Maximal Sprinting for Middle/Long Distance Running

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It does not matter if I can reach a higher VO2max in 5 minutes when I have to cross the finish line in 102 s

- Vebjørn Rodal (800 m Olympic champion, 1996)

Tony Holler is WRONG!

Pillar #13:

Keep distance coaches away from sprinters!

Speed 101

Sprint training and development is not based on or guided by sport science (Haugen et al., 2020)

There is a lack of evidence-based research identifying best practices for speed development

A chasm exists between empirical knowledge of speed development and experiential knowledge of coaches (Waters et al., 2019)

Speed 101

Q12 What are your top training priorities for *developing* athletes? Rank in order of importance (1 = most important, 14 = least important)

Q13 What are your top training priorities for *elite* athletes? Rank in order of importance (1 = most important, 14 = least important)

Training Priority	Rank
Arm positioning	
Bend Running	
Block Starts	
Endurance	
Footwork	
General strength conditioning	
Aerobic Fitness	
Max Velocity	
Posture	
Power	
Reaction time	
Skill specific conditioning	
Speed Endurance	
Strength	
Other	

Speed 101

Coaches

Developmental training priorities:

- General strength conditioning
- Posture
- Footwork
- Skill specific conditioning
- Arm positioning

Coaches

Elite training priorities:

- **Maximum velocity**/Skill specific
- **Maximum velocity**
- Skill specific conditioning
- Power
- Reaction time

Speed 101

Sport Mechanists

Developmental training priorities:

- **Maximum velocity**
- Skill specific conditioning
- Posture
- General strength conditioning
- Arm positioning/Aerobic fitness

Sport Mechanists

Elite training priorities:

- **Maximum velocity**
- Maximum velocity
- Posture
- Power
- General Strength/ Aerobic Fitness/Strength

Dimensions of speed

Speed phases:

- Acceleration: 0 - 10 m
- Maximum velocity: 30 - 80 m
  - Maximum velocity is also the fastest 10 m split in the maximum velocity phase
  - Elite sprinters attain MV later in the phase
- Velocity maintenance: after maximum velocity has been attained

Maximum velocity

Maximal sprint speed (MSS)

- 40 m up to 60 m
- Total distance time and 10 m splits (if possible)

Speed 101

Speed reserve is an athlete's efficiency while sprinting. The faster the athlete, the less effort needs to be expended to maintain maximum velocity (Crick, T., 2013).

Speed 101

1. Sprinting = acceleration, maximum velocity (MV), deceleration
2. **MV exists in a 10 m window**
3. **Sprinting (maximum velocity) takes place between 30 - 60 m**
4. A 10 m fly with a 30 m fly start is an efficient means of measuring maximum velocity
5. **If an athlete is not sprinting at ≥95% of MV, it's not sprinting**
6. Electronic timing is accurate and precise
7. Apples to apples = meters to meters
8. Sprinting = Vertical application of maximal force in a downward direction
9. Low intensity training 48 hours before and after sprint efforts
10. Arms aren't as important as you think

