



Effect of fatigue in spatiotemporal parameters during 100 m front-crawl event monitored through 3D dual-media automatic tracking

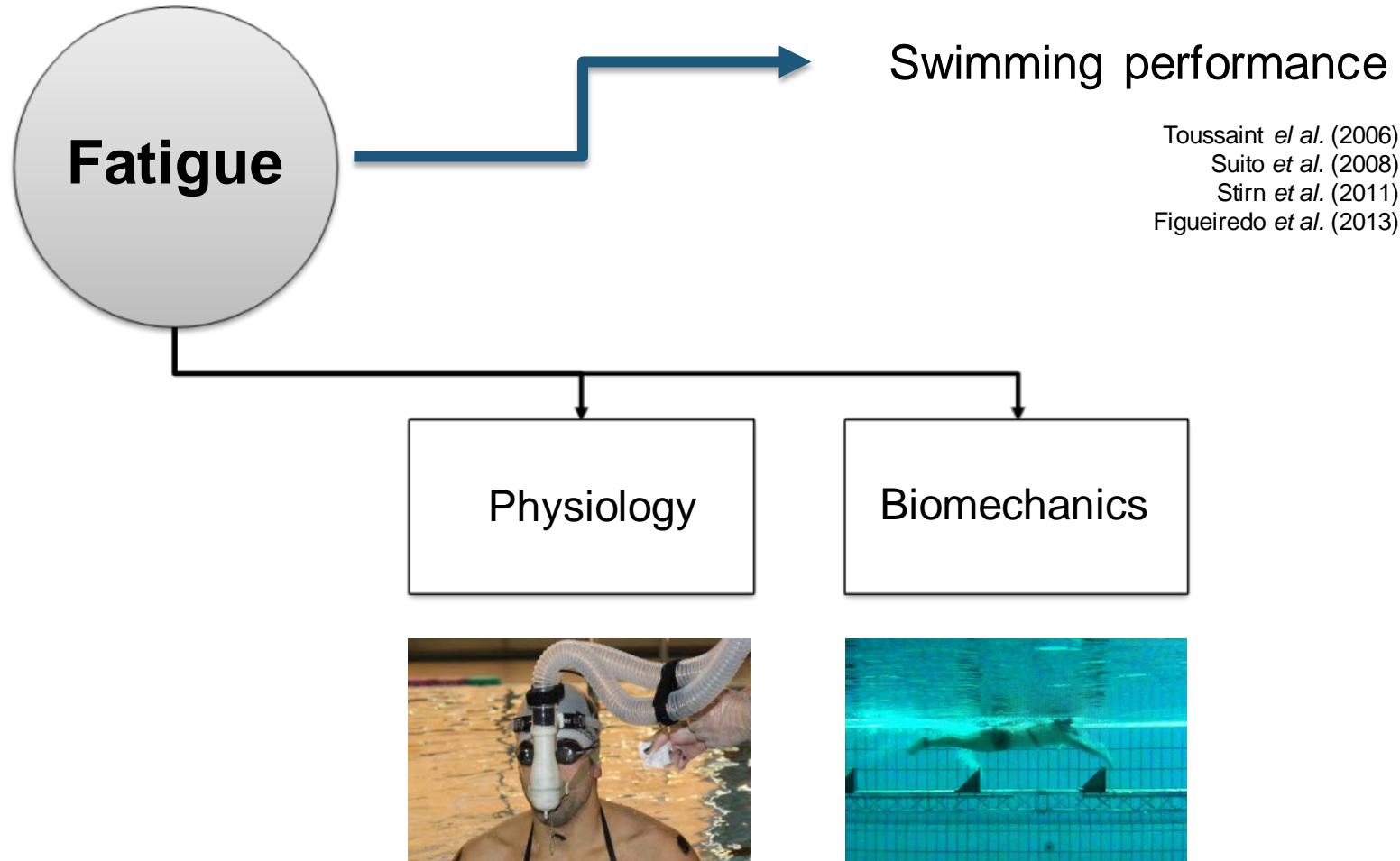
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Introduction



