Living Conditions on Mars

Gravity: 38% the Earth's

Temperature: -140~20°C

Sun light: 43% the Earth's

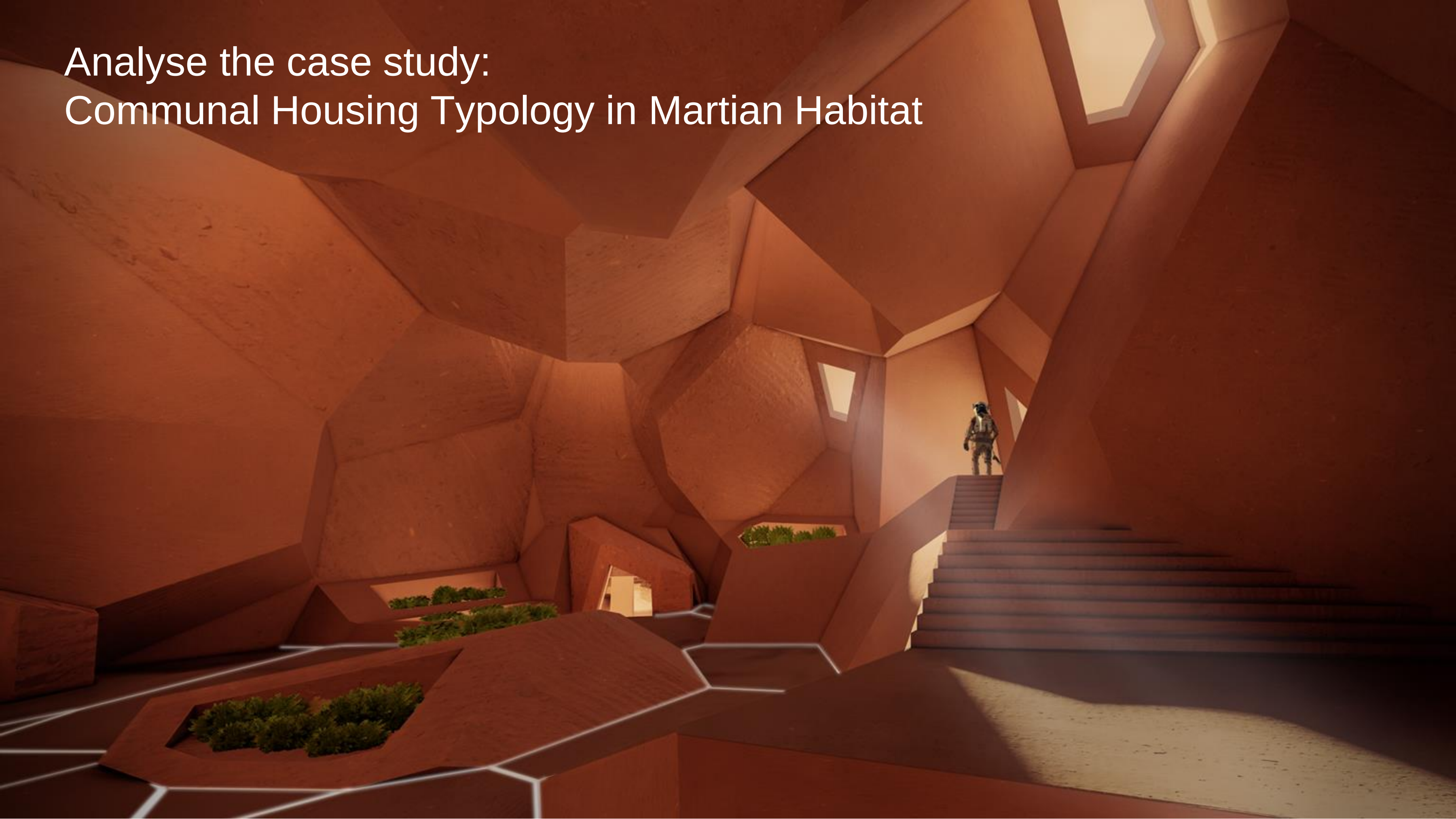
Pressure: 600 Pa, 0.6% the Earth's

Wind: 160km/h

Atmosphere: 96% CO_2

Geology: silicon, oxygen, metals …

Analyse the case study:
Communal Housing Typology in Martian Habitat



Challenges on Mars:

1. Lack of construction
2. Lack of human labor forces
3. High average radiation level
4. Low average ground temperature
5. Daylight Acquisition

How does it adapt to the challenges?

1. Using local materials(regolith)
2. Using technologies of D2RP, CV and HRC
3. Cells for light tunnels are elongated, in which radiation is weakened while bouncing within the tunnel and reaches the courtyard as mild indirect light
4. Designing most of the space underground
5. Public entrance and dining room is located towards the communal courtyard; working space protrudes above the ground to receive more natural light

What are the challenges for printing out the units?

