100-meter Hurdles
Technical Analysis

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Thanks and Acknowledgements

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Global Overview: 100m Hurdles

- The 100/110m Hurdles is not one race,
- It can be a series of 11 interconnected maximum accelerations
- Hurdlers must bring their speed to the event
Global Overview of 100m Hurdles

• Is the Technical Model for the Women’s 100-meter Hurdles Different From The Men’s 110-meter Hurdles?

• What Should Be The Philosophical Approach In The Women’s 100-m Hurdles?

• Is Drill Technique Interfering With Execution of The Advanced Technical Model
## Race Model for the 100m Hurdles

<table>
<thead>
<tr>
<th>Pure Acceleration</th>
<th>Transition</th>
<th>Maximum Rhythm I</th>
<th>Maximum Rhythm II</th>
<th>Re-Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 meters</td>
<td>25.5 meters</td>
<td>25.5 meters</td>
<td>25.5 meters</td>
<td>10.5 m</td>
</tr>
<tr>
<td>IN</td>
<td>O</td>
<td>IN</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>0m</td>
<td>13m</td>
<td>38.5m</td>
<td>64m</td>
<td>89.5m</td>
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<tr>
<td>H1</td>
<td>H2</td>
<td>H3</td>
<td>H4</td>
<td>H5</td>
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<tr>
<td>PushPushPush</td>
<td>Drive Taller</td>
<td>Quick Rhythm</td>
<td>Grab Back</td>
<td>Hot Track</td>
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<tr>
<td>Hip Extension</td>
<td>Hip Extension</td>
<td>Hip Flexion</td>
<td>Hip Extension</td>
<td>Hip Flex</td>
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<td>Acceleration</td>
<td>Vmax</td>
<td>Vmax</td>
<td>Vmax</td>
<td>Vmax</td>
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<tr>
<td>Ground Prep</td>
<td>Ground Prep</td>
<td>Recovery</td>
<td>Ground Prep</td>
<td>Recovery</td>
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<tr>
<td>Focus</td>
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<td>Focus</td>
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</table>
Usual Key Components: 100m Hurdles

- Start and Acceleration
- Preparation for Take-Off
- Take-Off
- Lead Leg Attack
- Trail Leg Recovery
- Lead Leg Landing
- Trail Leg Re-Acceleration
- Arm Action
Often Forgotten or Under-emphasized Components

• **Under Emphasis on Start to H1**
• **Strides between the Hurdles**
  • Second Step: Air Phase after Re-Acceleration with Trail Leg
  • Range Step (Wells, T)
• **Under-emphasis of Active Trail Leg and Arm Re-Acceleration**
• **Under-emphasis of a Continuous Active Arm Action**
• **Acceleration Mechanics from H10 to Finish**
Significant Performance Parameters

• **Highest Average Horizontal Velocity Wins**
• **Must Generate Greater than 9.00 m/sec**
  • Elite Women: 9.13 m/s (0.93 sec)
  • Elite Men: 9.22 m/s (0.99 sec)
    • Vertical Displacement, Leg Length, Hurdle Spacing make a greater challenge for Men
• **Generation of Horizontal Force at Speed Wins**
“Golden Position” at Take-Off”
Dr. Ralph Mann, USATF Chief Biomechanician

- From the Proper Distance to the Hurdle
- Traveling at 9.0 m/s or faster
- Lead Leg at Ankle Cross (Stepping Over Knee)
- Must Possess Adequate Strength & Power/BW
The Sprint Hurdles Start

- Not Appreciably Different from Sprint Start for Women Depending on Power to Body Weight Ratio and Limb Length. (7 Steppers)
- Must Be Consistent in Technical Execution

<table>
<thead>
<tr>
<th>Step Length</th>
<th>Distance</th>
<th>Increase</th>
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<td>Front pedal to line</td>
<td>38</td>
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<tr>
<td>Place of first step</td>
<td>59</td>
<td>97</td>
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<tr>
<td>Place of second step</td>
<td>112</td>
<td>171</td>
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<tr>
<td>Place of third step</td>
<td>133</td>
<td>304</td>
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<td>Place of fourth step</td>
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<td>767</td>
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<td>935</td>
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<tr>
<td>Place of eight step</td>
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<td>1095</td>
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<tr>
<td></td>
<td>1095</td>
<td>205</td>
</tr>
<tr>
<td></td>
<td>1300</td>
<td></td>
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</table>
Acceleration to the 1st Hurdle

- Not Appreciably Different from Sprint Acceleration for Women Depending on Leg Length and Power to Body Weight Ratio.
- Must Have Consistent Acceleration Pattern to Deliver the Hurdler to the Identical Optimal Take Off Point
- Utilization of the “Acceleration Ladder” to Teach Aggressive Attack to Take Off Point
1st Hurdle Preparation for Take-Off