Speed 101

Maximum velocity (MV) exists in a 10 m window

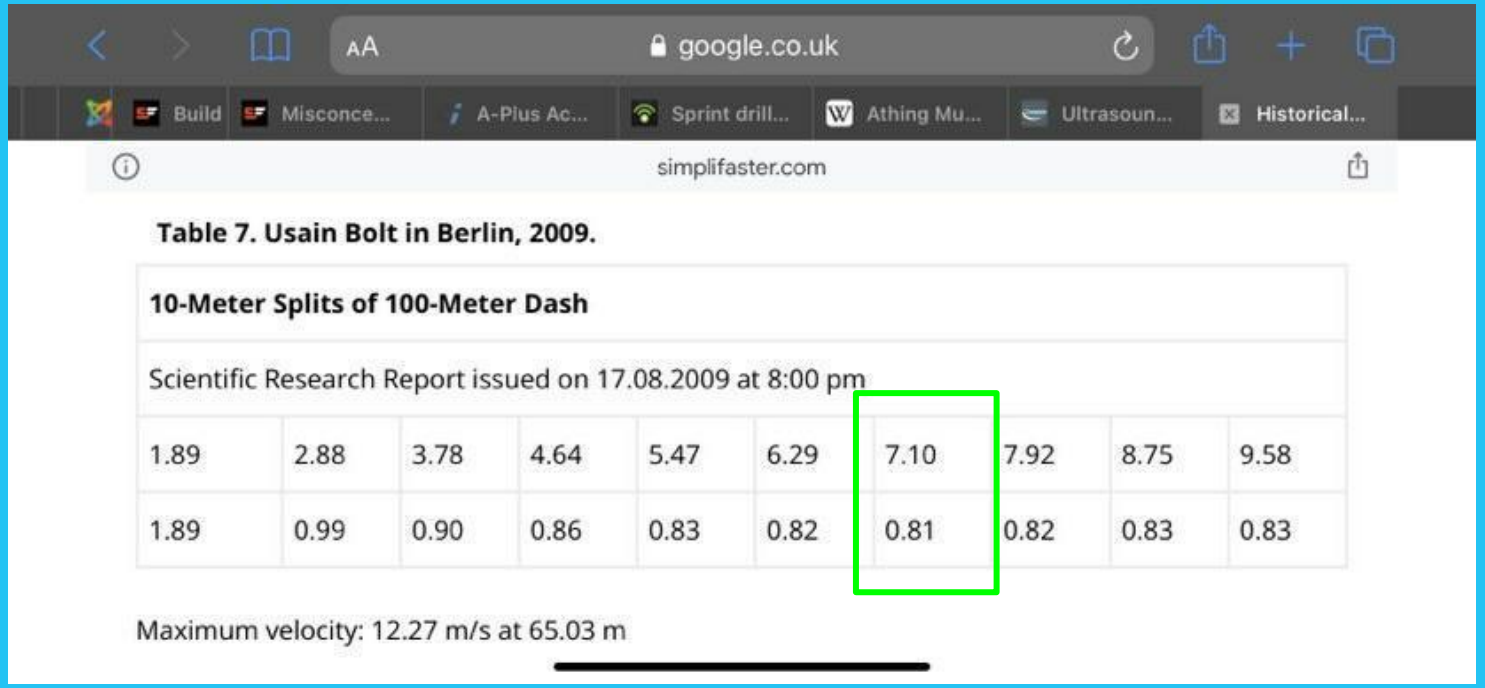

Table 7. Usain Bolt in Berlin, 2009.

10-Meter Splits of 100-Meter Dash									
Scientific Research Report issued on 17.08.2009 at 8:00 pm									
1.89	2.88	3.78	4.64	5.47	6.29	7.10	7.92	8.75	9.58
1.89	0.99	0.90	0.86	0.83	0.82	0.81	0.82	0.83	0.83

