

The Effectiveness of Augmented Reality for Astronauts on Lunar Missions

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Introduction

The uses of Augmented Reality (AR) and Head-Up Displays (HUDs) are becoming more prominent in industries such as aviation, automotive and medicine.

An AR device such as the Microsoft HoloLens can project holograms onto the user’s natural field of view (FOV) to assist with completion of a variety of tasks. Future lunar missions could incorporate AR for astronauts to ease task load and improve accuracy.

The study evaluated the usability, subjective workload, and task performance of using the Microsoft HoloLens to complete tasks that are analogous to those completed by astronauts on a lunar mission, including navigation, rock sample collection, and maintenance tasks.

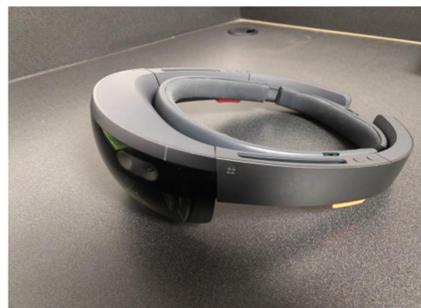


Figure 1. Microsoft HoloLens.

Procedure

The study consisted of three astronaut tasks. The tasks were displayed in the form of checklist holograms to the user. These were as follows:

- Navigation to the lunar base and conducting maintenance on a bacteria filter component. The user followed the checklist hologram (Figure 2) to conduct the maintenance task.
- Navigation to a specific crater and collecting a rock sample (Figure 3).
- Navigation to a specific crater and initiating a call to mission control using the Remote Assist application for guidance on a rock sample collection task (Figure 4).



Figure 2. Astronaut maintenance task.



Figure 3. Astronaut rock sample collection task.

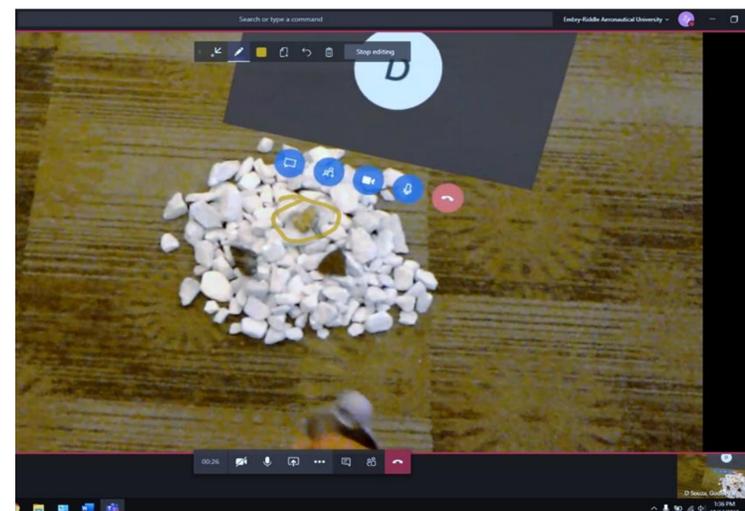


Figure 4. Remote Assist function.

Summary of Results

The results from the tests conducted showed that AR in the space industry can possibly help and benefit astronauts by providing procedural task information and thus reducing error (Braly, Nuernberger, & Kim, 2019).

The results showed improvements from Mission 1 to Mission 2 in task performance, workload, and usability among the participants (Figure 5). Participants showed a decrease in overall workload, reduction of task errors, and positive usability of the device and UI.

The researcher concluded that an interactive AR checklist helped in task performance, which included information access, and reduction of error (Neumann & Majoros, 2002).

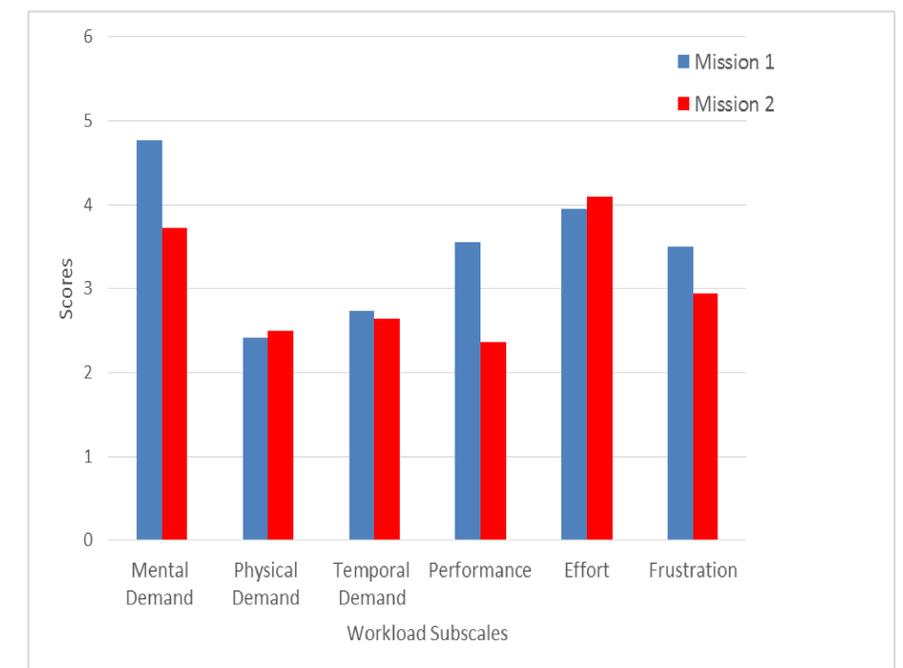


Figure 5. Participants’ NASA TLX in Mission 1 vs. Mission 2. Note: Performance was rated from 1 (Perfect) to 20 (Failure).

References

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