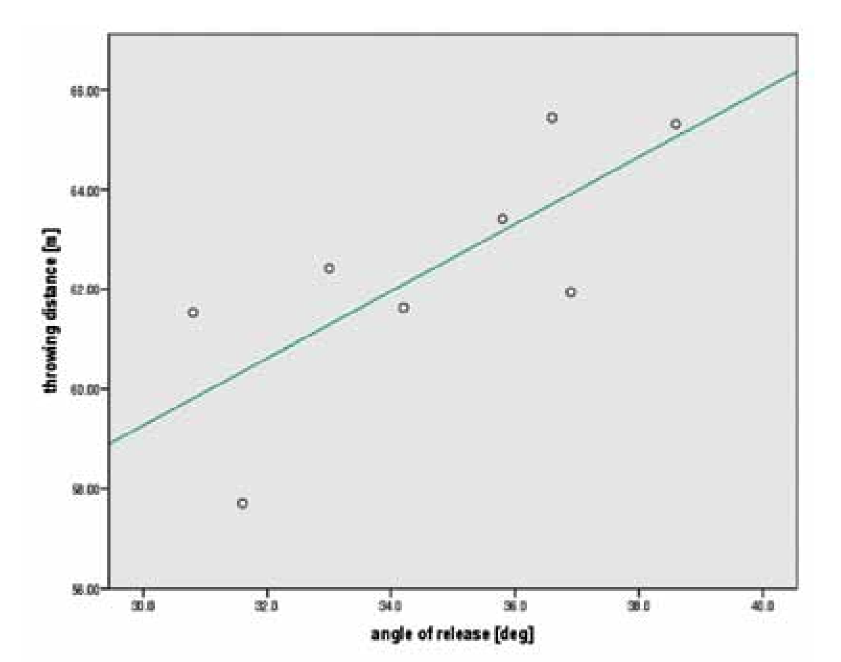

Figure 6: Correlation between throwing distance and angle of release in the analysed attempts of the top women discus throwers at the 2009 IAAF World Championships in Athletics

Table 7: Average values of selected biometric parameters of two groups the top women discus throwers and selected kinematic parameters of their analysed attempts at the 2009 IAAF World Championships in Athletics

	dist.	height	weight	v0	α0	γ0	P_{max}	foott -drl_t3	tsata _t3	finap blt4_t5	mavha t1_t5	mavta t4_t5	vstdbl _t4
	[m]	[m]	[kg]	[m/s]	[deg]	[deg]	[kW]	[deg]	[deg]	[m]	[deg/s]	[deg/s]	[m/s]
g1	64.72	1.77	86	23.73	37.0	28.2	2.63	183	44	2.52	0.16	3.81	4.38
g2	61.70	1.82	86	23.60	34.0	30.6	2.41	250	57	2.84	0.20	2.74	4.55

v0	release velocity
α0	angle of release
γ0	angle of attitude
Pmax	maximum tangential performance
foottdrl_t3	angle of foot at touchdown right leg
sahs_t4	separation angle between hip and shoulder axes at touchdown of brace leg
finap_t4_t5	final acceleration path from touchdown brace leg until discus leaving hand
phase time_t3_t4	mean phase time between touchdown of right leg and touchdown of brace leg
vhmax_t4_t5	mean angular velocity throwing arm between touchdown of brace leg and discus leaving hand
vsmax_t4_t5	linear velocity of shoulder at touchdown of brace leg

