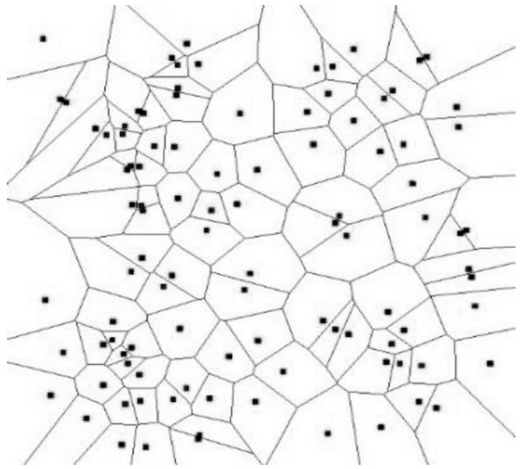
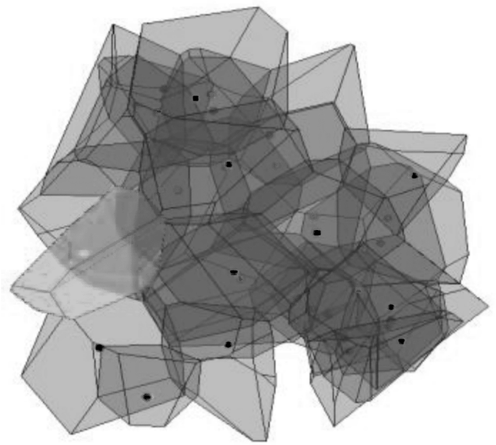
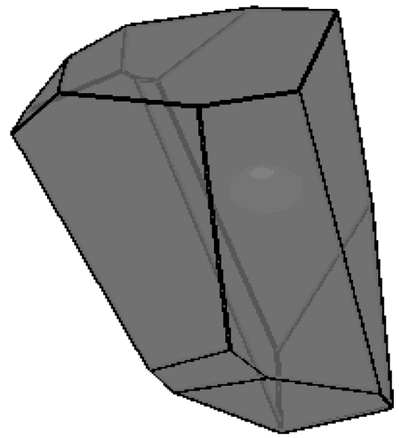
MOON HABITAT