A collision check should be made on every tool path generated to ensure no damage will be made to either the component, the environment, or the robot. It is important that the initial non-milled block is placed in the same coordinate location as the computer modeled bounding box in the reference frame of the robot. Also ensure that the workflow is such that the milled block doesn't need to be moved during any part of the process so that any misalignment issues don't ruin the component.

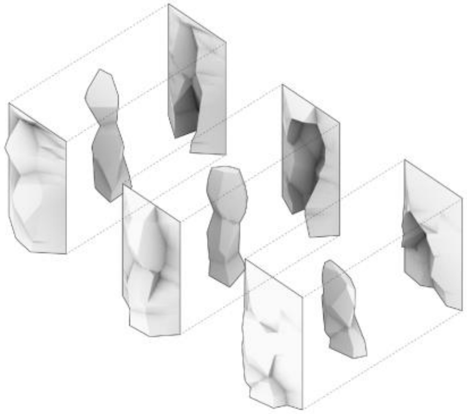


Fig. 18. Meshes for generation of drilling tool path

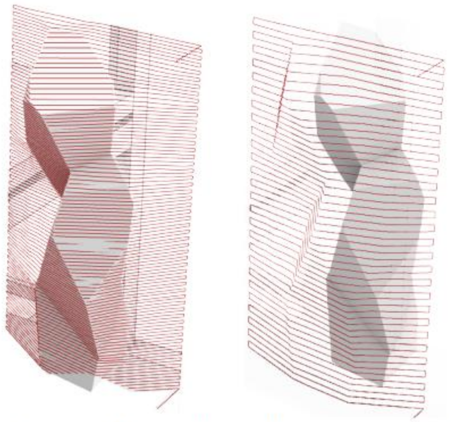


Fig. 19. Precise tool path(left) near the component, and loose tool path(right) to remove excessive foam

How do they assemble the units?

They need to create 2 holes that will be used for assembling the components together. For this, they choose 2 faces that are suitable and create toolpaths that deepen the topography creating a graspable edge.

In this project they want that the robot can identify the components, identify where they can be grabbed, and then have it grab the components and assemble them. For this they create a CV algorithm.

