

Technology for Training Load Monitoring in Sport

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The future

“In the future... training and rehabilitation programmes will use wearable and simple imaging technologies to estimate tissue level biomechanics derived from personalised neuromusculoskeletal modelling in real-time in the real-world.

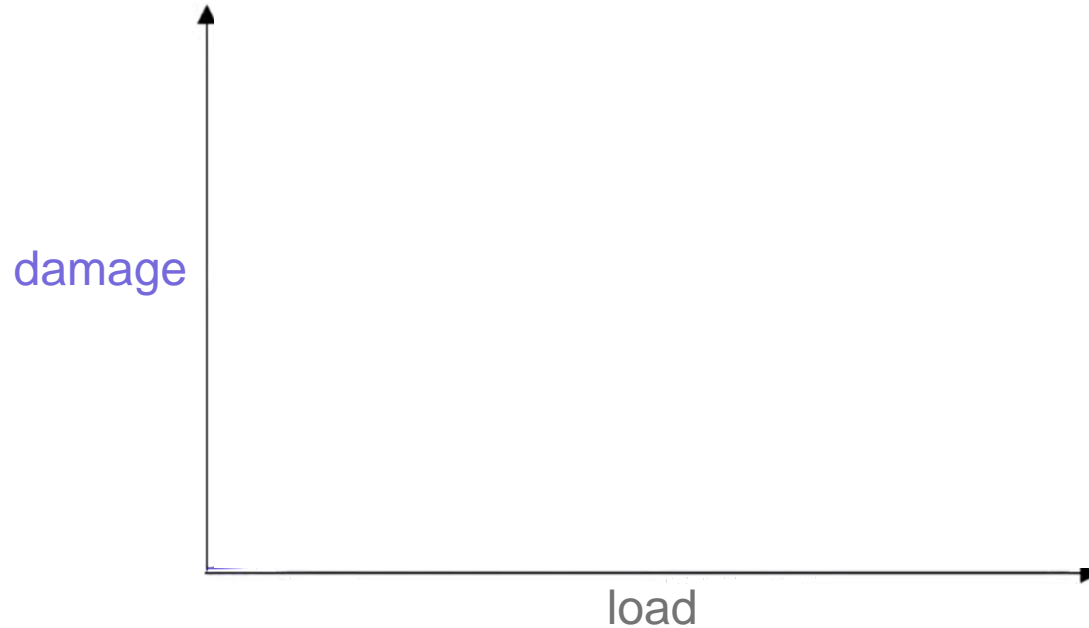
The future is not that far away.”

(Lloyd, 2021)