Catalina Persunaru
Jan Kwasnik
Katarzyna Prokopiuk
Marina Kathidjiotis

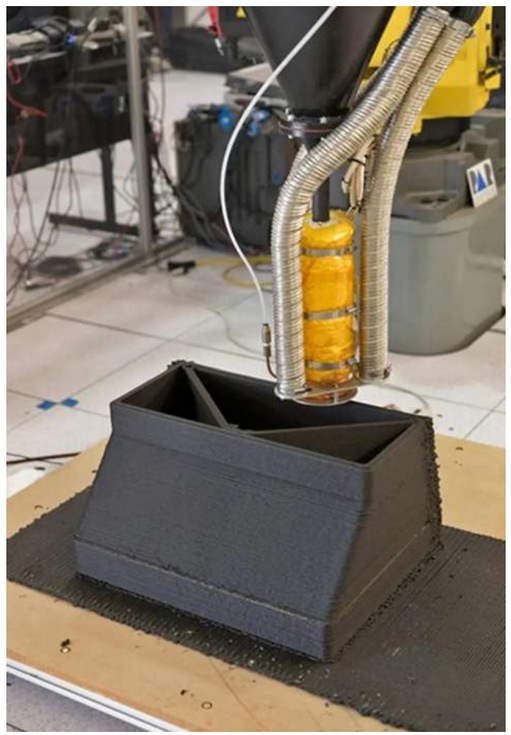
SCHEME



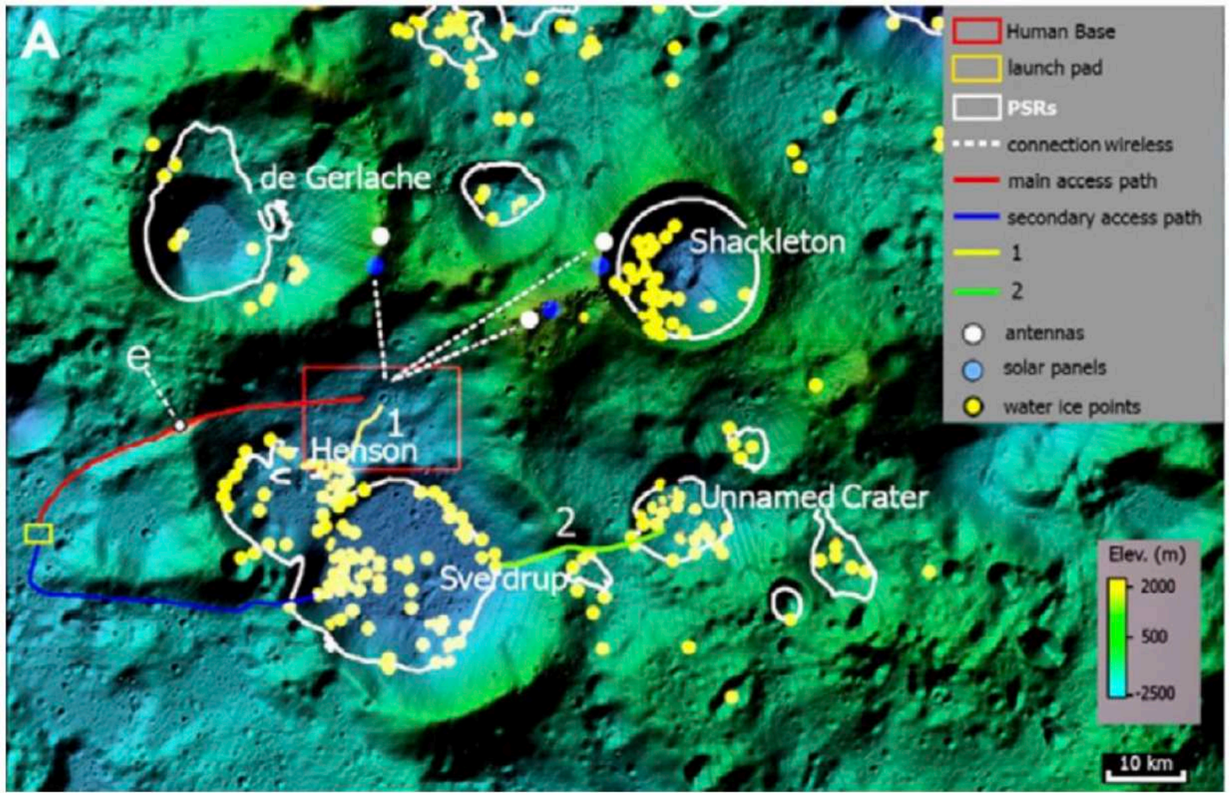




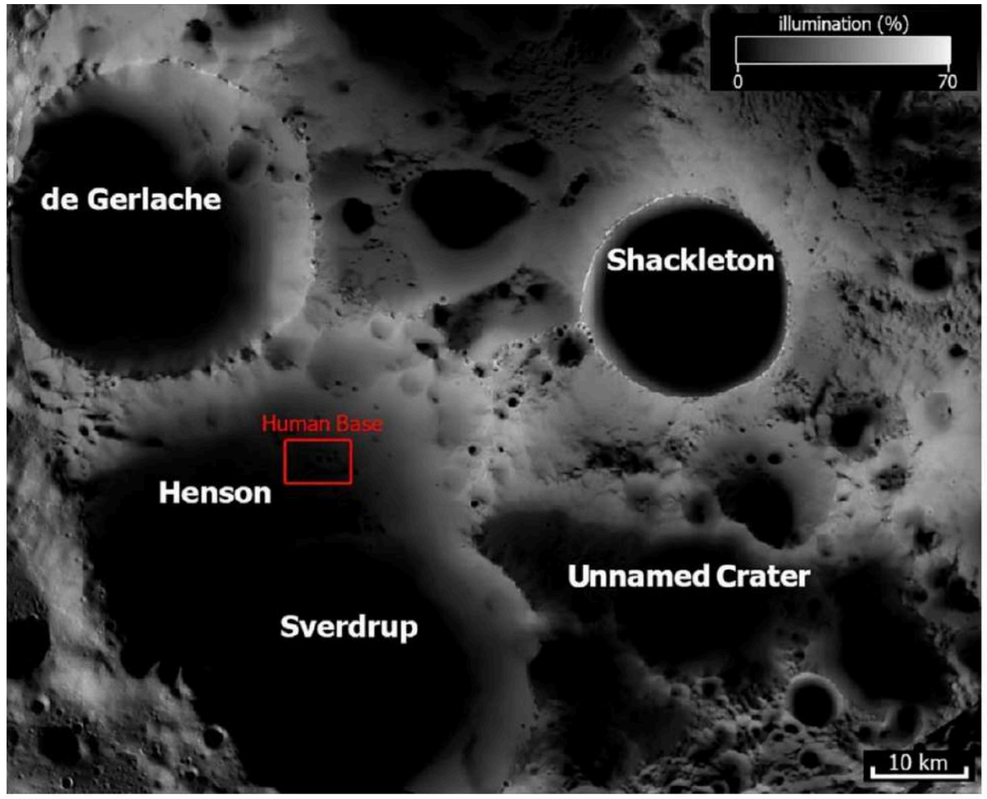
VORONOI PRINCIPLES



IN SITU MANUFACTURING