Fig. 20. Texturization and production of holes in component

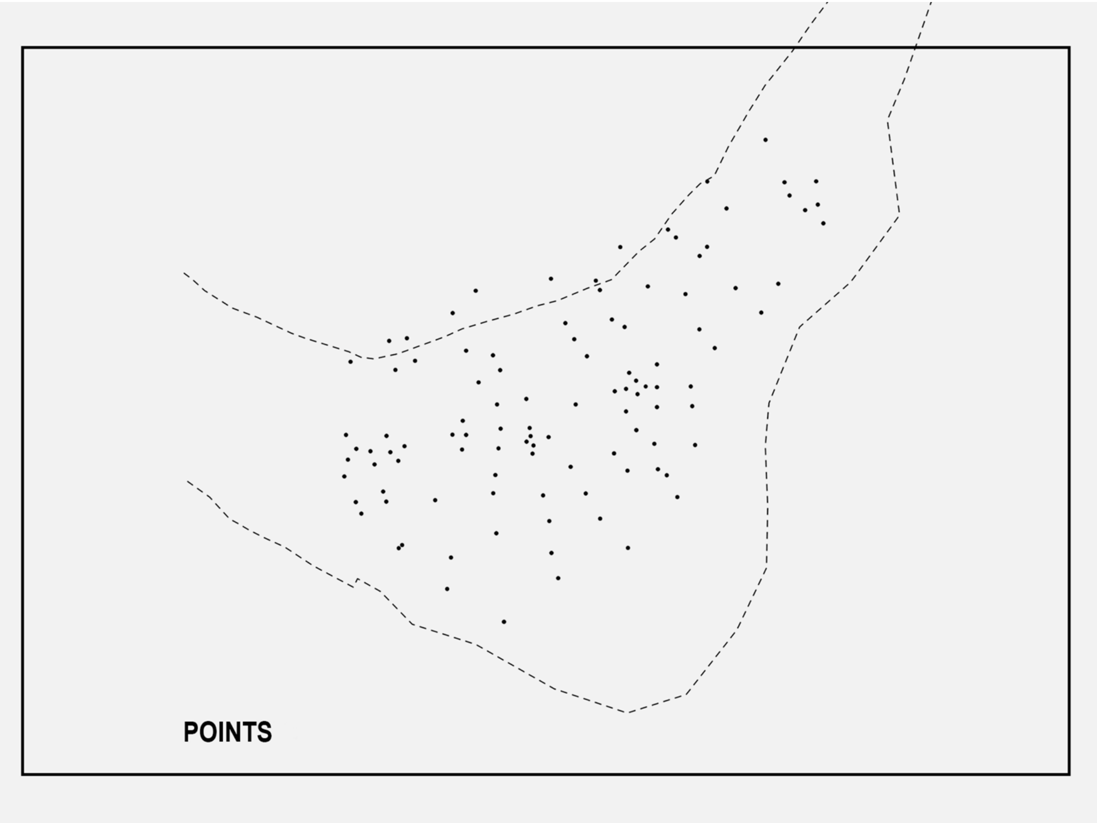
A PRACTICAL CASE OF VORONOI CELLS

Designer: DECA architecture

Location:the greek island of milos

Type:House

‘we used parametric design tools. instead of drawing lines, we refined our plans by moving points in space,’ adds carlos loperena, co-founder of DECA architecture. *‘voronoi’s formula ensured that each table, bed or tree enjoyed the most amount of space in relation to its neighboring areas.’*



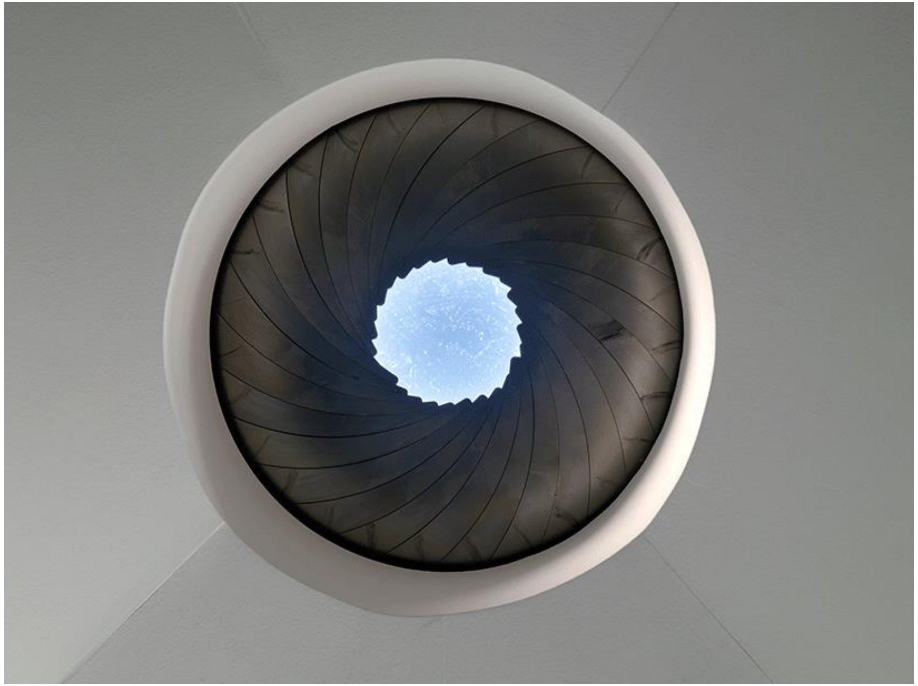
In Voronoi grids, as opposed to Cartesian ones, the points come first and the grid follows.

The grid is organic, not orthogonal. It conforms to the points. We went on site and we scouted for points that interested us.

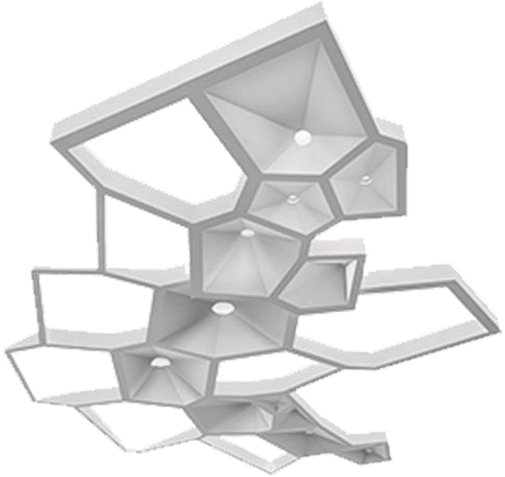
We inputed these points into Voronoi's formula, creating a grid around them. We used parametric design tools. Instead of drawing lines, we refined our plans by moving points in space and aligning views.

