Robotic Companion for Long Term Isolation Space Missions

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ABSTRACT

We tested robotic companions for their ability to reduce stress and create emotional bonds in the event of a Mars analog space mission. Two different robotic companion platforms were programmed with aggressive and passive personalities and given to crew members for a three-day evaluation. Surveys and feedback from crew members were used to evaluate the effectiveness of the robots? ability to reduce stress. Personality traits were examined in terms of the robots? Ability to create positive interactions with the crew. Utilizing this information, a new behavioral model is proposed that will provide sufficient complexity and adaptability for a robot companion to interact successfully with humans, and to create emotional bonds and mitigate distress in crew members.

HI-SEAS MARS ANALOG

The Hawaii Space Exploration Analog and Simulation (HI-SEAS) habitat is a dome (36 feet in diameter) with two floors. The main floor consists of a work area, kitchen, dining room, laboratory, and bathroom. It is attached to an 8-square-foot airlock that is connected to a 20-foot sea container. There is a portion of the dome blocked off by a back door. This area contains a washer and dryer and the networking/telemetry room. The first floor has 878 usable square feet, with a total of 993 square feet. (1)

PLEO ROBOT COMPANION

Pleo is modeled after a one-week-old Camarasaurus, a plant-eating sauropod from the late Jurassic period. By studying fossil records of this giant herbivore, and recreating animal motion with technology, INNOVOLABS created this robotic companion to interact with its users in a passive or assertive manner . (2)
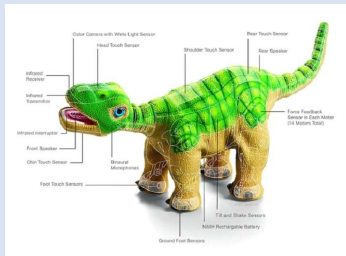
ROMIBO ROBOT COMPANION

Romibo is programmed to be a passive or demanding robotic companion. It demands attention aggressively through a verbally request to be pet If these demands are not met, Romibo will verbalize its needs more insistantly. (3) In its passive mode, Romibo will purr and blink to request attention from the user.
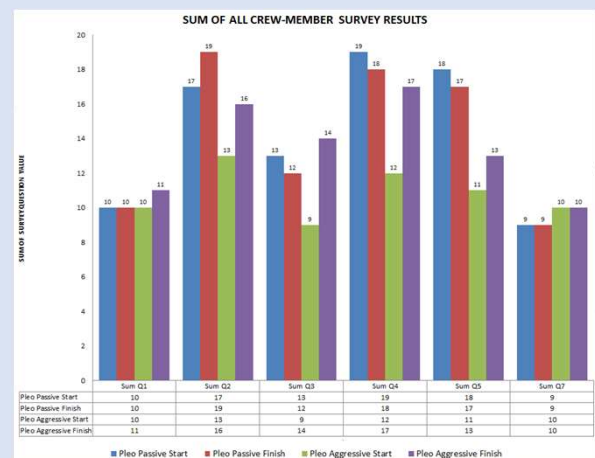

EXPERIMENTAL DESIGN

Robot companions are assigned to each member of the crew for a period of three days. Data for this experiment is in the form of recording the time and duration of human interactions with the robots. A detailed survey at the start and end of the three-day assigned period with each robot companion. This survey assesses whether the crew member had a positive or negative interaction with the robotic companion. It asks crew members to specifically talk about features of the robot companion that they liked or disliked. Finally a Positive and Negative Affect Schedule (PANAS) (4) survey is used to monitor the general mood of the crew member interacting with the robot. The crew is also given a set of long answer questions asking about their interaction with the robot. Please see the conference publication for details.

RESULTS AND CONCLUSIONS

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Overall, the changes in attitude and emotional bonding towards the robotic companion were small but present. There was a general trend toward having a slightly more positive view of the companions, and emotional changes moved in a positive direction. The aggressive-style personalities risked taxing the crew members quickly, and interactions seemed to produce more negative emotion. Passive personalities showed a greater increase in positive interactions and emotions toward the companion. The crew was highly engaged with the companion over a short period of time, and the limitations in behavior caused the crew members to lose interest. The fact that the crew did not continue to interact with either of the robotic companions after the assigned period indicates a lack of overall interest in the companions due to a lack of capabilities and simple behavior.

SUM OF ALL CREW-MEMBER SURVEY RESULTS

	Sum Q1	Sum Q2	Sum Q3	Sum Q4	Sum Q5	Sum Q7
Pleo Passive Start	10	17	13	19	18	9
Pleo Passive Finish	10	19	12	18	17	9
Pleo Aggressive Start	10	13	9	12	11	10
Pleo Aggressive Finish	11	16	14	17	13	10

■ Pleo Passive Start ■ Pleo Passive Finish ■ Pleo Aggressive Start ■ Pleo Aggressive Finish

REFERENCES

(1) Hawaii Space Exploration Analog and Simulation (www.hi-seas.org)
(2) www.pleoworld.com
(3) Origami Robotics: twitter.com/origamirobotics
(4) Crawford, John R.; Henry, Julie D. "The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample". British Journal of Clinical Psychology. 43 (3): 245–265