- Drive the hips over the hurdle from the impending lead leg (Range Step)
- Little or no deviation from late Pure Acceleration Mechanics
- Take Off Distance can be marginally closer than that of remaining hurdles as velocity is lower
1st Hurdle Take-Off

• Continued Acceleration Action Through the Hurdle
  • Attack with Negative Foot Speed
• Firm Foot Initiates Ground Contact
Preparation for Take-Off for Remaining Hurdles in Race

• Similar to Strategy Employed by LJers
• Active Foot Plant, Dorsi-Flexed Ankle, Ball of Foot
Preparation for Take-Off (Quick)

- Reduce Range of Motion by Keeping the Foot Low on Recovery (Step Over the Ankle)
- Attempt to Reduce Air Time and Catch the Center of Mass on its Ascending Ligand
- Create High Negative Foot Speed
- Minimize Frontside Distance at Touch Down
- Distance of Foot from Center of Mass
  - Women: 0.30m   Men: 0.41m
- Distance of Foot from Center of Mass Sprinting
  - Women: 0.28m   Men: 0.38m
First Hurdle Clearance

• Quality of Clearance Determined by Take Off

• Hip Distance Away from Hurdle While Foot Lands Under Hip
Hurdle Clearance Time (TO to TD)

- Minimizing Air Time without Compromising the Next Ground Contacts
  - Elite Women: 0.27 sec
  - Elite Men: 0.30 sec
- Determined by Several Key Factors
  - Efficiency of Take-Off
  - Body Position at Take-Off
  - Limb Re-Arrangement Capacity
Lead Leg Attack Mechanics

- Take Advantage of Ground Reaction Force from Range Step
- Advanced Technical Model Focuses on Pop the Thigh Forward
  - Lack of Early and Aggressive Hip Flexion often results in Lead Leg Locking over the hurdle
Trail Leg Recovery Mechanics

- Trail Leg Knee Must race the Opposite Side Hand (McFarlane, B)
- Trail Leg Must be at near Full Flexion and in Sagittal Plane at Lead Leg Landing
Lead Leg Landing Mechanics

- Lead Leg Negative Thigh Speed Impacted by Trail Leg Thigh Recovery Speed
- High Negative Foot Speed at Touch Down
- Minimal or No Frontside Distance
- Dorsi-Flexed Ankle (Males: Plantar-Flexed)
- Shin Sinks while Hip Continues to Extend
- Only 50% Negative Vertical Velocity Handled by Lead Leg
Trail Leg Re-Acceleration Mechanics

• Trail Leg Aggressively Windmills into Active Negative Thigh Acceleration
• Reduced Air Time Allows Remaining Negative Vertical Forces to be Handled by Trail Leg
• Often Action is Inhibited by Opposite Arm Lingering Behind the Body
Steps Between the Hurdles

• Step One: Lead Leg Touchdown to Trail Leg Touchdown

• Air Time for Each Step:
  • Elite Women: AT - 0.069 sec + GT – 0.087 sec = 0.156
  • Elite Men: AT - 0.075 sec + GT – 0.085 sec = 0.160
Steps Between the Hurdles

- **Step Two: Trail Leg Re-Acceleration to LL Penultimate**

- **Air Time for Step Two:**
  - Elite Women: $AT - 0.107 \text{ sec} + GT 0.100 \text{ sec} = 0.207 \text{ s}$
  - Elite Men: $AT - 0.127 \text{ sec} + GT 0.100 \text{ sec} = 0.227 \text{ sec}$

- **Air Time for Step Three:**
  - Elite Women: $AT - 0.110 \text{ sec} + GT 0.097 \text{ sec} = 0.207$
  - Elite Men: $AT - 0.103 \text{ sec} + GT 0.097 \text{ sec} = 0.200$
Second Step Mechanics (Range)

- Explosive Projection of the Hips Toward and Over the Hurdle Rail
Horizontal Foot Speed at Take Off and Between the Hurdles

- Minimize Breaking Forces that are Incurred to Generate Needed Vertical Velocity
- Take Off (Before the Hurdle)
  - Women: 6.86 m/sec  Man: 6.34 m/sec
- Step One (Lead Leg Touchdown)
  - Women: 9.30 m/sec
- Step Two (Trail Leg Reacceleration)
  - Women: 9.4 m/sec
- Step Three (Range Step/Penultimate Step)
  - Women: 6.80 m/sec
Re-Acceleration Off Last Hurdle

- An Opportunity to Snatch Victory Away from Defeat
- Always Can Reach Higher Speed than in Race as There are Three to Four Additional Steps
- Must be Continually Rehearsed
Finish Technique

• Finish Technique must be regularly rehearsed if it is to be properly executed under pressure of competition.
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