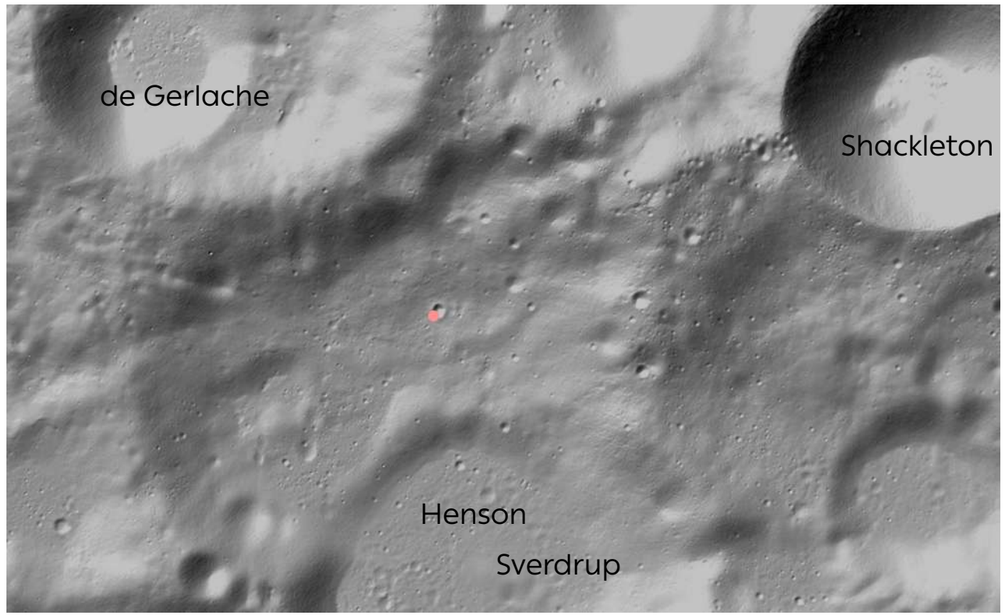


The chosen location on the lunar South Pole: multiple water ice points, variable resources, (semi) continuous visibility of Earth, constant daylight



Optimal sunlight exposure – possibility of power generation without excessive radiation