Short high-intensity swimming events

100m

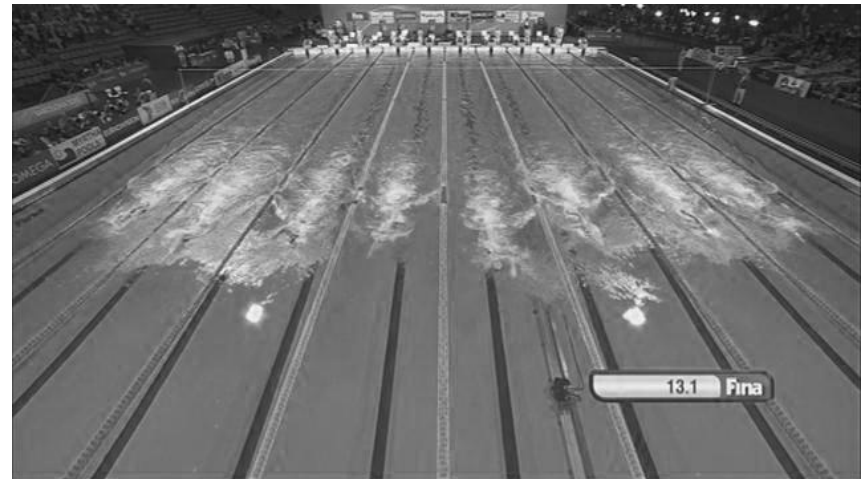
Performance compromised



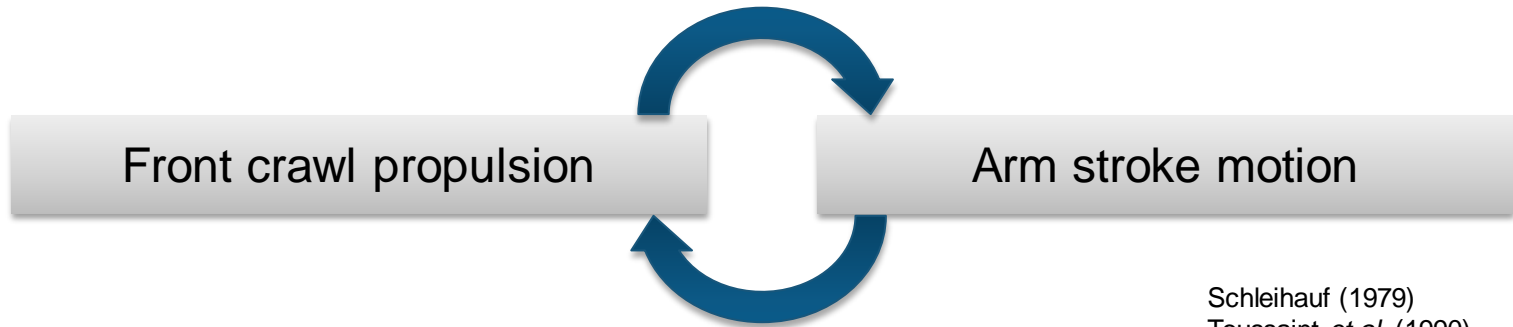
Decrease in power production



Changes in stroking
biomechanical parameters



Toussaint *et al.* (2006)

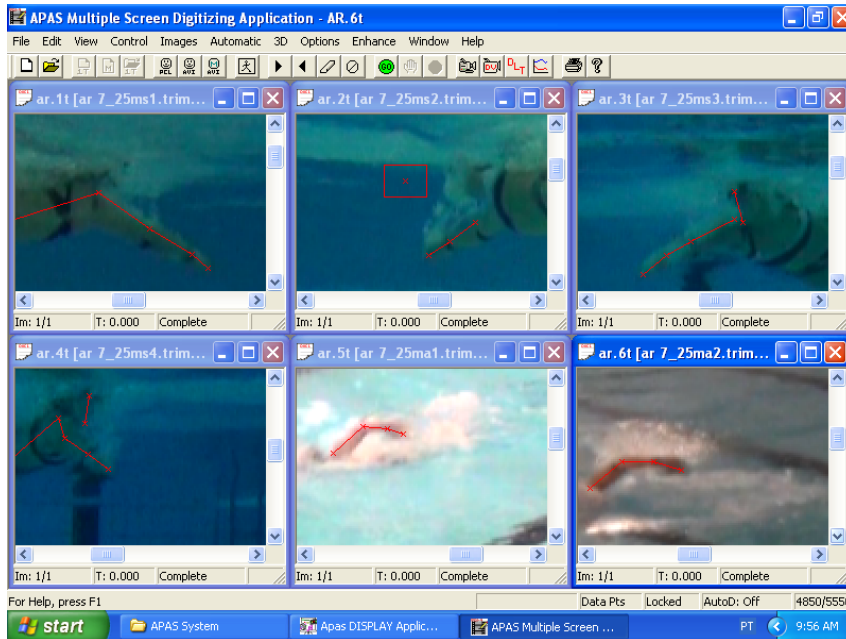


Schleihauf (1979)
Toussaint *et al.* (1990)
Deschodt *et al.* (1999)
Berger *et al.* (1995)

