National 400H Event Project - Continuity of Speed Across the Barriers

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A simplistic view of how effective a 400m hurdler is at minimizing their loss of speed in negotiating the ten barriers in the 400m hurdle race, is to determine the differential between their flat 400m time and their hurdle performance.

Typically this is estimated to be between 2.5 and 3.5 seconds at elite level for male athletes, with theoretically a slightly smaller differential for the women [given the lower raise of body mass in negotiating the 2'6" barriers – and thus lesser flight time]

Currently there is a 3.60 sec. differential between Men's 400m and 400m hurdles world records, whilst on the women's side the differential is 5.01 sec. or, even excepting Marita Koch's now questioned mark, still 4.36 sec. Behind Marie Jo Perec's 1996 Atlanta Olympic winning time of 48.25 [see table 1]

T1	400m Hurdles WR	differential	400m Flat WR
Men	Kevin Young .... ..46.78<----------	---------- 3.60----------	---------> 43.18 Michael Johnson
Women	Kim Batten .....52.61 <----------	---------- 4.36----------	----------> 48.25 Marie Jo Perec
Women	Kim Batten .....52.61 <----------	---------- 5.01----------	----------> 47.60 Marita Koch

An analysis by Victor Lopez [1998] of the relative performances of the medal winners in the women's 400m hurdles at the 1997 Athens World Championships, highlighted the degree to which excellence technical precision could help minimize the differential and help indicate potential performance times for 400m hurdlers with world level 400m flat capability, if their differentials could be reduced to the level displayed by the Athens victor Nezha Bidouane [see table 2]. Working from hurdle flight times, Lopez calculated that Bidouane's race was worth 51.22 for a 400m flat time, giving her therefore a highly impressive 1.75 differential.

T2	1997 400H Gold	differential	Calculated* 400m Perf.
Women	Nezah Bidouane ...52.97<----------	---------- 1.75----------	----------> 51.22 Nezah Bidouane*

Lopez 1998

Whilst for many 400m hurdlers it is hard to make an accurate assessment of their 400m flat potential [either through seldom racing at the event and even more so, through not racing over the flat when in peak – Championship – shape], Lopez's figures were based on how much time the athletes spent in the air when hurdling as against the flight time of a normal running stride, on this calculation the performance estimate for the Bidouane's flat time correlates well with her actual 400m pb of 51.66.

Other observers have noted that the women's event especially seems under developed in comparison to the standard of 400m flat running. Parashuck – Irina Privalova's coach - speaking at an IAAF conference in Moscow stated his belief that if an athlete such as Perec or Hemmings could restructure their race and improve the hurdling efficiency, times of 51 secs or under would be realistic levels to strive for.

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Table 3 idealizes what times could be achieved by performers' if they had a differential as low as Lopez's calculation for Bidouane.

T3	Potential 400H Perf.	Bidouane's differential	Existing 400m PB
Women	Marie JoPerec .... ***50.00***<----------	---------- ***1.75***----------	---------> ***48.25***
Women	Irina Privalova .. .***51.64***<----------	---------- ***1.75***----------	---------> ***48.89***
Women	Deon Hemmings ...***52.38***<----------	---------- ***1.75***----------	---------> ***50.63***

Whilst it must be recognized that not everyone can reach Bidouane's level of sustained technical excellence, such calculations should provoke debate as to what levels of performance can be achieved by the excellent 400m runners with excellent technical efficiency.

Evaluating Technical Efficiency

There are obviously a number of factors that impact on the individual athletes differential:

- Hurdling efficiency on [if used] both left and right lead leg hurdling clearance
- Technical Hurdling Endurance
- Ability to spatially adapt approach to each hurdle without loss of velocity
- Ability to develop and execute optimal stride pattern to maximize effort distribution

The use of touch down times at each hurdle are commonly used by athletes and their coaches to evaluate both efficacy of both stride pattern and overall effort distribution. However what the UK athletics Performance analysis project launched in 2001 sought to look at was the ability of the athlete to maintain their approach speed into, over and away from the hurdles using both right and left leg lead for Intra-athlete comparison in a relatively user friendly approach using timing beam generated data backed up by video analysis, to provide combined normative and visual data to assess how effective the athletes were in maintaining velocity in 400m hurdling.

Methodology

The athletes were asked to run over three hurdles on the straight at full 400m hurdle spacing [or slightly reduced for certain individuals when away from the competition period of the year], with a run in mark established to allow for an unchecked clearance of the first hurdle.. Timing gates were stationed at 15m before the hurdle, 5m before the hurdle, 5m after the hurdle and 15m after the hurdle – giving in effect three 10m speed traps, one on general approach between the hurdles, the second on the actual accommodation and clearance of the hurdle and finally on the run – off speed from the hurdle.

