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Current state and future considerations of technology in sports science

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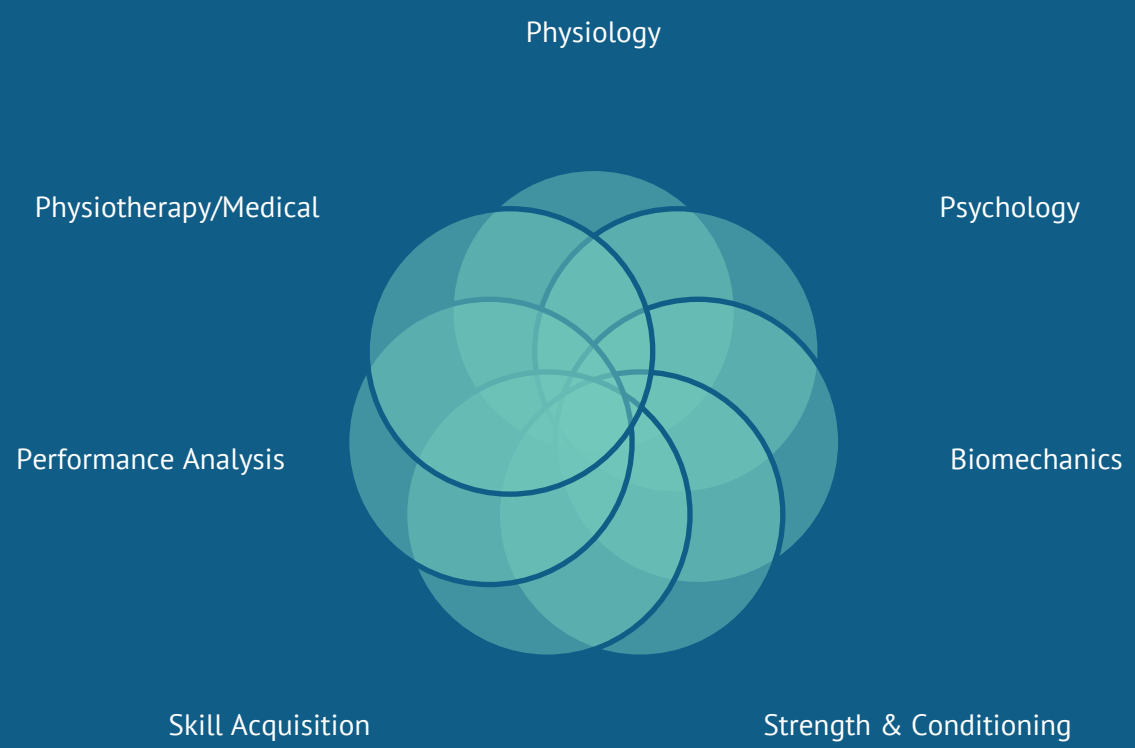
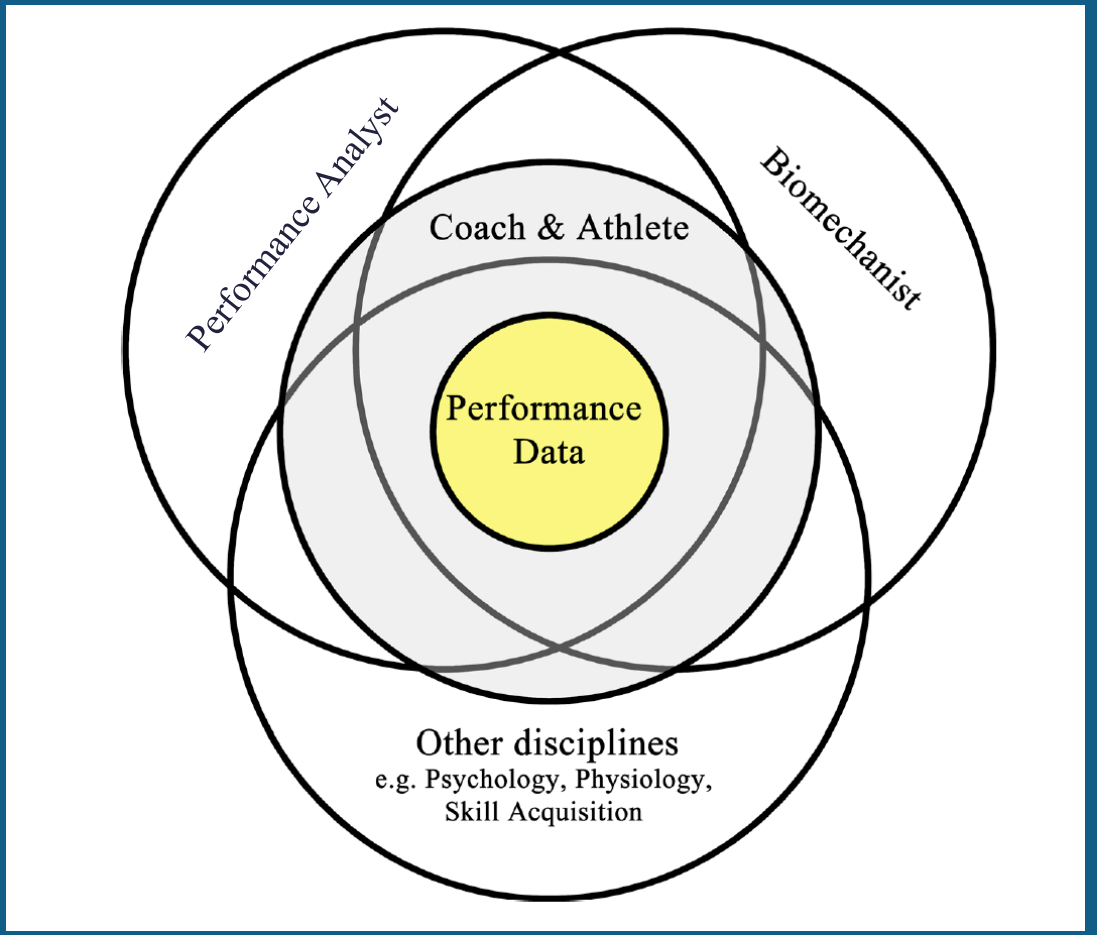
Current state of sports science: Multidisciplinary teams