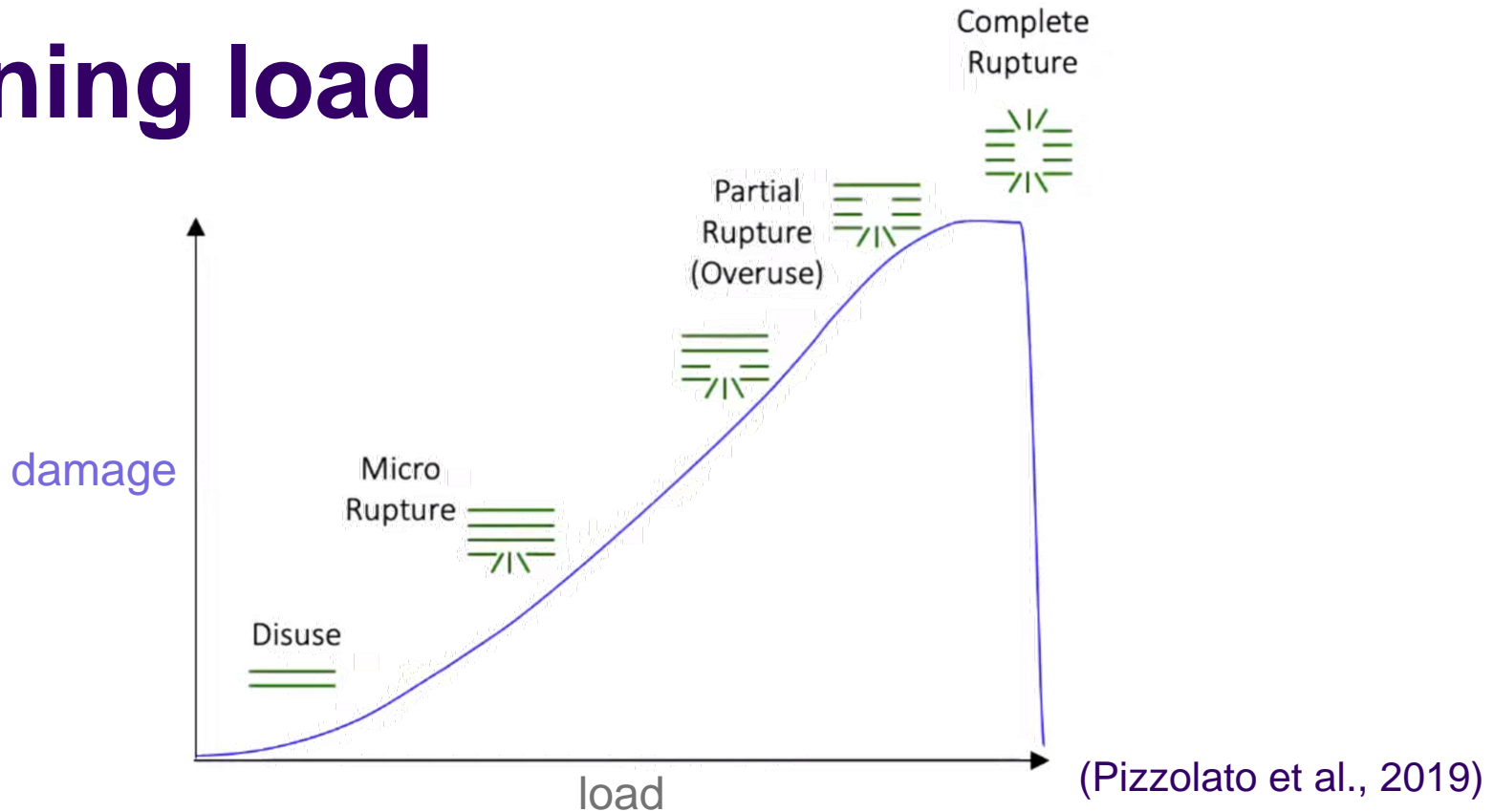


Training load

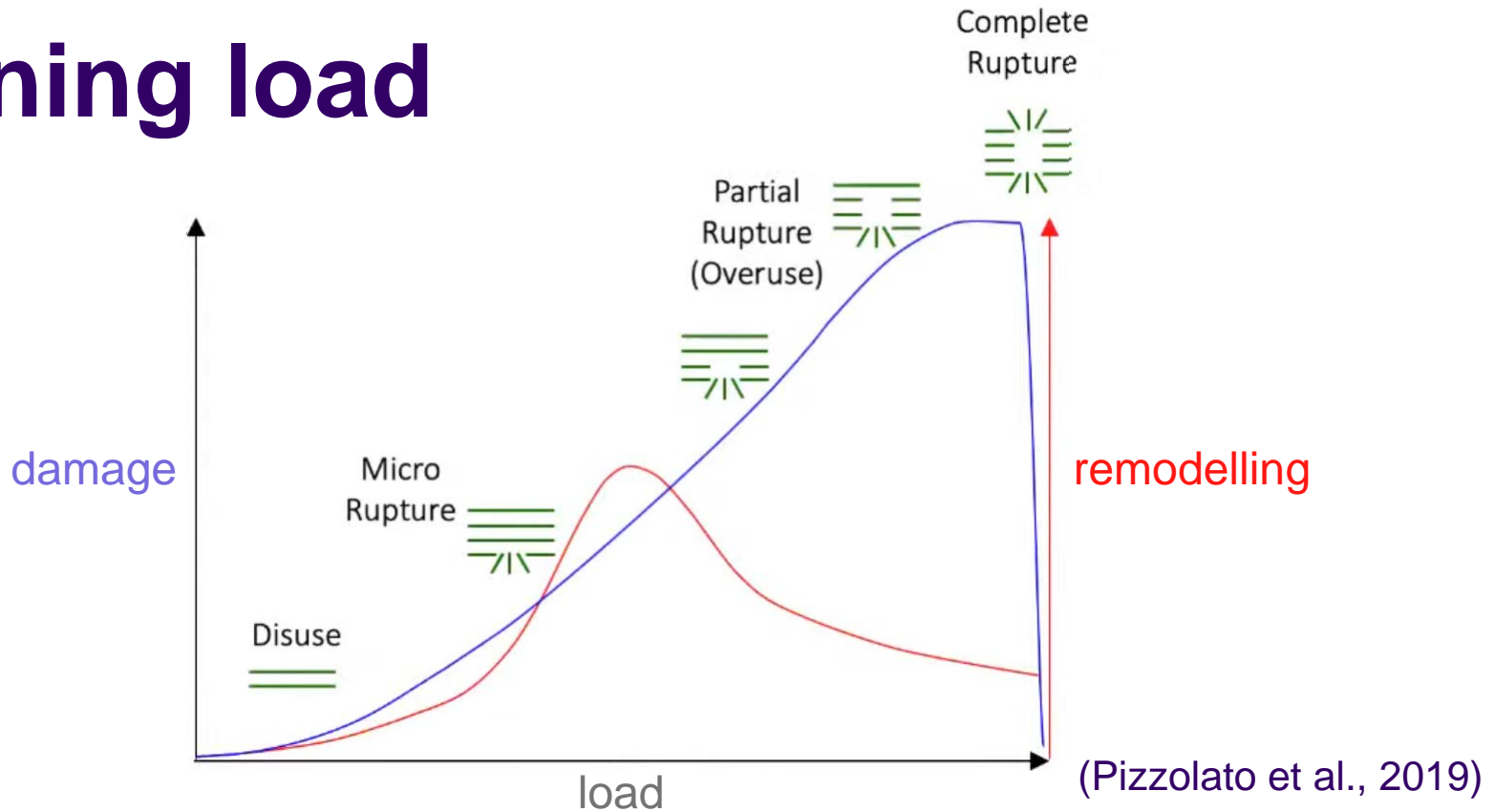
Training load