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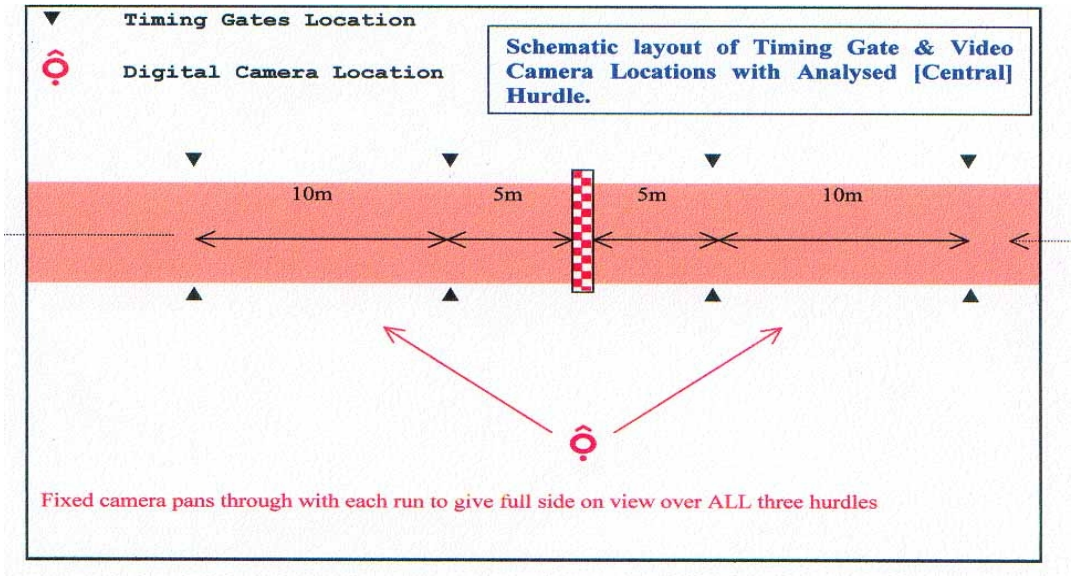


A digital video camera was stationed in line with the central / analyzed [2nd] hurdle, but coverage panned through with each athletes approach and run off over the 1st and 3rd hurdles respectively. Each athlete performed between 2 and 4 runs on each lead leg, to allow an overall picture built up and pattern of efficiency on each side identified.

Although ultimately times over the full 30m timed sections are of relevance, the crucial information for the project lies in the relationship in velocity of the three ten meter sections, with minimal drop off in speed being an indicator of good hurdling efficiency.

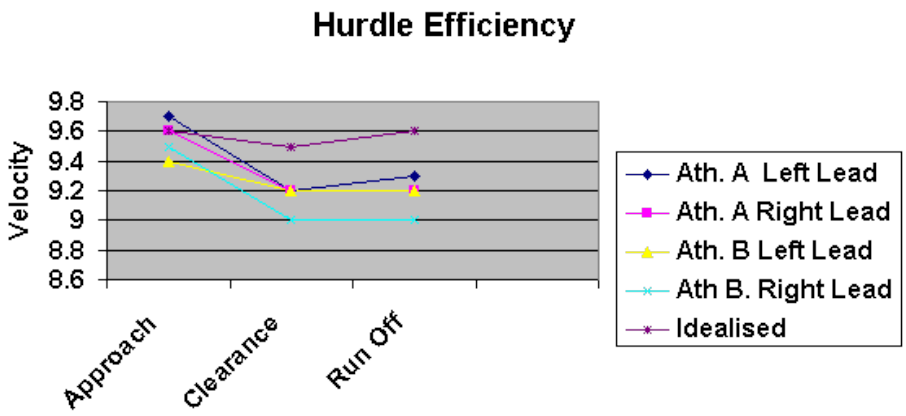
It has to be recognized that this efficiency is determined by a combination of Accuracy of Approach [i.e. the ability to adjust approach to the hurdle without compromising speed] and Hurdling Efficiency the ability to clear the hurdle itself with minimal disruption to running speed.

- The first 10m section establishes normal speed in between the hurdles

- The second 10m section looks at actual approach and clearance speed

- The third 10m section looks at how effectively the athlete can re-establish ‘normal’ pace in between the hurdles

Obviously the idealized aim is for only a very small loss of velocity in the second [clearance] 10 meters enabling a quick resumption of optimal speed between the hurdles. Table 1 shows data from the second velocity analysis session with UK elite level athletes, conducted in the early summer of 2001. Left and right leg data is shown for two athletes [both sub 50 second runners] at a time just prior to the on set of their summer seasons [a session conducted in March had notably lower velocities through out].



For both athletes there was a drop off of between 0.5m/s and 0.2 m/s from their approach 10m velocity to their clearance 10m velocity, but only for with the left leg lead of athlete A, was the run off the hurdle effective enough to recoup any lost momentum within the first 15m past the hurdle itself. Thus the importance of maintaining good clearance velocity is evident not only on how it impacts on negotiating the barrier itself, but also in determining how quickly the athlete can regain full pace in between the hurdles.

The long term of the project is to build up a profile for the elite level athlete and their coach of how effective both their right and left leg hurdling technique and how well this can be developed and/or maintained in the longer term.

It is also hoped to look at this data in terms of bend hurdling [rather than the work done to date purely on the straight] and equally to look at some fatigued scenarios, to see how well the concept of velocity maintenance in 400m hurdling stands up to these additional, race specific factors.