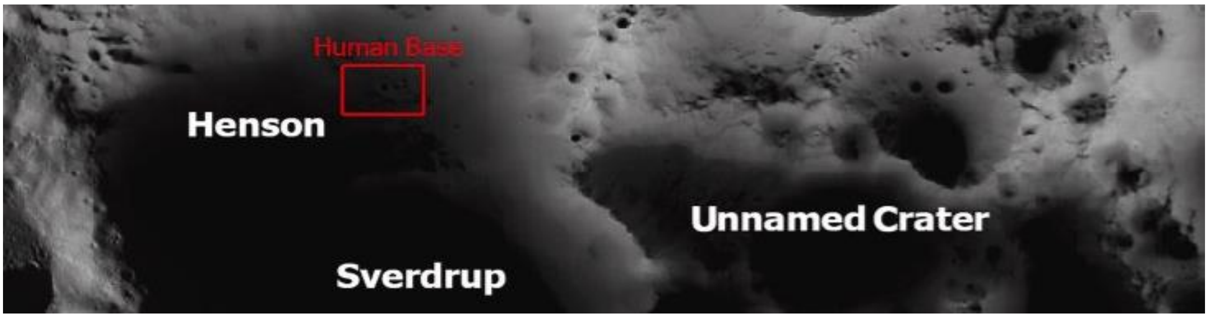
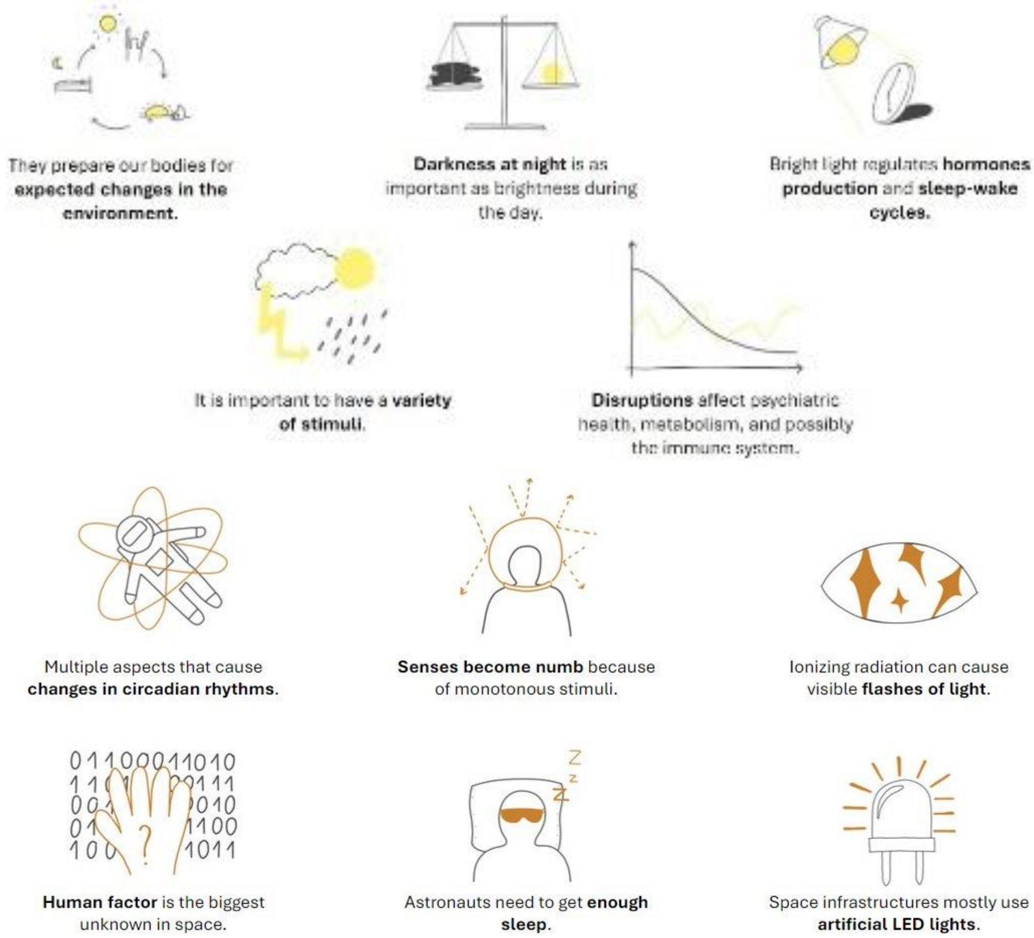