SITE SELECTION



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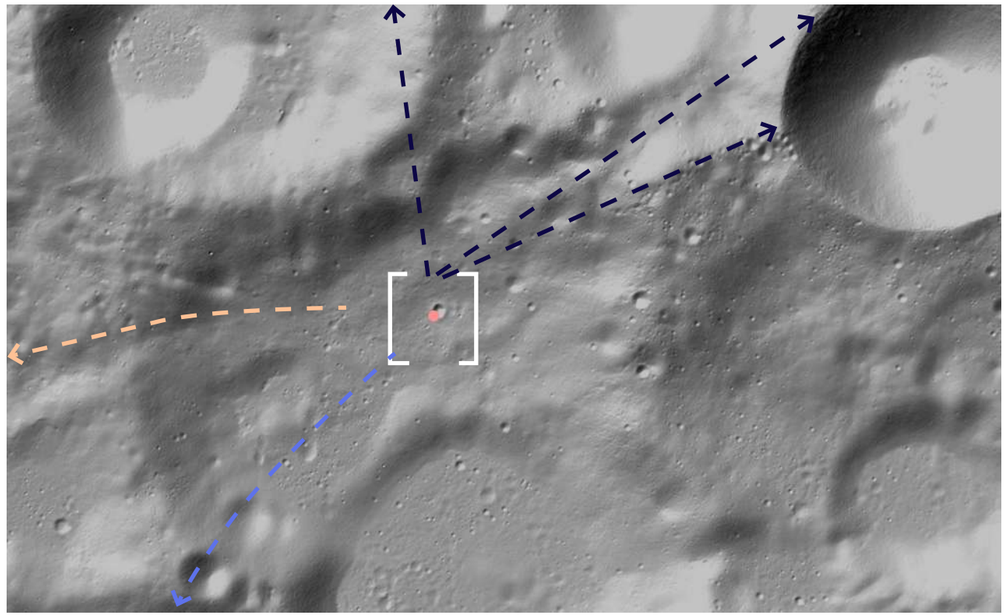
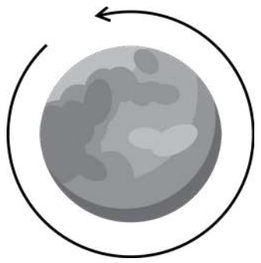


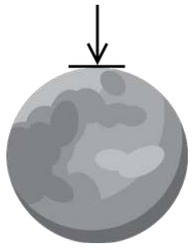
Optimal sunlight exposure – possibility of power generation without excessive radiation

SITE SELECTION

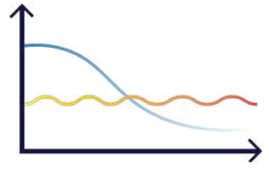
MACRO



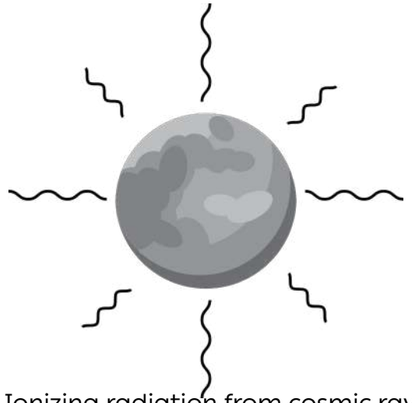
One lunar day is equivalent to 29.53 Earth days



Moon's surface gravity is 1.62 m/s2, \ 1/6 of the Earth's one



Drastic temperature differences from day to night. The temperature of a surface also varies when in sunlight or

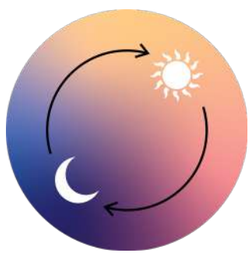


Ionizing radiation from cosmic rays is 200 times more than on Earth's surface

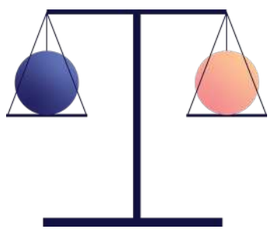
A permanent dust cloud exists around the Moon that sticks to the suits of the astronauts. If carried in their quarters while it can cause health issues

The Moon's atmosphere is nearly

CONTEXT ANALYSIS

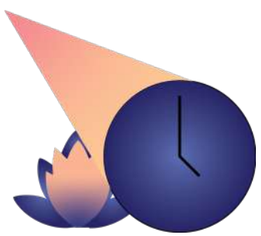


They prepare our bodies for expected changes in the environment.



