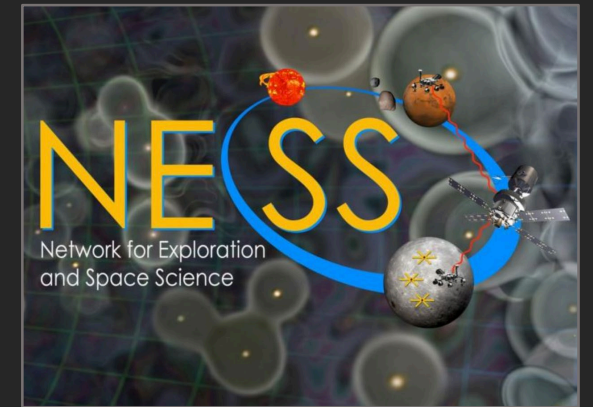




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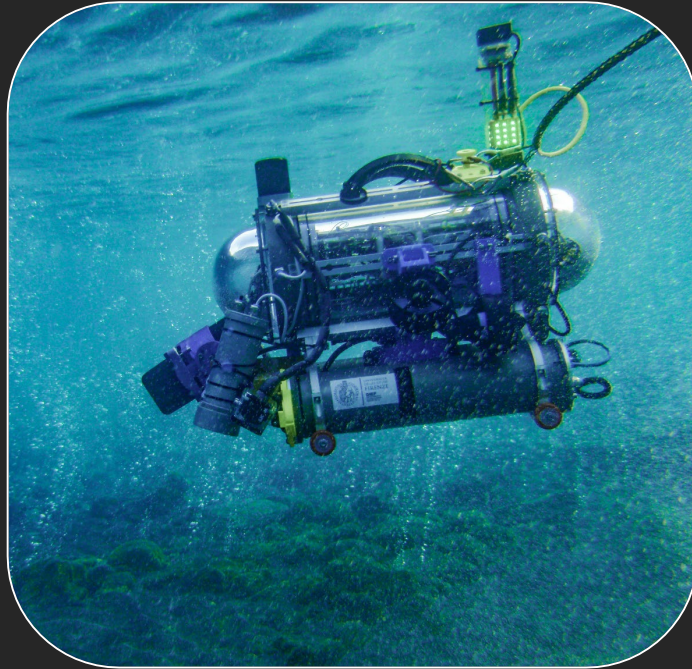
Virtual Reality Interfaces for Surface Telerobotics



Michael Walker, Jack Burns, and Daniel Szafir

CU Boulder NESS Team & Interactive Robotics and Novel Technologies Laboratory

The Field of Telerobotics



Robotic Advancements: Hardware

Robotic Advancements: Software

Robotic Advancements: Interfaces?