Moonoroi is a habitat on the Moon designed to accommodate six astronauts. Apart from dealing with harsh environment, the proposal focuses on the well-being of astronauts by addressing circadian rhythms studies and radiation issues. Additionally, it incorporates redundancy strategies that we considered critical for ensuring the reliability and safety of space missions. Having separate volumes helped in minimizing structural complexity and costs.

Natural light plays a crucial role in maintaining human well-being by regulating circadian rhythms, which govern the sleep-wake cycle. Disruptions to these rhythms, caused by altered light exposure, can impact various aspects of health, including sleep, psychiatric well-being, metabolism, and potentially the immune system. In space environments, where natural light is absent or significantly altered, artificial lighting systems are essential for maintaining astronaut well-being and performance. Innovative technologies like CoeLux's LEDs and SAGA Space Architects' Circadian Light Panel mimic natural sunlight to support circadian rhythms. Additionally, AR/VR technologies aid in exercise, maintenance, and studying human perception in space.



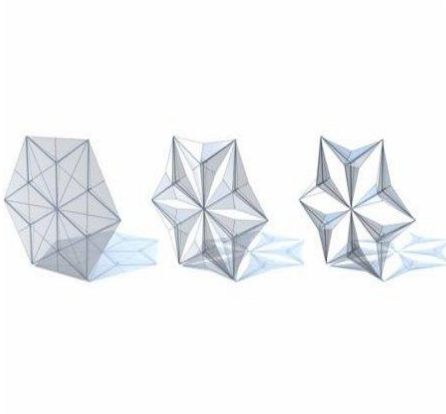
The Circadian Lights – a project by SAGA Architects

To deal with difficulties of food production on the Moon, we proposed to use innovative techniques such as hydroponics and aeroponics to grow plants without soil, while implementing closed-loop recycling systems to conserve and reuse water. Controlled environment agriculture (CEA) methods optimize plant growth by manipulating environmental factors, and advanced greenhouse technologies enable precise regulation of growing conditions. Additionally, the design incorporates alternative food sources like microalgae that will provide sustainable nutrition in lunar habitats.

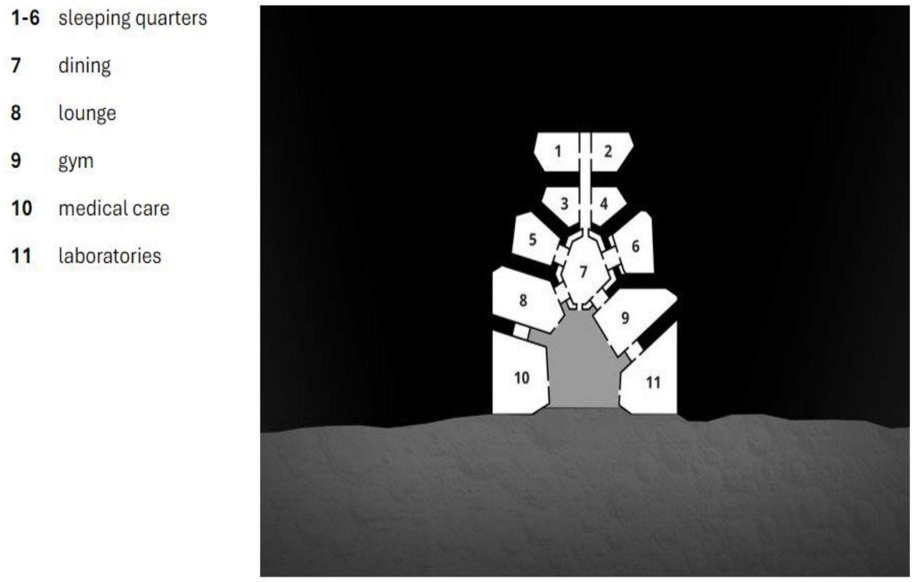
To mitigate space radiation exposure, a strategy involving hydrogen-rich shielding, particularly using water-filled windows, is proposed. These windows serve as radiation shields and energy-efficient cooling systems, while photovoltaic panels provide continuous electricity generation. Responsive shading systems and indirect light approaches, like solar tubes

combined with circadian rhythm simulation, further enhance radiation protection and astronaut well-being.

