INDUSTRIAL & SYSTEMS ENGINEERING
TEXAS A&M UNIVERSITY

Investigating Tactile Object-Proximity Feedbacks for Gestures in Virtual Environments

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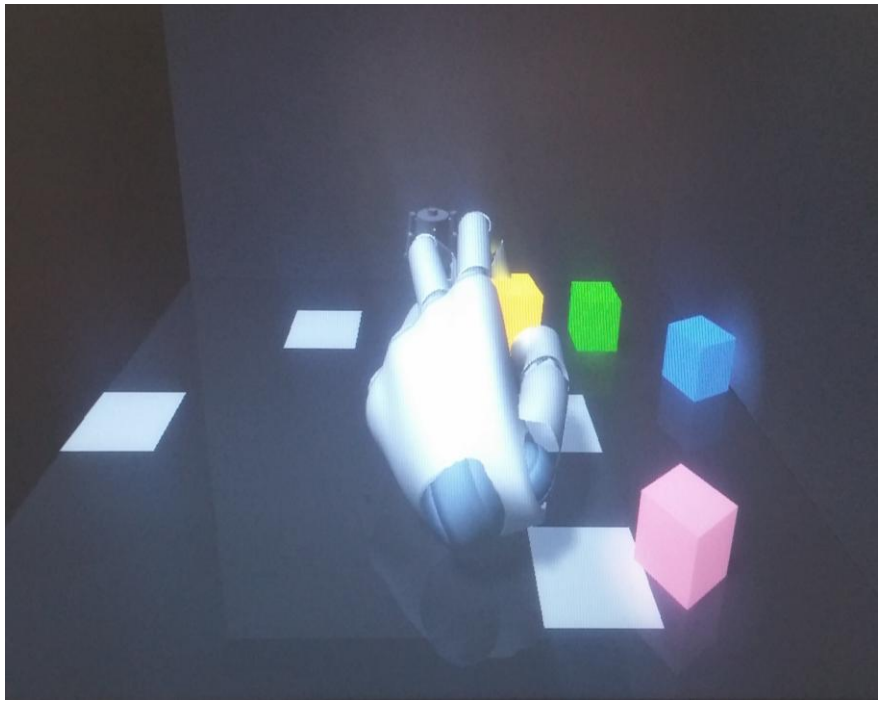
Object Proximity Mapping

- Predominantly used in remote calibration tasks and video-game interaction



Research Question

- Difficulties encountered with direct manual manipulation of objects in virtual environments: Depth perception going from a 2D to 3D space

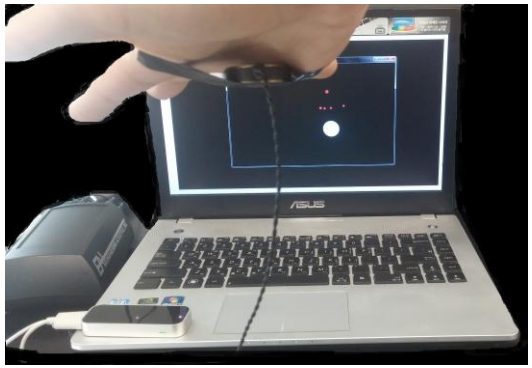
- Potential solution involves mapping vibration patterns based on object proximity (based on previous studies using sound proximity)

