Paper ID: 88769
student

35th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Interactive Presentations - 35th IAA SYMPOSIUM ON SPACE AND SOCIETY (IP)

Author: Prof. Shu-Yu Lin
Massachusetts Institute of Technology (MIT), United States

Ms. Lu Chen
Massachusetts Institute of Technology (MIT), United States
Dr. Lauren Landon
KBR, United States
Ms. Katya Arquilla
University of Colorado Boulder, United States

ACYCLIC FRAMEWORK FOR IDENTIFYING CAUSAL RELATIONSHIPS IN HABITAT DESIGN

Abstract

As long-duration exploratory missions become increasingly Earth-independent, risks due to human-system incompatibility become critical to address. Traditionally in the aerospace industry, human factors considerations are focused sets of recommendations for singular applications, which are not generalizable across the design space. In a space habitat, establishing objective and meaningful relationships between the individual, crew, environment, and mission outcomes has been challenging due to multidirectional influences between mission and system components. Additional complexities due to negative feedback loops (e.g., stress affecting sleep, in turn affecting stress) make characterization of influence within the system difficult.

In this work, we have designed a systematic approach to identifying causal relationships between mission parameters, habitat elements, crew composition, operational stressors, and behavioral health and performance outcomes. We leverage a Directed Acyclic Graph (DAG), often utilized in graph theory and systems engineering, which allows us to build a network of factors and connections. The acyclic property of a DAG allows us to clearly define causal relationships and provide clarity to the habitat design approach. Extensive literature review and subject matter expert interviews inform our design tool that links how habitats influence human health and psychology, as well as how habitat design parameters serve as powerful mediators between mission stressors and health outcomes. Herein, we explain the benefits and limitations of our approach to capturing complex human systems design implications and present the tool which is available to the public to explore, utilize, and critique.