Interfaces that scientists use to interact with planetary surface robots have not seen the same level of development and technological advancement as robot hardware and software. The design of robot interfaces has largely remained the same for decades, forcing scientists to view the rich 3D data returned by space exploratory robots on outdated 2D monitors.

**Motivation**

HMD Teleoperation Interfaces

Head-mounted displays (HMDs) operate in 3D and MR HMD technology advances have opened a new design space for robot teleoperation interfaces.

Immersive Teleoperation Interfaces

Stereoscopic displays built into HMDs allow operators to virtually embody the robot as if they're looking out of its 'eyes.' Immersion provided by VR HMD interfaces improves efficiency and situational awareness without increasing the workload of operators, even in multi-agent systems [Roldan et al. 2017].

Multi-Perspective MR Teleoperation Interfaces

Our research will examine multi-perspective MR HMD interface designs for lunar surface telerobotic missions:

- **Ego**centric Interfaces (1st person)
- **Exo**centric Interfaces (3rd person)

We hypothesize that interfaces with at-will switching between 1st and 3rd person perspectives will significantly improve telerobotic surface assembly and navigation operations.

**CU Boulder NESS Team’s Proposed Research**

Provide further justification for the inclusion of virtual reality (VR) and mixed reality (MR) infrastructure in future space missions leveraging concepts from the field of human-robot interaction.

**Conclusion**

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