Simulating Mars on Earth: Measuring Crew Function and Performance at a Mars Analog

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Our goal is to understand how humans survive and succeed in settings that have extraordinary physical, psychological, and interpersonal demands that require significant human adaptation for survival and performance.

Our chapter is focused on conducting research in this area, connecting with men and women who live and work in extreme environments, and providing “extreme” experiences to our members.
1. Define a research problem
2. Design a study
3. Apply ethical principles in study design
4. Conduct the study
5. Analyze data and develop sound conclusions from the results
6. Communicate results
Psychological challenges of long duration space flight
- Prolonged isolation
- Variable levels of workload
- High levels of stress
- Crew interactions
  • Currently no way to routinely measure the function and performance of space crews
Overall Study Purpose

- Research experience for undergraduate students
- Conduct studies in an accurate Mars analog
- Answer questions necessary for successful future long duration space flight missions
Chosen Analog
Method

- 7 participants
  - 3 male, 4 female
- 2-weeks at space analog
  - Mars Desert Research Station
- Each student conducted their own study
Effects of Gaming on Stress and Anxiety

Research problems:
› Do multiplayer games improve mood more than single player games
› Do electronic games provide more benefits than non-electronic games.

Method:
› Profile of Mood States (POMS)

Results:
› Overall mood increased
› Tension decreased on Game days
› Small sample size

Conclusion:
› Games seem to be effective coping method, further research needed.
Research problem:
› Can exercise reduce stress and improve mood in an isolated and confined environment?

Method:
› Varied low- and high-intensity workouts over 2 weeks, participants completed mood survey (POMS)

Results:
› Mood not significantly affected by exercise intensity
› Similarities between most crewmembers
› According to personal interviews, crewmembers enjoyed the high intensity workouts

Conclusion:
› Additional research with larger sample needed
Research problems:
› Does music affect stress while in an isolated and confined environment
› Do different music genres produce different effects?

Method:
› POMS, Perceived Stress Survey (PSS), Heart Rate, and Blood Pressure

Results:
› Slight variability in HR and BP over time, no clear patterns

Conclusion:
› Additional research with introduction of other genres and larger sample
Effect of Horticulture Activity on Stress

Research Problem:
- Does horticulture activity affect stress levels in an isolated and confined environment?

Method:
- Experimental group received 1hr of active horticultural activity session over 2 weeks and completed POMS, HR, BP

Results: V
- Variability in HR and BP, but no clear patterns

Conclusion:
- Additional research is needed to increase the sample size
Sleep Patterns & Fatigue in an Isolated & Confined Environment

Research problem:
- Do sleep patterns change between normal environment to an isolated and confined environment?

Method:
- Three stages of data collection: before, during, and after MDRS
  - Actigraphs, sleep journals, Pittsburg Sleep Quality Index (PSQI), activity logs, POMS

Results:
- Moderate differences between crewmembers
- Different levels of fatigue were present among crewmembers
- Extreme changes in sleep performance when environments were altered

Conclusion:
- Further research will be conducted with additional samples
Research problem:
- Does the design of a habitat affect mood and perception of the environment?

Method:
- Questionnaire, interviews, observations at beginning, middle, and end of mission

Results:
- Environmental factors were significant
- Negative observations about color
- POMS data variable, small sample size

Conclusion:
- Additional research, including analysis of crew quarters, is needed
Research problem: Currently no way to monitor crew function in real-time during spaceflight

Method: Administered questionnaires in evenings
- Group Environment Scale (GES)
  - Team cohesion
- Work Environment Scale (WES)
  - Team productivity
- Profile of Mood States (POMS) & Positive and Negative Affect Scale (PANAS)
  - Mood
- Perceived Stress Scale (PSS)
  - Stress

Results: The POMS and PSS showed fluctuations well. The GES and WES also showed fluctuations but they are currently too long.

Conclusion:
- POMS and PSS will be added to P-STAT
- Some items from the GES and WES will be added
- The P-STAT will undergo further testing during the next MDRS field season.
Future Research Plans

- Further data collection at MDRS winter 2013/2014
- Further data collection at other space analogs
- Present at HFAP and HFES conferences
- Increase involvement by creating more opportunities for further research
Thank you for your time!

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