

STRUCTURE, STRENGTH & SKILL

Assessing contributors to performance and injury



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LIVE BETTER THROUGH SPORT

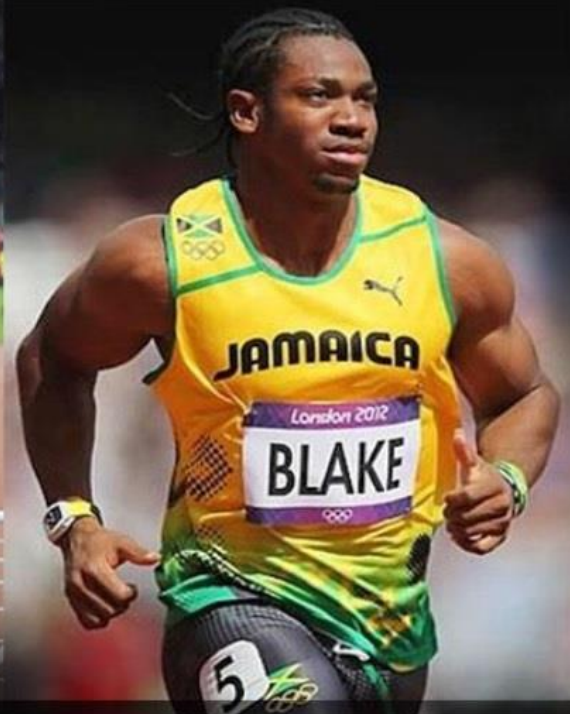




Danielle Scott Volleyball 6'2", 185 lbs.	Dara Torres Swimming 6'0" 150 lbs.	Kathy Collins Boxing 5'5" 137 lbs.	Olga Karmansky Rhythmic Gymnastics 5'1" 85 lbs.	Connie Price-Smith Shot Put 6'3" 210 lbs.	Shannon Miller Gymnastics 5'0" 97 lbs.	Stacy Dragila Pole Vault 5'7.5" 140 lbs.	Staciana Stitts Swimming 5'10" 140 lbs.	Cathy Sassin Adventure Racing 5'6" 138 lbs.	Dawn Ellerbe Hammer Throw 6'2" 240 lbs.	DeLisha Milton Basketball 6'1" 172 lbs.	Kim Chizevsky Bodybuilding 5'8.5" 135 lbs.	Annika Sorenstam Golf 5'5" 120 lbs.	Tara Nott Weightlifting 5'1" 105 lbs.	Tara Nott Long Jump 4'11"
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Lauren Distance Running 5'11" 125 lbs.	Tara Lipinski Figure Skating 5'1" 95 lbs.	Lisa Leslie Basketball 6'5" 170 lbs.	Cheryl Haworth Weightlifting 5'9" 297 lbs.	Svetlana Khorkina Gymnastics 5'5", 105 lbs.	Stacey Bowers Triple Jump 5'6" 130 lbs.	Jennifer Parilla Trampoline 5'1" 120 lbs.	Deena Drossin Long Distance Running 5'4" 105 lbs.	LeShundra Nathan Heptathlon 5'11" 175 lbs.	Tobey Gifford Sport Aerobics 5'3" 118 lbs.	Tabitha Yim Gymnastics 4'8" 85 lbs.	Amy Acuff High Jump 6'2" 145 lbs.	Stacy Sykora Volleyball 5'10", 135 lbs.	Jessica Howard Rhythmic Gymnastics 5'7", 100 lbs.
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VS



