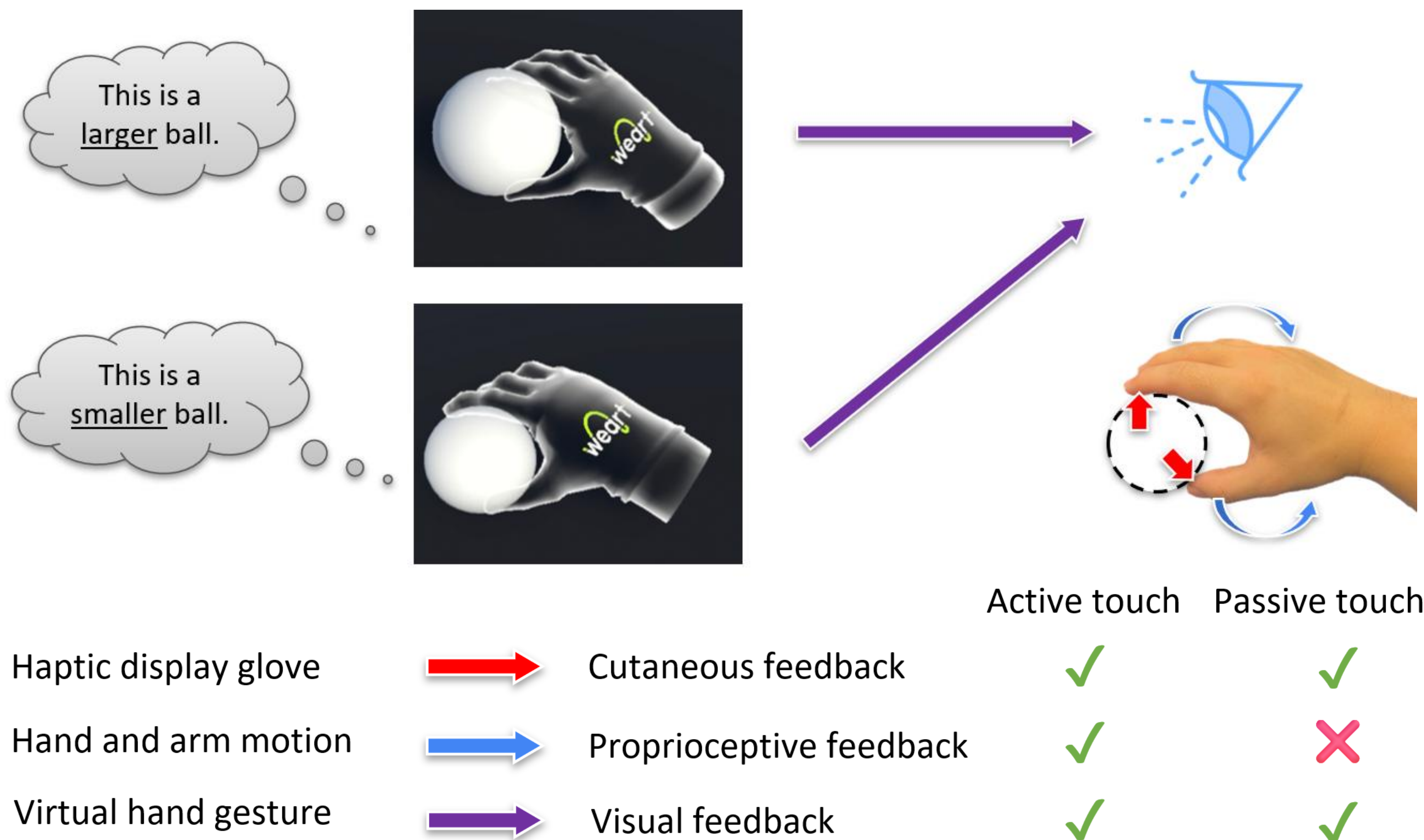# Exploring Shared Grasping Experiences in Virtual Reality