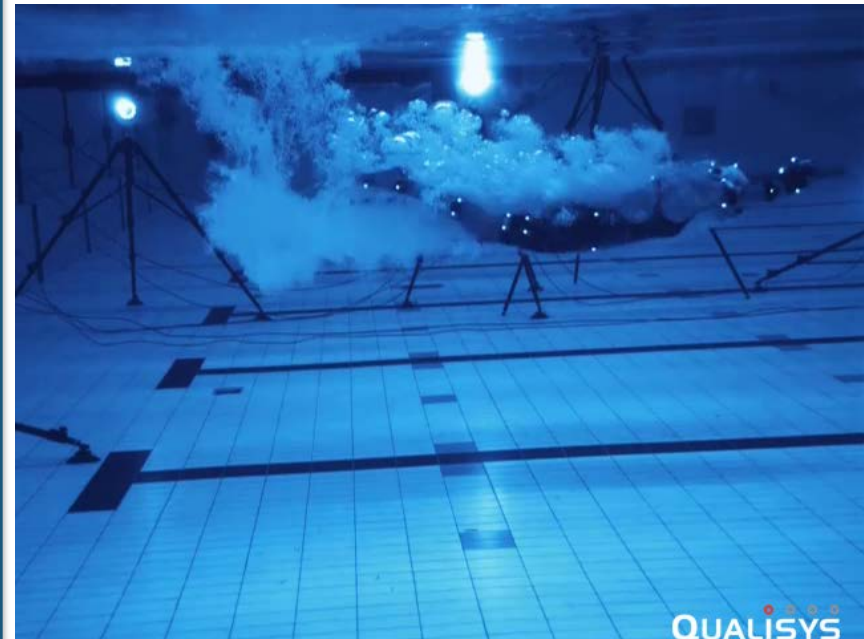


3D arm stroke kinematics

Video based systems (Manual digitizing)



Optoelectronic systems (Automatic tracking)

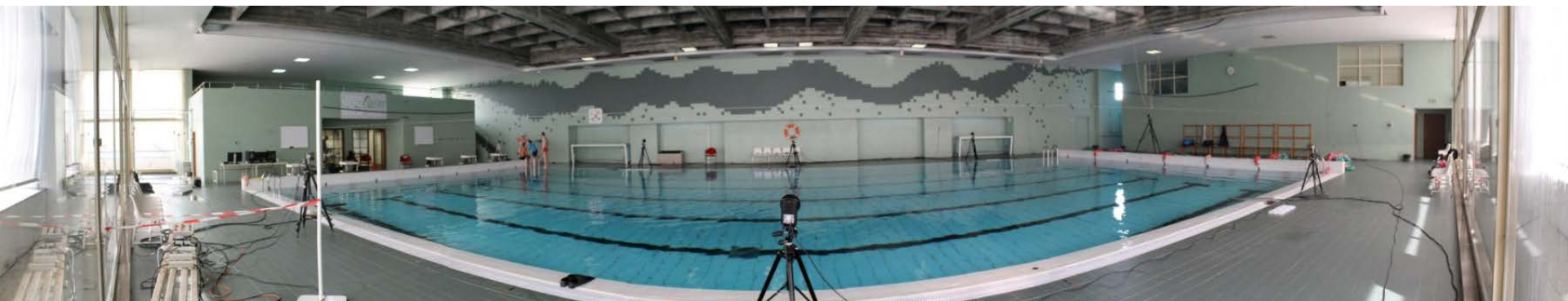
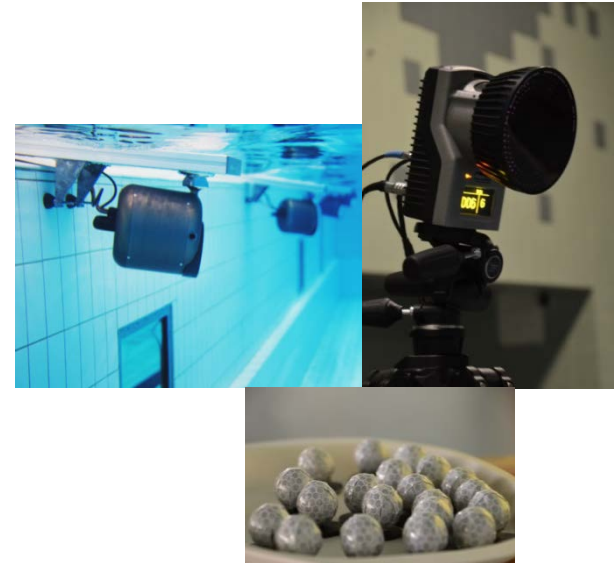