STRUCTURE, STRENGTH & SKILL

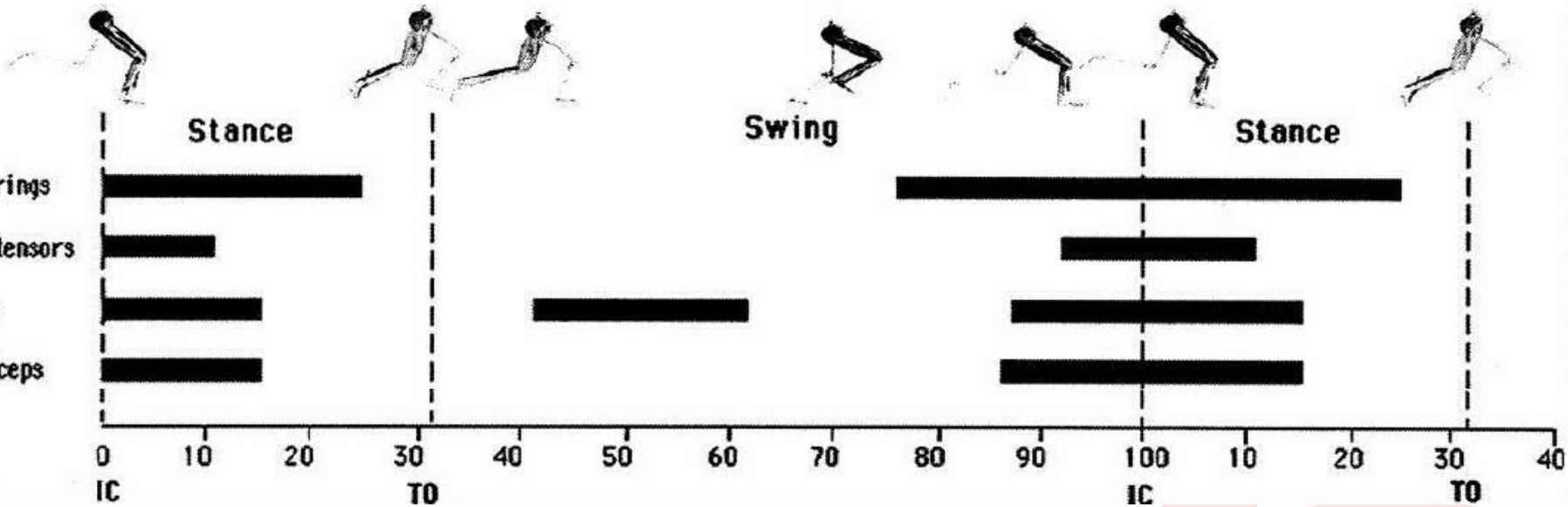
Assessing athletic performance & injury risks