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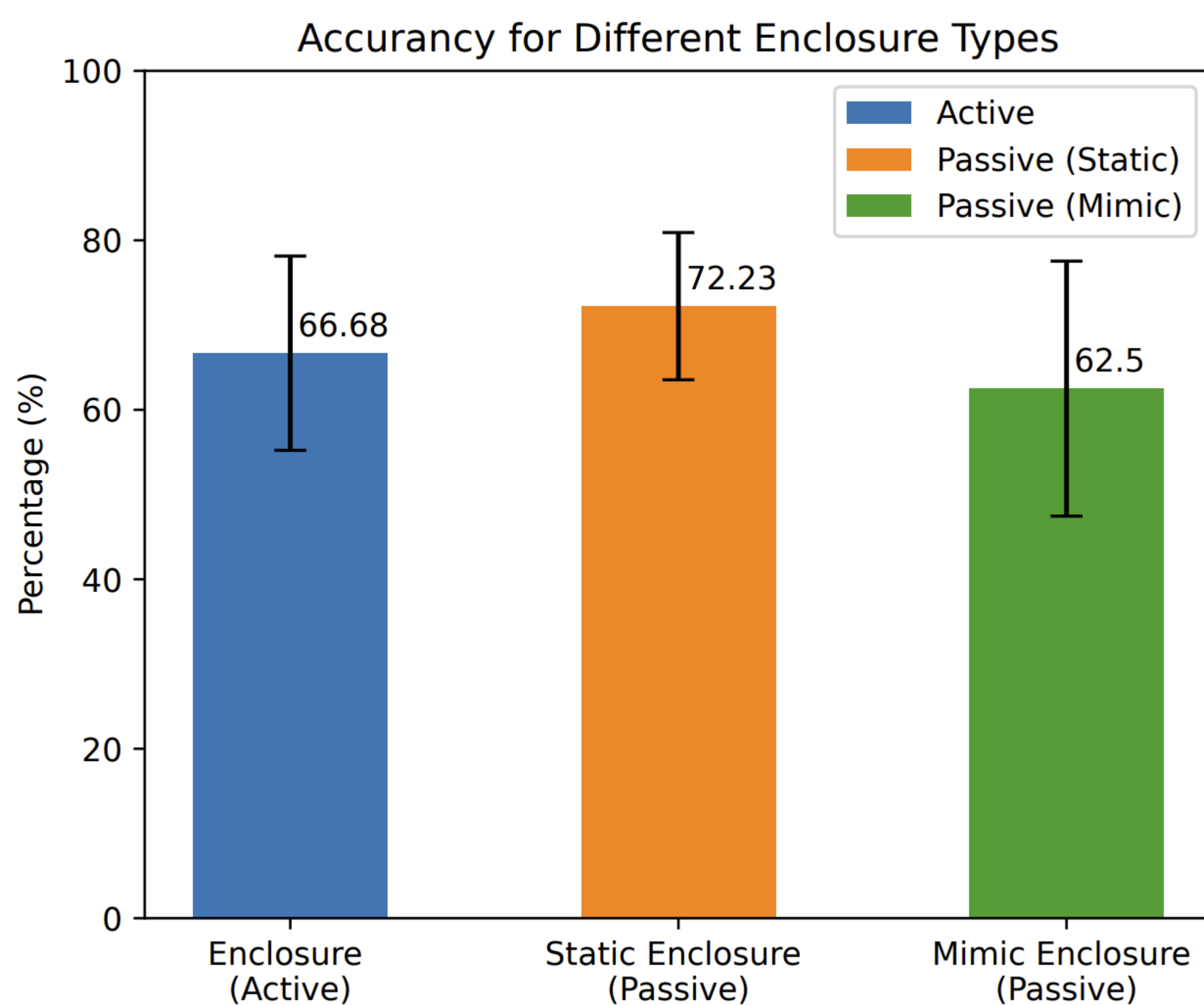College Station, TX, USA

Motivation

- Grasping is the most accurate strategy for determining the size of objects [1].
- Equivalency in performance of active touch between comprehensive haptic feedback and solely cutaneous feedback [2].

	Active touch	Passive touch
Haptic display glove — Cutaneous feedback	✓	✓
Hand and arm motion — Proprioceptive feedback	✓	✗
Virtual hand gesture — Visual feedback	✓	✓

Research question: What are effects of posture (proprioceptive haptic feedback) on perceptual acuity?

Hypothesis: Passive touch with stationary hand has the lowest performance due to the lack of proprioceptive feedback.

Preliminary results

Accurancy for Different Enclosure Types

- Active
- Passive (Static)
- Passive (Mimic)

66.68
72.23
62.5

Enclosure (Active) / Static Enclosure (Passive) / Mimic Enclosure (Passive)

Preliminary results of **mean accuracies** (4 participants):
- Active touch: 66.68%
- passive touch (static) : 72.23%
- passive touch (mimic) : 62.50%

Preliminary Conclusions & Future work

Conclusions
1. Unexpectedly, passive touch (static) yielded the highest accuracy.
2. Active touch outperformed passive touch (mimic) but was less accurate than passive touch (static).

Future work
1. Introduce tasks based on the JND (Just Noticeable Difference) principle to refine the assessment of size discernment capabilities.
2. Assess workload using the NASA TLX method.

