



Rationale

- Fatigue = risk factor for musculoskeletal disorders (MSD).
- Females > males** incidence rates [1].
- With **old age**, everyday fatigue increases.
- Motor variability = compensatory strategy to **mitigate fatigue** [2].
- Uncontrolled Manifold (UCM) analysis quantifies '**good**' and '**bad**' **variability** in relation to task performance.
- With fatigue, good variability (V_{UCM}):
 - Increases more in females than males [3].
 - Increases in older adults from rest [4].

Hypotheses

- Fatigue will cause a greater increase in female V_{UCM} values compared to males.**
- Fatigue will cause an increase in older adult V_{UCM} values compared to resting conditions.**

Participants

Table 1: Descriptive statistics of participants.

	Young	Old
N	18 (9f/9m)	16 (11f/5m)
Age (years)	24.4 ± 2.9	73.5 ± 7.3

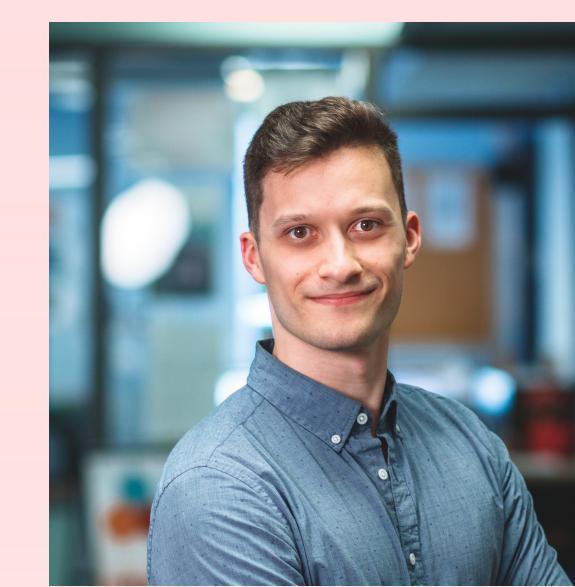
Data Collection

- Seated repetitive reaching task** moving at 2Hz between two targets [5].
- Perceived exertion (Borg CR-10) measured after each minute. Task terminated ≥ 8 .
- Upper limb + trunk kinematics** collected for final 30s of each minute (100Hz, 7-camera, MX3 Vicon, Oxford Metrics Ltd.).



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Data Analyses

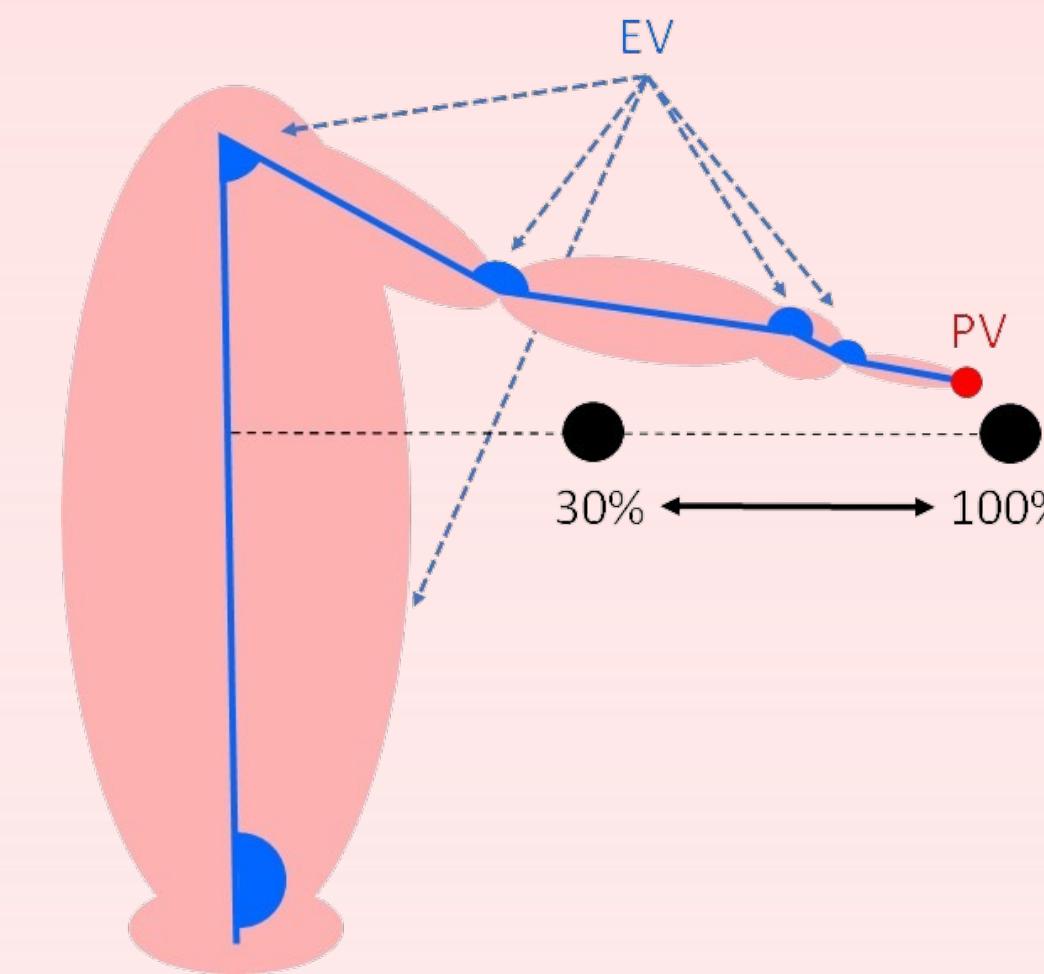


Figure 1: A diagram of the experimental protocol.