Units

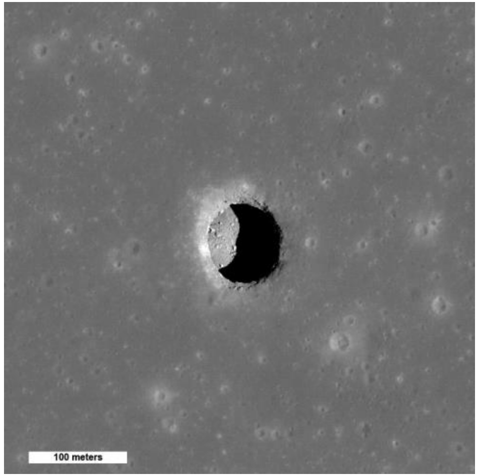
MECHANICAL SKYLIGHT

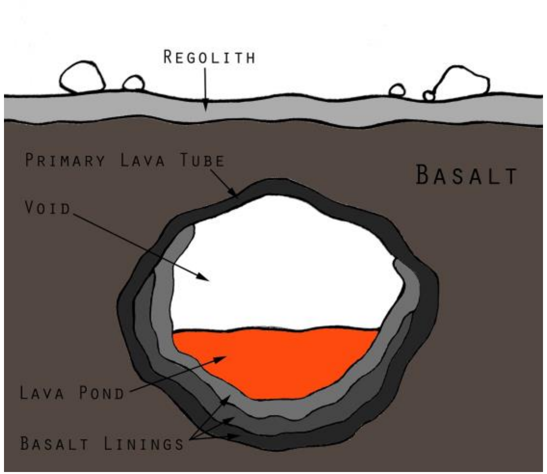


The skylights at the apex open creating an effective passive ventilation system. A black out device is placed under each skylight. It is a mechanism that works like the shutter of a camera lens. For ambient illumination, a circular metal disc suspended under the apex conceals a linear light.



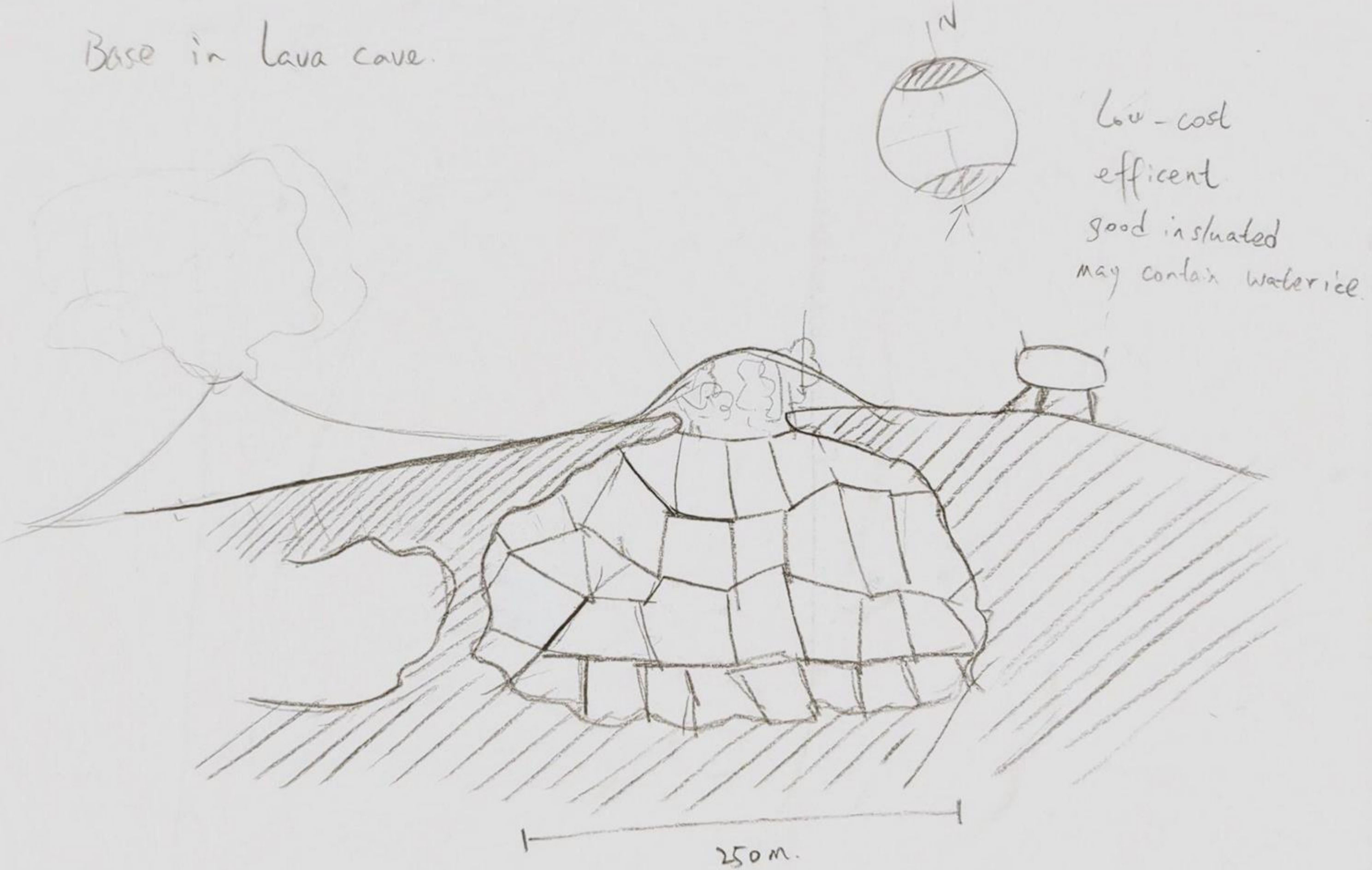
Concept-Nature cavities built on lava tube



