Synchronicity: A Measure of Multi-Joint Movement Coordination in Device Assessment

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Background

- We introduce ***Synchronicity***: a quantitative movement quality assessment
- We apply this metric to 3 motion studies
- The metric is an indicator of device embodiment and function

Metric

$$S = \frac{\mathbf{v}_1 \cdot \mathbf{v}_2 \cdot \mathbf{v}_3 \cdots \mathbf{v}_N}{N * t}$$

S : movement Synchronicity score

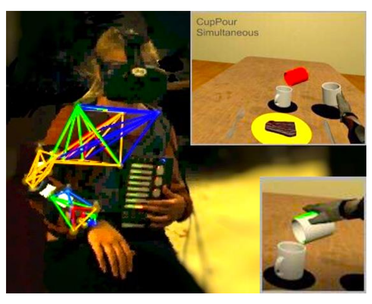
$\mathbf{v}_i$: angular velocity of joint rotation

N : number of joints t: movement duration

Methods

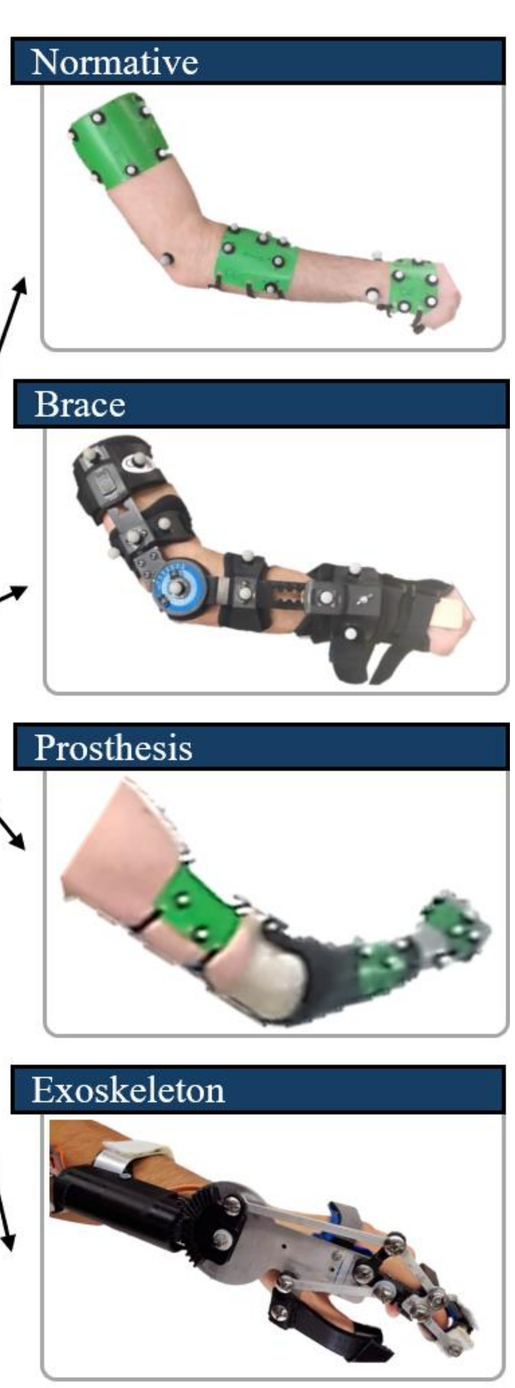
- Coordination between the torso, shoulder, and elbow are used to assess normativity across three studies





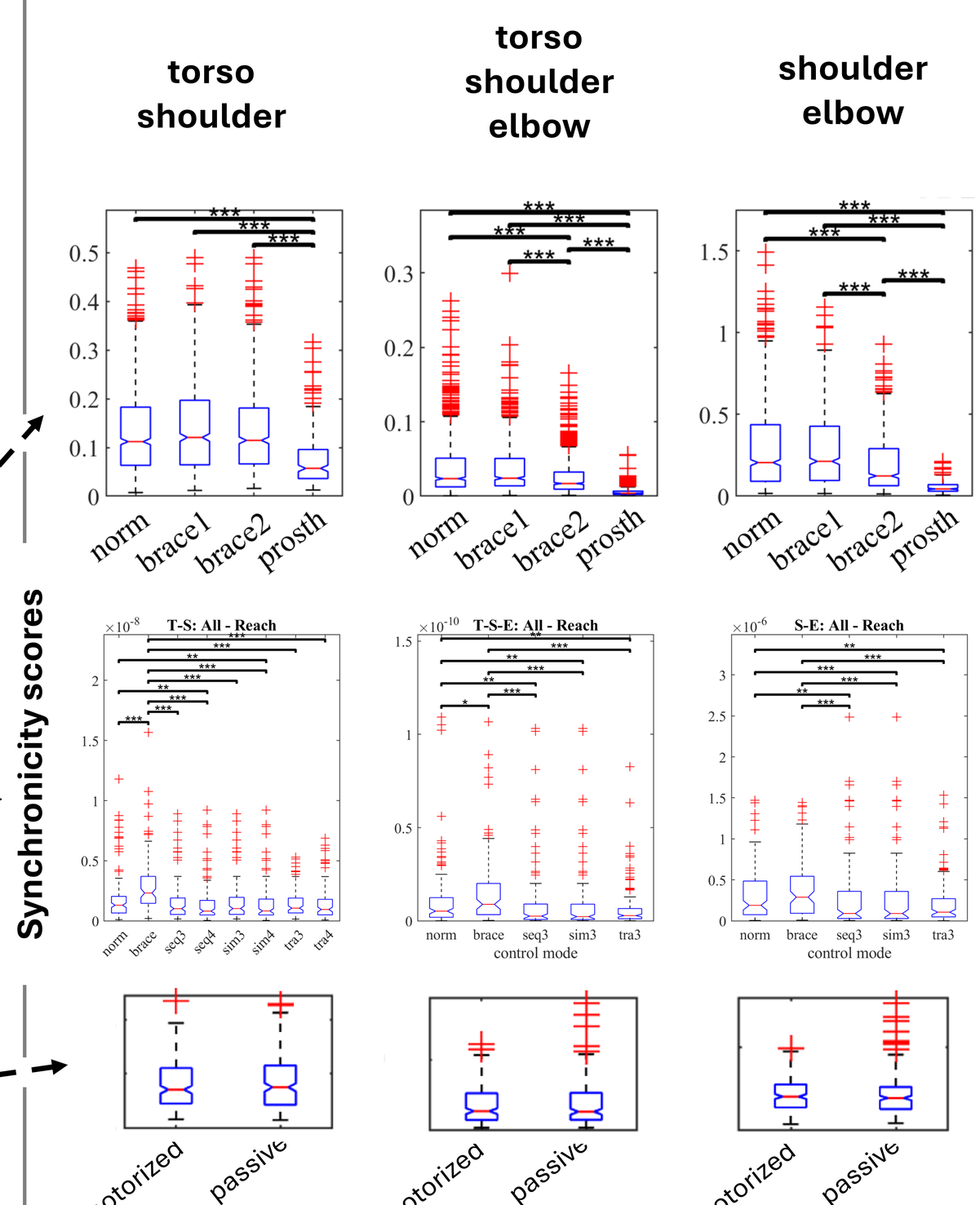






Results

- Prostheses negatively affect synchronicity of residual joints
- Synchronicity is affected by device embodiment and task simplicity
- Embodiment appears to be binary
- Grasping did not affect synchronicity



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