- First (**NF**) and final (**FT**) minutes compared.
- Data low-pass filtered (zero-lag, 2nd order, Butterworth, 7 Hz cut-off frequency).
- UCM [2] linked 11 **Euler angles (EV)** to the **endpoint fingertip position (PV)** for individual forward reaches.
- RM ANOVA - Sex*Phase*Condition*Age (Tukey's HSDs post-hoc).

Main Results

Table 2: Significant main effects from statistical analysis.

	F	Sig.
Sex	4.25	P < 0.05
Age	7.13	P < 0.01

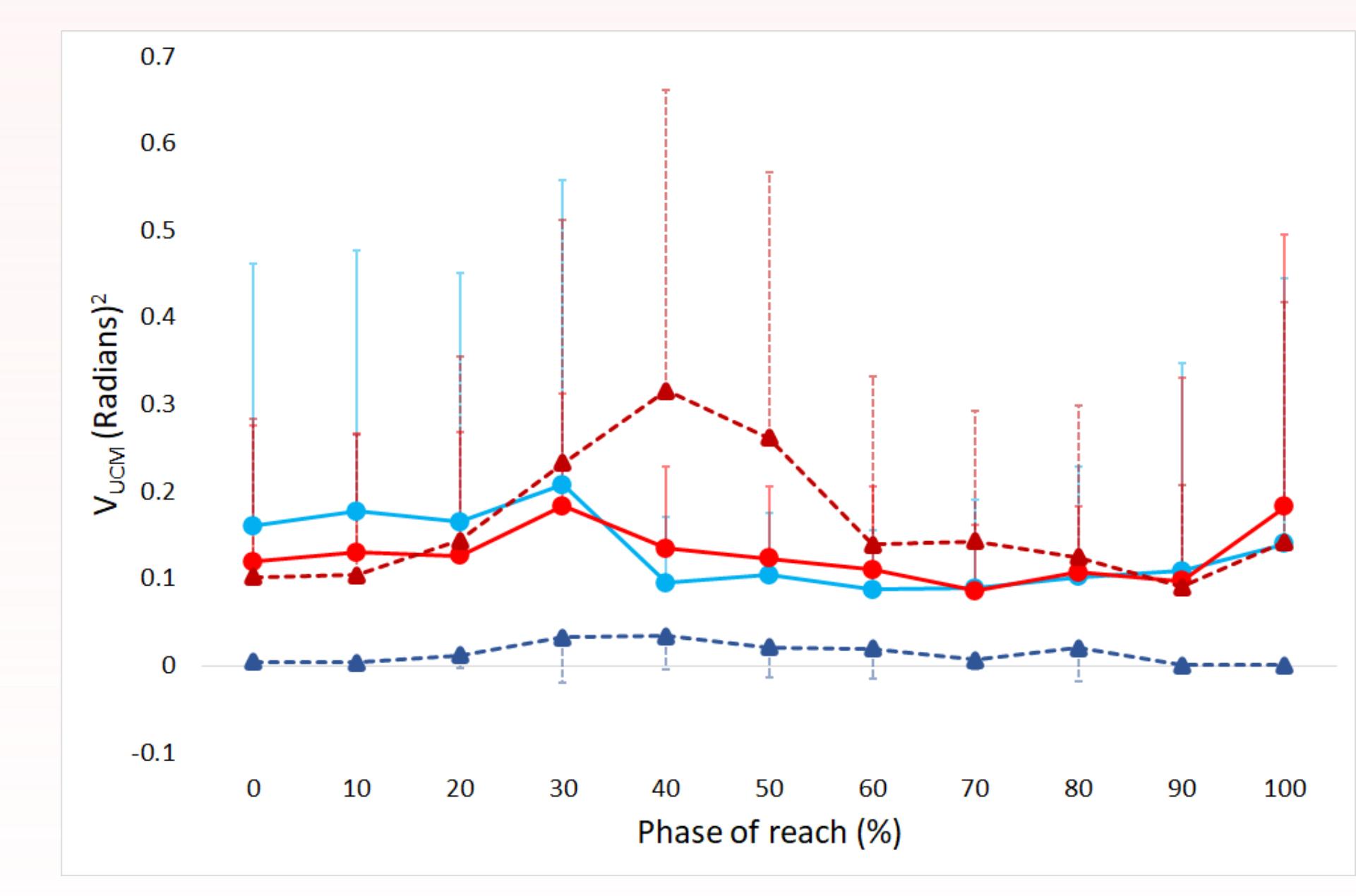


Figure 2: Mean (± standard deviation) VUCM values at NF.

