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

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REDUCED GRAVITY EXPERIMENT: INVESTIGATING THE EFFECTS OF REDUCED GRAVITY
ON CIRCULATION IN HABITAT ARCHITECTURE

Abstract

The Reduced Gravity Experiment is an ongoing research project aiming to test the effects of reduced gravity on circulation and mobility in Space Architecture. Due to the different gravitational conditions of other planets, it would be insufficient to replicate architectural scenarios that have evolved out of the specific conditions existing on Earth for Habitat Architecture in Space. When aiming to inhabit extra-terrestrial landscapes we must allow for site-specific conditions to shape the architecture. This paper presents the development and early results of a simple mechanism for simulating reduced gravity, with the aim to test the performance of multiple architectural scenarios within a reduced-gravity environment.

The Reduced Gravity Experiment is best suited for testing architectural elements associated with vertical mobility, such as stairs, ceiling heights, and vertical spatial arrangements, including platforms, shelves or other storage systems. NASA conducted similar experiments in the 1960s, testing 'self locomotion' when walking up stairs, climbing a ladder and pole, and jumping up onto a platform.

This research paper analyses and evaluates the results from a proof-of-concept conducted in October 2018, where over 130 participants were invited to walk on a series of three ramps and stairs with differing inclinations, while strapped into a counterweight system used to simulate approximately one third of Earth's gravity. The purpose is to collect empirical data that can inform the design of Space Architecture, which has never before been done on this scale. The results, verbally collected from the participants, indicate that an inclination of around 60 degrees provides the most natural movement under approximately one-third of Earth's gravity, almost double the standard on Earth (around 32 degrees). The second Reduced Gravity Experiment will take place in March 2019.

What differentiates the Reduced Gravity Experiment from NASA's Gravity Simulation Techniques from the 1960s are, firstly, the large number of participants that took part in the first Reduced Gravity Experiment in October 2018, and secondly, the fact that the Reduced Gravity Experiment collects data from 'normal' people, instead of trained astronauts. Other than NASA's Gravity Simulation Techniques, the effects of reduced gravity on standard architectural elements is a relatively overlooked subject within Space Habitation. In addition to adapting existing architectural technologies already used on Earth, the intention of the Reduced Gravity Experiments is to discover new methods of movement and circulation for architecture in Space, in preparation for future extra-terrestrial habitats.