

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

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SHAPING A SPACE: FRACTAL DESIGN STRATEGIES FOR AUGMENTING SPACE HABITAT  
PERFORMANCE

**Abstract**

Long-duration Mars missions present unprecedented psychological challenges, requiring low-friction, multi-modality integrated counter-measures which are perceived to be of inherent personal value to astronauts.

From an environmental perspective, Mars-bound astronauts face two “Earth out of view” transit periods consisting of approximately eight months of environmental stasis and dangerous boredom compounded by constant existential risk from micrometeorites and solar events. On the surface, astronauts are likely to experience a shielded habitat environment with limitations on visual access to the Martian surface. Environmental stasis is a known stressor to human performance and aggregates with other stressors in threatening psychological resilience and subsequent mission performance.

Meaning-making is an important component of salutogenic responses to stressful psychological experiences, allowing those experiences to be integrated with personal values and goals rather than be experienced as trauma. This is critical to long term mental health and mission performance.

While virtual reality platforms have obvious applications as environmental countermeasures, this modality provides further opportunities to enhance meaning-making and personal growth through an ergonomic integrated of both experience mapping and audio journaling.

We propose an innovative application of Spatial Therapeutics, a VR-enhanced psychotherapeutic approach based upon research in environmental psychology and spatial cognition, currently being developed for clinical use in long term psychodynamic and psychedelic psychotherapy.

The proposed approach would provide astronauts with an ergonomic approach to three critical needs:

- A simple approach to audio-journaling their experiences.
- A platform for spatially arranging physicalizations of those recordings/events into an experiential map building an interactive, dynamic personal narrative for reflection.
- Passively exposing astronauts to dynamic biophilic visual environments with known cognitive and affective benefits which may counteract the static nature of the physical mission environment.

Regular use of this therapeutic “personal space” produces a virtual map of personal experiences and reflections, able to be revisited at will. Enhancing reflection on values and personal motivations may help astronauts navigate the challenging yet meaningful experiences of missions, building internal resilience against mission stressors through value alignment. This has further utility on return to Earth as a record of experiences and realizations which would be an invaluable resource for reflection and integration in the psychological de-orbiting process.

This paper contributes to the critical discussion of psychological support systems for deep space missions. It concludes with a discussion of current efforts to validate this psychotherapy modality clinically and how it may be adapted to performance environment such as polar and long-duration spaceflight.