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Locomotion and Interaction Mechanics in a Multiplayer Virtual Reality Environment

Background

- **VR** is now **consumer ready**

- Desire for **Social Aspect**

- **Locomotion** and **Interaction** create believable environments

- How do these translate to **multiplayer**?

- **Comfort**
  - Very easy to make users nauseated

- **Ease**
  - Should be intuitive, anyone can pick it up!

- **Consistency**
  - Users should share experiences

VIVE

unity

Player Avatar

- **Perception** is important

- Inverse Kinematics
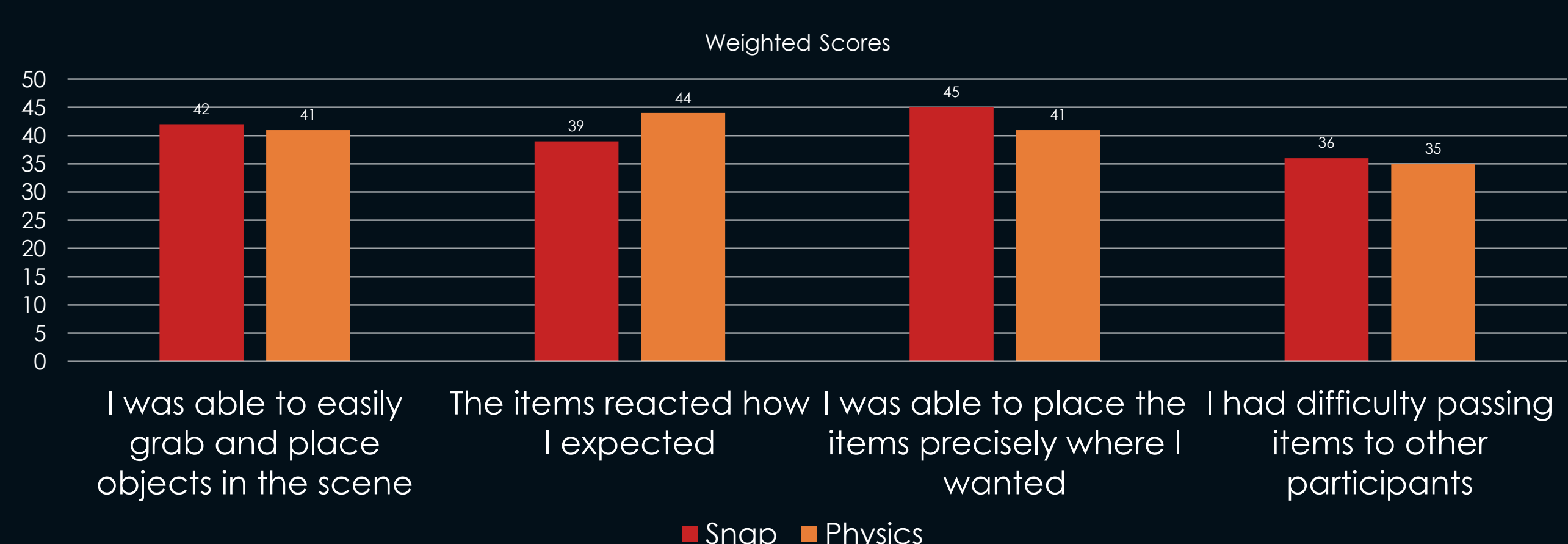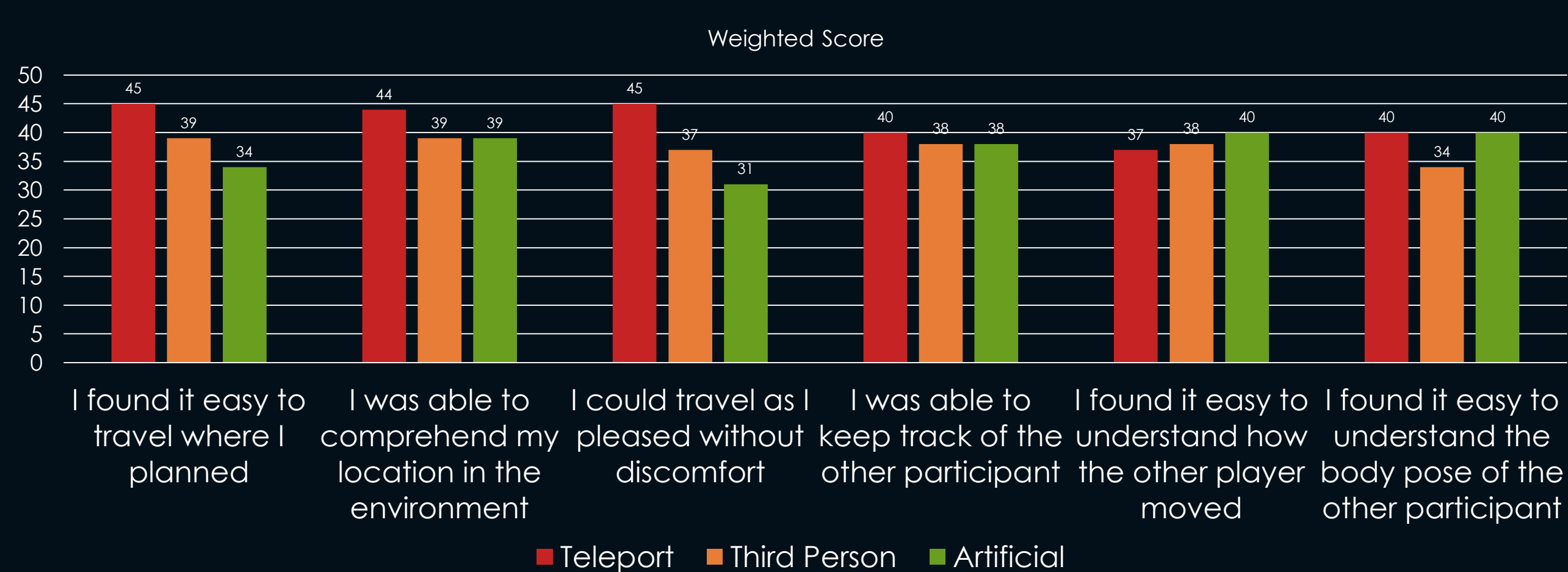
- Upper-Body only