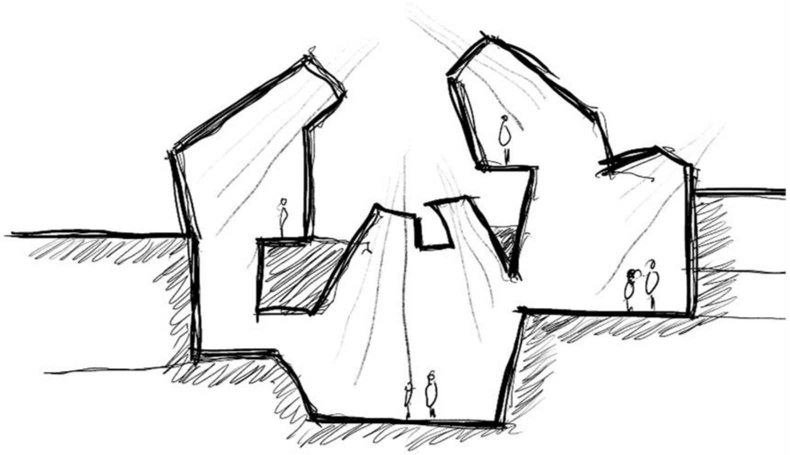


Lunar lava tubes may potentially serve as enclosures for human habitats. Tunnels larger than 300 metres (980 ft) in diameter may exist, lying under 40 metres (130 ft) or more of basalt, with a stable temperature of −20 °C (−4 °F).[22] These natural tunnels provide protection from cosmic radiation, solar radiation, meteorites, micrometeorites, and ejecta from impacts. They are insulated from the extreme temperature variations on the lunar surface and could provide a stable environment for inhabitants.

Base in lava cave.

