EUROPEAN MARS SOCIETY COFERENCE

14-16th October 2016

Human Factors for Mars

Irene Lia Schlacht[1], Antonio Del Mastro[2]

[1] *PhD, Human Factors Studies coordinator - Italian Mars Society,*
irene.schlacht@mail.polimi.it - (+49 176 3588 2695, +39 320 316 8723)

[2]*Antonio Del Mastro, Director Italian Mars Society*
segreteria@marssociety.it

Here, the latest Human Factors and Habitability research of the Italian Mars Society performed in the context of virtual reality mission simulations will be presented, along with applications in common contexts.

How can interior design, tools, procedures, or nutrition improve the health, safety, and efficiency of the crew? Can variables such as work scheduling, sleep cycles, leisure time, and communication be modified to improve team performance? These are the questions NASA uses to explain what is addressed by Human Factors and Habitability research. Specifically focusing on more long-term/long-distance missions such as the recent Moon Village project of ESA or the Mars missions of NASA, these variables become crucial primarily with regard to human safety. However, research on human factors also has strong applications to improve safety and quality of life in our daily life context.

Well aware of the importance of Human Factors and Habitability research, the Italian Mars Society has been performing Human Factors and Habitability research during V-MARS virtual mission simulations, a virtual simulation system developed to test possible missions to Mars, including rescue procedures.

Here, the research projects will be presented:

1. The first research project investigates how to increase trustworthiness in virtual reality.

2. The second research project aims to test a Human Factors debriefing procedure in a virtual reality scenario.

3. The third research project is scheduled for December 2016 and will implement a treadmill to increase the performance of the virtual reality system and will also investigate physiological and biomechanical aspects.

The first Human Factors research project considering mainly the application of virtual reality (VR) for safety, entertainment, and education purposes verified how to increase trustworthiness in virtual reality to perform scientific applications. In this particular case, a Mars mission test was performed in two scenarios with different results. The first scenario was in Bergamo Scienza with public access to the simulation for volunteers. In this context, there were 17 volunteers, mostly under the age of 35, and the entertainment aspect came out stronger than the others. A first mission of this kind was held at Madonna di Campiglio with selected and trained users in a restricted environment; here, the scientific purpose was also to test VR treadmills developed for this research. Comparing these experiences, it was concluded that in order to increase trust and scientific application in a virtual reality simulation, key factors might include not only the system itself but also the real environment where the system is used, as well as the selection and training of the users. The results were presented at HAFE 2016.

The further development of the research project is a human factors debriefing procedure aimed at letting the crew find problems and solutions regarding human-system interaction autonomously, considering that in long-duration and long-distance missions, the capacity of the crew to solve problems autonomously will be the most important element. The methodology uses a holistic approach to take into account socio-cultural, psychological, operational, environmental, and physiological aspects. The main problems and solutions referred to increasing the quality of the system, the tasks, and the equipment. Operational

aspects emerged as the most frequently discussed problem; in particular, in the past experiences “Motivity” was the most frequently recurring word associated with “uncomfortable”. The proposed solution was to get strong involvement from the crew in the design development of the new VR mission and involvement of the overall team in testing the system prior to the mission. The results of the research carried out till now were presented at HAFE 2015 considering the comparison of result with other methodology applied for debriefing and training on dangerous environment on earth.

On the basis of these results, the Motivity system will be strongly improved, in terms of both comfort and performance. In particular, as a further human factors investigation, the Italian Mars Society is establishing synergy with biomechanical and physiological research to be performed on a treadmill while experiencing a VR mission simulation. An update both in the hardware and in the software of the system enabling the VR simulation of low gravity while walking on a treadmill is the next task to ensure optimization of the simulation experience and to allow higher quality of the test and the training application. Our first research on this sector was published on AHFE 2016.

In conclusion, the research projects presented here illustrate the scope of the activities of the Italian Mars Society focused on Human Factors for virtual reality applied to a Mars mission simulation. In particular, the main issues investigated in the past research projects and which will be further analyzed in future developments were related to increasing the trust of the user in the virtual reality system, increasing the overall user-system interaction, and improving the virtual reality simulation. These first results can be applied to increase performance in Mars missions as well as in common and scientific contexts. Further investigation foreseen in the future could give statistical relevance to the results.