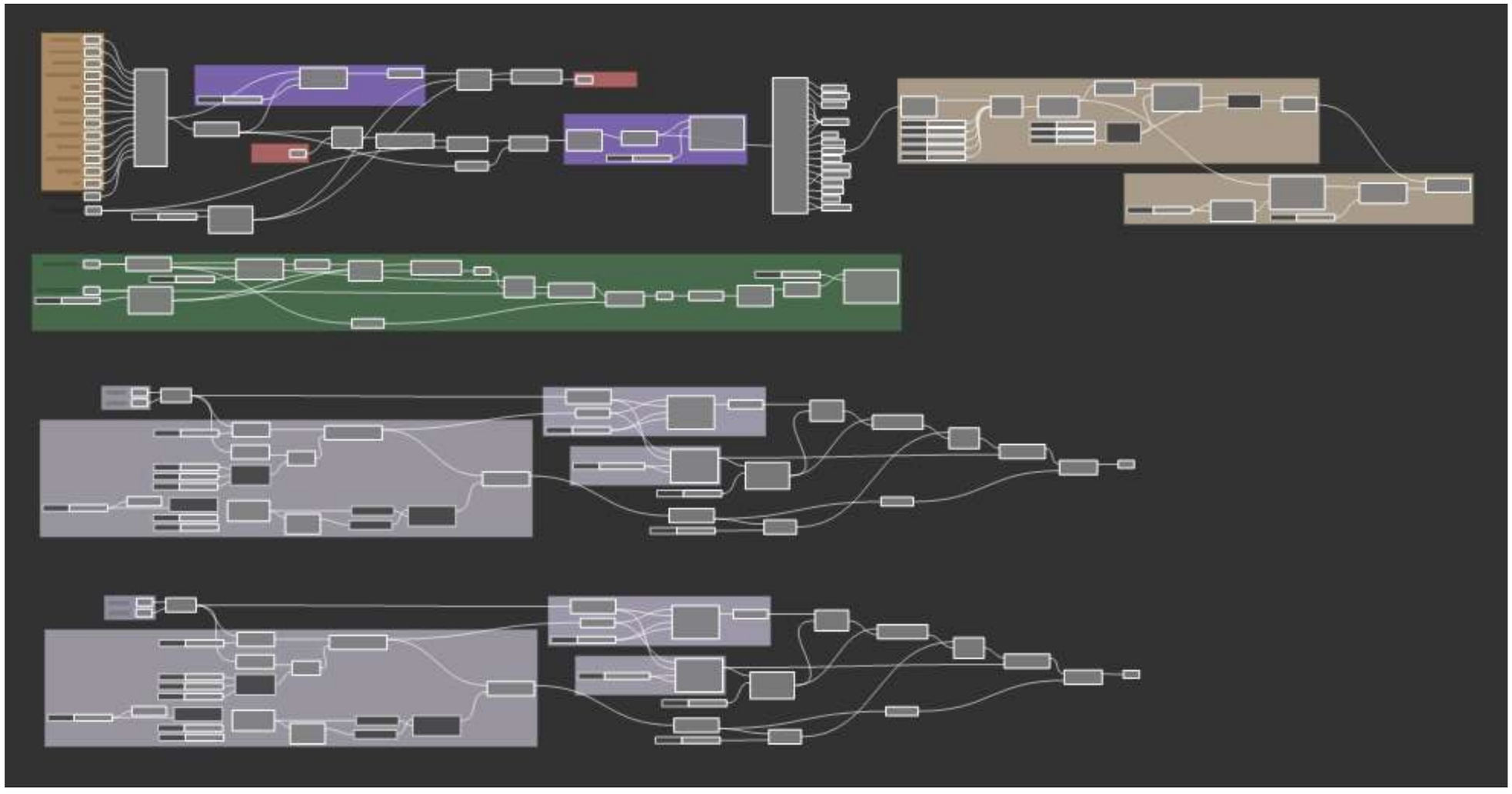
Darkness at night is as important as brightness during the day.