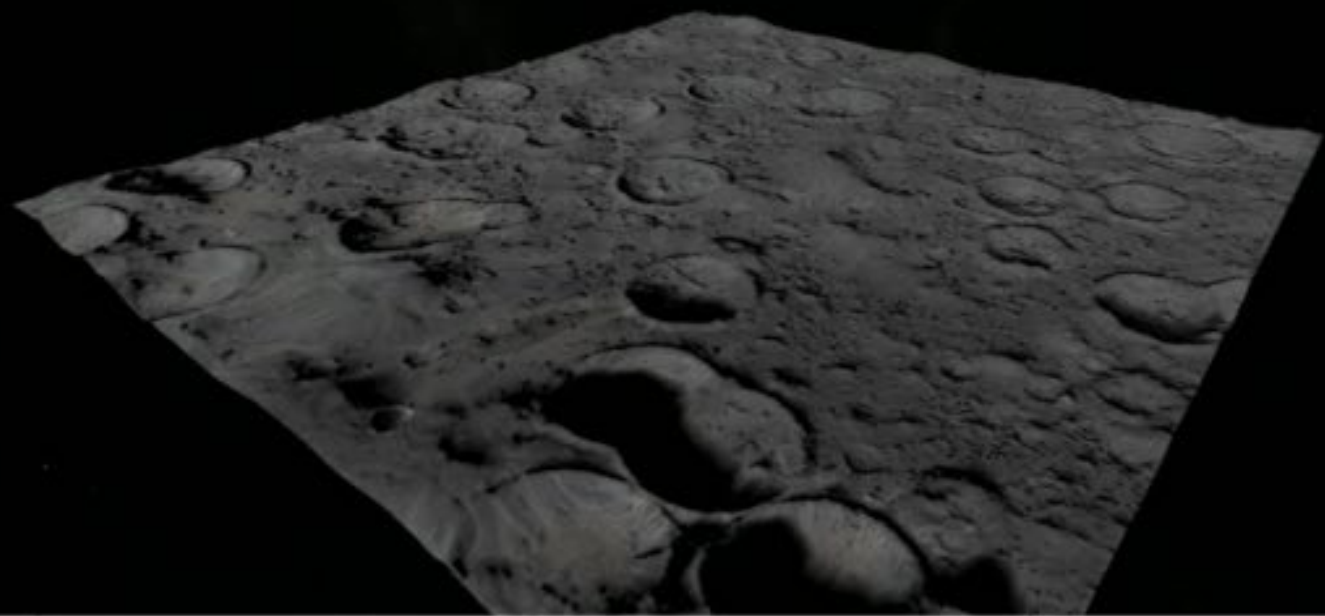


Virtual Reality Headsets

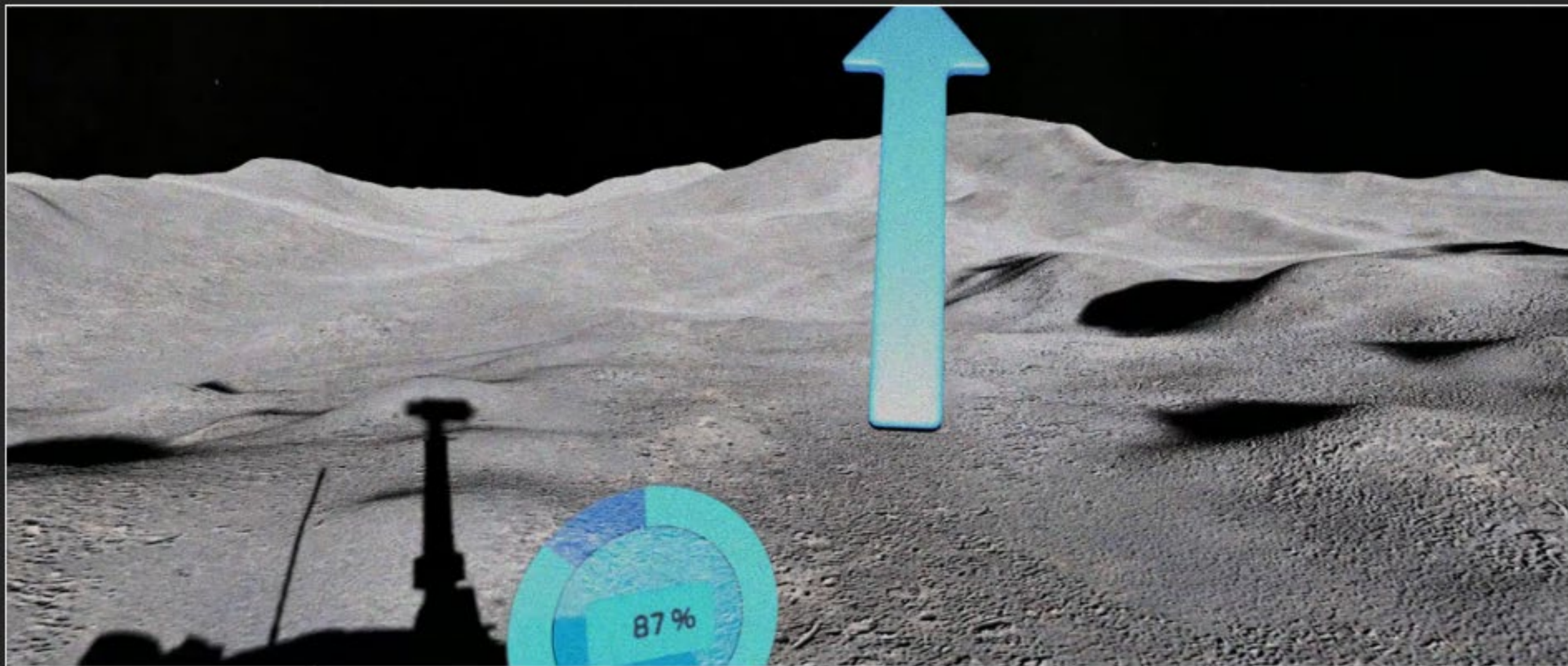


VR Headsets and Robots









Experiment: Traditional Interface vs. VR Interface



Experiment: Design

2 x 1 (Standard Interface or VR Interface)