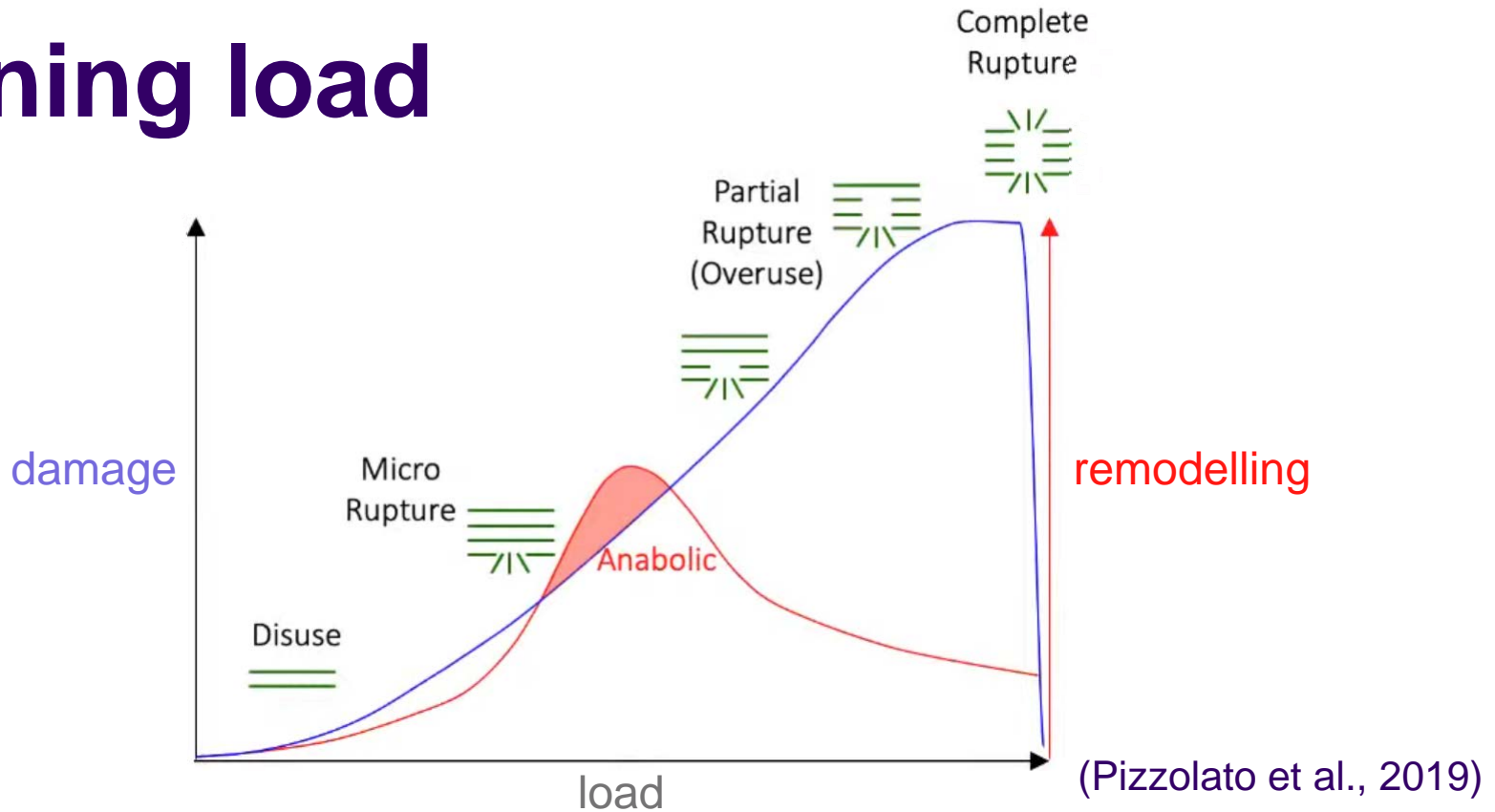
Training load



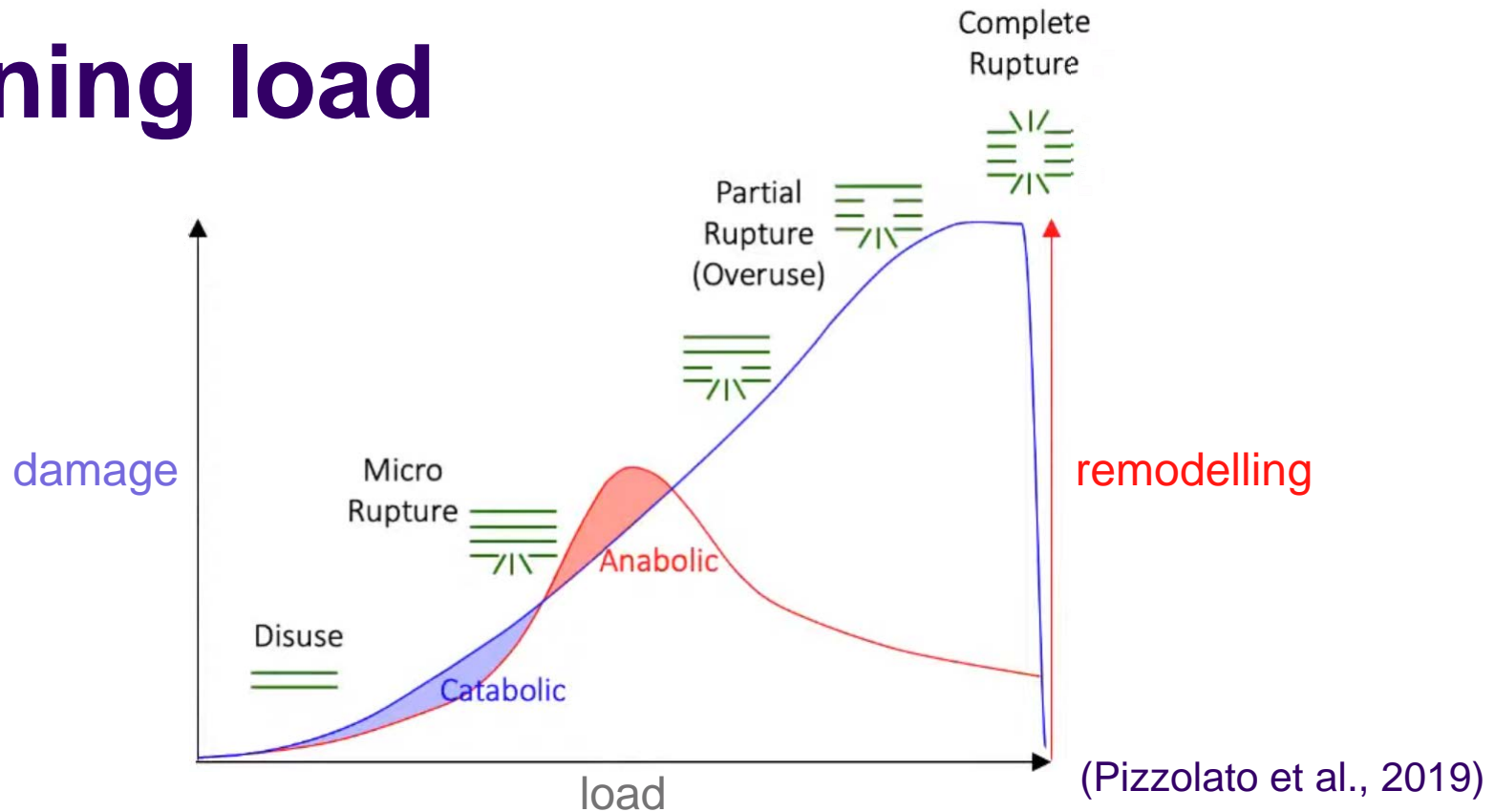
Training load



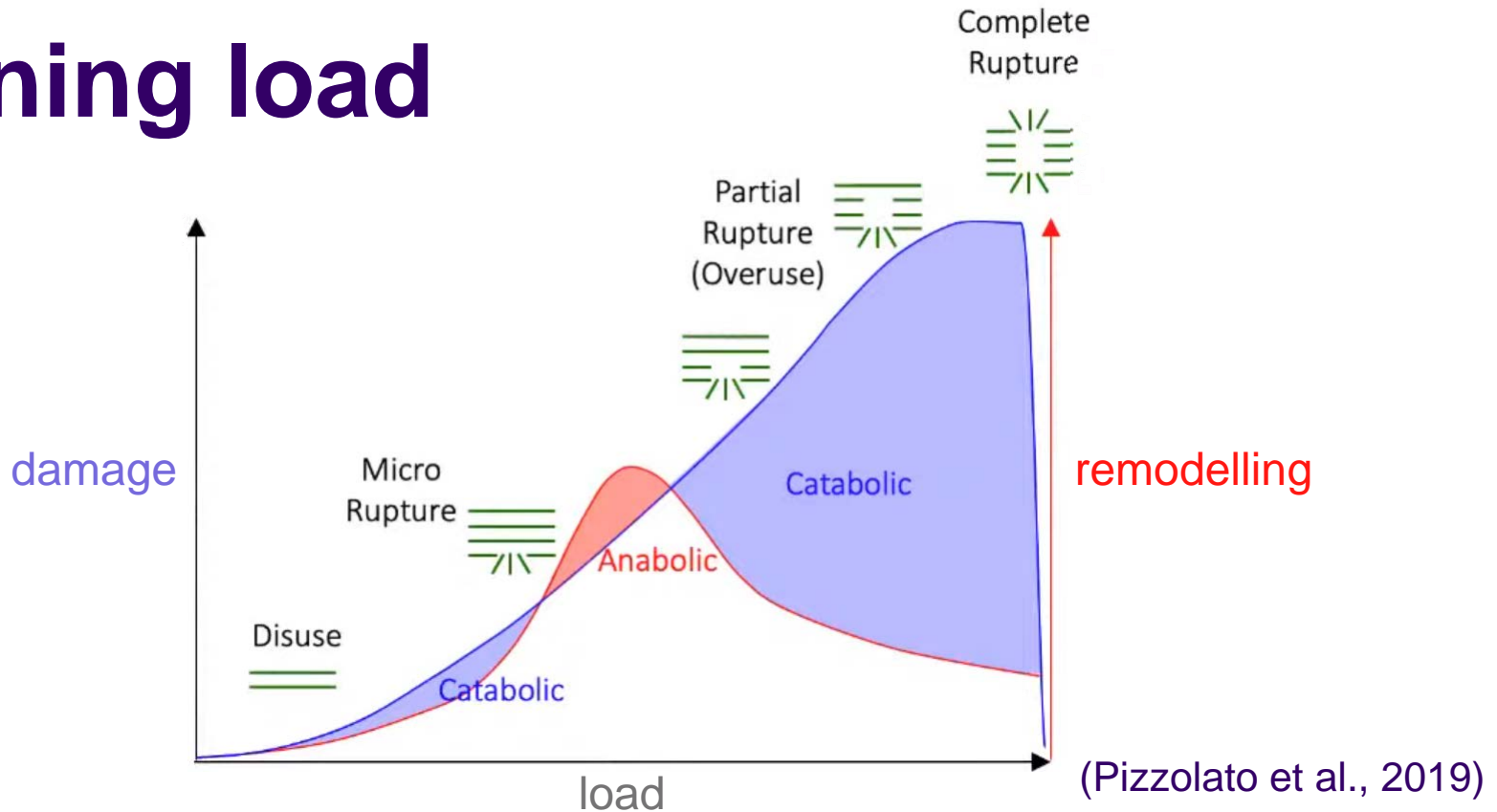
