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Use of the Kinematic Chain in the Fencing Attacking Lunge

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The Attacking Lunge in Fencing

Determinants of Fencing Lunge Performance

COORDINATION

- 'Experts' vs novice isolated arm vs full lunge movement *(Yiou and Do., 2000)*

	Isolated *touche* condition	Sequential *touche* + *lunge* condition
	V_{Fmax}	V_{Fmax}
Experts	2.66 ± 0.29	2.90 ± 0.30**
Novices	2.47 ± 0.36	2.52 ± 0.29

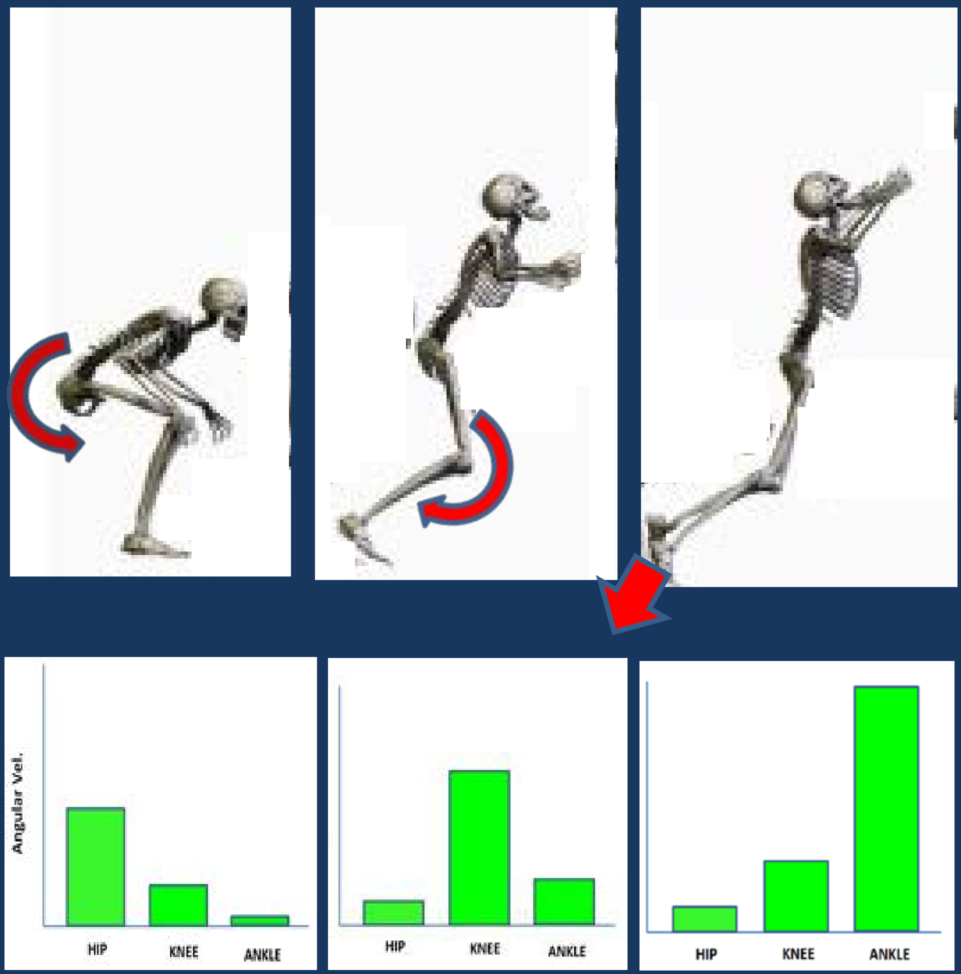
ARM MOVEMENT

- Kinematics and EMG showed no difference with sword arm *(Frere et al., 2011)*

LOWER EXTREMITIES

- Elite lunge further - 1.17 ± 0.17m vs 1.02 ±0.01m (*Gholipour et al., 2008)*
- Statistical model - Rear knee, hip and lead hip *(Bottoms et al., 2013)*
- Kinematic and EMG – rear hip extensors, rear knee, and plantarflexors strongly correlated with forward velocity (*Guilhem et al., 2014)*

The Kinematic Chain



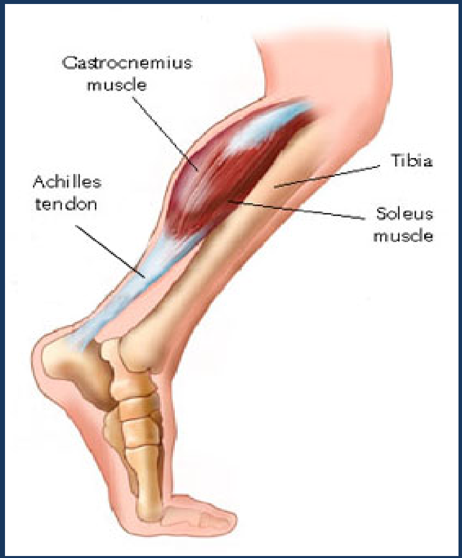
- **Proximal to distal sequencing**

  Bobbert and Soest (2000)

- **Increasing angular velocity**

- **Capitalizes on neuromuscular design**

  Kurokawa et al. (2001)



Aim: To investigate whether skilled fencers utilise a sequential kinematic chain in the rear leg of the fencing attacking lunge.

