Dynamic motor responses to visual displacements during training: How virtual reality (VR) can explore the role of expectation in motor training

Sophie Dewil, Yu Shi, Zack Marvin, Raviraj Nataraj
MOCORE Lab, Department of Biomedical Engineering, Stevens Institute of Technology

Introduction

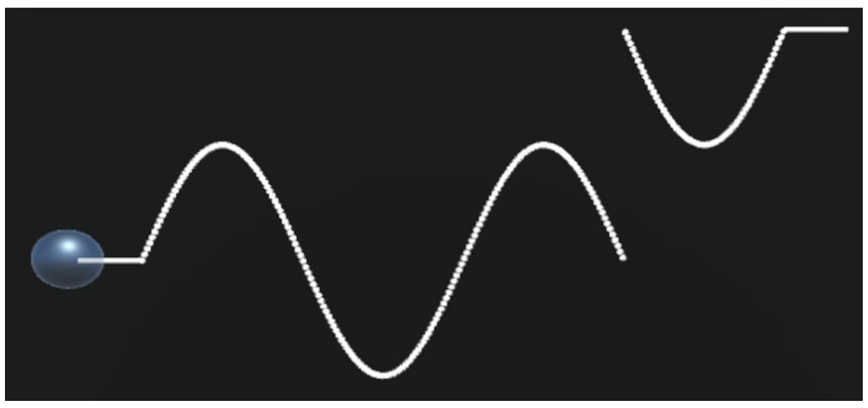
- **Physical therapy (PT)** to rehabilitate motor function after a neurological trauma like spinal cord injury (SCI) or stroke [1] has notable hurdles:
  - Time intensive and energy consuming
  - Marginal outcomes [2]
- Virtual Reality (VR) increasingly used to supplement PT
  - increase engagement
  - decrease clinician burden [3], [4]
- Sensorimotor predictions fundamental to **motor learning** [5]
- Visuomotor adaptation to train users to move in novel environmental dynamics leads to neurological shifts and motor changes [6]
- In this study, participants experience expected or unexpected visual input to force dynamic shifts during a **reaching protocol** in VR

Methods

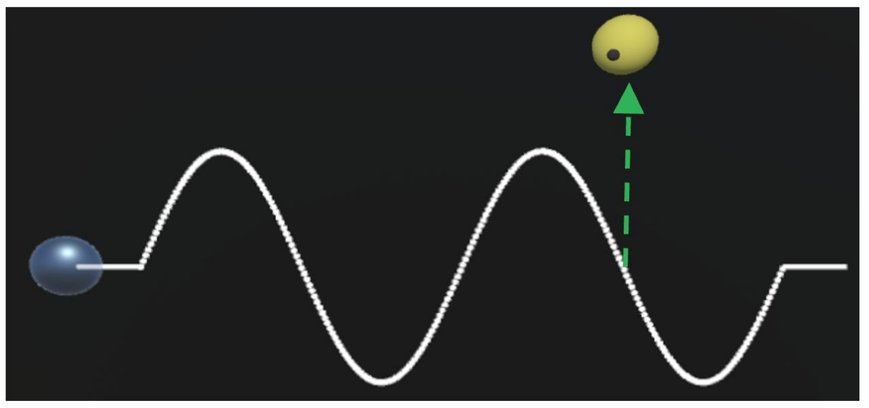
- Neurotypical participants (n=7)
- Equipment:
  - Marker-based motion capture (Prime17W, Optitrack)
  - Custom digital environment (Unity)
- Experimental Task*:*
  - Trace a sinusoid shape
  - Two training conditions:
    1. **Expected**: latter segment of the sinusoid is shifted from the start of the trial
    2. **Unexpected**: visual feedback of the participant's movement was vertically disrupted during the trial
  - Post environment: running trace where sinusoid appears in front of the participant's position
- Tracing error: primary performance metric