Objective

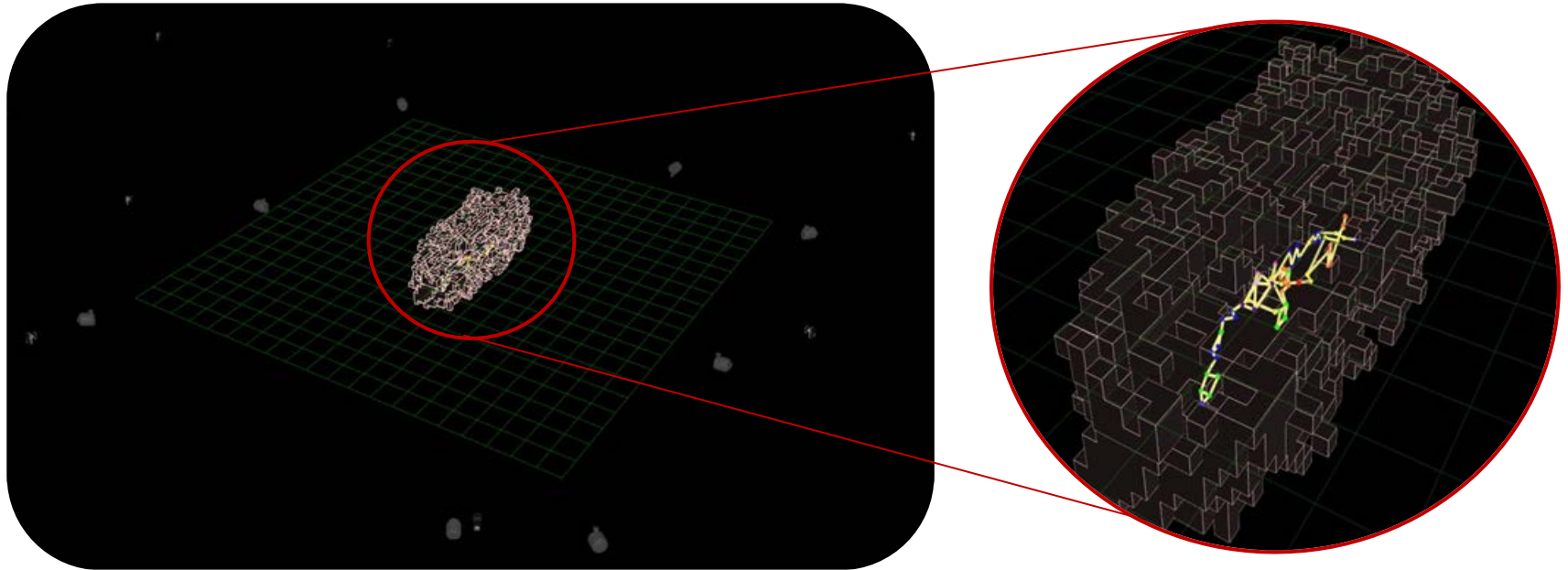
To analyse the effect of **fatigue** on **3D arm-stroke kinematics** during a **100 m** event monitored through **a new 3D dual-media automatic tracking**

Data collection

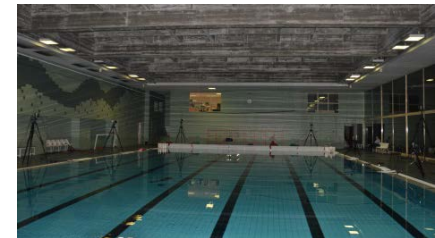
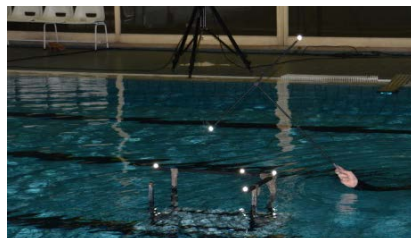
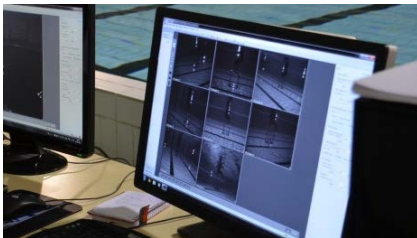
- Subjects
 - 6 male swimmers (25.47 ± 4.69 years, 1.82 ± 0.04 m, 73.14 ± 6.14 kg)
- Protocol
 - 100 m front crawl maximal effort (push off start, open turns)
- Protocol recording
 - 8 underwater + 7 land cameras (Qualisys AB, Gothenburg, Sweden)