Within-Subjects Design

12 Subjects

Gender: 10 Male & 2 Female

Average Age = 22

Evaluated over a series of robot teleoperation assembly tasks



Experiment: Apparatus & Environment

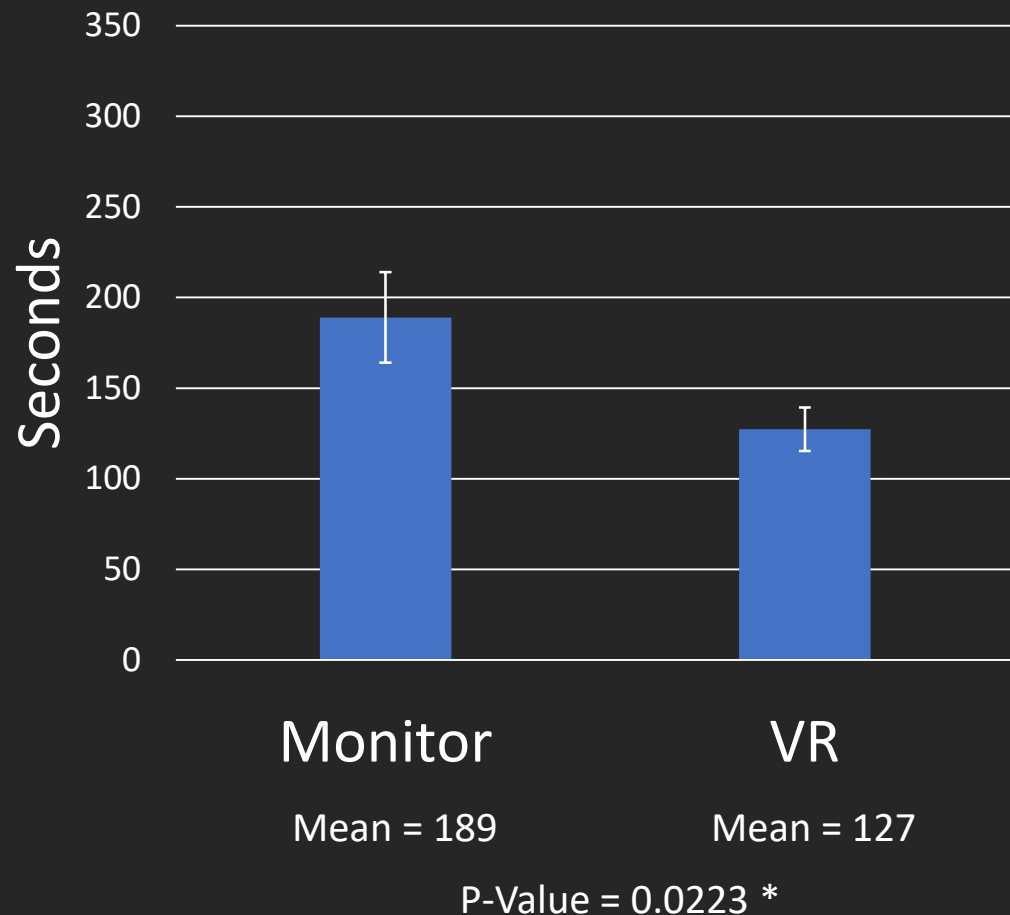


Experiment Task Two: Object Stacking

