Biomechanics & Energetics of Human Movement - The legacy & the future

Sauvik Dasgupta[1], Yoshiyuki Kobayashi

ExPART, HARC, ITH, AIST, JAPAN

Email: sauvik.dasgupta@aist.go.jp[1]

Motivation & Relevance

- Traditionally biomechanical experiments are costly, time-taking, requires specific expertise and done (mostly) within labs
- Uses marker-based Mo-cap systems, embedded force plates, Electro-myo-graphy (EMG) sensors and mask-based Oxygen consumption devices
- Most biomechanical studies have low sample size (Median -> ~ **12-21**)
- Movement dynamics rarely measured in clinical settings/outside lab
- Data collection, processing & generating dynamic musculoskeletal simulations takes several days
- Inertial Measurement Units (IMUs) and marker less, video-based Mo-cap systems are current alternatives
- Future alternatives can be used by common people in daily-life as a web/mobile application
- Useful in obesity management, global activity monitoring and less burden on experimental subjects

The Legacy

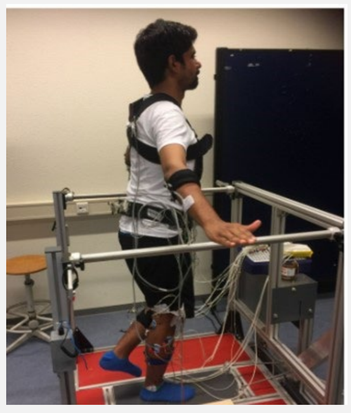


Fig.1: Checking balance and Mo-cap in an experiment

Fig.2: Mo-cap on a treadmill

Fig.3: Usage of a Douglas bag to collect expired air

Fig.4: Usage of a face-mask setup to measure Oxygen consumption

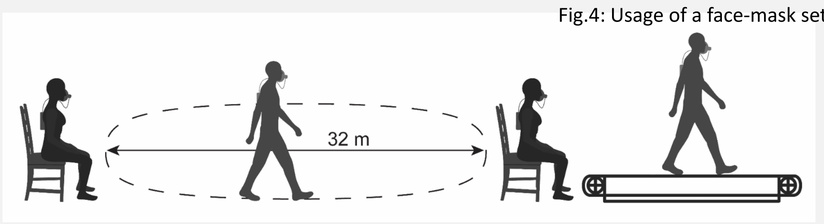


Fig.5: Overground and Treadmill Walking: Experimental setup

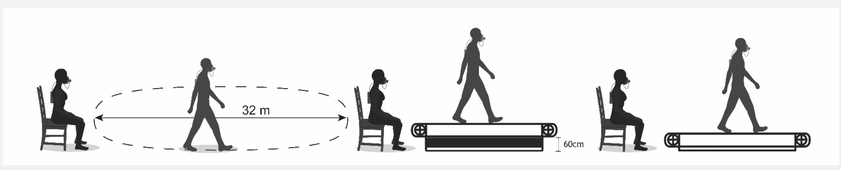


Fig.6: Overground, High and Floor-level Treadmill Walking: Experimental setup

The Future

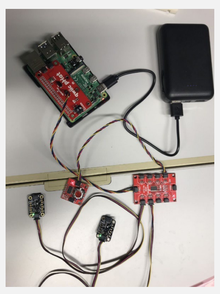


Fig.7: (Wearable) OpenMetabolics: Original and current prototype

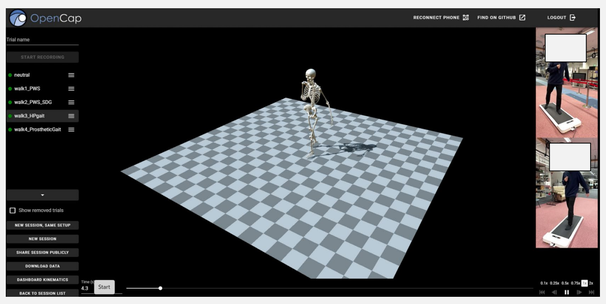


Fig.8: OpenCap: Markerless Mo-cap

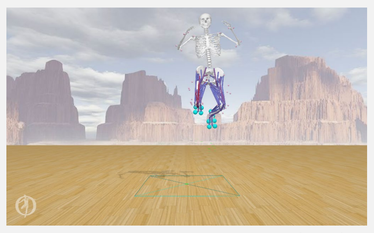


Fig.9: Counter Movement Jump (CMJ)

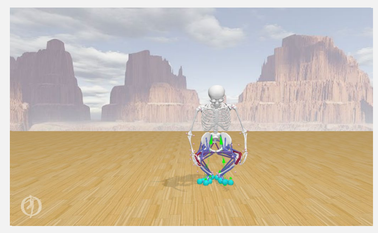
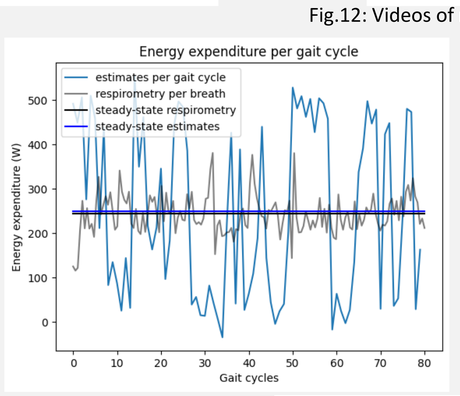
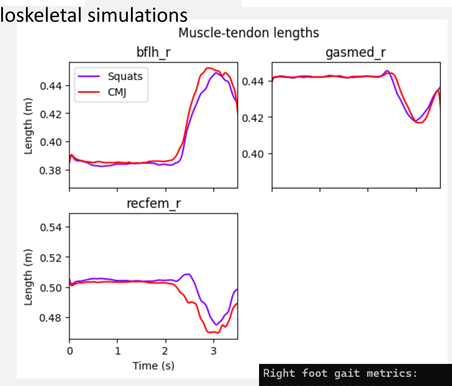


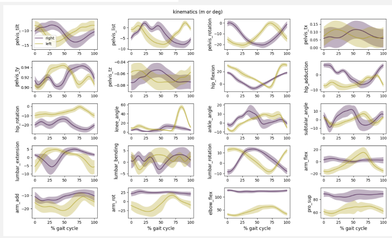
Fig.10: Squats

Fig.11: Sit-2-Stand (STS)

Fig.12: Videos of musculoskeletal simulations







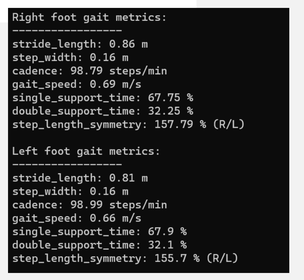


Fig.13: (Selected) results of energy expenditure predictions from IMUs & musculoskeletal simulations

References & Contact Details

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