Main Results (cont.)

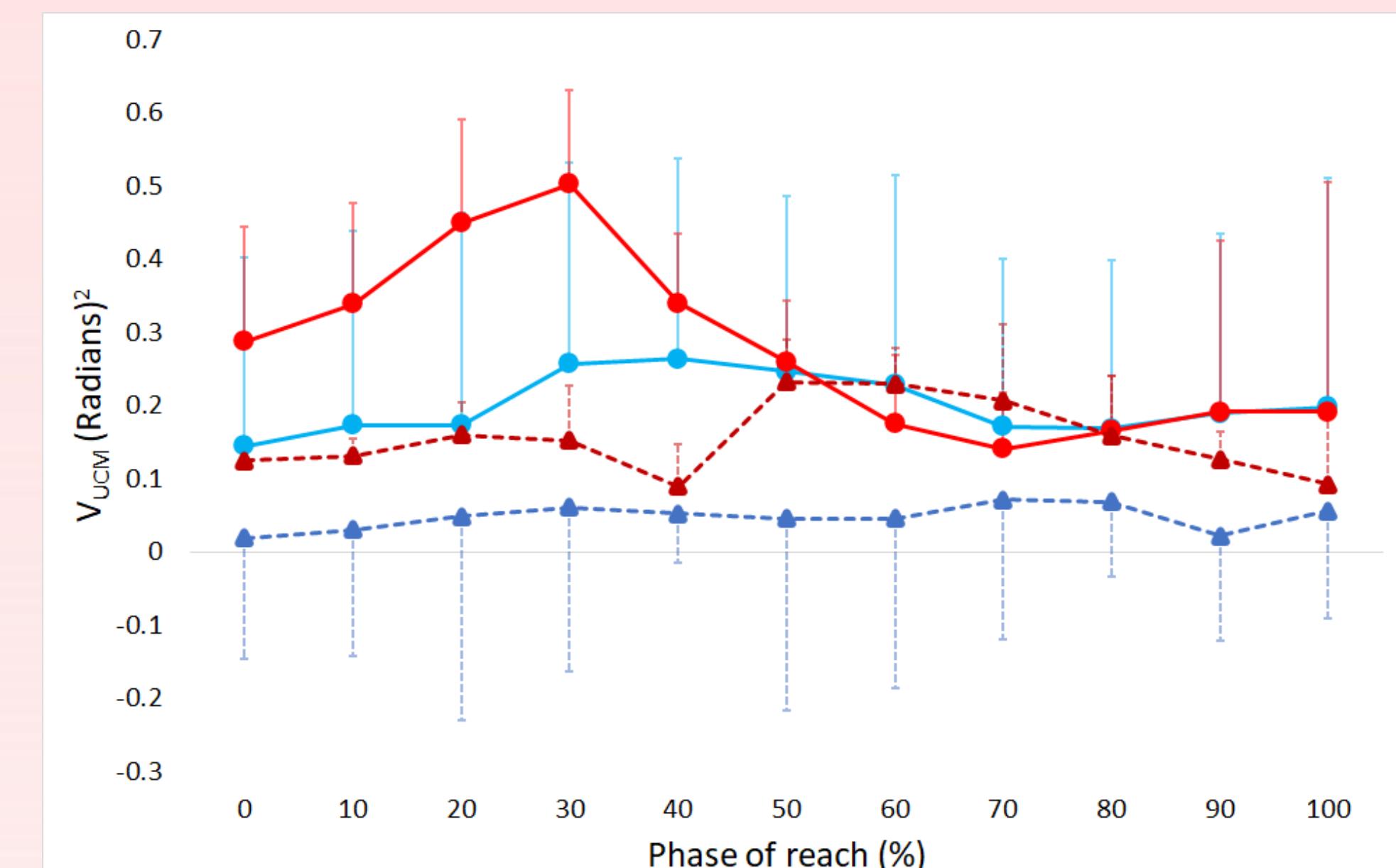


Figure 3: Mean (± standard deviation) VUCM values at FT.

Discussion

- From NF to FT, old males and females show relatively unchanged V_{UCM} values.
 - Loss of motor flexibility [4].
- Old males < old females (Figures 2 + 3).
 - Male > female age-related decline in motor flexibility.
- Small sample size for old males.
 - Small SD values (Figure 2) = mean representative of the current sample.
 - Higher powered studies to confirm.

References

- [1] de Zwart (2000). Int Arch Occup Environ Health. 74(1).
- [2] McDonald (2019). Appl. Ergon. 75.
- [3] Hasanbarani (2021). J Biomech. 110769.
- [4] Bailey (2021). XXVIII Congress of ISB.
- [5] Bailey et al (2020). J Biomech, 99: 109574.