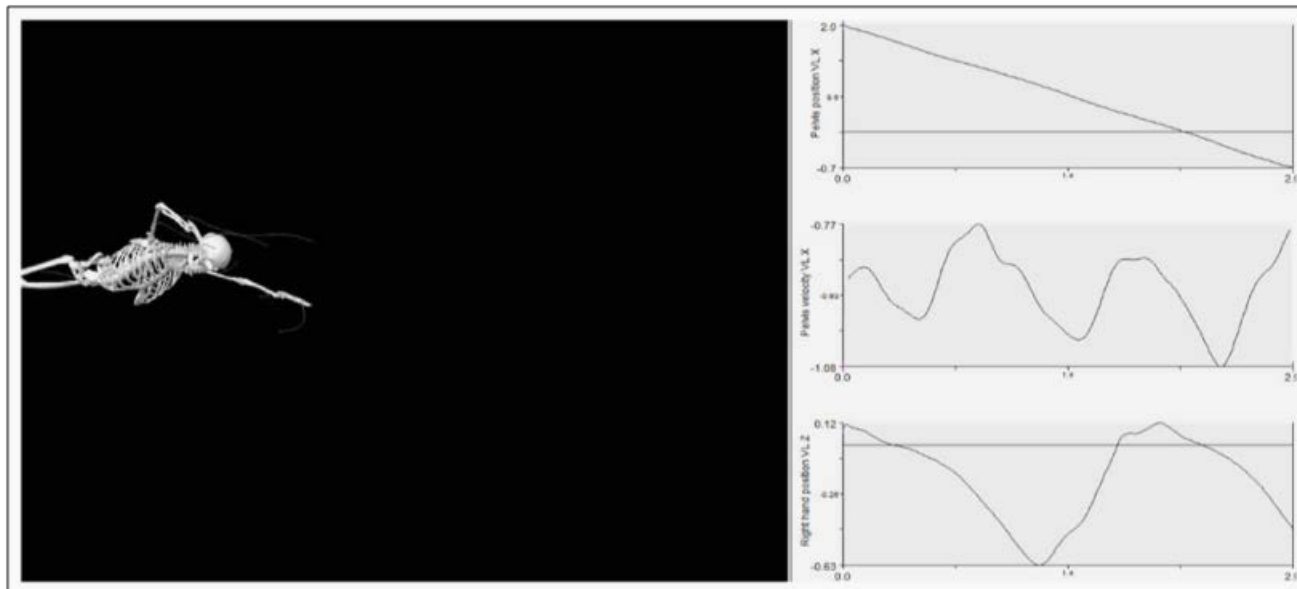
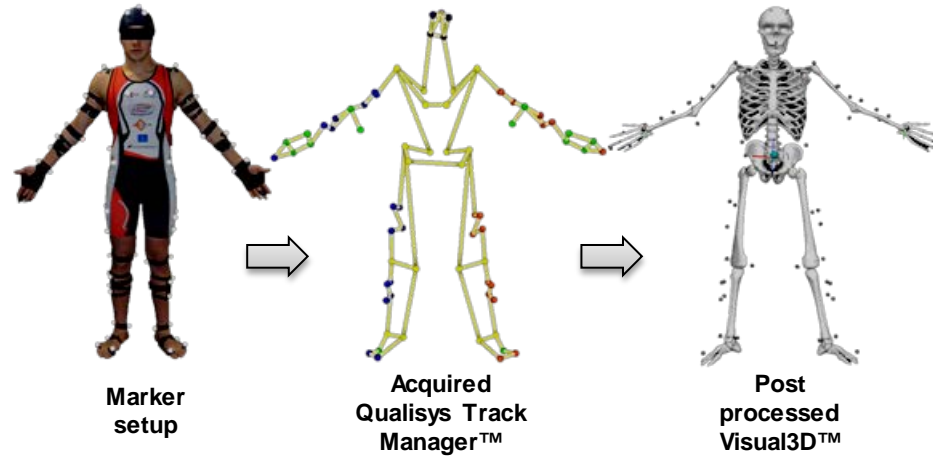


Data acquisition and processing

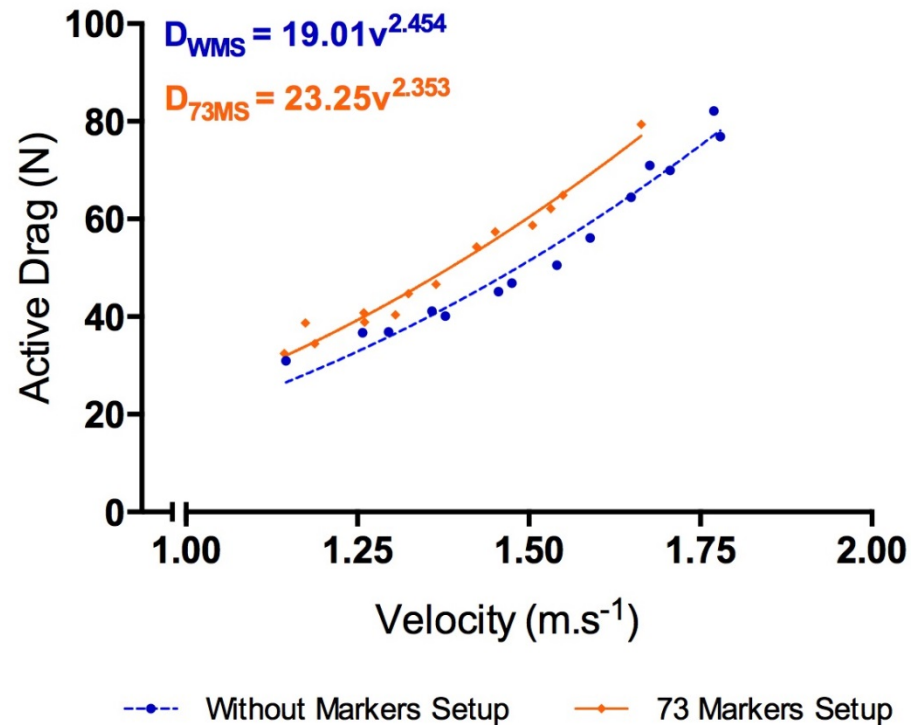


Dual media calibrated with Qualisys Track Manager™ version 2.7
(Qualisys AB, Gothenburg, Sweden)