IN RUNNING

Understanding muscular contributors



Muscles as shock absorbers

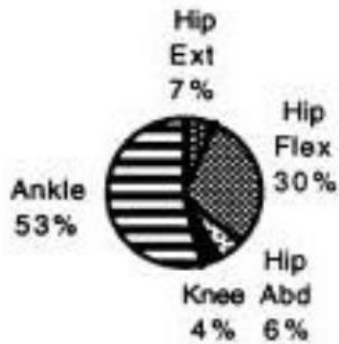
Early swing: Only hip flexors activated

Late swing: Hamstrings working eccentrically

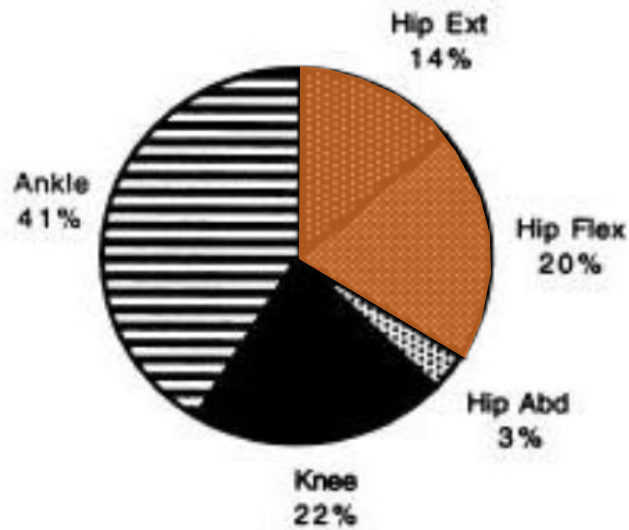
Novacheck, 1998

RUNNING VS WALKING

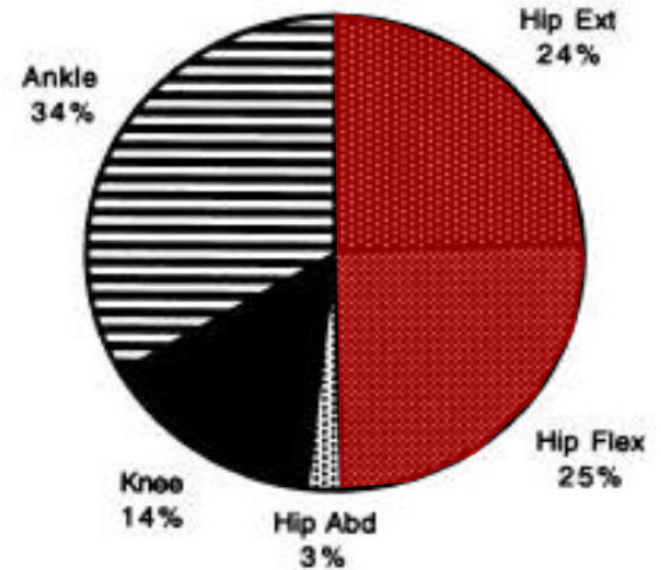
Understanding muscular contributors



Walk
(1.2 m/sec)



Run
(3.2m/sec)



Sprint
(3.9 m/sec)

Novacheck, 1998

STRUCTURE

- Anthropometry
 - Longer muscle fascicle length
- Range of motion
 - \uparrow Leg Length = \uparrow SL = \downarrow SF
 - Risk of muscle strains
- Mobility
 - Ineffective motion execution
- Stability