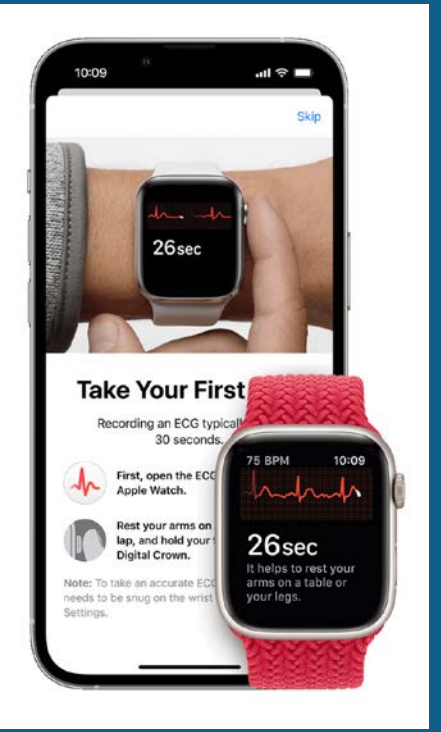


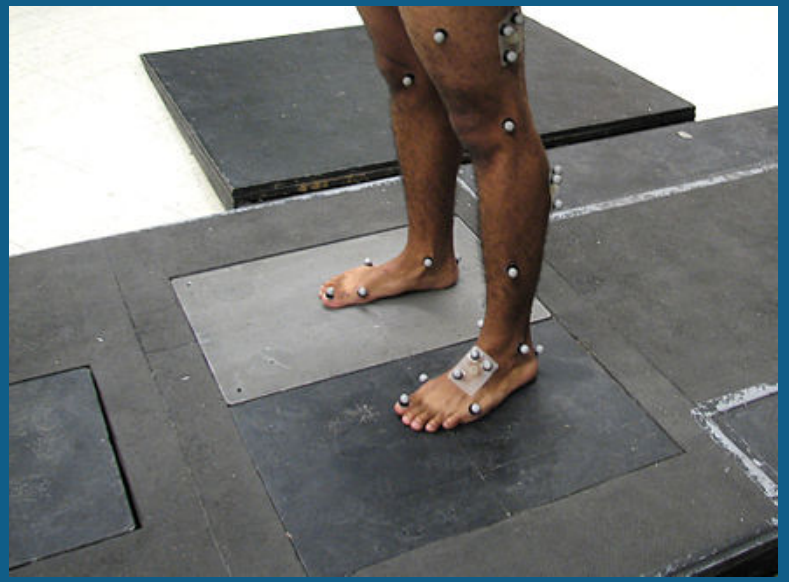
Sensors + Data

- GPS
- Inertial Measurement Units
  - Accelerometer
  - Gyroscope
  - Magnetometer
- 3D Camera Systems / IMU suits

Sensors + Data

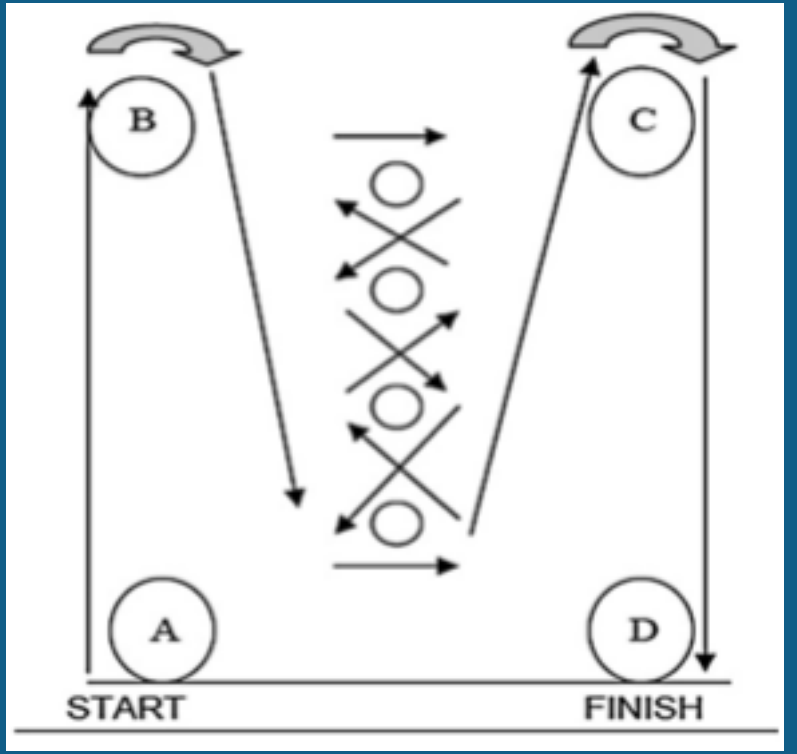
- LEDs (&smart watches)
  - optical heart-rate monitors
  - photoplethysmography (PPG)
- Force
- Pressure





Sensors + Data

Isokinetic Dynamometer



Agility testing (e.g. Illinois Agility Test)