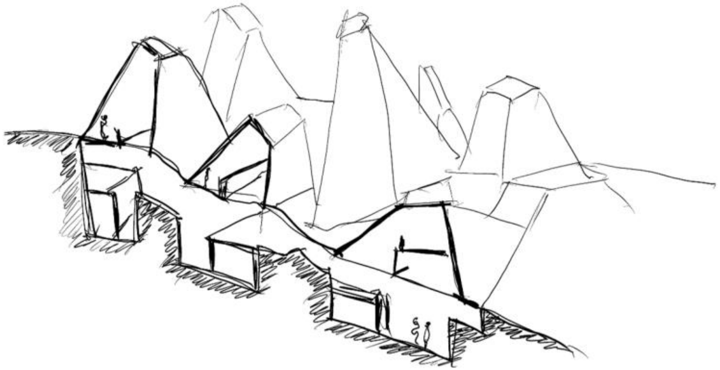


CONCEPT DEVELOPMENT

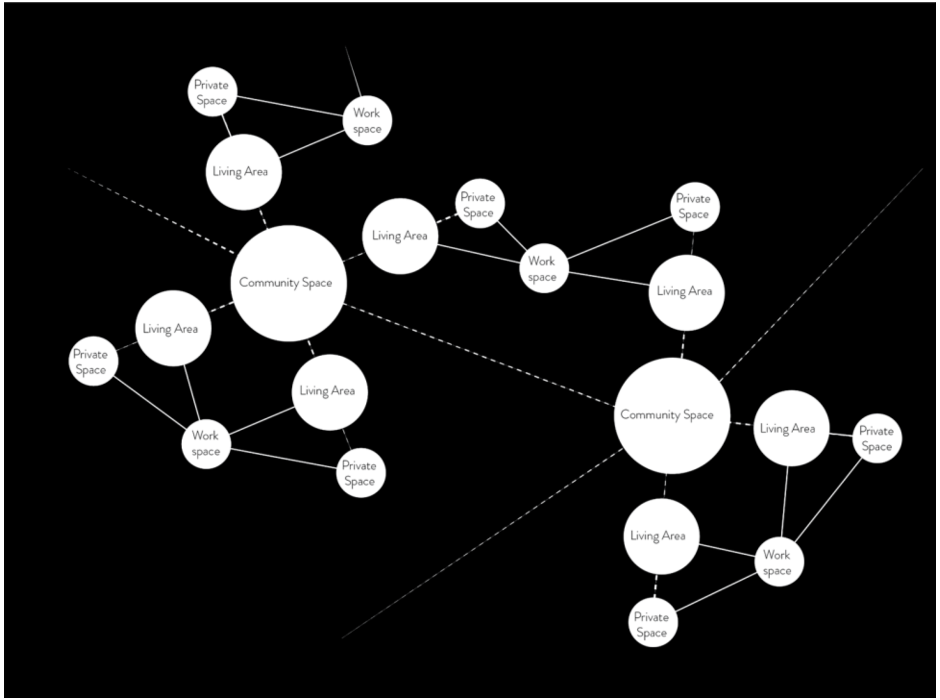


In the design, several underground individual units are connected with the central community space. Different clusters are also interconnected with each other through underground tunnels, which also link different communities.

The project also integrates each element with voronoi design, which enables cell customization for different functions while maintaining constructional and structural efficiency.



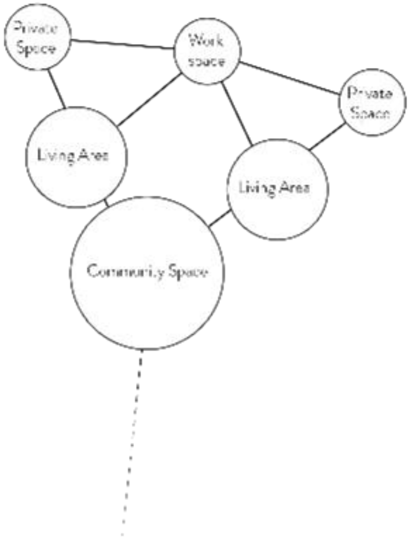
UNITS



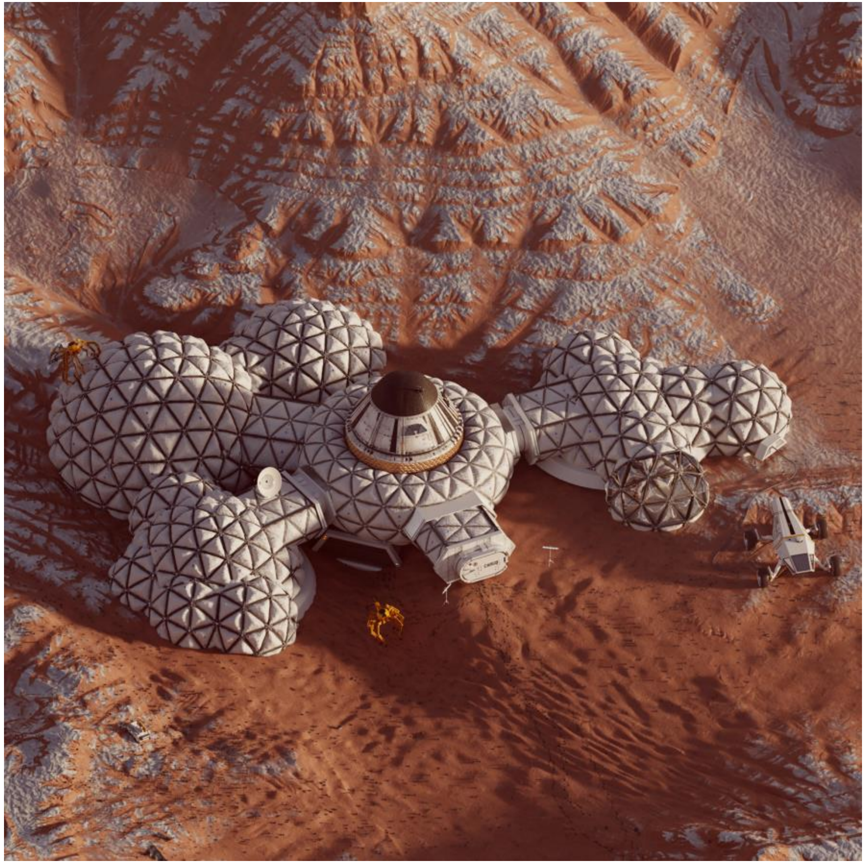
The units are designed to connect with common community spaces while being interconnected with workspaces.

Two units share a common workspace/machinery spaces thereby being efficient in space utilization.

These workspaces connect with units in other communal units which helps maintain the strength and rhythm of the voronoi concept.

