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HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)  
How Can We Best Apply Our Experience to Future Human Missions? (2)

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SPATIAL, COGNITIVE AND EXPERIENTIAL DIAGNOSIS: A USER-CENTERED APPROACH TO  
EVALUATE THE HABITABILITY OF MANNED RESEARCH STATIONS IN EXTREME  
ENVIRONMENTAL CONDITIONS.

**Abstract**

In the past, the design of manned research modules within extreme environmental conditions was viewed as an engineering problem. As missions increased in duration, the issue of liveability gradually became an issue of habitability, opening the way for architects to contribute to the design of a functional interior. This paper explores and compares the issues of habitability and well-being within the facilities of two existing research stations, located in extreme environments, Concordia in Antarctica and the International Space Station. The scope of the study is to analyse the design and technological specifications of the stations' spaces that are specifically addressed for the activities of sleep, hygiene, food and leisure during the everyday living conditions of the crew. It is an activity-based study that employs knowledge from architecture, human factors and cognitive neuroscience in order to evaluate the interior of the examined stations through three diagnostic tools, the Spatial, the Cognitive and the Experiential.

The Spatial Diagnostic Tool provides the groundwork for mapping and analysing the activity of the human body in space through time. It targets the creation of the Average Spatial Image, which is evaluated with parameters emerging from the livable-habitable duality. The Cognitive Diagnostic Tool provides the groundwork for mapping and analysing the spatial and environmental elements as mental constructs recorded in the human mind. It is employed for the creation of the Average Cognitive Image which is evaluated in comparison to the actual architectural space. Finally, the Experiential Diagnostic Tool is used for mapping and analysing the psychological fluctuations of the crew members through time. It results in the creation of the Average Experiential Image which is evaluated with parameters emerging from the psychological depression – psychological comfort duality.

The critical assessment of the three diagnostic images provides a methodology to examine the level of human activity and performance in direct relation with the interior environment of existing manned research modules as well as to revise and promote habitability within them. Moreover, the findings of this study provide a very helpful tool for the human-centered interior design and evaluation of new habitable modules, for earth or space long-term exploration missions, from the very beginning.