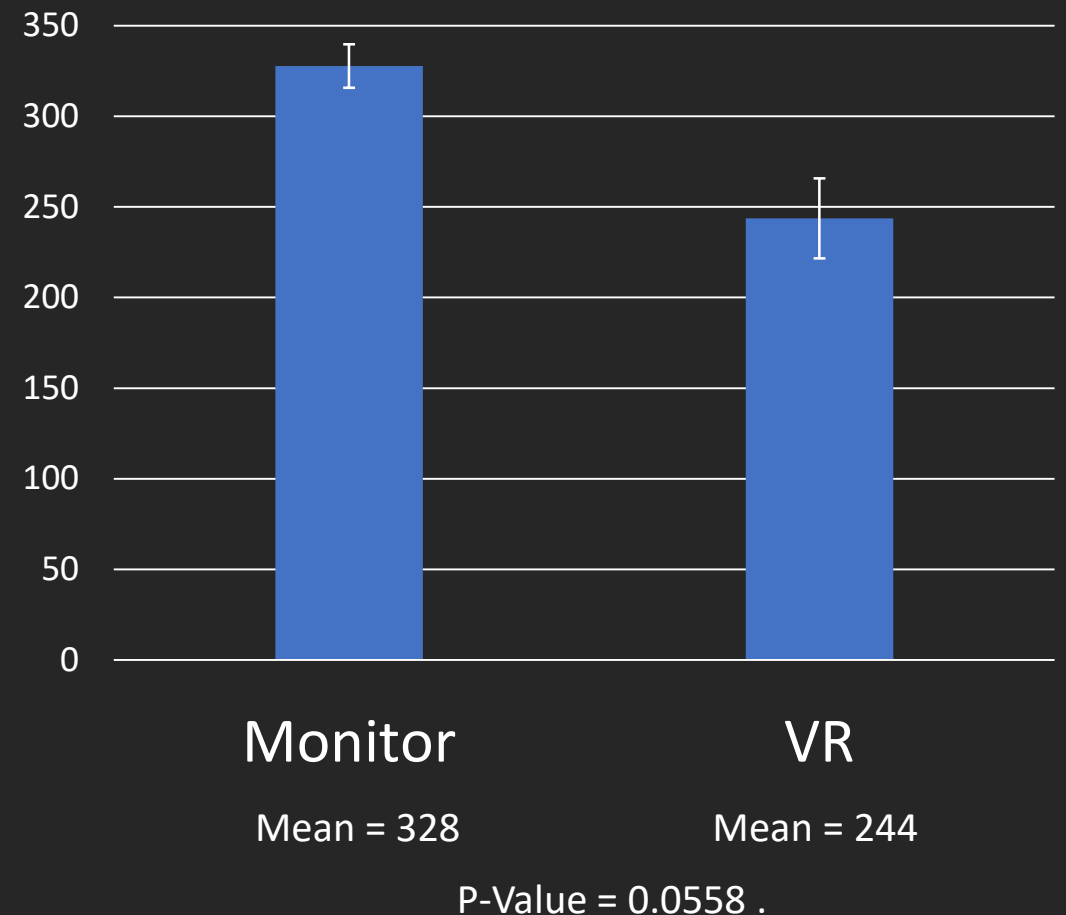
Experiment Task Three: Object Sorting

Stacking: Time to Complete

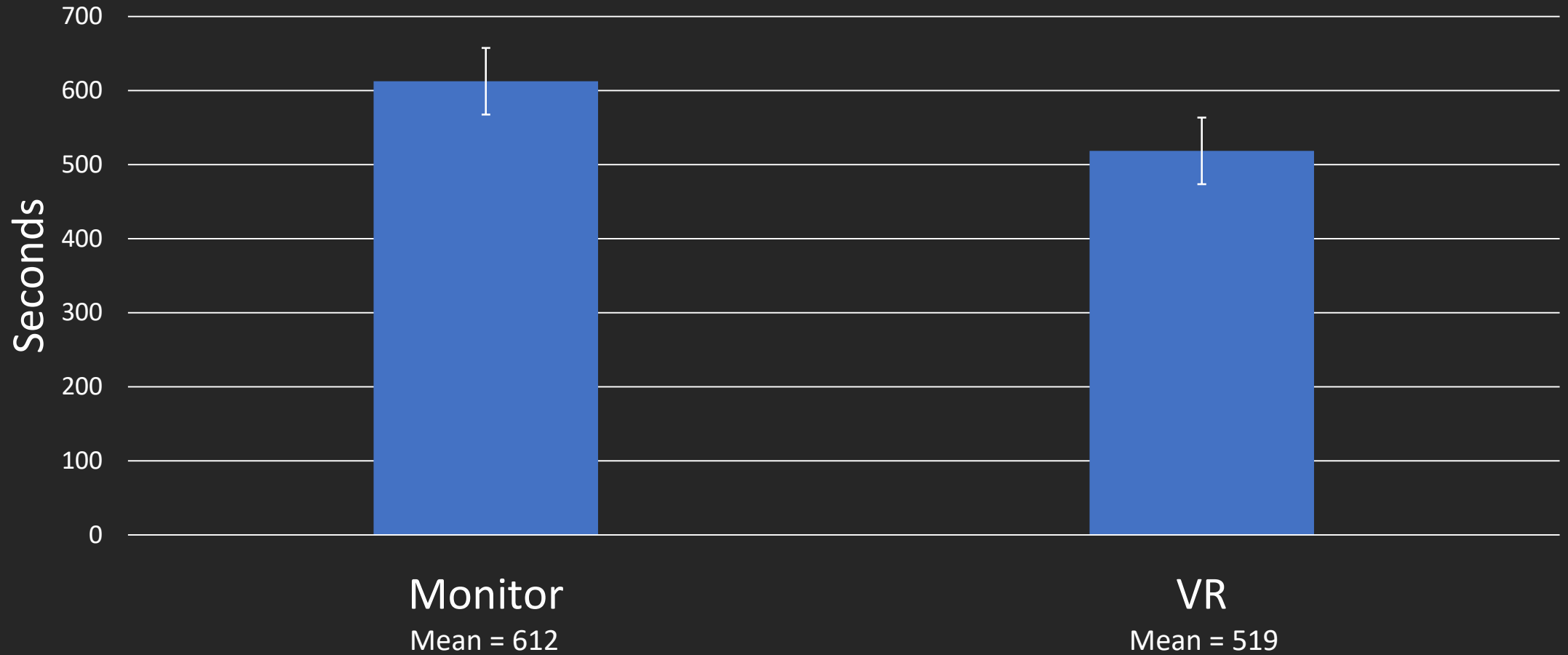
Cubes



Cylinders

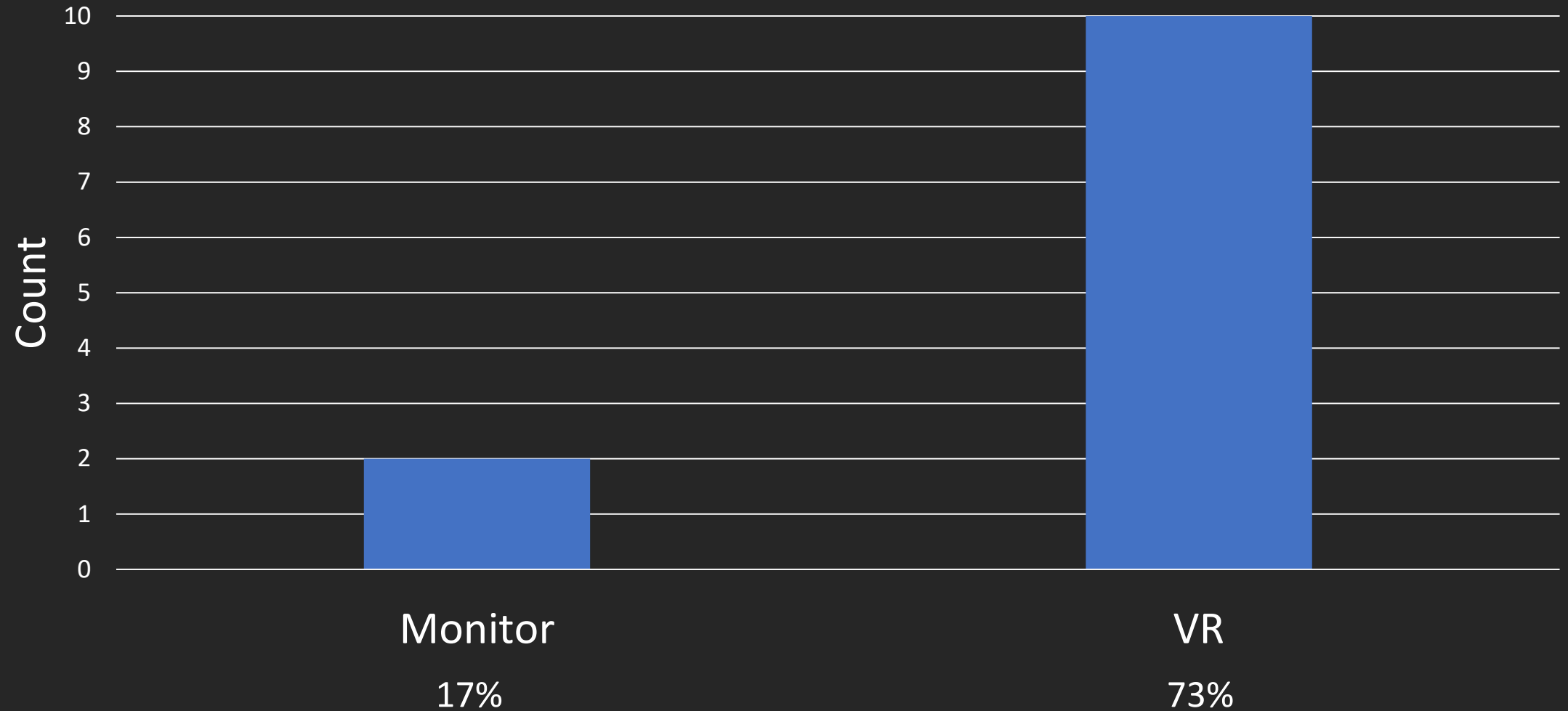


Sorting: Time to Complete



P-Value = 0.122