Maximum velocity: 12.27 m/s at 65.03 m

Speed 101

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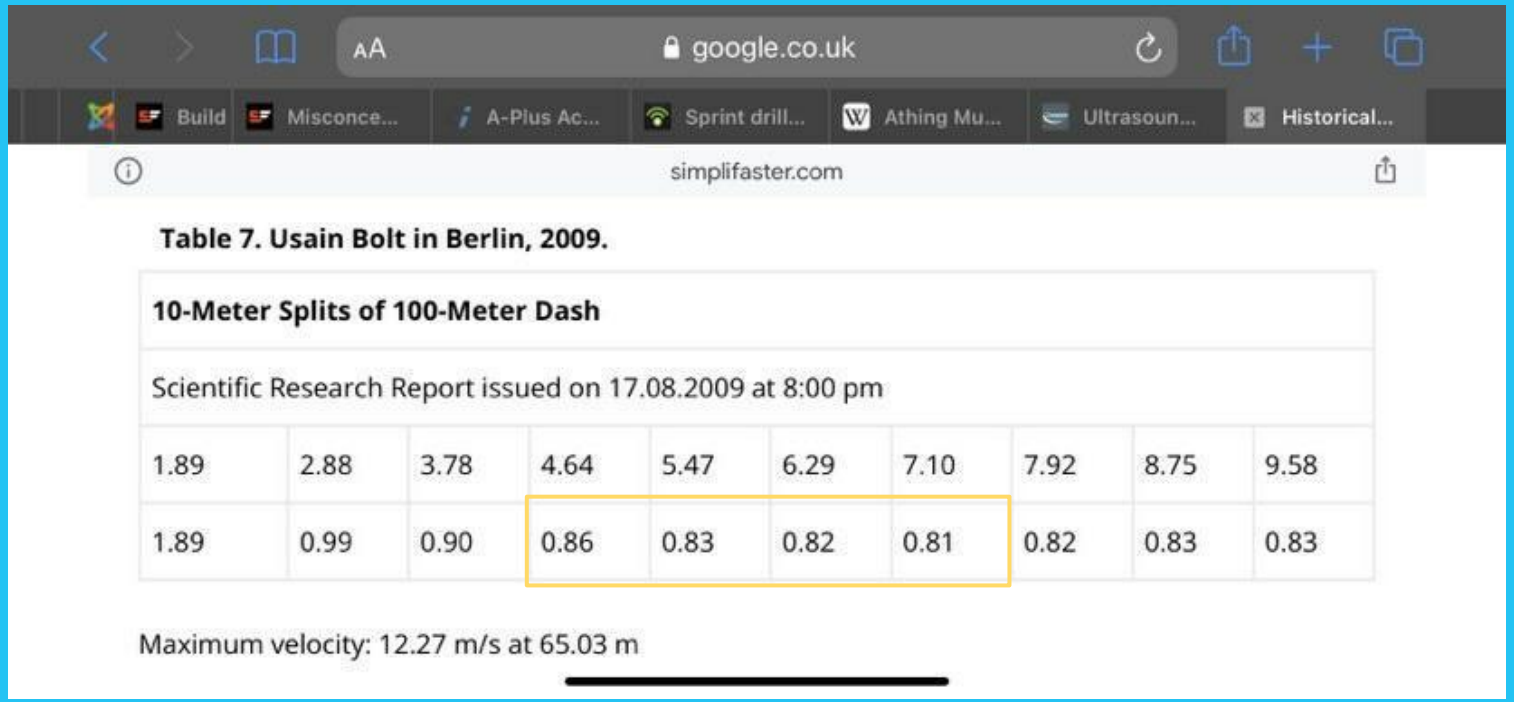

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Speed 101

If an athlete is not sprinting at ≥95% of MV, it's not sprinting

Sprinting intensity should be ≥ 95% of an athlete's maximum velocity for performance enhancement (Haugen, et al., 2020).

Key factors in running performance

Performance metrics:

Speed Reserve Ratio (SRR): MSS/MAS

Anaerobic Speed Reserve (ASR): MSS - MAS

Maximal Aerobic Speed (MAS): 1,600 m (total distance time and 400 m splits)

Maximal Sprinting Speed (MSS): 40 m (10 m split and total distance)

Speed reserve ratio (SRR)

Speed reserve ratio (SRR)

Maximal sprint speed (MSS)/Maximal aerobic speed (MAS)

Aerobic/Anaerobic Contributions

800 m:

70/30% or 60/40%

1,500 m - Marathon:

75-85%/15-25%

Haugen et al. (2021)

Subgroups based on Speed Reserve Ratio (SSR)

400 - 800 m (speed):

SRR: ≥ 1.58

800 m (specialist):

SRR: ≤ 1.57 to ≥ 1.47

800 m - 1,500 m (endurance):

SRR: ≤ 1.57 to ≥ 1.47

1,500 m - Marathon:

?

