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CHALLENGES OF ASTRONAUT INTERFACES WITHIN MEDICAL SYSTEMS

Abstract

The rapidly changing profile of astronaut crews and increased remoteness of planned long-duration human spaceflight (LDHSF) missions require new approaches to designing onboard medical systems and astronaut interfaces. Inflight medical capabilities will need to be increased, and new approaches to human-system integration of onboard intelligent systems developed. The role of human-centered design in creating intuitive and inclusive support ecosystems that could play a pivotal role in the future of human spaceflight, especially when it comes to increasing crew autonomy and decision making. Although significant breakthroughs have been made in the understanding of risks and in their probabilistic modeling, there are significant gaps remaining in "closing the loop" with the crew, including interface usability, inclusivity, and intuitiveness. Emphasizing a human-centered approach early, during mission formulation and design, is required to decrease the risks of inadequate human system integration within human-agent interactions. "Human beings make mistakes because the systems, tasks, and processes they work in are poorly designed" (Dr. Lucian Leape, MD). On future LDHSF, the Cyber-Physical-Human (CPH) teams will rely more than ever before on the human-centredness of design, design of trust, and trustworthiness of the medical systems within User Experiences and User Interfaces. The design of future cyber-agent interfaces and the nature of the human-machine interactions are of paramount importance to minimize risks, improve the crew's safety, and decrease mission costs. In this paper, we systematically discuss the emerging challenges of astronaut interfaces within medical systems, multi-modality of interfaces, including touch interfaces, Augmented Reality (AR), Virtual Reality (VR), and voice-controlled agents, in the context of human-centered design, and three-dimensional trust: human¿agent, agent¿human, and agent¿database.

Keywords: human-centered design, astronaut interfaces, crew interfaces, medical systems, human-system integration, human spaceflight, design for safety