STRUCTURE: FUNCTIONAL MOVEMENT SCREEN

Range of Motion, Mobility & Stability

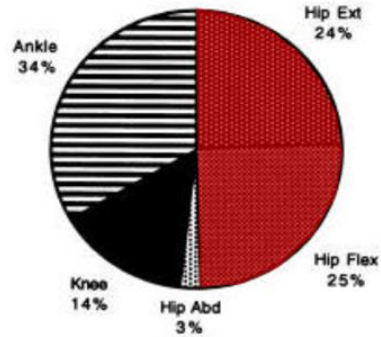


STRENGTH ASSESSMENT

Strength/Power of Isolated Joint

Performance

- Concentric Hip Flexion
- Concentric Hip Extension



Novacheck, 1998

Concentric Hip Extension



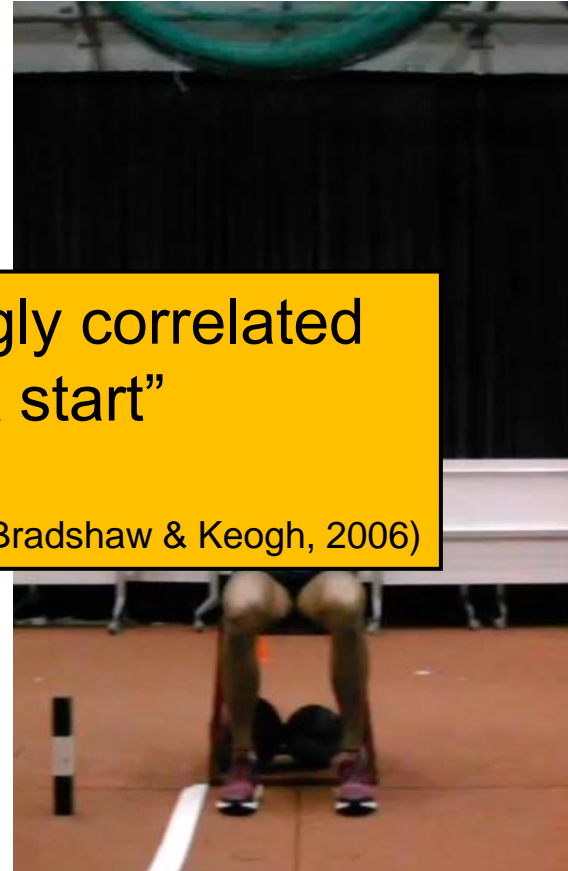
Injury Prevention

- Eccentric Hamstring

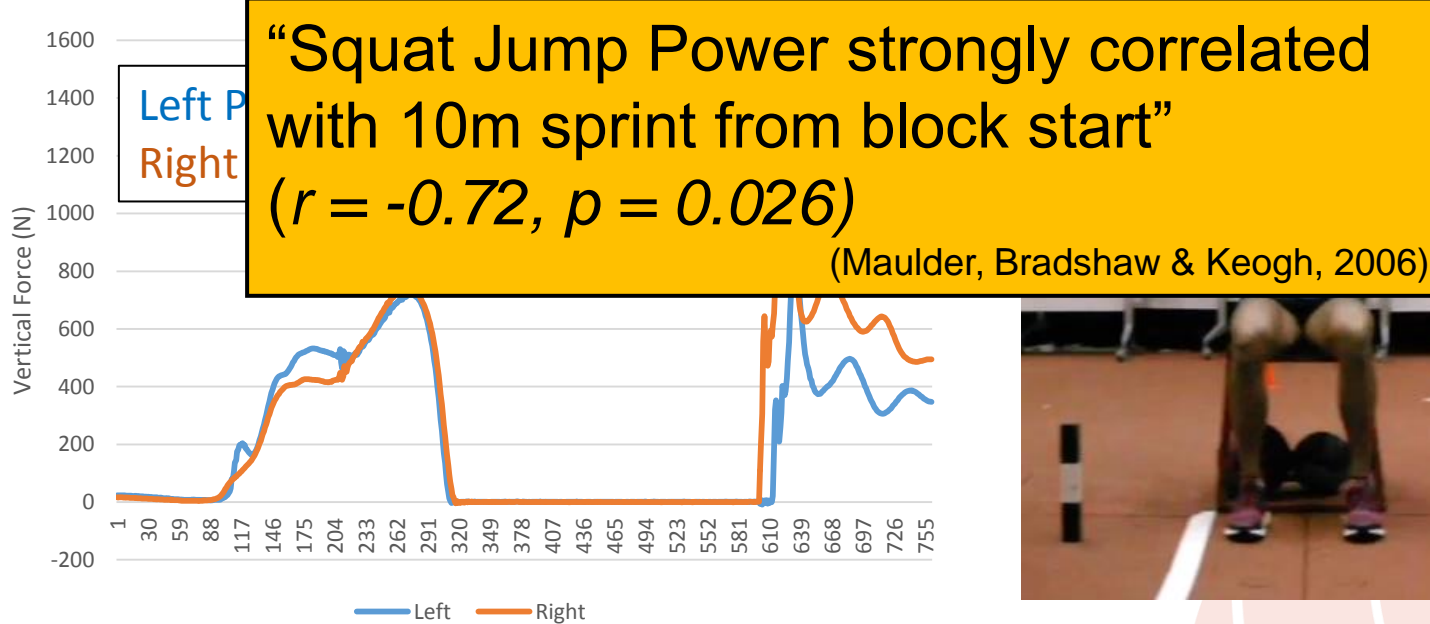


STRENGTH ASSESSMENT

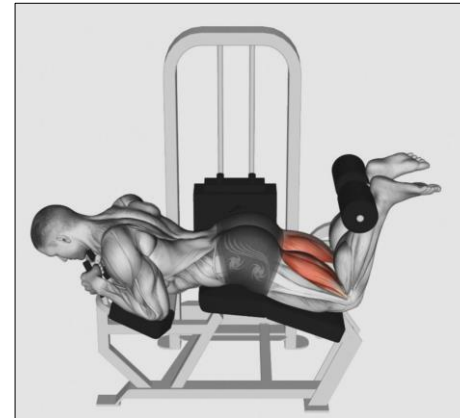
Explosive Strength for Block Starts



Squat Jump w/o arms



STRENGTH ASSESSMENT



SKILL

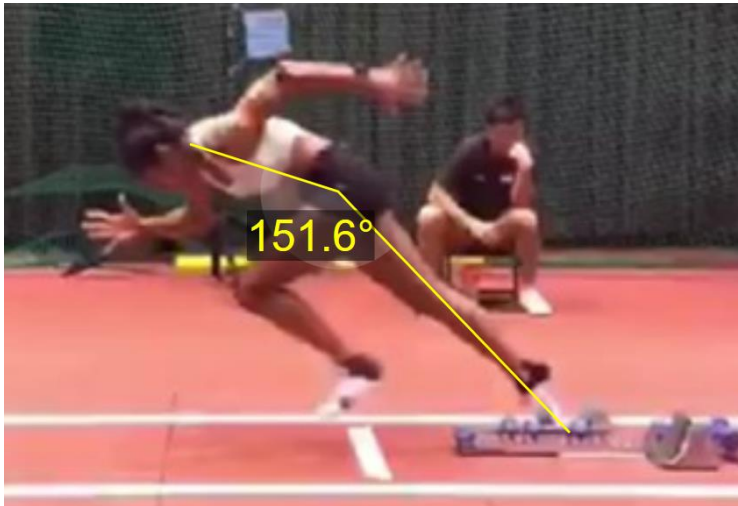


Is there transfer from strength to skill?