Experiment Set Up

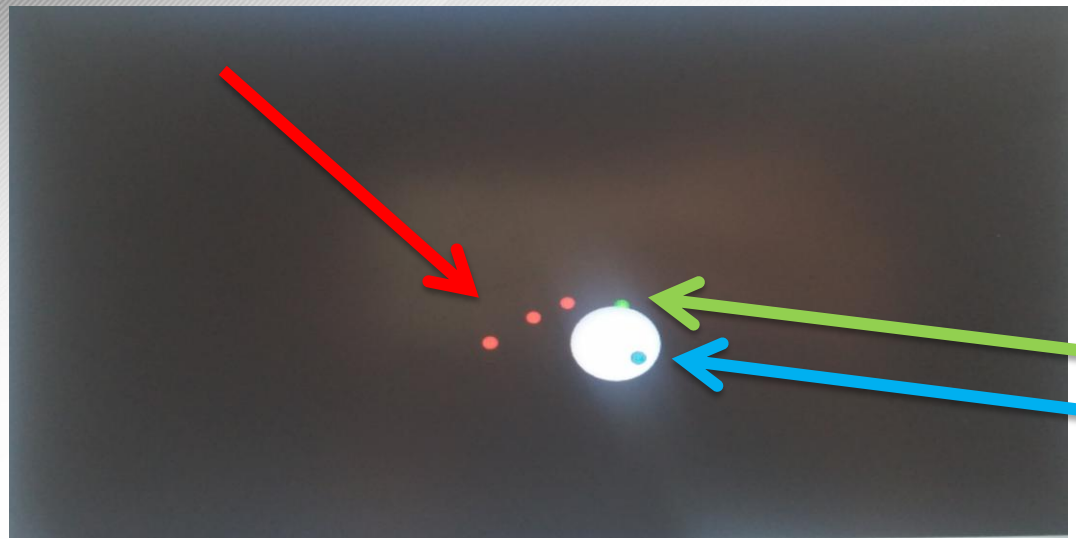
- Leapmotion device as sensor

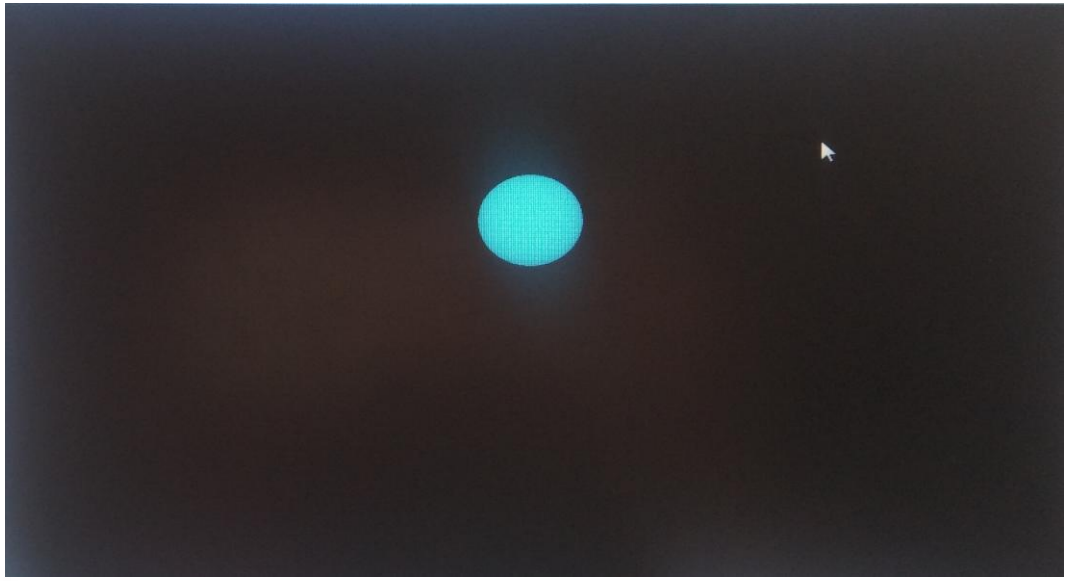
- C-2 tactors: One tactor placed on the dominant hand

- Tactor connected to Leapmotion via processing programming language



Experimental Design: Task





- Goal is to quickly and accurately grab 30 objects presented on screen
- Touching finger is green, hovering finger is blue and far fingers are red
- When the object is grabbed, it turns cyan, disappears, and the next sphere appears