Method

Participants

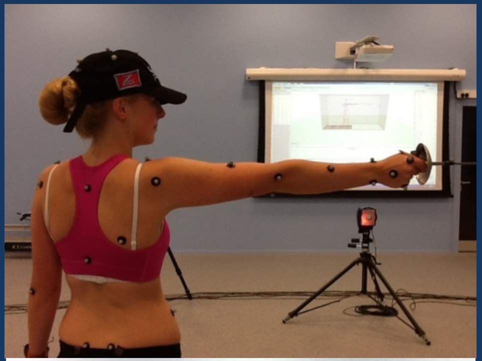
- **6 novice** (age 22y ±10, height 177.7cm ± 8, mass 74.6kg ± 16.1)
- **4 skilled** (age 24y ±14, height 181cm ± 5, mass 71.9kg ±15.2**)**

Procedure

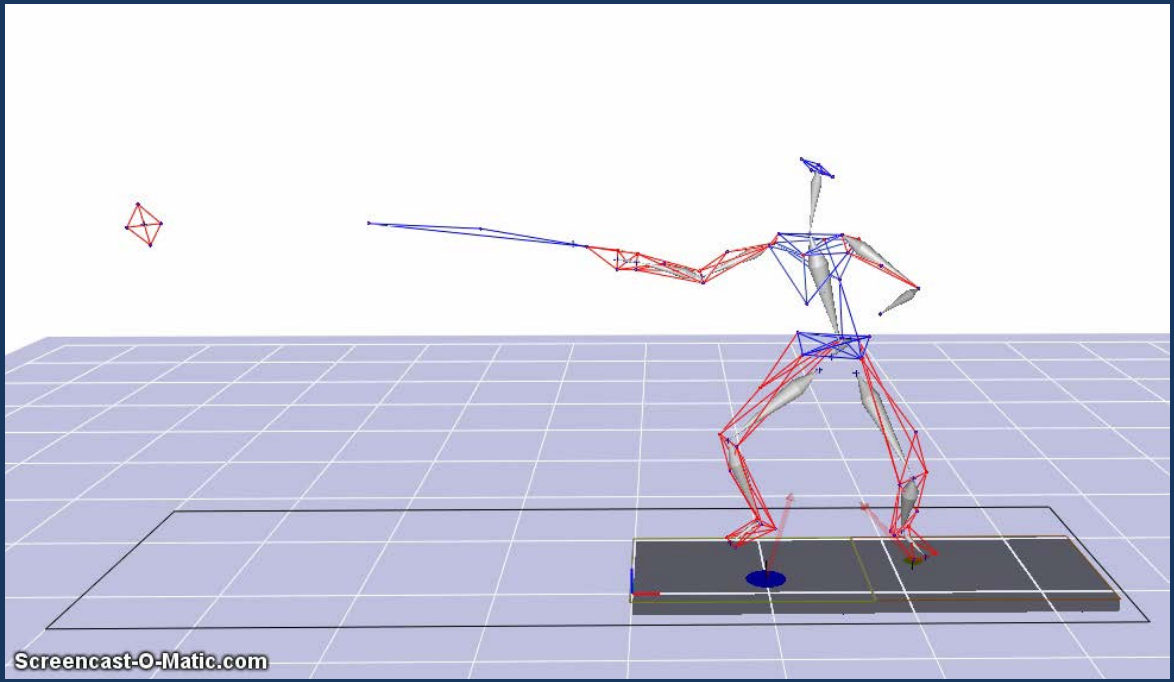
- 8 maximal explosive lunges at target following auditory cue
- Maintained ecological validity
- Whole body kinematics (200Hz)
- 2 integrated force plates (1000Hz)