(Haugen et al., 2021; Sandford et al., 2019)

Anaerobic speed reserve (ASR)

Anaerobic speed reserve (ASR)

Maximal sprint speed (MSS) - maximal aerobic speed (MAS)

Maximal aerobic speed

Maximal aerobic speed (MAS)

Any distance used to represent VO_{2max}

- 400 m on up (XC: 5K)
- Total distance time and splits (if possible)

Maximal sprint speed

Maximal sprint speed (MSS)

- 40 m up to 60 m
- Total distance time and 10 m splits (if possible)

Aerobic Contributions

- Middle distance
  - 800 m: 65 - 75%
  - 1,500 m: 80 - 85%
- Middle-long distance:
  - 3,000 m: 85 - 90%
  - 5,000 m: 90 - 97%
  - 10,000 m: 97%
- Long distance
  - Half marathon: 98%
  - Marathon: 99.9%

Billat (2001)

Aerobic Contributions

- 800 m: (60.3 ± 9)%
- 1,500 m: (77 ± 7)%
- 3,000 m: (86 ± 7)%

Duffield et al. (2005)

Aerobic Contributions

- 800 m: (66 ± 4)%
- 1,500 m: (84 ± 3)%

Spencer and Gastin (2001)

The role of maximal sprint speed in running performance

Assessing running speed helps determine race strategy, the quality of training programs, and provides insights to optimized training intensities and volumes in a training period

Riberio et al. (2020)

The role of maximal sprint speed in running performance

The ability to adapt and manage the acidification and development of a higher blood concentration of lactate without performance capacity diminishing is critical

Riberio et al. (2020)

The role of maximal sprint speed in running performance

A fast Maximal Sprinting Speed (MSS)determines the proportion of ASR an athlete can work at and may influence high intensity training tolerance

(Sandford et al., 2019)

Maximum Velocity and Cross Country Performance

Athlete	MV	Race PR
A1	1.14	18:59.0
A2	1.15	18:20.0
A3	1.17	18:35.2
A4	1.20	22:10.3
A5	1.21	19:11.6
A6	1.22	18:44.2
A7	1.23	18:20.0
A8	1.23	18:37.7
A9	1.24	18:57.1
A10	1.26	18:20.6
A11	1.26	21:17.0
A12	1.30	20:35.1

Athlete	MV	Race PR
A13	1.30	19:43.5
A14	1.31	23:46.5
A15	1.33	18:38.1
A16	1.35	20:10.8
A17	1.40	23:43.7
A18	1.42	23:53.5
A19	1.42	19:42.9
A20	1.44	21:40.0
A21	1.56	26:39.9
A22	1.61	23:00.0
A23	1.75	25:55.7
A24	1.83	25:37.1

Maximum Velocity and Cross Country Performance

	Maximum Velocity (MV)		*1,600 PR*	MV	1,600 time	*Speed Reserve Ratio (SRR)*
Athlete	**Max**	**Ave**		MSS m/s	MAS m/s	*SRR = MSS/MAS*
A1	1.27	1.32	4:33	7.87	5.86	1.34
A2	1.18	1.22	5:00	8.47	5.33	1.59
A3	1.16	1.19				
A4	1.32	1.35				
A5	1.26	1.38				
A6	1.12	1.15	5:00	9.80	5.33	1.84
A7	1.36	1.40	5:22	8.26	4.97	1.66
A8	1.15	1.24	6:15	8.70	4.27	2.04
A9	1.30	1.36				
A10	1.22	1.23				
A11	1.42	1.48				
A12	1.76	1.81				

Maximum Velocity and Cross Country Performance

Thomas Breitbach	
MSS (MV in m/s)	
1.19	8.4
MAS (1,600)	
4:19	259
1,600 in m/s	6.18
SRR = MSS/MAS	
	1.36
ASR = MSS-MAS	
	2.22

