Exploring Novel Input Techniques for HCI: Promoting Ubiquitous Rehabilitation Through Accessible Design

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INTRODUCTION

- With the development of personal computing devices, information is easily available with the click of a mouse or tap from a finger.
- For people with limited movement in their arms and hands, interacting with technology can be a difficult or impossible task.

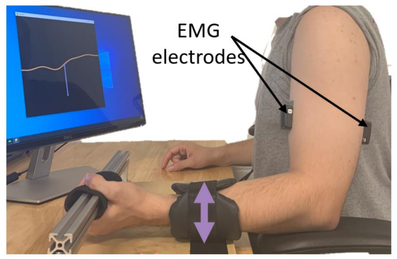
How can **novel sensing technology** assist in making device more **accessible** for people with limited motion?

My research demonstrates the potential of **muscle interfaces** as an **alternative input technique** for people with and without limited movement to continuously interact with technology.

METHODS

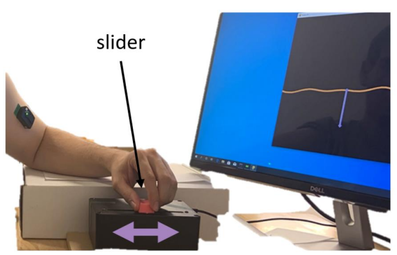
PARTICIPANTS

- 11 participants without limited motion.
- 3 participants with limited motion.



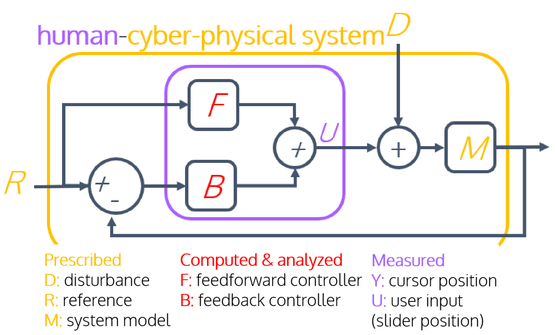
TASK

- Track yellow reference trajectory with purple cursor .
- Two tasks:
  - Velocity-based (e.g. driving powered wheelchair).
  - Acceleration-based (e.g. driving a car).
- Randomized muscle or manual.



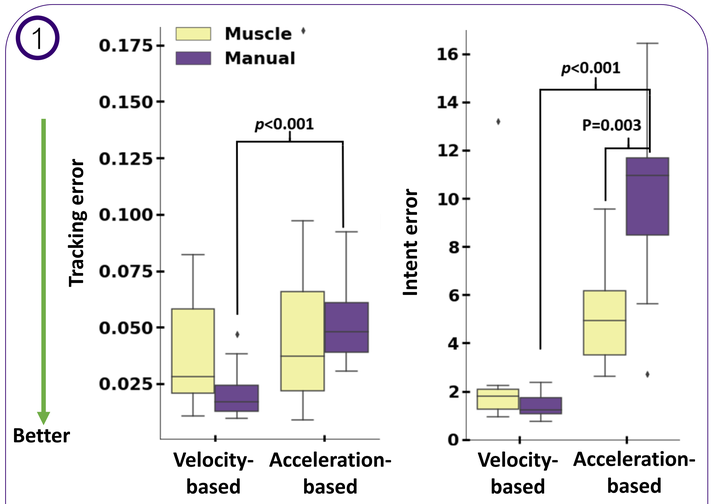
ANALYSIS

- Extract feedforward (F) and feedback (B) controller values and quantify tracking and intent error.
- Two-way ANOVA with paired t-test.

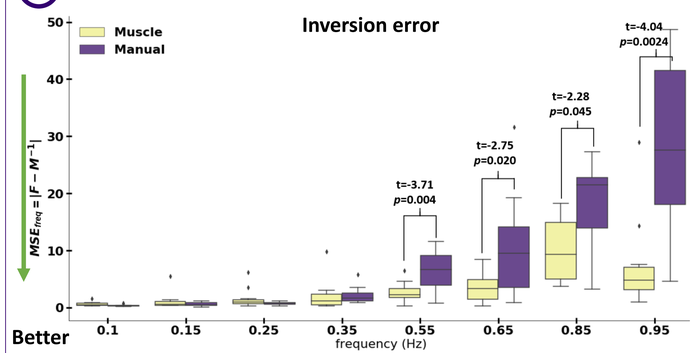


RESULTS

11 UNIMPAIRED

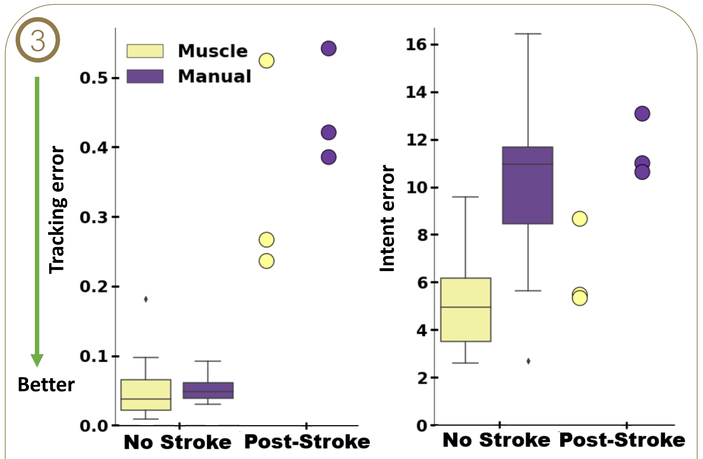


Muscle interface improves intent for acceleration-based task.



Muscle interfaces useful for high-frequency acceleration-based tasks.

3 POST-STROKE



Post-stroke participants have high tracking error, but comparable intent error compared to unimpaired participants.

CONCLUSION

Discussion

- Muscle interfaces could provide advantages for people without limited motion for high-frequency, acceleration-based tasks like **flying a drone through a forest**.
- Participants with limited movement appear to have **difficulty with performing feedback control**.

Future work

- Enhance intent and help minimize disturbances with AI

REFERENCES

1. Yamagami M et. al. Decoding Intent With Control Theory: Comparing Muscle Versus Manual Interface Performance. CHI 2020.
2. Yamagami M et al. Assessment of dry epidermal electrodes for long-term electromyography measurements. *Sensors*. 2018

ACKNOWLEDGEMENTS

This research was supported by the NSF CISE CPS Program (award # 1565529, 1836819) and the Washington Research Foundation Funding for Innovation in Neuroengineering.