Experiment Setup
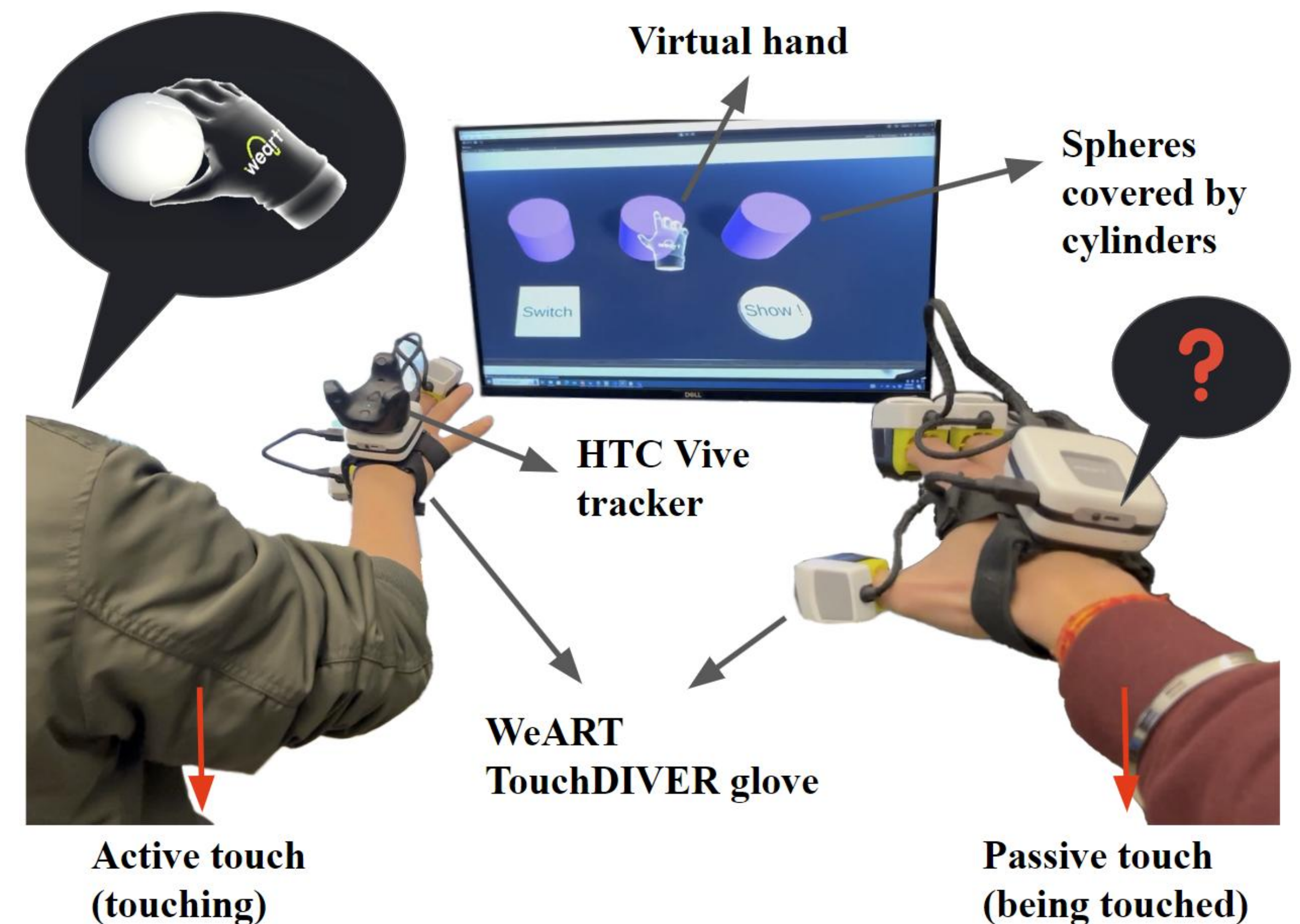
- **Left participant:** actively interacting with virtual objects built in Unity via haptic display glove (WeArt TouchDiver).
- **Right participant:** observing this interaction through the same monitor and feeling the identical feedback from the glove.

- **Switch button:** switch positions of these three balls.
- **Show button:** show the balls inside the cylinders.

Experiment Procedure

- ◆ **Participants:** 4 students (2 male, 2 female)
- ◆ **Task:** Answer "What's the size order of these balls?"
- ◆ **Condition 1 (Static)**
  - ➢ Active touch: actively grasping the balls inside the cylinders
  - ➢ Passive touch: **keep hand stationary**
- ◆ **Condition 2 (Mimic)**
  - ➢ Active touch: same with condition 1
  - ➢ Passive touch: **mimic the hand behavior**

References & Acknowledgements

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- D. Prattichizzo, C. Pacchierotti, and G. Rosati, "Cutaneous force feedback as a sensory subtraction technique in haptics," IEEE Transactions on Haptics, vol. 5, no. 4, pp. 289–300, 2012