- Block starts
- Top speed sprinting

SKILL ASSESSMENT

Block Starts (2D Video)



Poorer force transfer
through centre of mass

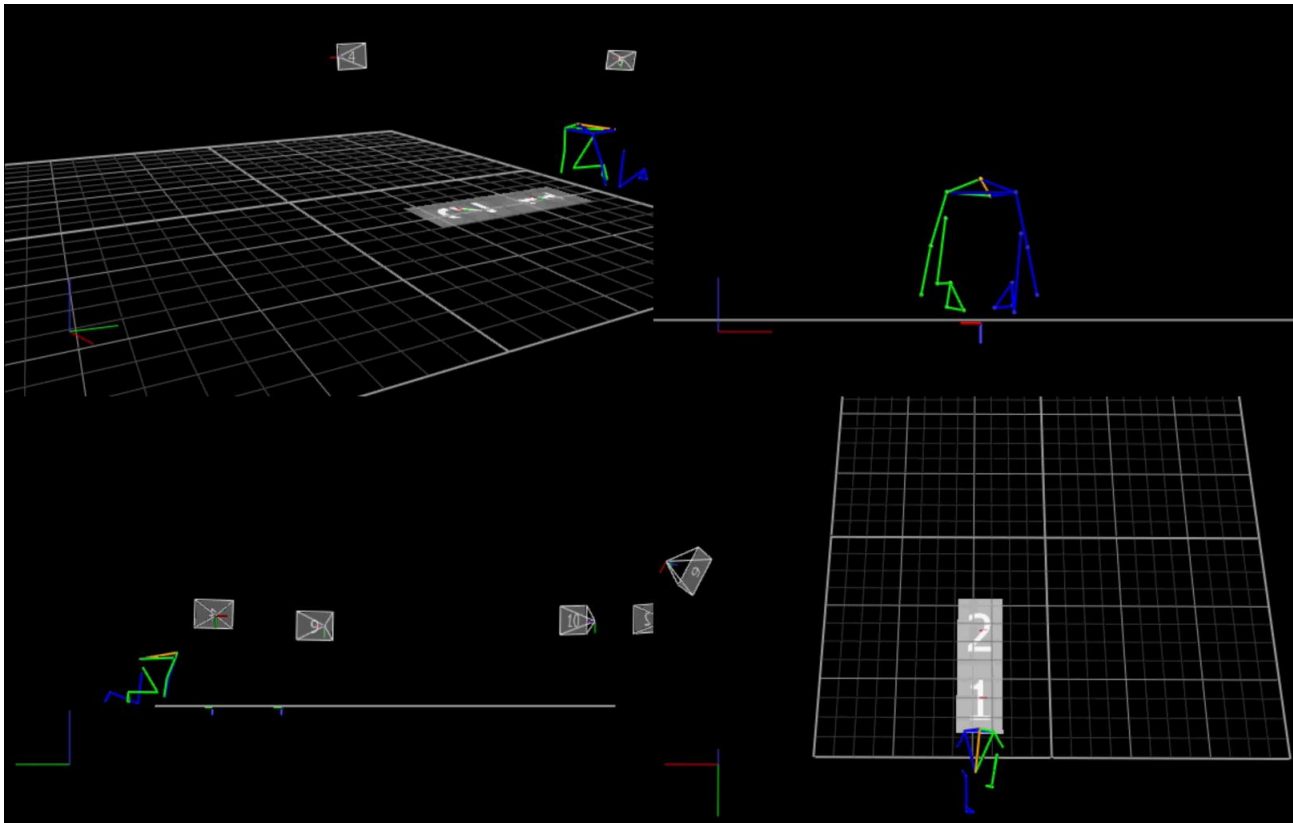
VS



