Humanitarian Technology: Science, Systems and Global Impact 2016, HumTech2016, 7-9 June 2016, Massachusetts, USA

ANSIBLE: Virtual reality for behavioral health

Peggy Wu*¹, Jacquelyn Morie², Pete Wall³, Tammy Ott³, Kim Binsted³

¹SIFT, LLC, 319 N 1st St Suite 400, Minneapolis, 55401 USA
²All These Worlds, LLC, 2036 South Oxford Avenue Los Angeles, CA,90018 USA
³University of Hawaii at Mānoa, 2500 Campus Rd., Honolulu, HI 96822 USA

Abstract

We describe a virtual reality telecommunications ecosystem developed under funding from NASA entitled ANSIBLE: A Network of Social Interactions for Bilateral Life Enhancement. ANSIBLE is a communication support toolset which enables multi-faceted human-human and human-virtual agent interactions designed to accommodate technical and environmental limitations of long duration space flight. The primary objectives are to address communication limitations and provide telehealth options to combat behavioral health threats in future long duration exploration class missions. The system is current being evaluated in a human subject study that takes place at the Hawaii Space Exploration Analog and Simulation (HI-SEAS) facilities in Waimea, HI. There, an international mixed gender group of scientists are undergoing adjustments in physiology and lifestyle that are analogous to some of the challenges in a confined environment over twelve month isolation mission under Mars-exploration conditions (e.g. with communication latencies and blackouts, in close quarters, under restricted water and energy use). Preliminary analysis show that the ANSIBLE treatment group scored better perceived social closeness and perceived relationship satisfaction in self-report surveys compared to a control group who participated in a prior eight month isolation mission in the same facility and used only conventional asynchronous communication methods (i.e. email, voice and video recordings). In the real world, verbal interactions go hand-in-hand with interactions with tangible things. Virtual items can be called upon to serve as powerful and meaningful aides for communications. We posit that the observed increase in social connectedness is due to the affordances of VR, where situational contexts that are often not communicated in traditional telecommunication are made explicit in the virtual world.

1. Introduction

Future manned exploration class spaceflight missions beyond lower Earth orbit present unprecedented challenges in engineering as well as the psychological support to future astronauts. An estimated network latency of 22 minutes each way will impact communications between Space and Earth, which in turn will influence the crew’s autonomy. The potential no-abort and no-resupply scenario can add to anxiety and stress during a two and a half to three year mission to Mars. Evidence from historic spaceflight and analogs such as research stations in Antarctica also suggest that prolonged durations of social and sensory monotony can adversely impact psycho-social health (see [1] for review). While sensory monotony is not sensory deprivation or sensory loss, sensory deprivation and sensory loss have been linked to changes in communication and psychosocial skills (e.g. [2] and [3]). Asynchronous (i.e. non-real time) communication technologies are currently limited to email and instant messaging. Communications often go hand-in-hand with tangible objects and environmental contexts. Limiting the persistence of all interactions in telecommunications to text, voice, or video is unnatural, but VR can unleash new dimensions of interaction that allows for shared manipulation of objects and shared experiences, leading to increased shared mental models and social...
connectedness, which facilitate efficient communication. We describe A Network of Social Interactions for Bilateral Life Enhancement (ANSIBLE), a persistent world used in an ongoing experiment at a Mars surface simulation facility involving an international crew of six individuals conducting a twelve month isolation mission [4].

2. Method

We began the design process by performing an extensive literature review of real-world stimulus and experiences that have been shown empirically to improve psychological wellbeing. We then categorized possible content and strategies, and evaluated the feasibility of implementing them in a virtual environment. Sample categories include nature-inspired scenes for combating sensory monotony, virtual agents as actors for combating social monotony, opportunities for calling positive memories and reflecting on gratitude, participating in cultural and familial rituals, creating shared experiences, perceiving work as meaningful, and capabilities for creative pursuits.