Training load



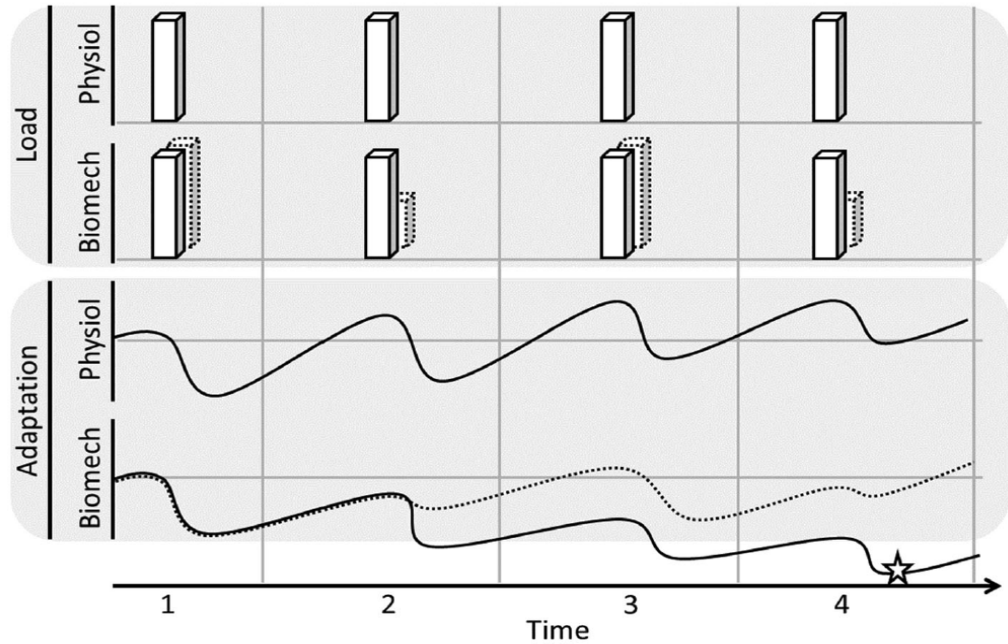
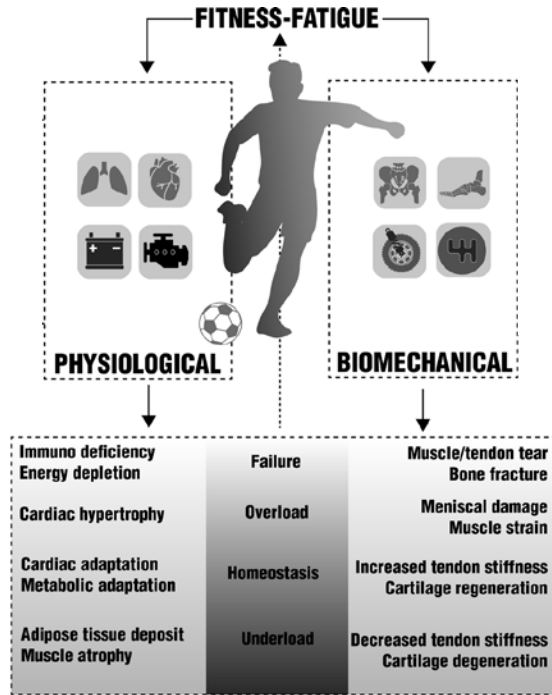
Training load