Maximum Velocity and Cross Country Performance

Ben Stricker						
	MV	200 m	400 m	800 m	1600 m	3,200
2022 Track				2:10.85		10:00.14
2023 Track	1.09	26.09	55.28	2:03.12	4:26.57	9:43.74
	MV	5,000				
2022 XC	1.20	16:18.9				
2023 XC	1.09	16:06.3				

Maximum Velocity Top Performances

	Athlete	Time	Sport
1	Gabriel Olsen	0.95	Track/Soccer
	AC Zylka		Track
	Alexander Maggit		Track
2	Aidan Lynch	1.00	Track
3	Jacob Lorbecki	1.01	Soccer/Baseball
4	Devin Frank	1.02	Track/Football
	Lily Strong		Track
	Desmond Wilson		Track
5	Max McQuide	1.03	Track
6	Matt Jelinski	1.04	Track
	A. Groskopf		Track/Football
	Kieran Schindler		Track
7	Jetta Mays	1.05	Track
	Sennet Siodlarz		Track/Football
8	Austin Villarreal	1.06	Track/Basketball
9	Nick Hansen	1.07	Football
10	Naomi Wilson	1.08	Track/Basketball
11	Andrew Kronenberg	1.09	Football
	Maia Mays		Track
	Maximum Velocity		
	10 m fly (30 m fly start)		

Maximum Velocity Top Performances

Maximum Velocity	Performance
Elite	< .90
Excellent	.99 - .90
Very Good	1.09 - 1.00
Above Average	1.19 - 1.10
Average	1.29- 1.20
Below Average	≥ 1.30
Created by Nat Senior and Ajamu Olaniyan (topflightone.com)	

Maximum Velocity Top Performances

Max Velocity for Optimal 100m Performance (Min. values)

100m time	Max V (m/s)	Fastest 10m	Fly 30m (Fastest 30m segment)
9.40	12.55	0.80	2.41
9.50	12.50	0.80	2.42
9.58WR (Men)	12.50	0.80/0.81	2.43
9.60	12.19	0.82	2.47
9.70	12.05	0.83	2.51
9.80	11.92	0.84	2.54
9.90	11.78	0.85	2.57
10.00	11.64	0.86	2.60
10.10	11.51	0.87	2.62
10.20	11.37	0.88	2.66
10.30	11.24	0.89	2.69
10.40	11.10	0.90	2.72
10.49WR (Women)	11.23	0.89	2.69
10.50	10.97	0.91	2.75
10.60	10.83	0.92	2.78
10.70	10.70	0.93	2.81
10.80	10.59	0.94	2.84
10.90	10.47	0.95/0.96	2.87/2.90
11.00	10.35	0.96/0.97	2.90/2.94
11.10	10.25	0.97/0.98	2.94/2.96
11.20	10.12	0.99	2.99
11.30	10.03	0.99/1.00	2.99/3.02
11.40	9.89	1.01	3.04
11.50	9.76	1.02/1.03	3.08/3.11
11.60	9.65	1.03/1.04	3.11/3.14
11.70	9.53	1.05	3.17
11.80	9.41	1.06	3.19
11.90	9.30	1.07/1.08	3.23/3.26
12.00	9.20	1.08/1.09	3.26/3.30

Created by **Nat Senior** of NSX Performance
https://youtube.com/@nsxperformance?si=DU1qA3e2jCBQU9oN

Instagram: nsx_gms

Key terms

Acceleration
Aerobic
Anaerobic
Anaerobic capacity
Anaerobic speed reserve (ASR)
Anaerobic threshold

Key terms

Maximal aerobic speed (MAS)
Maximal sprint speed (MSS)
Maximum velocity (MV)
Speed reserve ratio (SRR)
Splits (10 m)
Velocity maintenance

Resources

Ascent Endurance x Top Flight Interview (part 1):

https://youtu.be/txPMLhOicKQ?si=ck7G9J3Zoycrm3Sq

Speed 101

https://youtu.be/AysYqcFIcjE?si=Azf_2OHC4kyW9wg5

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