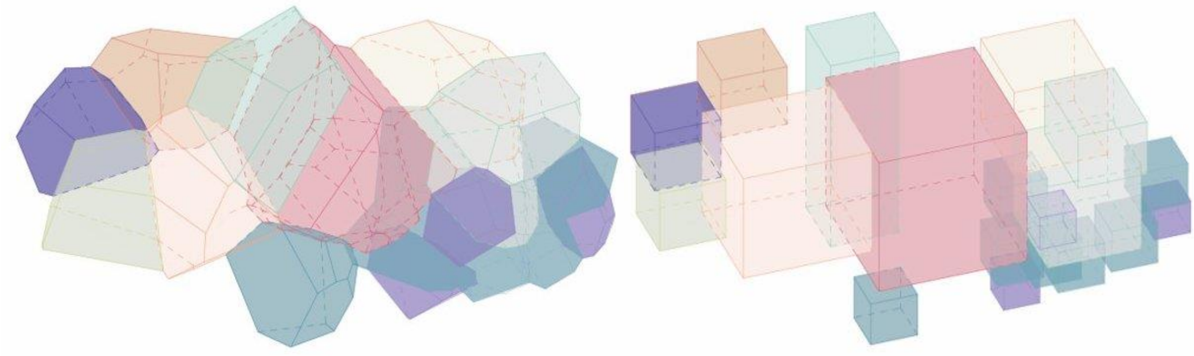
Having all of those principles in mind, we developed several iterations of the design. We experimented with placement and connections of the cells to find the optimal output. In the first iteration we designed the Voronoi cells as separate volumes, with corridors connecting them. Even though we planned a variety in the cell sizes the output was unsatisfactory, with cells not differing enough from one another. In the next step we added some missing functions to the program. Our main challenge throughout the process was the design, conceptual and parametric, of the differentiated lighting conditions and their right placement in the building.



In the next iteration, we managed to fix the issues that we encountered in the first tries. In the Voronoi scheme, we use thick walls that isolate each volume not only from external radiation, but possibly also from the surrounding rooms in case of malfunction. In those walls we carve passages that can be used as airlocks. This way the design is more compact and works better in terms of materiality. The new functions we added enhanced the safety and comfort of the



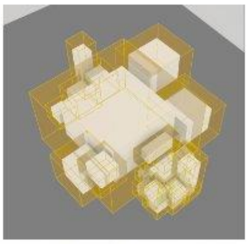
astronauts. In our final step so far, we developed proper light solutions and varied them throughout the cells.



1

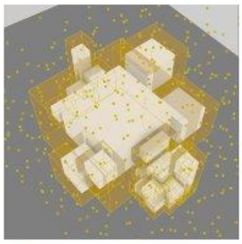
Input: boxes representing each function

2



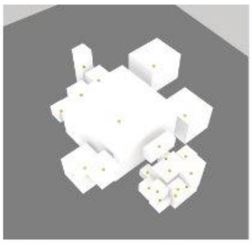
Offset the volumes to restrict possible points

3



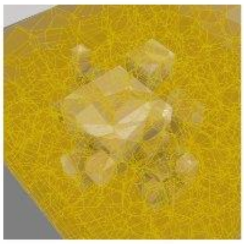
Populate box with points outside offset volumes

4



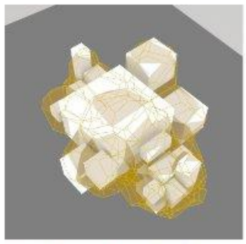
Find centers of each box and merge with other points

5



Voronoi 3d

6



Select the cells with the same centers as the boxes