Training load

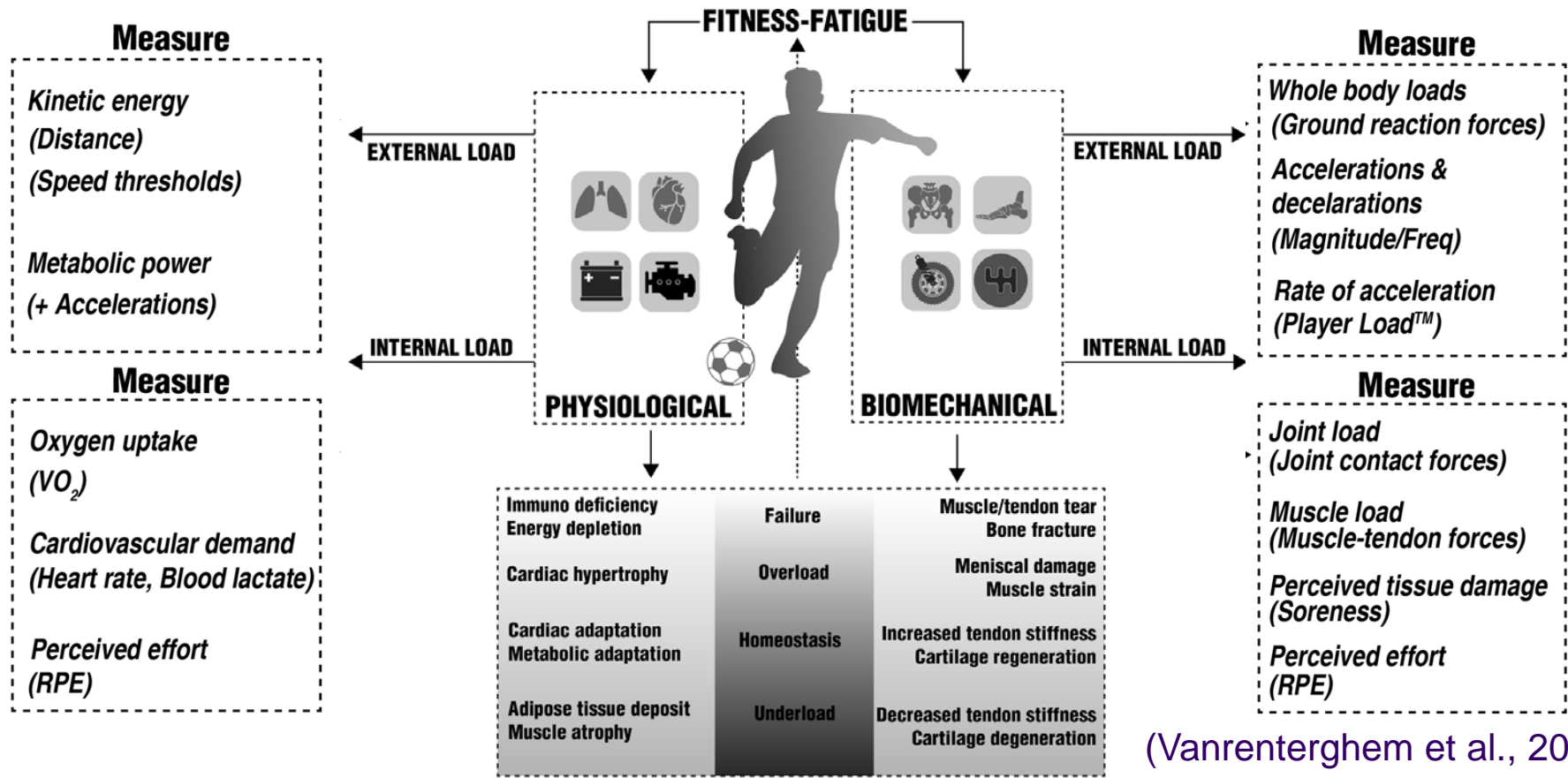


Physiological / biomechanical load



(Vanrenterghem et al., 2017)





(Vanrenterghem et al., 2017)



GPS / GNSS







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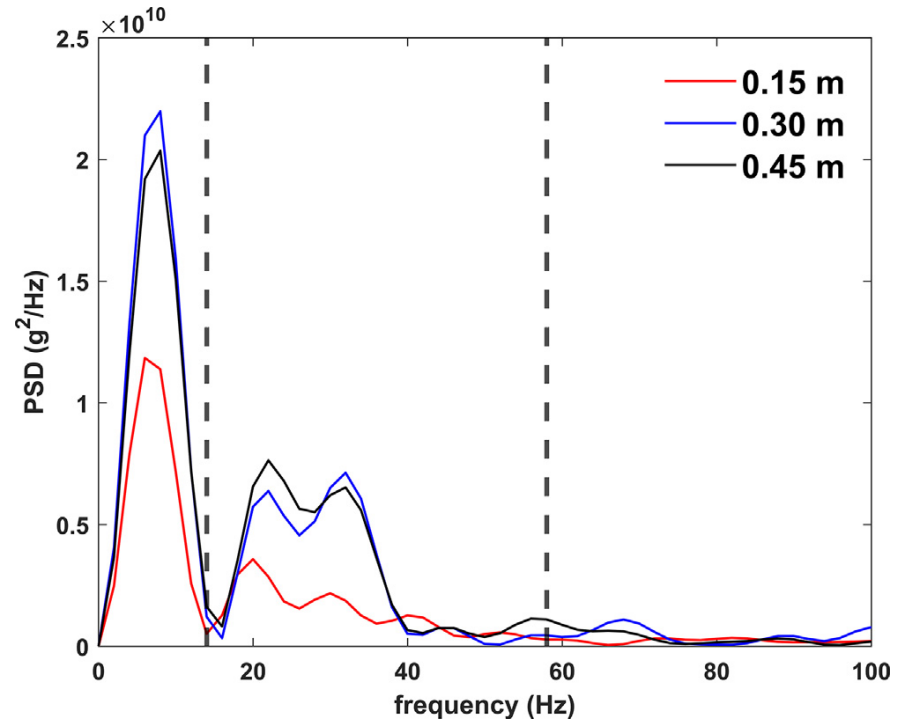
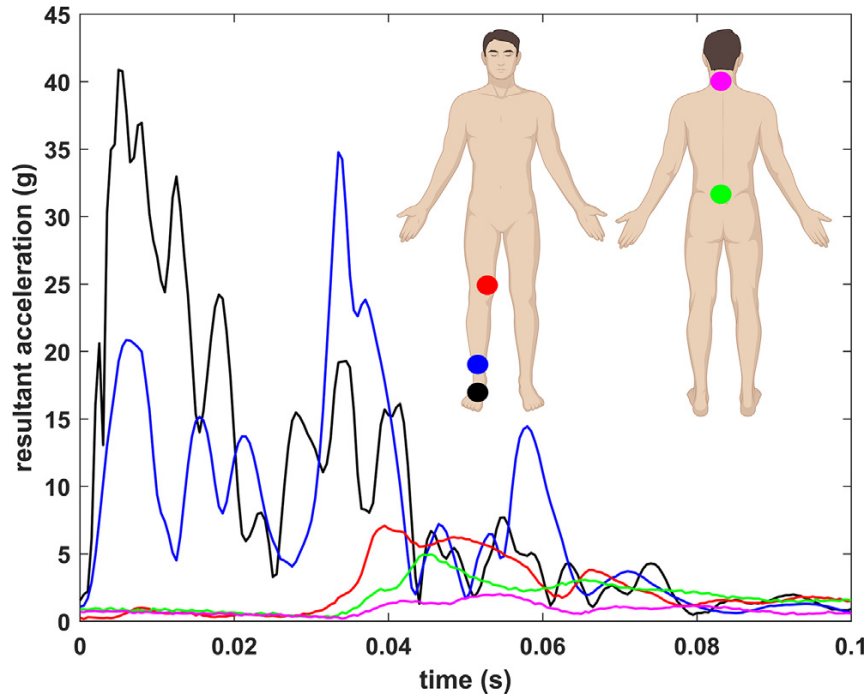
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Modified load vectors