Post Process

- Custom written Matlab code



Method



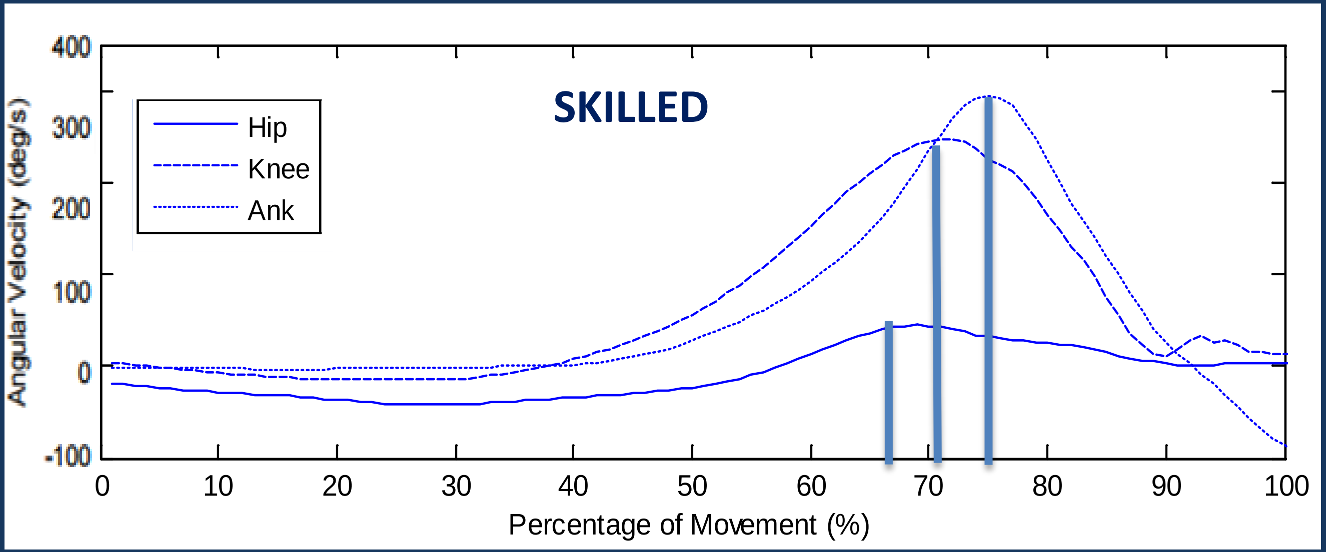
- Temporal patterning
- Sword velocity
- Lead leg displacement
- 3D joint kinematics
- GRF / Impulse

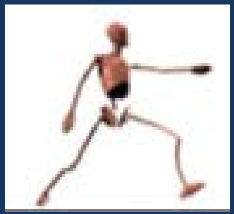
Results: Performance Parameters

Variable	Novice	Skilled
Reaction Time (s)	0.21	0.21
Movement Time (s)	0.69	0.70
Lunge Distance (leg lengths)	0.83	1.12*
Max Sword Velocity ($m.s^{-1}$)	2.63	3.21*

- **Both elbow extension and lead leg ‘kick out’ show no differences…**
- **Rear leg must be propulsive driver**