Participant view in VR

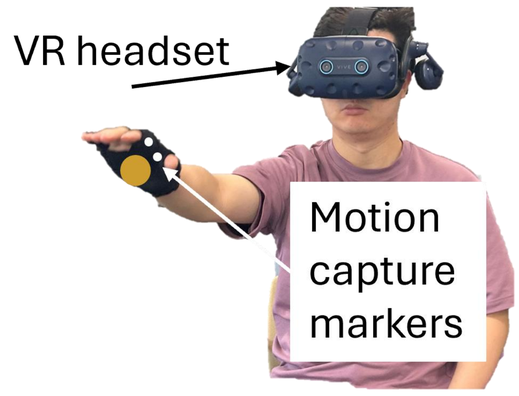
Expected condition



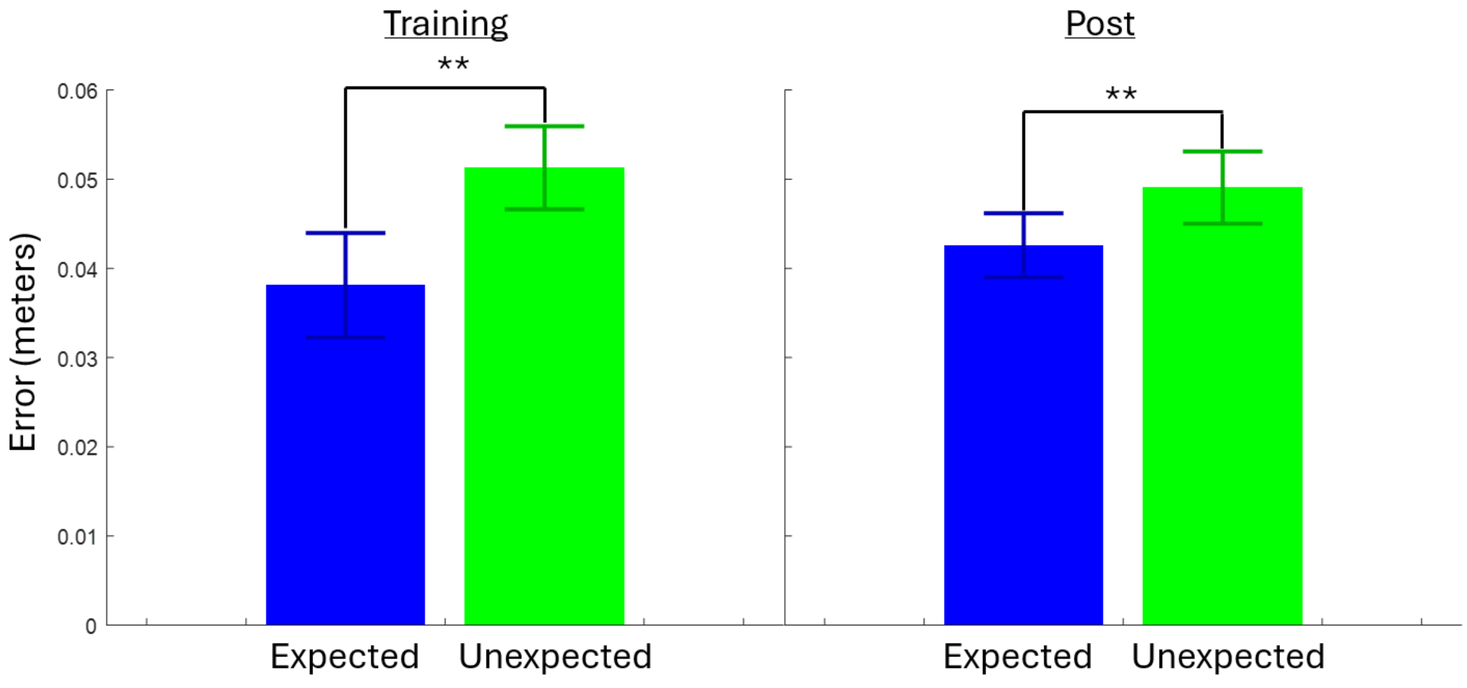
Unexpected condition



Equipment setup



Results



Discussion

- Completing a reaching task with expected forced dynamic shifts produced greater performance than unexpected forced dynamic shifts in both training and post trials ($p < 0.01$)
- Counter to hypothesis that unexpected environmental dynamics will encourage movement exploration and promote motor learning
- Future studies should review the effect of agency on results

Acknowledgements

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