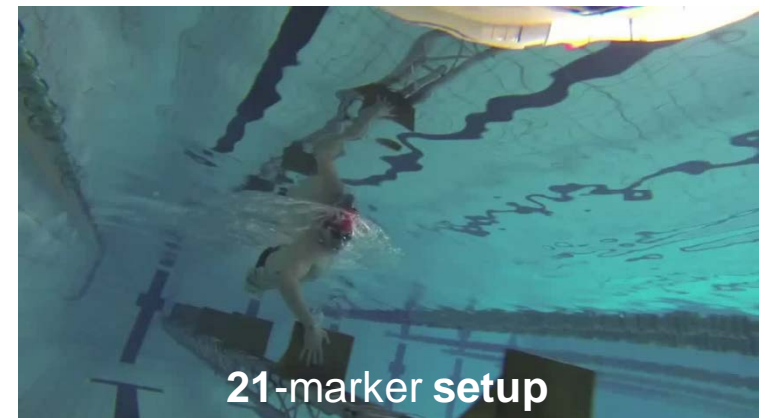
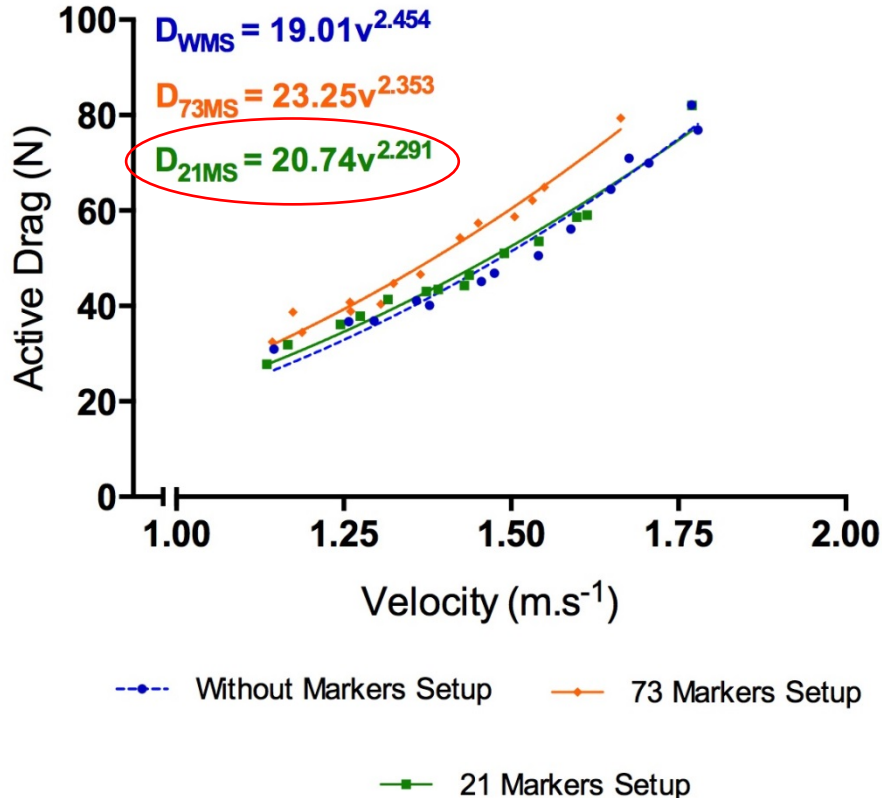