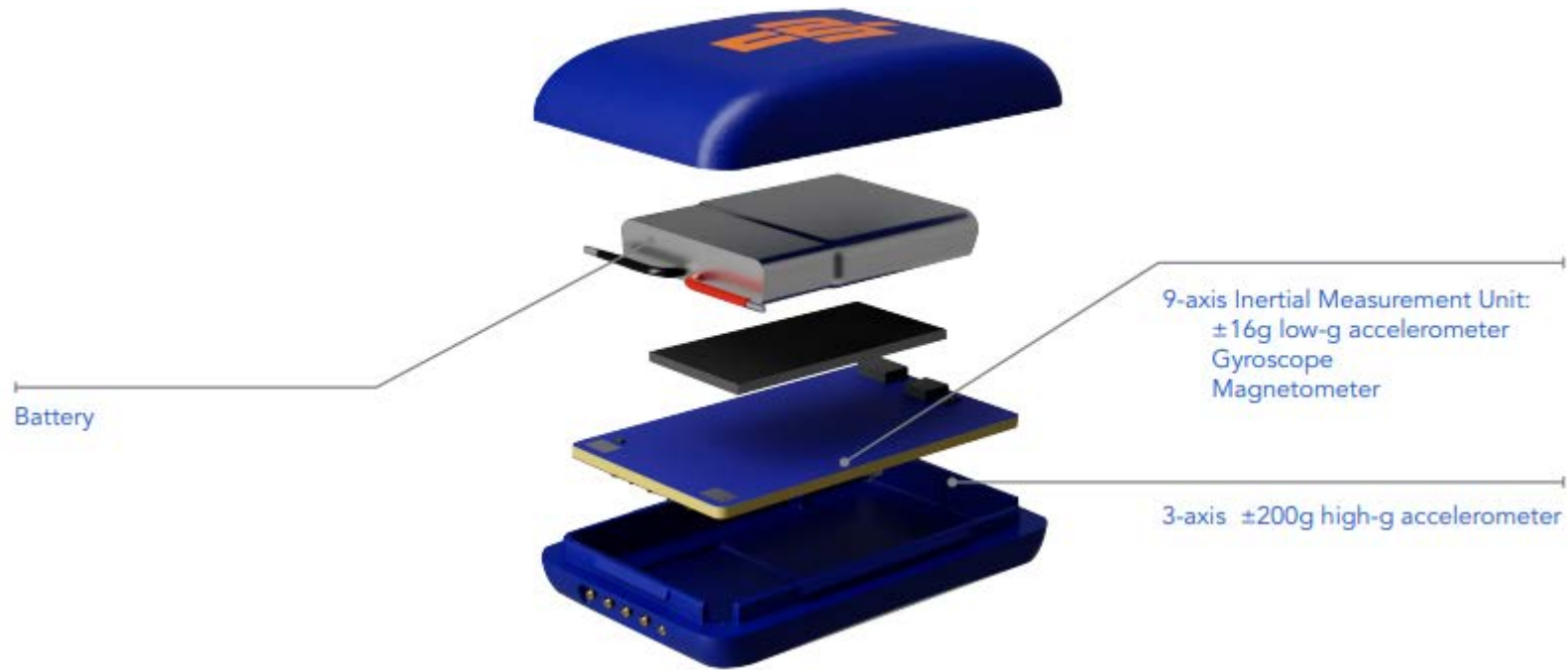
$$PL = \frac{\sqrt{(Ac1_n - Ac1_{n-1})^2 + (Ac2_n - Ac2_{n-1})^2 + (Ac3_n - Ac3_{n-1})^2}}{100}$$

$$DSL = \sum_{i=1}^n IMPACT_i^k \times SF$$

Sensor position



Inertial measurement units (IMUs)





XS



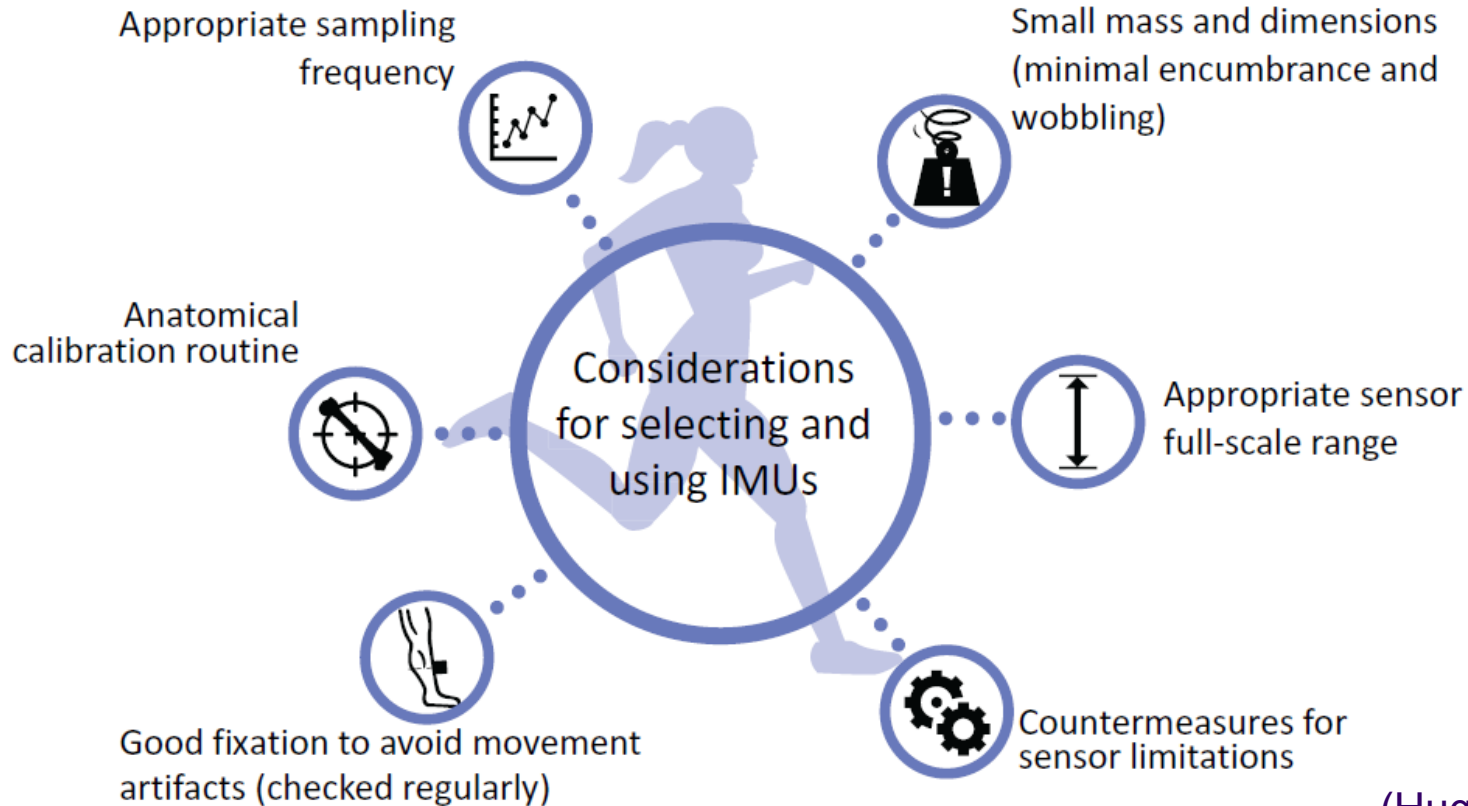
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(Hughes et al., 2021)



Injury-research Readiness Level (IrRL) framework

IrRL1: research	IrRL2: development	IrRL3: deployment
Exploring causal relationship	Building on established causal relationship	
Laboratory or in field setting		In field setting
Mixed instruments		No lab-based technology
Developing research perspectives		Using set guidelines


(Preatoni et al., 2022)



