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Space Architecture: Habitats, Habitability, and Bases (1)

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NEW APPROACHES TO HABITABILITY: THE INTERNATIONAL SPACE STATION
ARCHAEOLOGICAL PROJECT

Abstract

The aim of space archaeology is to understand the interaction of technology and human behaviour in off-Earth environments. This paper presents the methodology and results of the first archaeological study focused on human habitation in outer space. The International Space Station (ISS) is the only extant, continuously-occupied location in space, with more than 20 years so far. The International Space Station Archaeological Project (ISSAP) aims to extend the purview of archaeology, and provide critical insights about humanity as it moves into the wider solar system.

So far there have been no substantive analyses of data collected from space sites. The principle obstacle to carrying out an archaeological study of a site in space, whether in low Earth orbit or on the surface of another planetary body, is the multi-million-dollar price tag of fieldwork. We have developed a new methodology to allow analysis of sociocultural aspects of life on ISS. These methods are re-imaginings of traditional archaeological practice. The research program includes the following components:

1.Image analysis: using machine learning to catalogue associations between crew members, spaces within the station, and objects/tools. 2.Development of procedures for ISS crew to perform archaeological surveys on-site. 3.Investigation of ISS cargo return ("de-integration") activity, and analysis of the values and meanings associated with returned items.

Questions that can be addressed through the application of archaeological methods include: how people adapt their behaviors and tools to the requirements of life in space; how a crew composed of people from different nations, with different languages and cultures, uses material culture to build cohesion, and manage conflict; gendered use of spaces and objects; identifying spaces and objects associated with work, leisure, rest, intimacy, observation, and surveillance; and how microgravity shapes the development of ISS's society and culture. Using machine learning and statistical analysis based on NASA image archives, our preliminary results show that icons placed in the Zvezda module change over time in relation to events on Earth, and that crew movement through ISS is structured according to gender and nationality. Ultimately, the project will offer space agencies and commercial entities evidence-based ideas about how to design space habitats to promote stable societies, and thus mission success.