Better force transfer
through centre of mass

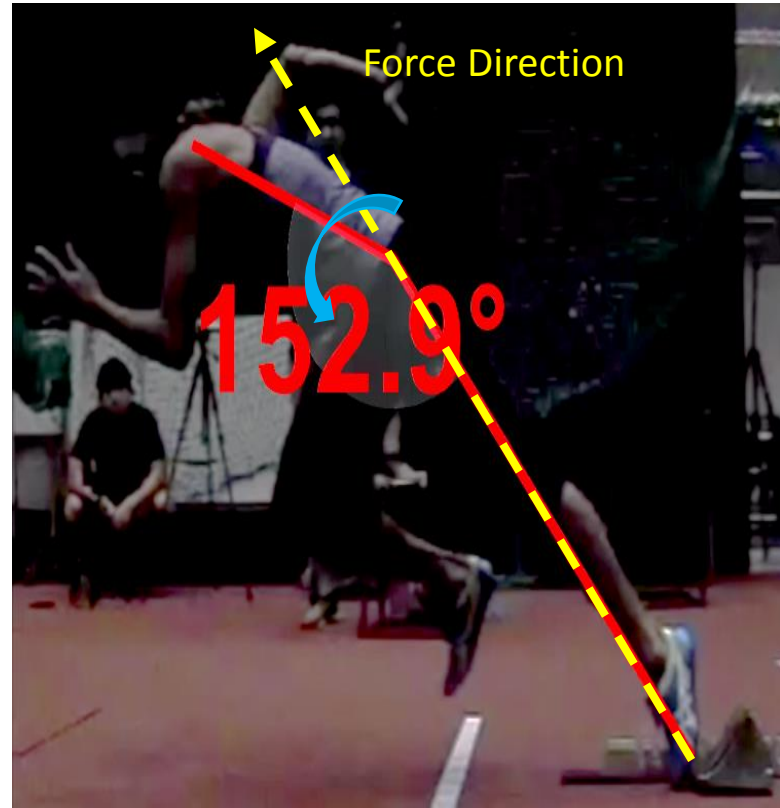
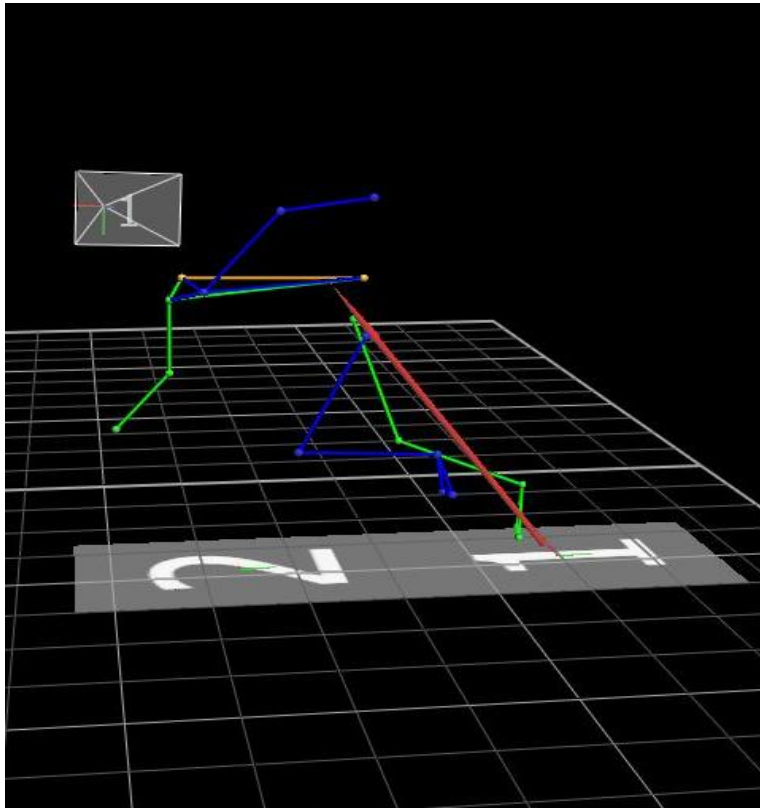
SKILL ASSESSMENT

Block Starts (3D Motion Analysis)