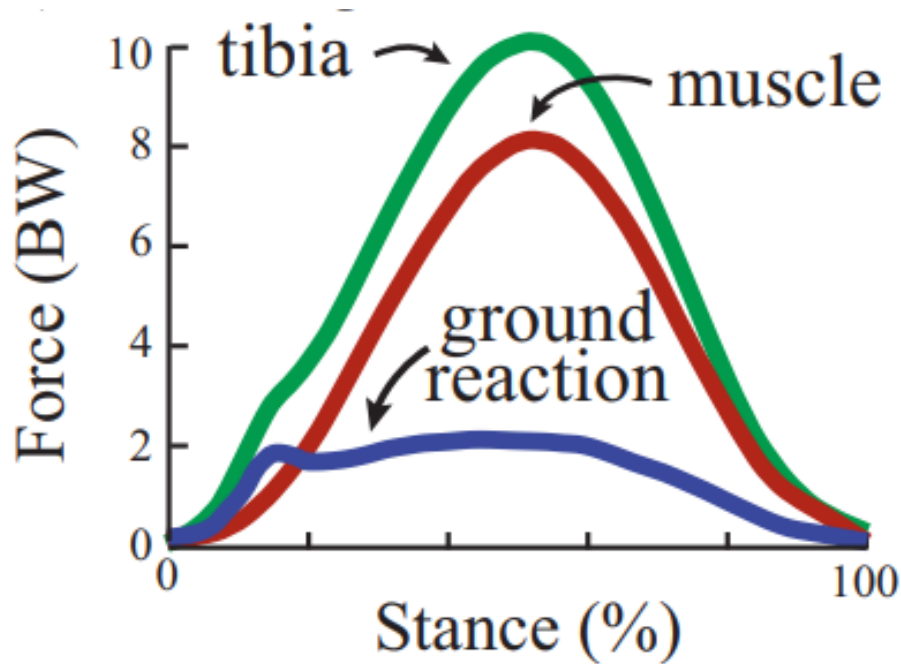
SPORTS MEDICINE AND BIOMECHANICS



Inter-unit reliability of IMU Step metrics using IMeasureU Blue Trident inertial measurement units for running-based team sport tasks

Mark Armitage, Marco Beato and Stuart A. McErlain-Naylor 



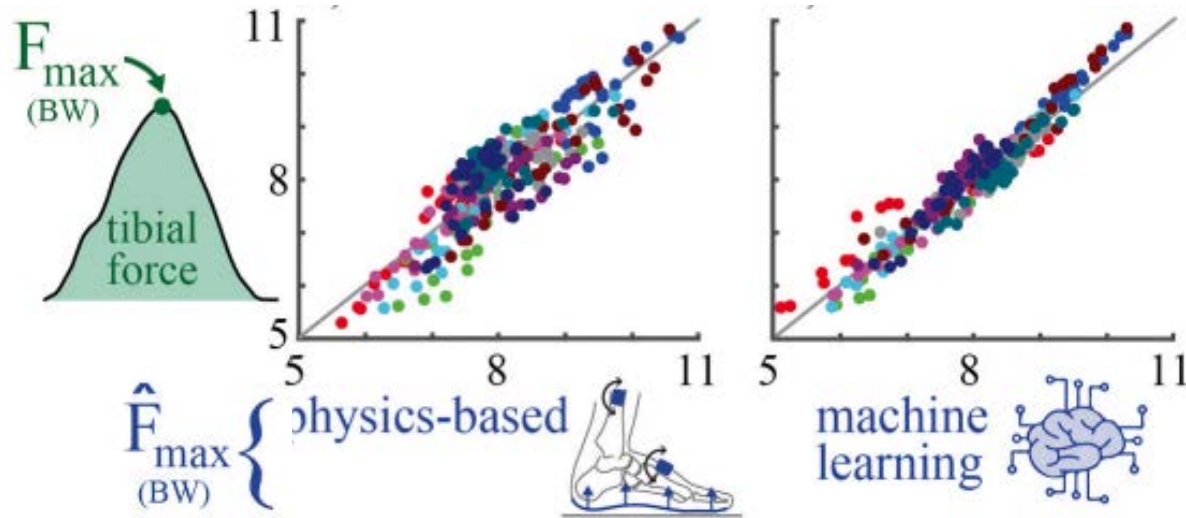


You go for a run down the street.
 You feel the ground force on your feet.
 You may think these reveal
 The bone loads that you'll feel,
 But this thinking is just incomplete.

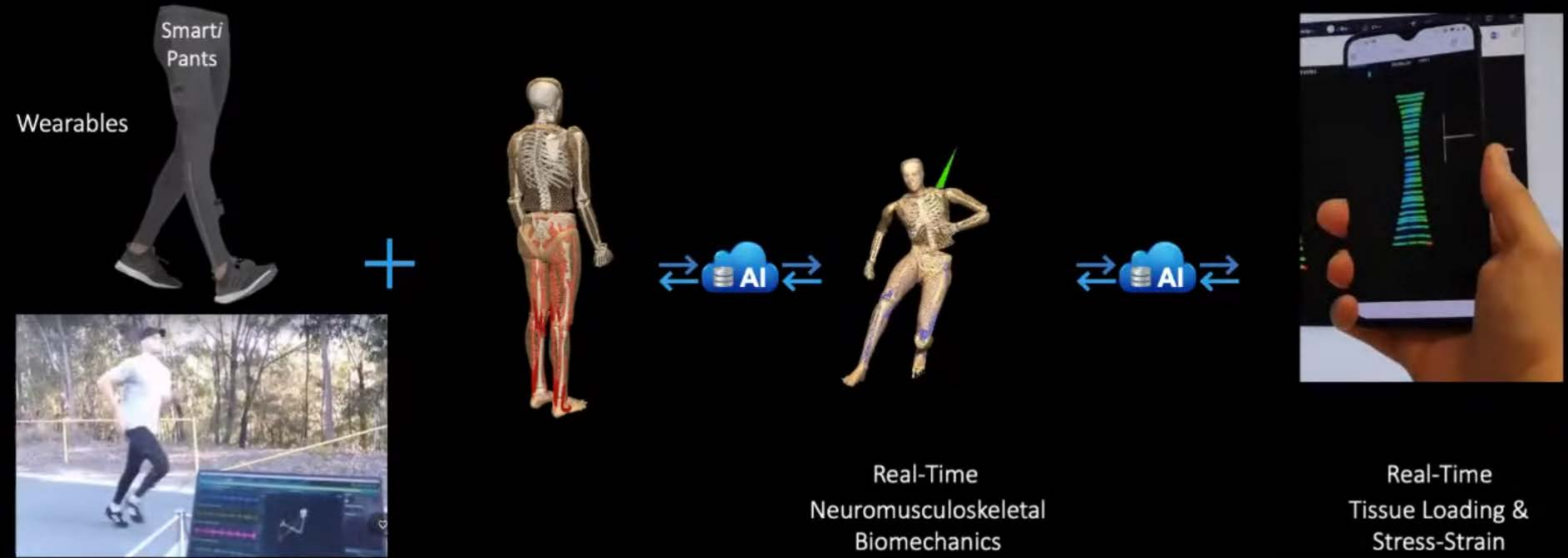
The force due to ground reaction
 May be a stress fracture distraction.
 Don't assume force on shoe
 To mean tibia load too
 Since bone load's mostly from muscle contraction.

(Matijevich et al., 2019)

Can we predict it?