- Client Authority
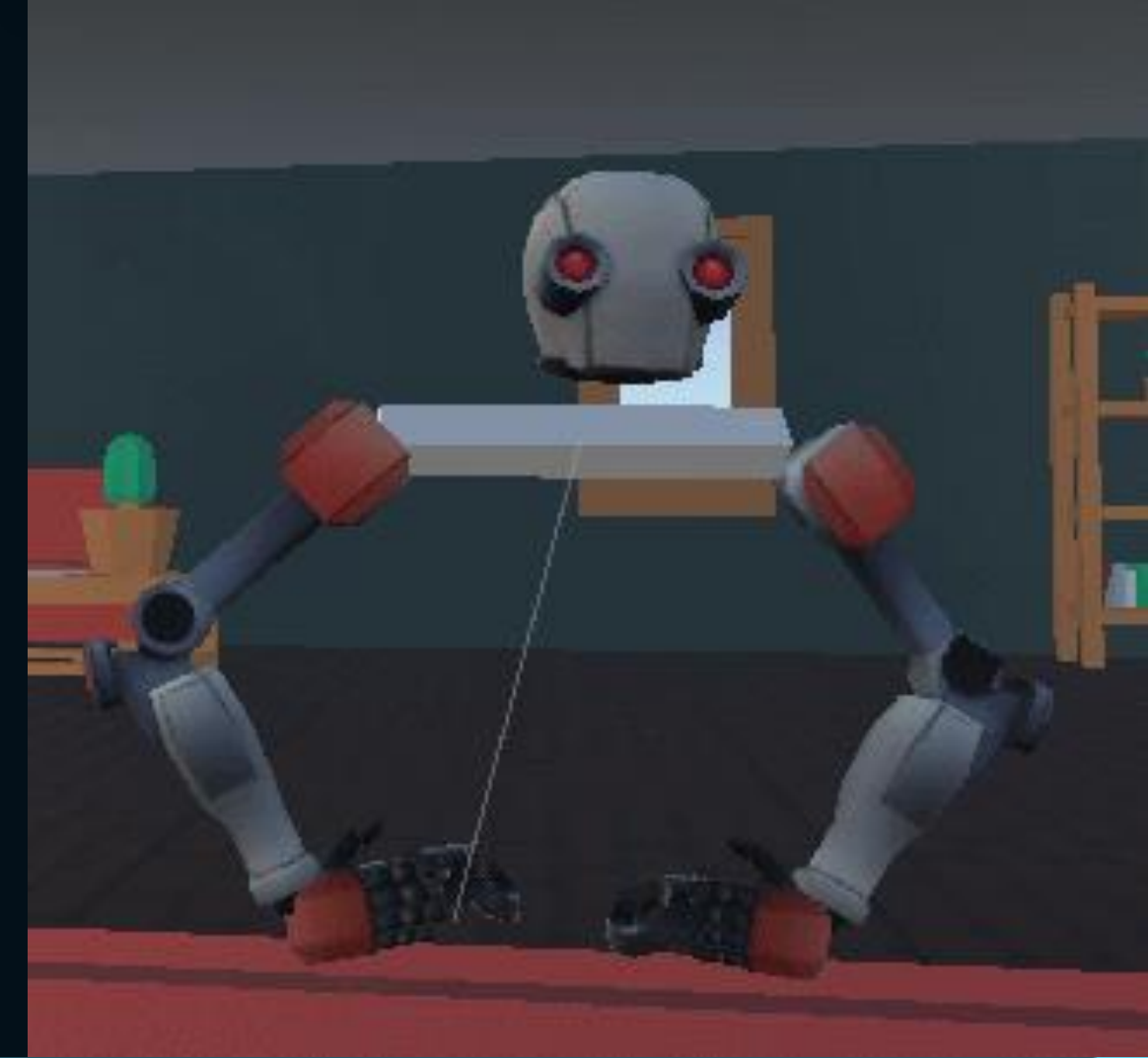
Locomotion

- **Teleportation**
  - Instant movement – **little to no nausea**!
  - Instant travel time – how does this affect observer?

- **Artificial Locomotion**
  - Involves Travel time
  - Slow movement to reduce risk of motion sickness
  - Conflict between eyes and vestibular system – **nausea**!

- **Third-Person Avatar**
  - Involves Travel time
  - Instant relocation
  - Different view for player and observers

Interaction

- **Physics-Based** Interaction
  - High degree of interaction
  - Intuitive – items react as expected
  - Distributed – clients control their own items
  - Lot of state to send over network

- **Event-Based** Interaction
  - Much smaller network overhead
  - Less reactive to environment
  - Suitable for specific applications (design)

Results

- **Preferred Locomotion**:
  - Teleportation was preferred by participants
  - Found it difficult to observe movement of other players
  - Fine control allowed for precision movement
  - Worked well for tile-based maze

- **Preferred Interaction**
  - Both interaction methods scored similarly
  - Reduced item interactivity with environment not an issue
  - Application-specific – bandwidth usage, precision

Weighted Score

	I found it easy to travel where I planned	I was able to comprehend my location in the environment	I could travel as I pleased without discomfort	I was able to keep track of the other participant	I found it easy to understand how the other player moved	I found it easy to understand the body pose of the other participant
Teleport	45	44	45	40	37	40
Third Person	39	39	37	39	38	34
Artificial	34	39	31	38	40	40

Weighted Scores

	I was able to easily grab and place objects in the scene	The items reacted how I expected	I was able to place the items precisely where I wanted	I had difficulty passing items to other participants
Snap	42	39	45	36
Physics	41	44	41	35

Test Scenario

- **Co-operative tests**

- **Maze**
  - Explores Locomotion
  - Users guide each other
  - Tests remote perception

- **Combinations**
  - Enter combination by interacting
  - Tests Interaction methods