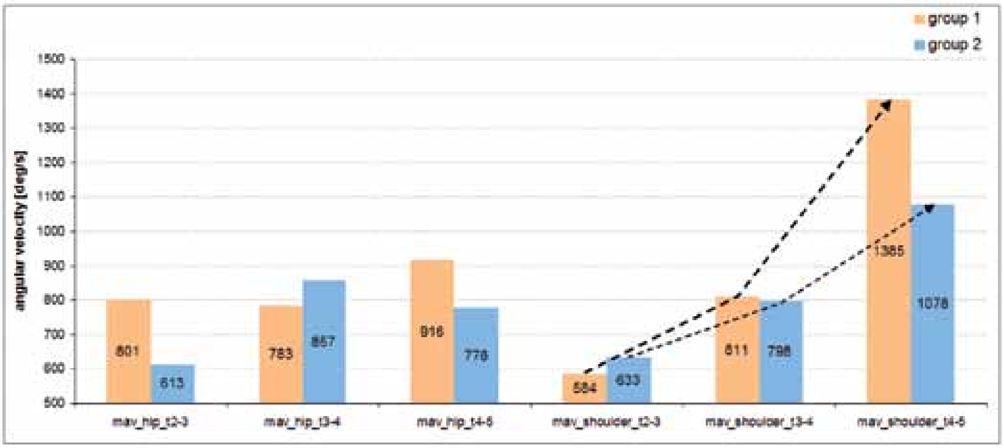

Figure 7: Differences in maximum angular velocities of the hip and shoulder axes in three vital phases of the throwing movement of the analysed attempts of two groups of the top women discus throwers at the 2009 IAAF World Championships in Athletics (t2-3: flight phase; t3-4: amortisation/single support, t4-5: delivery phase)

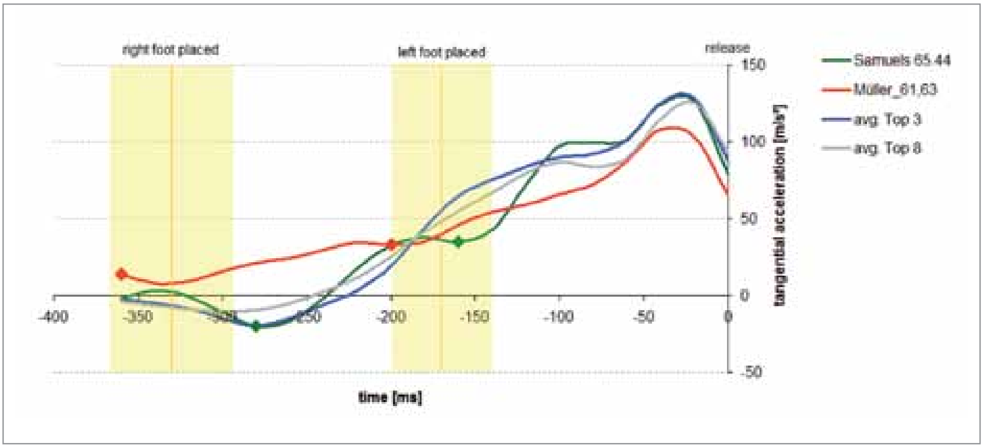

Figure 8: Acceleration of the discus in the main phases of the throw in the analysed attempts of the winner and other top women discus throwers at the 2009 IAAF World Championships in Athletics

ahead of the discus. The throwers succeeded in achieving this, but the torque between the two axes was apparently increased too much (see Table 7, tshtdbl_t4: g1=44° vs. g2=57°).

In addition to the torque between throwing arm and shoulder axis, the average total torque in the power position is 14° lower in the better group (g1=102°, g2=116°).

In the final movement, the differences built up in the preparatory phase become obvious. Both shoulder and hip axis of g1 were faster on average than those of g2. This was also true for the angular velocity of the throwing arm, although it is not depicted in the presentation.

A comparison of the average courses of acceleration of the top three and top eight with those of Samuels and Müller shows differences between the touchdown times and the release (Figure 8).

An accentuated characteristic is clearly revealed with Samuels. Although for Müller the course is altogether more constant, an accentuated increase after the touchdown of the brace leg is missing just as much as a pronounced maximum. Accordingly, the right part of the graph of acceleration (velocity maximum before discus leaving hand) remains clearly below the average of her opponents. Usually the courses show a short drop (slight wave trough) at the moment of touchdown of the feet, but especially in the low point of the discus. The latter is possibly connected with overcoming the inertia of the discus at this point in time.

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