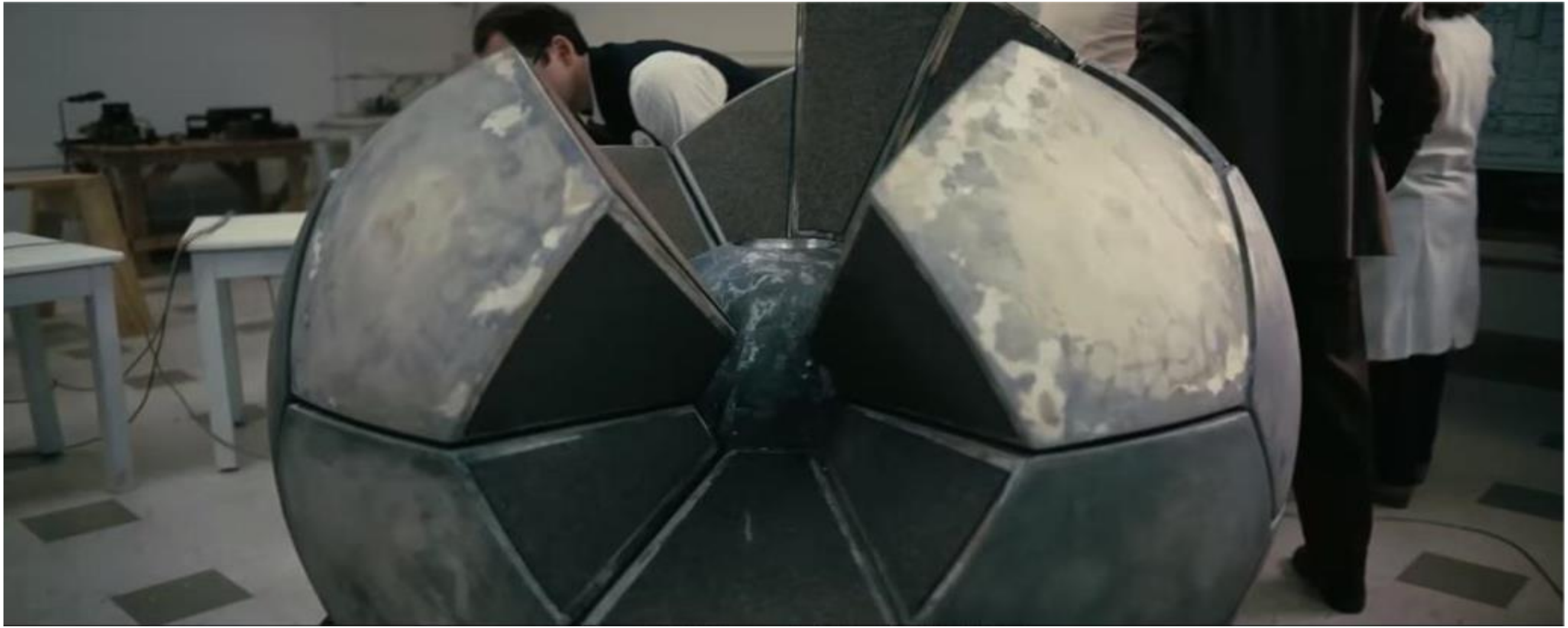


CONCEPT ANALYSIS

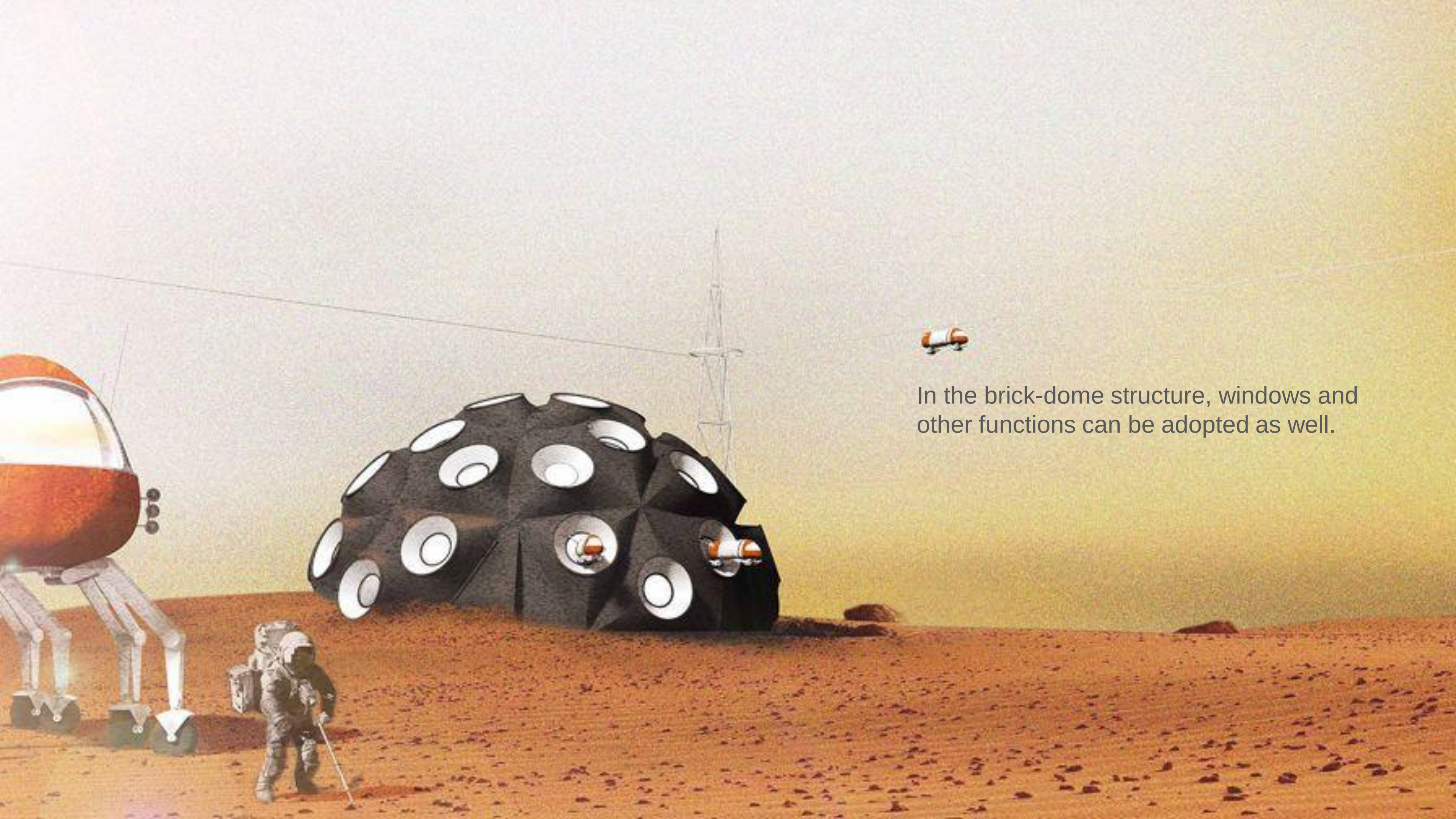


The Mars bases in some sci-fi movies use **dome** structures. It can create the maximum space with the minimum surface area. Meanwhile, some **inflatable** structures can help to cope with the air pressure difference between indoors and outdoors.

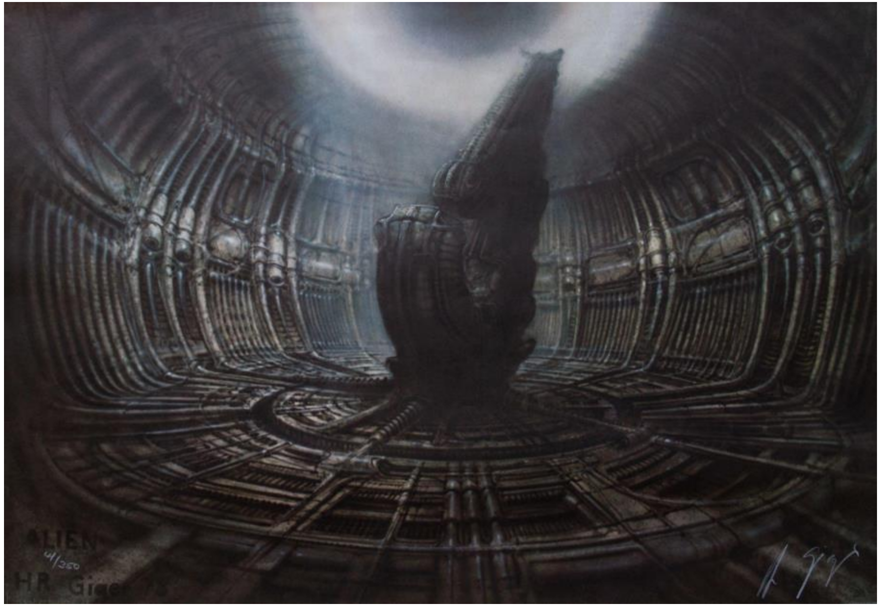
Construction adaptability



In the movie Oppenheimer, a similar **brick form** was used in the structure for the atomic bomb.


In the brick-dome structure, windows and other functions can be adopted as well.

CONCEPT ANALYSIS



H. R. Giger’s “biomechanical” art in the movie Alien. Building structures will grow organically rather than be built.

THANK YOU

DIYA, WAN, ZHANG, ANAN, GRAYSON