Experiment Design: Treatment conditions

Participants performed the task under 3 vibration conditions

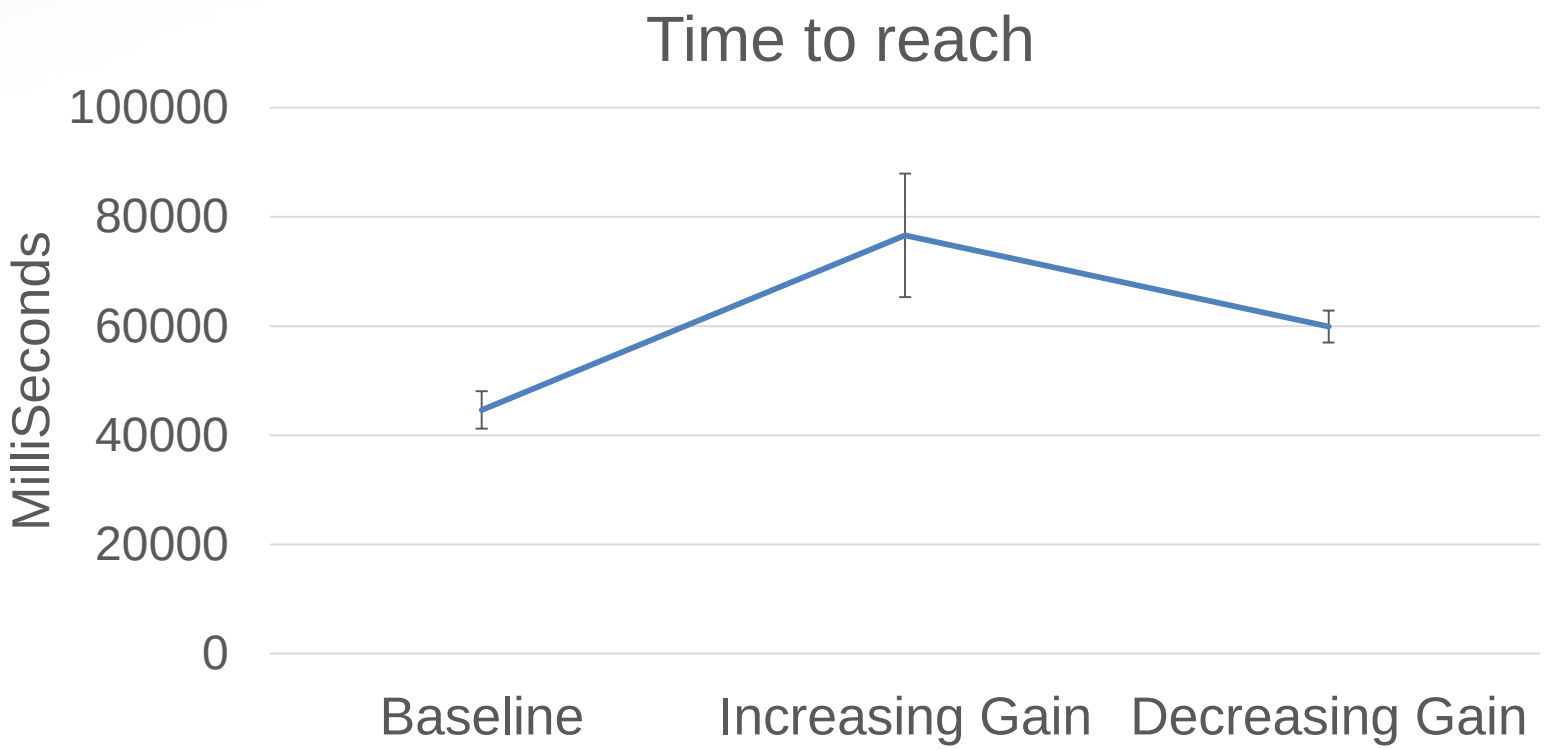
1) Baseline without vibration
2) Increasing gain intensity while getting closer to the object
3) Decreasing gain intensity as getting closer to the object