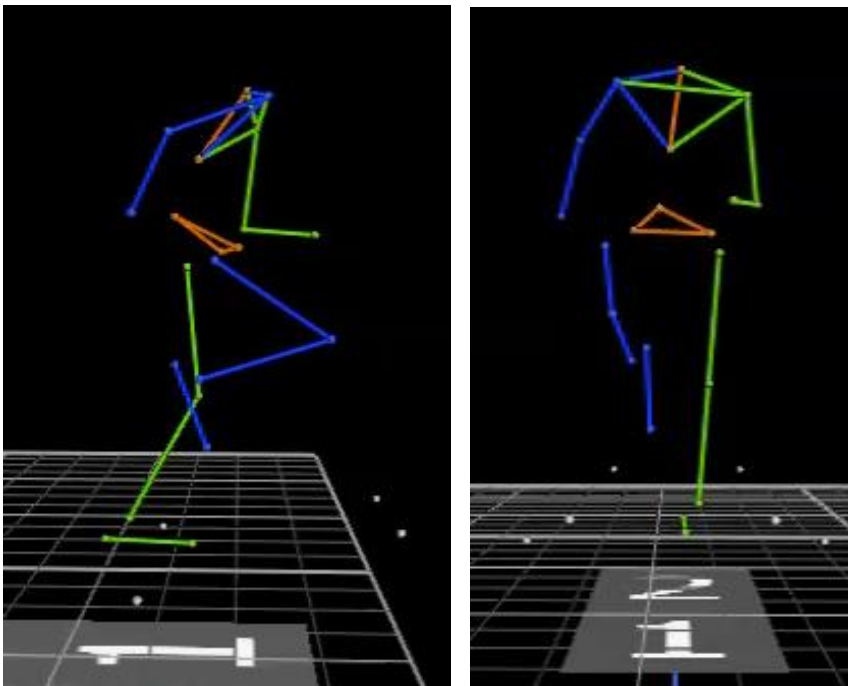
SKILL ASSESSMENT

Block Starts (Strength to Skill)



SKILL ASSESSMENT

Top Speed Sprinting (Stride Asymmetry)

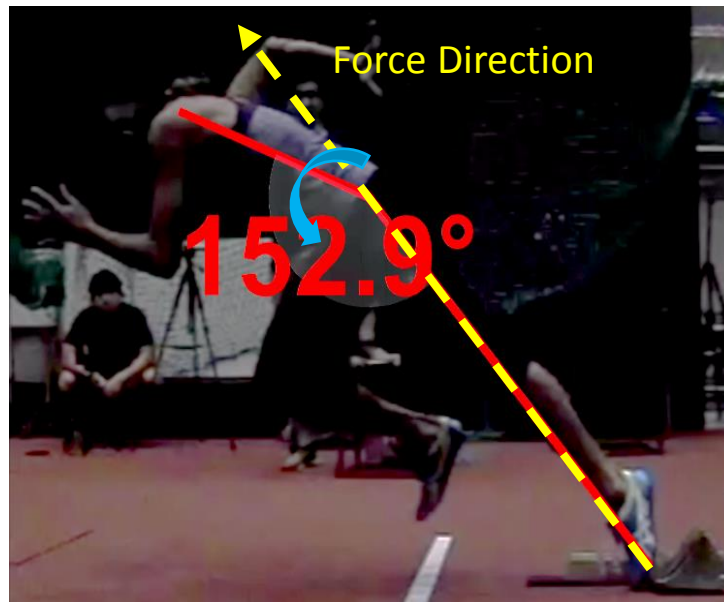


Strength VS Skill

	LEFT	RIGHT
Hip <u>Flexor</u> Peak Torque	75.3 Nm	61.6 Nm
<u>Forward</u> Swing Velocity (Knee)	4.3 m/s	4.7 m/s
Hip <u>Extensor</u> Peak Torque	116.9 Nm	110.3 Nm
<u>Backward</u> Swing Velocity (Knee)	4.4 m/s	4.7 m/s