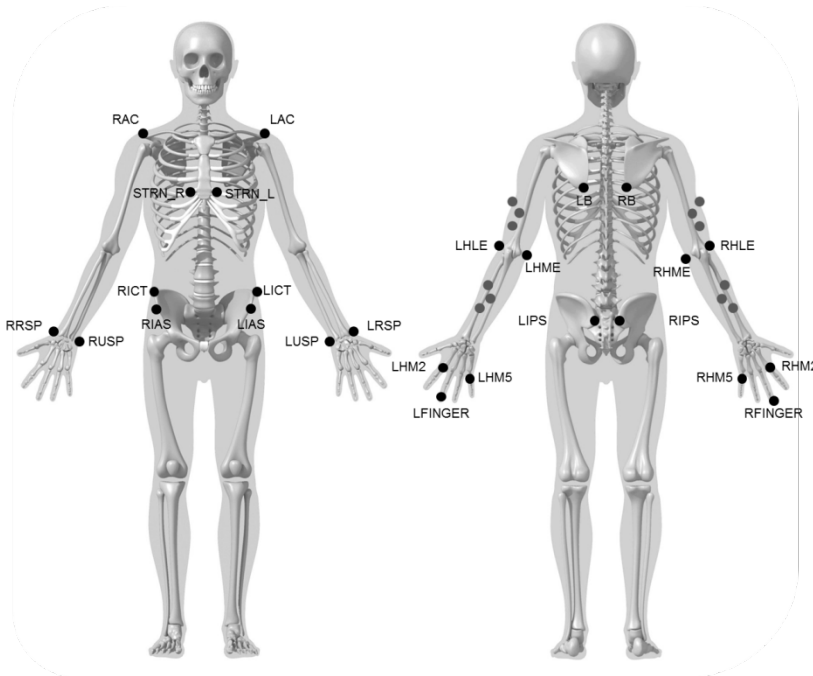
Marker setup drag assessment



Marker setup drag assessment

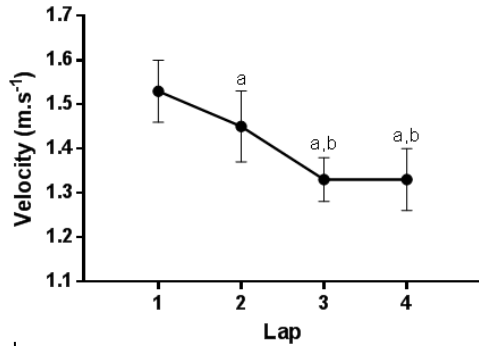


Marker setup and variables

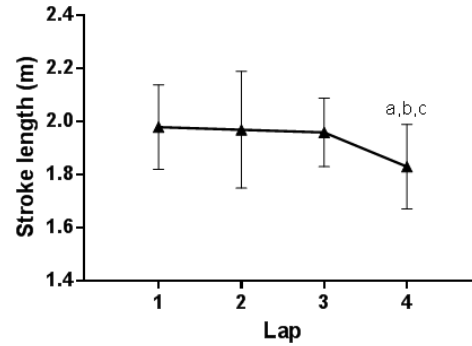


- Pelvis CM Velocity ($\text{m}\cdot\text{s}^{-1}$)
- Stroke frequency (Hz)
- Stroke length (m)
- Hand CM velocity ($\text{m}\cdot\text{s}^{-1}$)
- Hand CM Backward amplitude (m)
- Hand CM Amplitude slip (m)
- Hand CM depth (m)
- Hand CM width (m)
- Hand CM range (m)
- Index of coordination

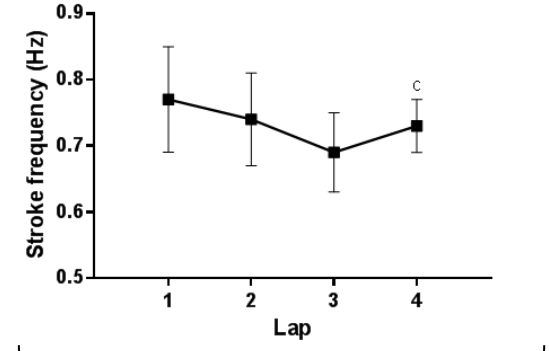
Velocity



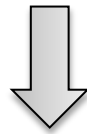
Stroke length



Stroke frequency



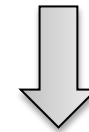
Fatigue



Propulsive force

Craig *et al.* (1985)
Keskinen and Komi (1993)

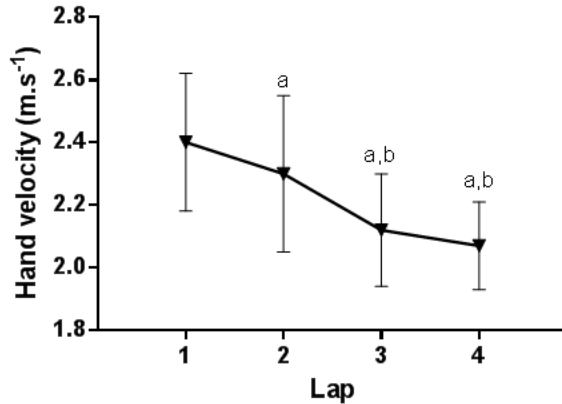
Compensate SL ↓



Attempt to maintain velocity

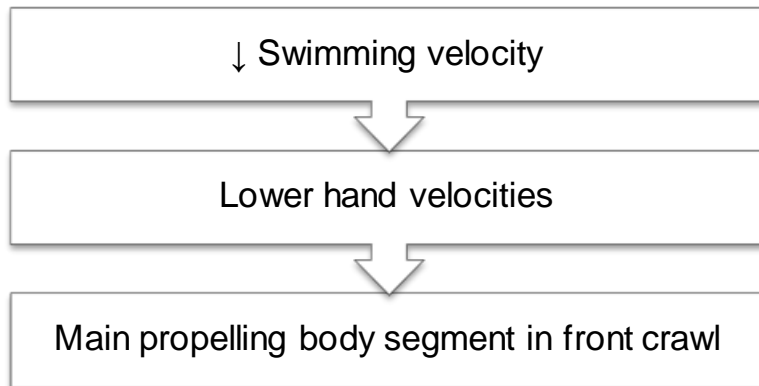
Chollet *et al.* (1997)
Alberty *et al.* (2008)

Hand velocity

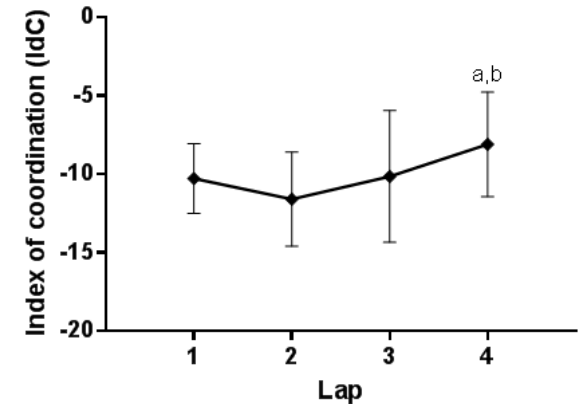


Inability to maintain mechanical and muscular response

Aujouannet *et al.* (1997)