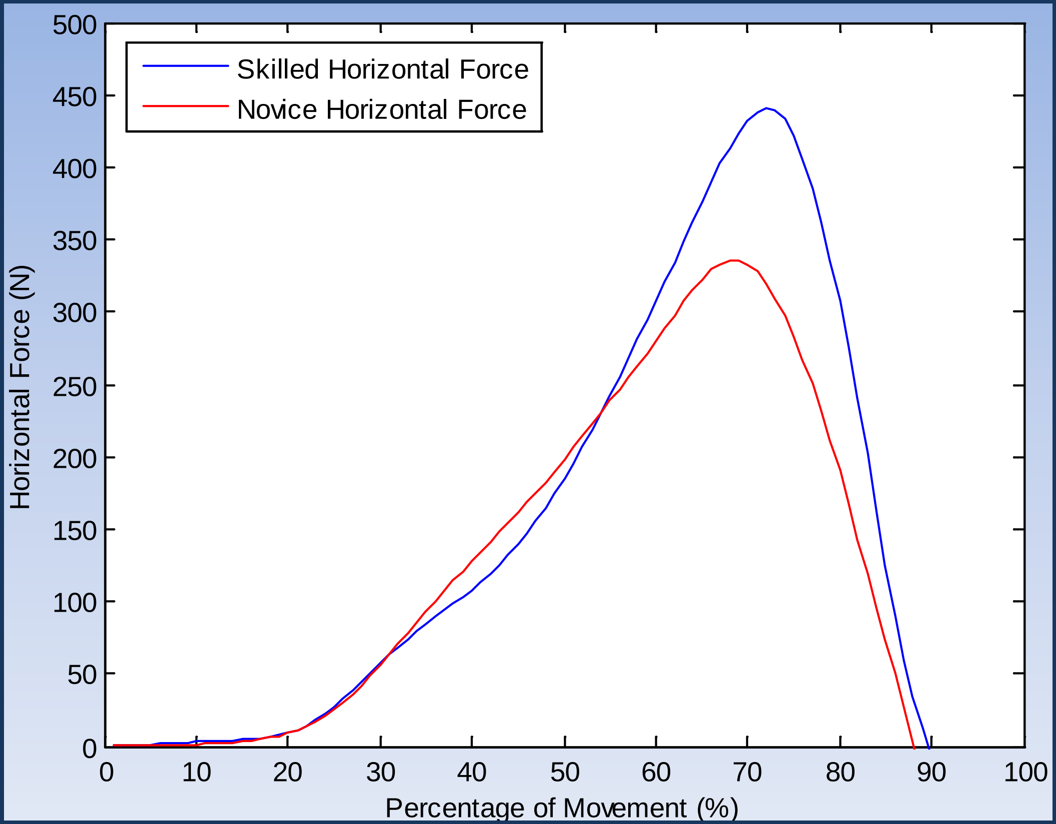
Results: Kinematic Chain





Results: External Kinetics

Variable	Novice	Skilled
Peak Vertical Force (BW)	0.84	0.90
Peak Horizontal Force (BW)	0.61	0.89*
Normalised Vertical Impulse	0.11	0.13
Normalised Horizontal Impulse	0.08	0.13*

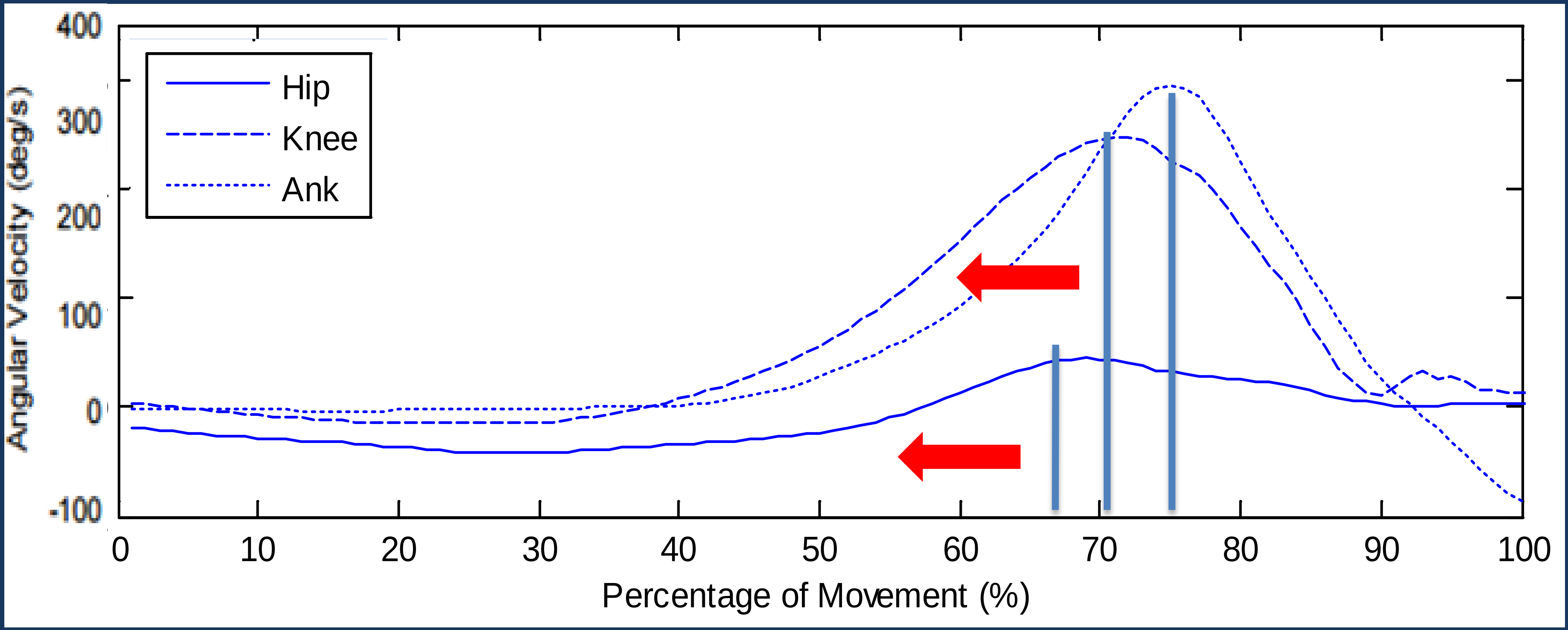


- **More EFFECTIVE FORCE**

Conclusion

- More skilled athletes demonstrate greater sword velocity
- Greater sword velocity is developed sequentially through a rear leg kinematic chain
- The ankle contribution was significantly greater in skilled performers
- This resulted in greater horizontal impulse. Therefore EFFECTIVE propulsive force

Future Direction / Application



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Thank you for listening.

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