Experiment Design: Performance measurements

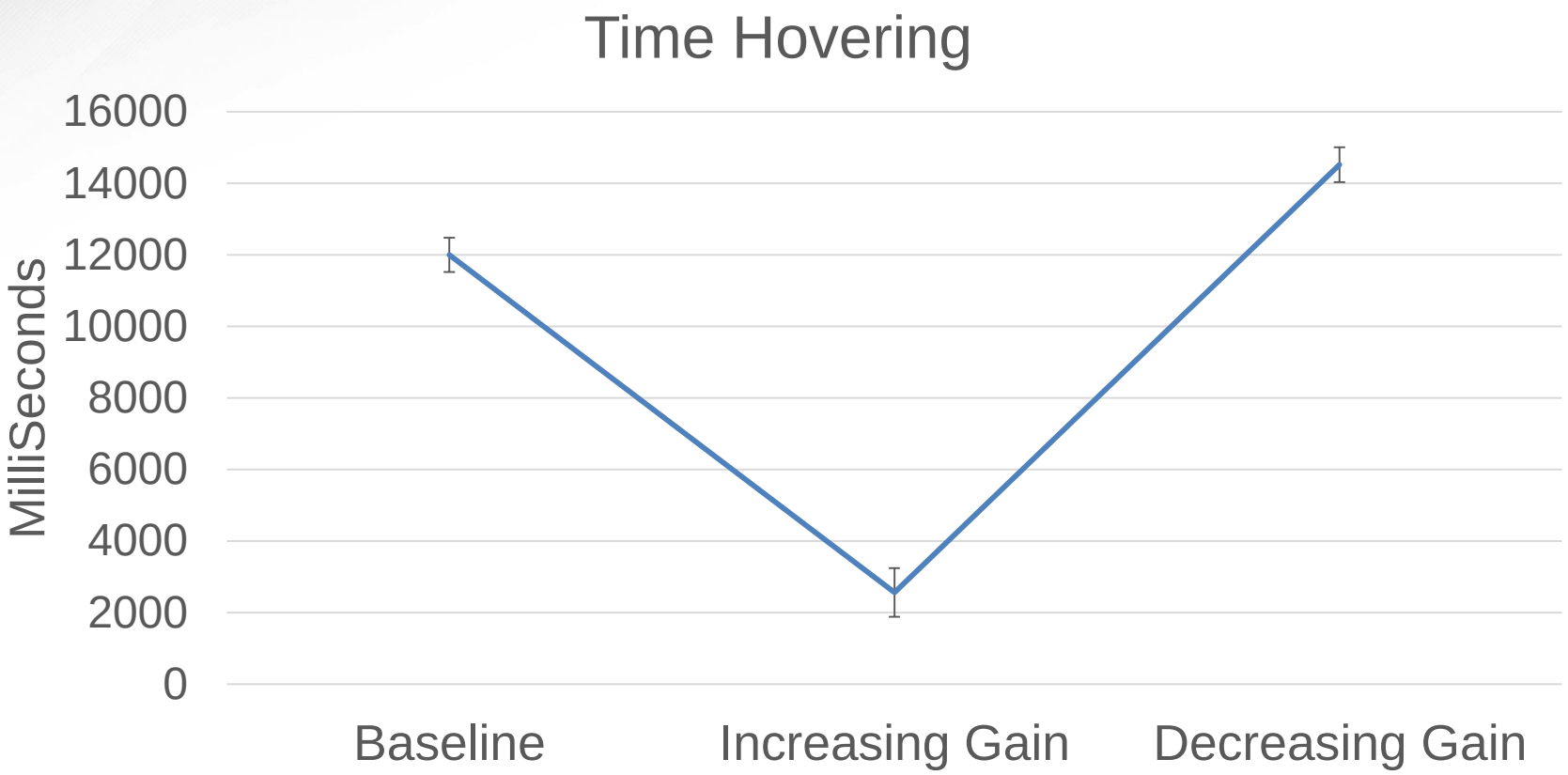
- Time to reach the object (red)
- Time hovering around the object (blue)
- Time touching the object (green)