SKILL ASSESSMENT

Utilising more tools to provide more resolution

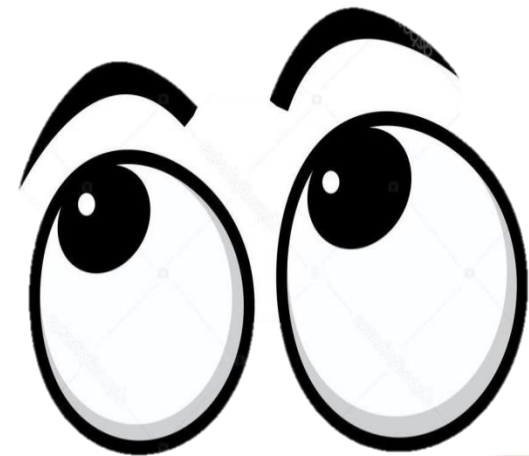
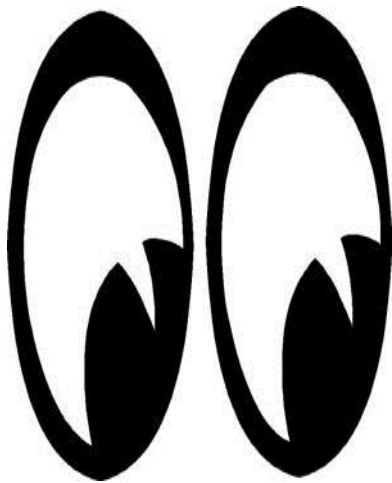


How to change the posture?

SKILL ASSESSMENT

Utilising more tools to provide greater resolution

Vision and Action



SKILL ASSESSMENT

Utilising more tools to provide greater resolution

Vision and Action

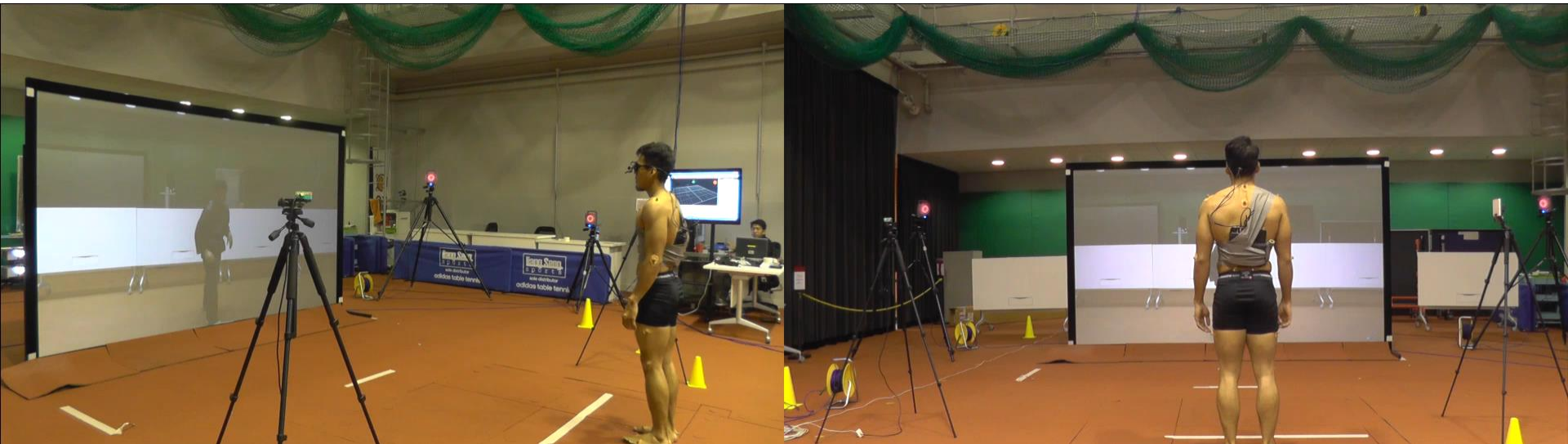
Using gaze manipulation to alter start posture



ALL ROUNDED ASSESSMENT

Towards a more holistic approach

Game-realistic visual environments to assess & train skills



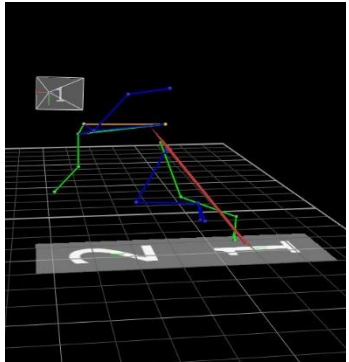
SCREENING AND EVALUATION PROTOCOL



Structure



Strength



Skill