(Matijevich et al., 2020)



(Pizzolato et al., 2020)



@AntoineFalisse



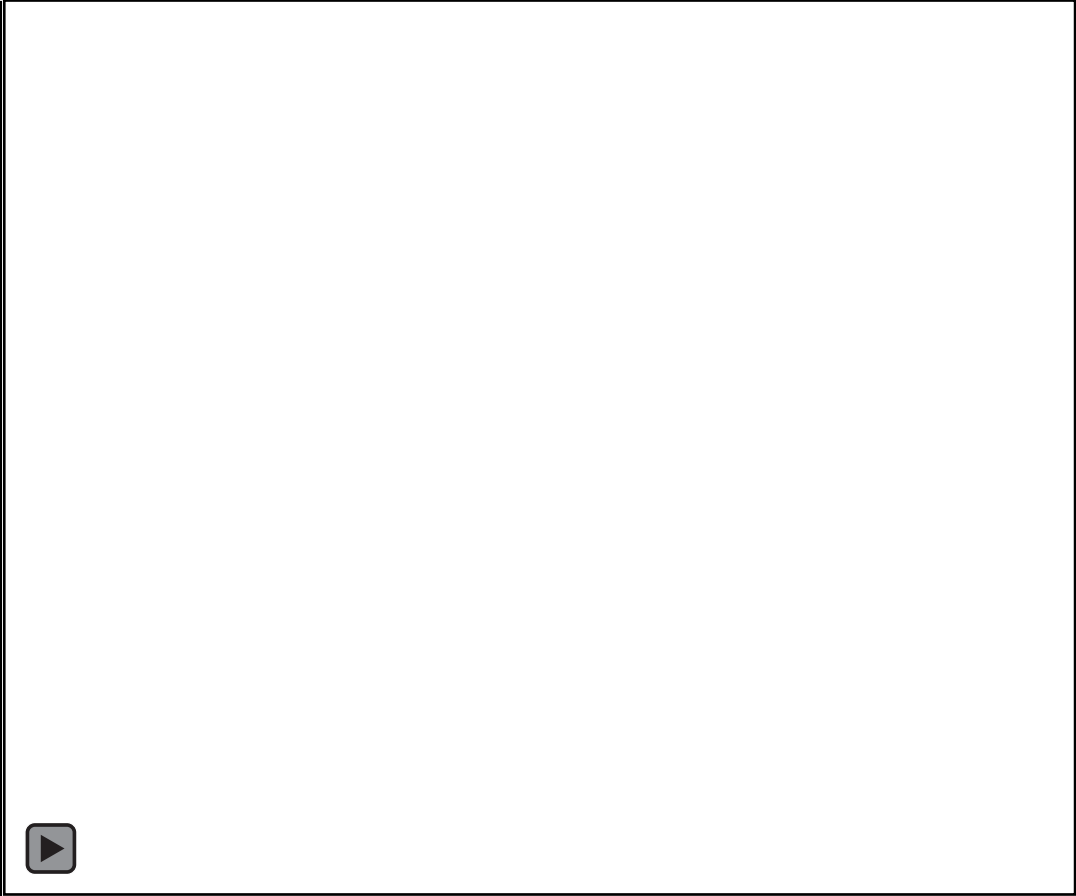
lrich et al., 2022a)



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ich et al., 2022a)



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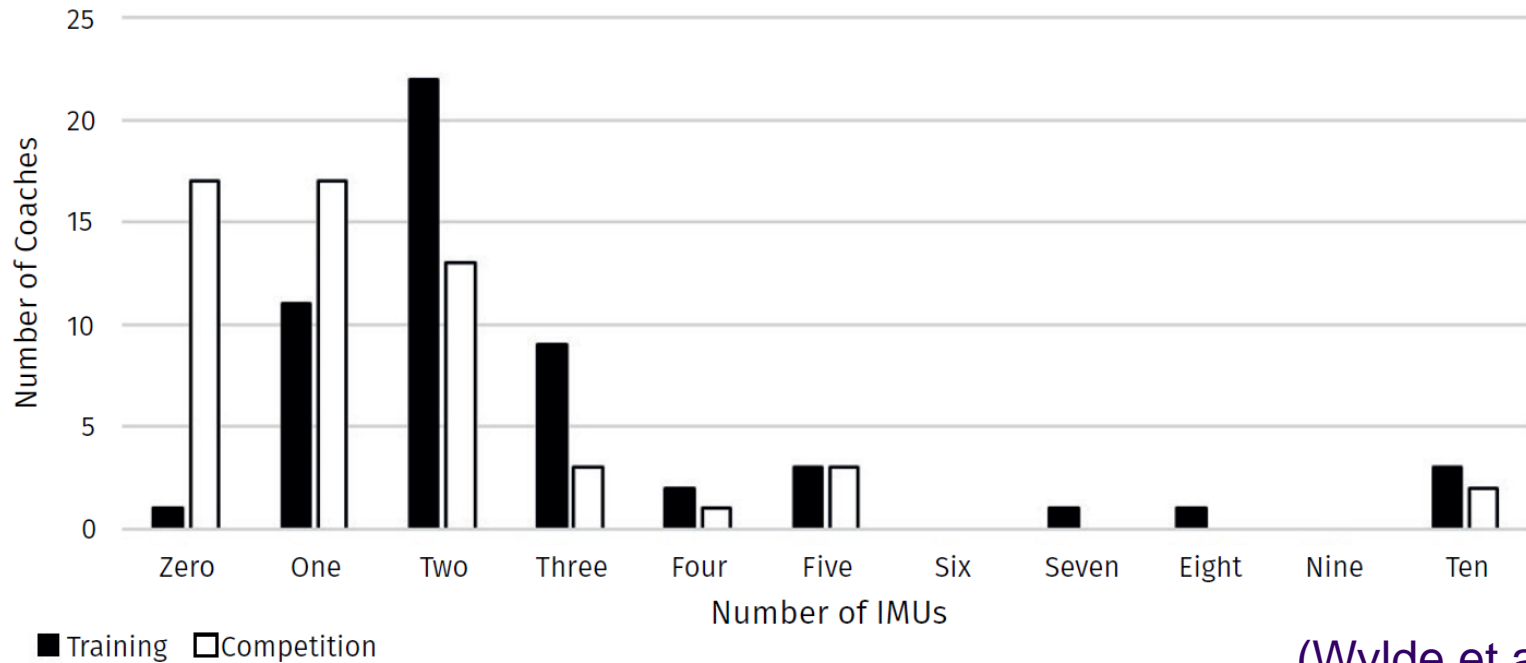


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Consider the context



(Wylde et al., 2021)



GOODHART'S LAW

WHEN A MEASURE BECOMES A TARGET,
IT CEASES TO BE A GOOD MEASURE

IF YOU
MEASURE
PEOPLE ON...

NUMBER OF
NAILS MADE

WEIGHT OF
NAILS MADE

THEN YOU
MIGHT GET

1000'S OF
TINY NAILS

A FEW GIANT,
HEAVY NAILS



sketchplanations



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“In the future... training and rehabilitation programmes will use wearable and simple imaging technologies to estimate tissue level biomechanics derived from personalised neuromusculoskeletal modelling in real-time in the real-world.

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