![Fig. 1. Nature inspired virtual environment implemented in ANSIBLE where subjects can visit independently or with others.](image1)

![Fig. 2. Simulated Mars astronauts leaving messages for their friends and family around a festive dinner table.](image2)
We implemented functionalities and content in a persistent virtual world that is robust to network outages and delays using the results of the literature review and feedback from astronauts and other NASA personnel. We also deployed ANSIBLE at a Mars surface simulation facility and to conduct a formal study with a group of scientists, who began their 12 month isolation mission in August, 2015.

The group of individuals living within the habitat consists of a mixed gender team of six scientists. They perform exploration tasks such as geological field work and life systems management while isolated on the Mars-like northern flank of Mauna Loa on the island of Hawaii, 8200ft above sea-level. Communications to those outside the habitat are delayed to simulate conditions on the Mars surface and they primarily use email to maintain connection with the outside world, including heavy reliance on Mission Support to process information requests. The conditions (habitat, mission profile, delayed communication, partial self-sufficiency) are explicitly designed to be similar to those of a planetary surface exploration mission. Daily routines include food preparation from only shelf stable ingredients, exercise, scientific research, geological field work carried out by humans or robots, equipment testing, and tracking resource utilization such as food, power, and water. These rigorous routines support a suite of innovative behavioral and psychological tests and tasks performed through funding by NASA. The purpose of the study described in this paper is to evaluate the impact of a persistent virtual world in facilitating asynchronous communications as measured by social connectedness and satisfaction of social relationships to individuals living outside the habitat.

In an eight month isolation mission conducted at the same facility, we collected data from a control group, which included six crew members and eight family and friends. Participants used traditional asynchronous communications (i.e. email and delayed instant messaging) to communicate with each other. In the ongoing ANSIBLE group, we recruited six crew members and a total of thirty three friends and family members who used traditional asynchronous communications as well as the ANSIBLE virtual world to communicate during the twelve month isolation mission. ANSIBLE uses OpenSimulator, an open source multi-platform multi-user 3D platform, to host over twenty 3D regions. To simulate the effects of a network latency, we used a dual server architecture with the “Space” server residing within the habitat and the “Earth” server at a remote site. The servers are synchronized at the end of each day, thus “Space” participants and “Earth” participants cannot log in simultaneously. Crew members and family/friends answered weekly questionnaires regarding their social connectedness and satisfaction with each other.

3. Results

We examined two questions from the Circles of Closeness Survey [5, 6, 7] comparing the first 150 days data from the control and ANSIBLE group: “How close do you feel to your family/friends”, and “How satisfied do you feel with your family and friends”. For the first question, the ANSIBLE group reported feeling greater closeness to family and friends (M=1.5) than the control group (M=0.5), F(1,109.7)=5.5, p<.05. For the second, the ANSIBLE group reported greater satisfaction with their family and friends (M=3.1) than the control group (M=1.3) F(1,24.1)=4.9, p<.05. It is worth noting that although crew members can log onto ANSIBLE simultaneously, we did not expect to find any communication or social connectedness benefits, and this was supported in the data as no significant effects were found in the crew’s answers to “How close do you feel to other crew members”.

4. Discussion

The results suggest that the use of virtual environments can improve social connectedness over email and delayed instant messaging, a concept that is relevant for real time and asynchronous communications [8, 9]. Based on anecdotes from participants and observations of their behaviors in the virtual world, we speculate that increase social connectedness occurs because virtual reality technologies enable individuals to utilize virtual environments and artifacts to build a common situational understanding implicitly, something that difficult to achieve through traditional means of tele-communications. Virtual Worlds create a synchronized, common meeting place that geographically separated individuals share, allowing them insight into the situational context and background information that is often not explicitly communicated, but nonetheless important to convey the underlying message. This is the essence of the enhanced communication modalities that can be provided through virtual environments.

Acknowledgements

The above work was sponsored by NASA’s Human Research Program under contract #NNX14CJ06C. We would like to thank NASA personnel Lauren Leventon, Laura Bollweg, Jason Schneiderman, Diana Arias, Brandon Vessey, Al Holland, and Ron Moomaw for their oversight and direction. We would also like to thank the HI-SEAS crew members and their family and friends for their support.
References