Sensor + Data

Lactate

Glucose

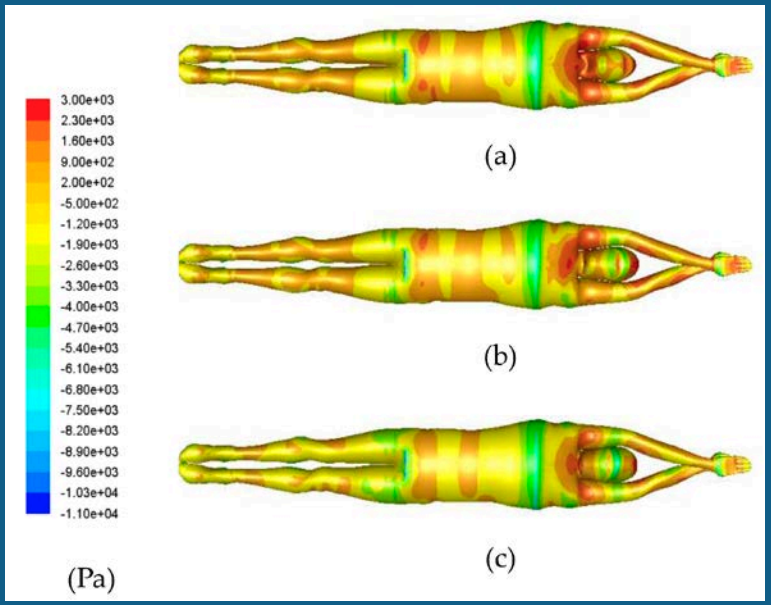
VO_2 Max

Key questions arising…

- Lab or Field based?
  - What are the key metrics?
  - How much is ‘data quality’ important/practical?
- Who is the purchaser – Professional vs Public?
  - Team / Individual
- Who is the user of output data – Coach / athlete or Public?
  - Are there data gathering / data mining opportunities for enhancing AI / Machine Learning?
- Can we consolidate all this ‘tech’ to one system?
  - Modular?
- Can we have data sharing platforms to combine data?

The future!

- Multi-Sensor / Fast (self) Calibration / Easy setup
- Body Area Networks
- Pressure sensing (akin to Computational Fluid Dynamics)
  - Personalise clothing to task
  - How we contact equipment
- Quality of movement assessment
  - What tasks are essential and standard in a sport/setting
- Considerations
  - Accessibility around the world
    - Cost, data training needs
  - Sustainable materials
  - Ask the user!



Contact / recent publications

- Dr. Andy Callaway, acallaway@bournemouth.ac.uk
- https://staffprofiles.bournemouth.ac.uk/display/acallaway

- Dunne, C., Callaway, A.J., Thurston, J., Williams, J.M., Validity, reliability, minimal detectable change, and methodological considerations for HHD and portable fixed frame isometric hip and groin strength testing: A comparison of unilateral and bilateral testing methods, Physical Therapy in Sports (2022), doi: https://doi.org/10.1016/j.ptsp.2022.07.002.

- Watt, A.A., Callaway, A.J. & Williams, J.M. In vivo through-range passive stiffness of the lumbar spine: a meta-analysis of measurements and methods. *Med Biol Eng Comput* **60,** 2133–2157 (2022). https://doi.org/10.1007/s11517-022-02609-w

- M.J. Wylde, A.J. Callaway, J.M. Williams et al., Limb specific training magnitude and asymmetry measurement to discriminate between athletes with and without unilateral or bilateral lower limb injury history, Physical Therapy in Sport, https://doi.org/10.1016/j.ptsp.2022.05.008

- Wylde, M., Adilah Masismadi, N., Chee Yong, L., Callaway, A. and Williams, J., 2021. Placement of inertial measurement units in Racket Sports: Perceptions of coaches for IMU use during training and competition. *International Journal of Racket Sports Science*, 3 (1), 45-55.

- Anwary, A.R., Yu, H., Callaway, A. and Vassallo, M., 2021. Validity and Consistency of Concurrent Extraction of Gait Features Using Inertial Measurement Units and Motion Capture System. *IEEE Sensors Journal*, 21 (2), 1625-1634.

- Wylde, M., Baranee, K., Young, L. and Callaway, A., 2019. Axis Specific Player Load to Quantify Lower Limb Biomechanical Loading in Adolescent Badminton Players. *International Journal of Racket Sports Science*, 1 (1), 37.

Image sources:

- Pressure field: https://www.intechopen.com/chapters/49251
- Pressure pads: https://nebula.wsimg.com/a9982f57ed04d69c40e3076c2297db9e?AccessKeyId=B18BA5DD5608F4673D03&disposition=0&alloworigin=1
- Qualisys Cameras: https://cdn-content.qualisys.com/2014/02/oqus-outdoors-horse-mocap-square.jpg
- https://www.iprsmediquipe.com/assets/product-images/_resampled/paddedimageWzY3NCwzNDBd/MVP-knee-flex-ext.jpg
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- PlayerMaker.com