Overall Preferred Assembly Task Interface



Follow Up Experiments

Explore more complex VR interfaces

Body Tracking

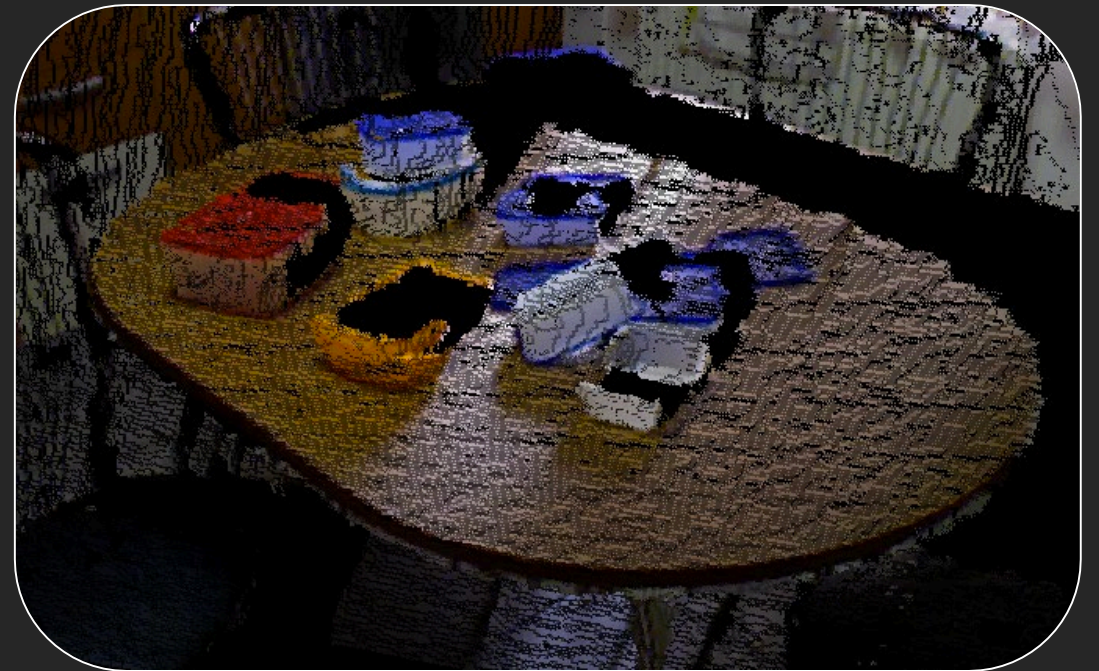
Head Tracking

Hand Tracking

Full-Body Tracking

Assistive Augmented Reality

Integration of Point Clouds



VR Telerobotics: Looking to the Future

Advance from VR Simulation to Teleoperation

Take Advantage of the Lunar Gateway

Prepare for Mars



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Thank You!

Questions?



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