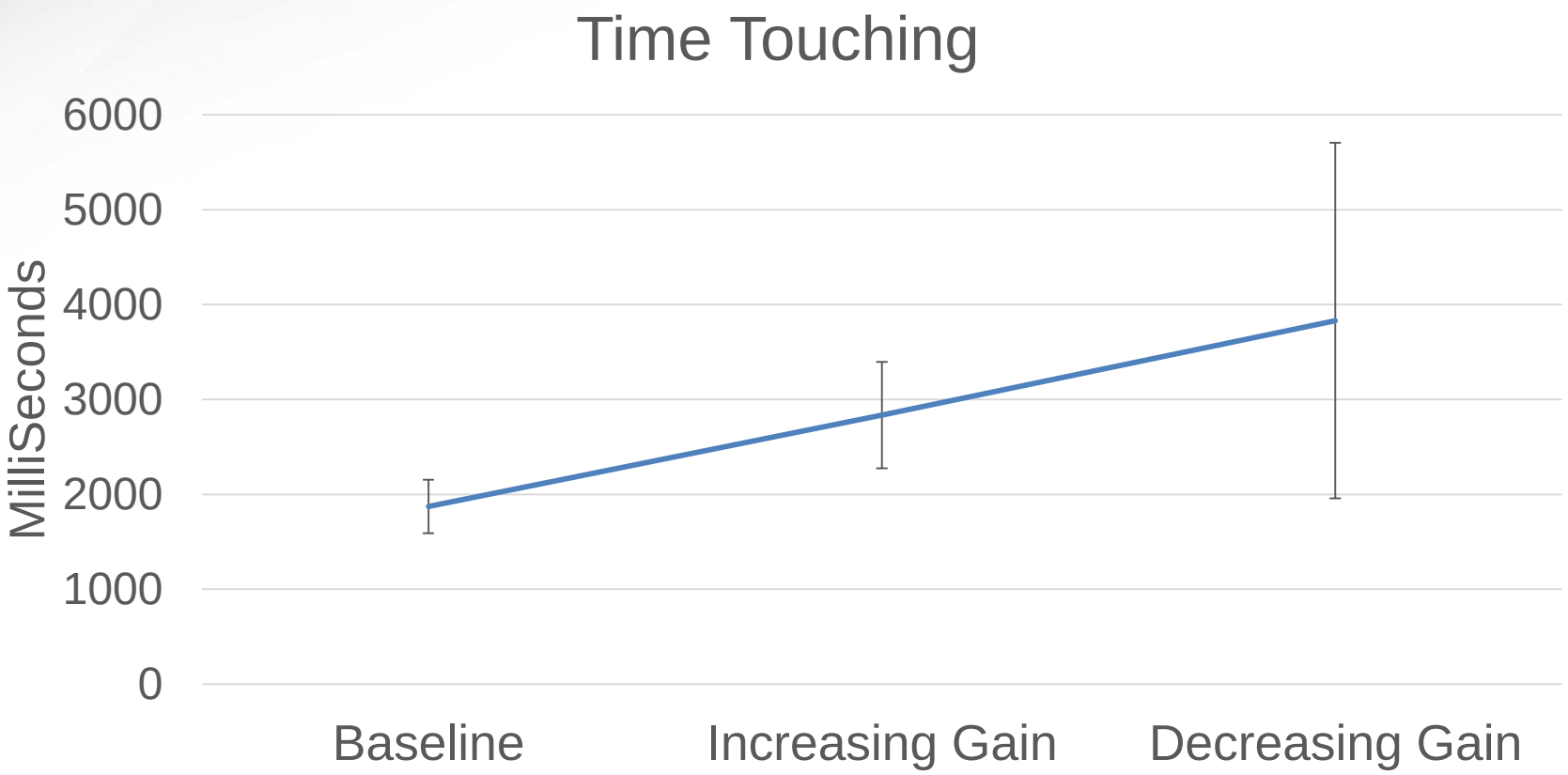
Preliminary Data

- 5 Participants from Texas A&M University



Preliminary Data




Time Touching
6000
5000
4000
3000
2000
1000
0
MilliSeconds
Baseline
Increasing Gain
Decreasing Gain

Preliminary Conclusions

- Results suggest the best performance is with the Baseline condition

- Reasons
  - The use of 1 tactor in the hand versus 5tactors on the fingers
  - Insufficient training on what the vibrations meant
  - Learning effect should be considered

Continued Work

- This experiment is still under development
  - Adjust so using tactors on fingers (more sensitive, potentially better mapping), instead of a single location
  - Use tactors on dominant and non-dominant hand
  - Place several tactors in a way to map direction
  - Participants announce when they are touching the object
  - Modify the number of virtual object
  - Modify representation of objects

Questions