IdC



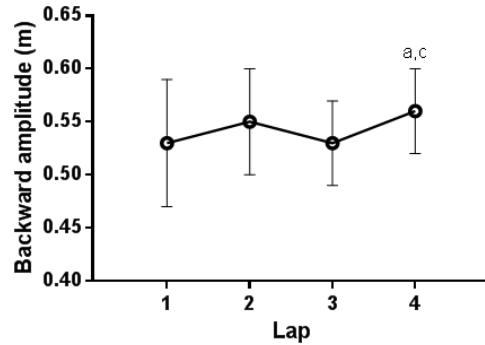
↓ lag time between propulsive phases



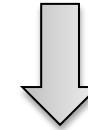
Seifert *et al.* (2005)
Alberty *et al.* (2005)
Alberty *et al.* (2008)

Fatigue

Backward amplitude



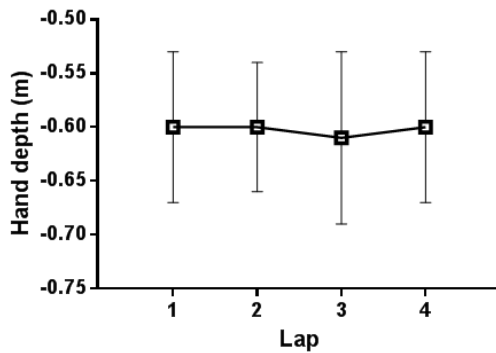
↑ Time during entry phase



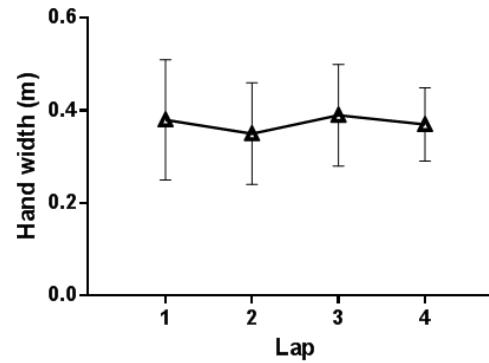
Fatigue

Goldfuss & Nelson (1971)
Aujouannet *et al.* (2006)

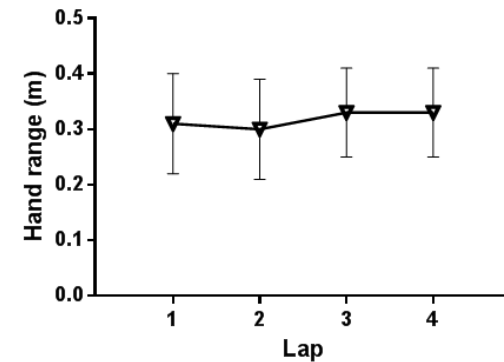
Hand depth



Hand width



Hand range



Conclusions

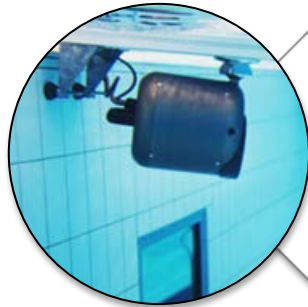


Fatigue

- Swimming velocity declined → SL and hand velocity decrease
- Swimmers adapted coordination path

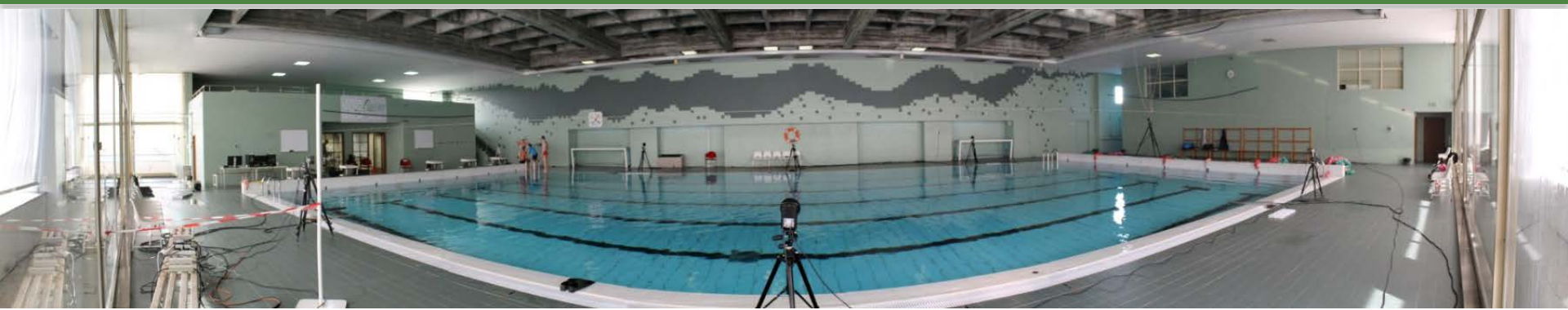
Way to improve performance

- Useful for coaches and swimmers



Motion capture system

- Dual-media 3D tracking
- Realistic real-time data
- Practical use for kinematic analysis in swimming



Thank you for your attention!

Acknowledgements

FCT

Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA E DO ENSINO SUPERIOR

- PTDC/DES/101224/2008
(FCOMP-01-0124-FEDER-009577)

- SFRH/BD/81337/2011