It is important to have a variety of stimuli



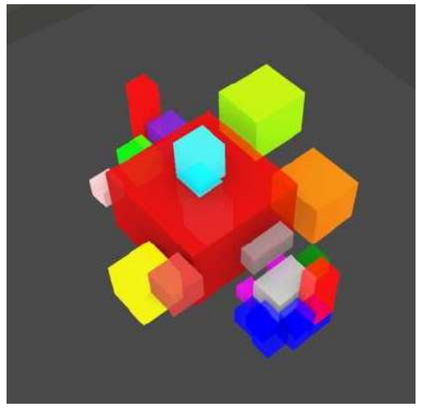
Bright light regulates hormones production and sleep-wake cycles.

CIRCADIAN RYTHMS



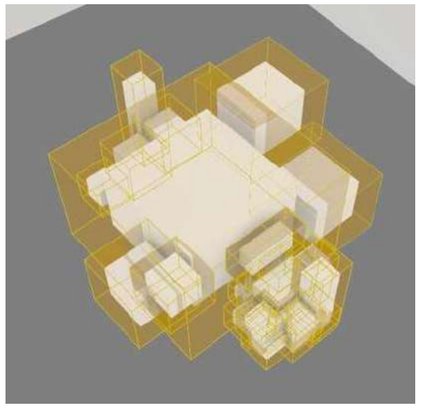
THE ALGORITHM

1



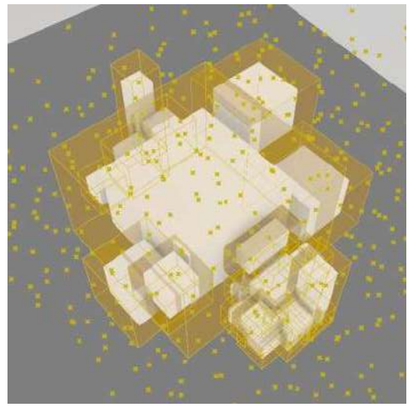
Input: boxes representing each function

2



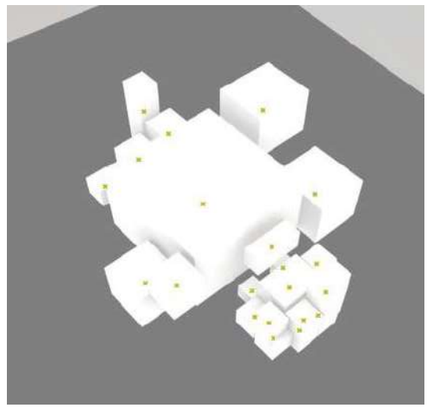
Offset the volumes to restrict possible points

3



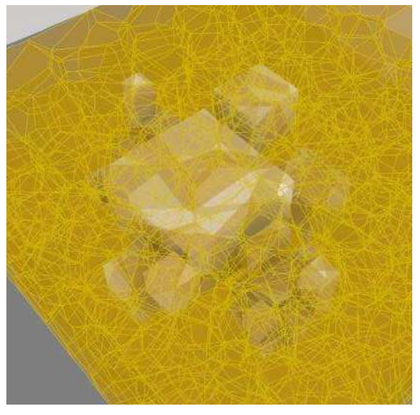
Populate box with points outside offset volumes

4



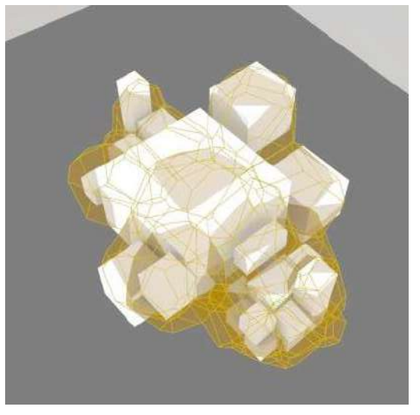
Find centers of each box and merge with other points

5



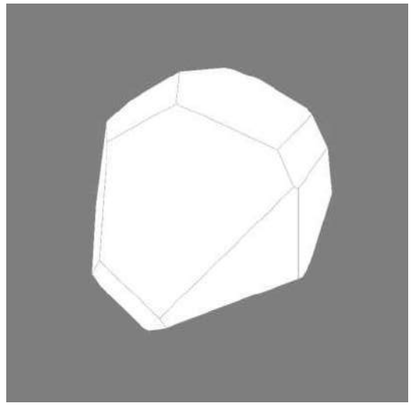
Voronoi 3d

6



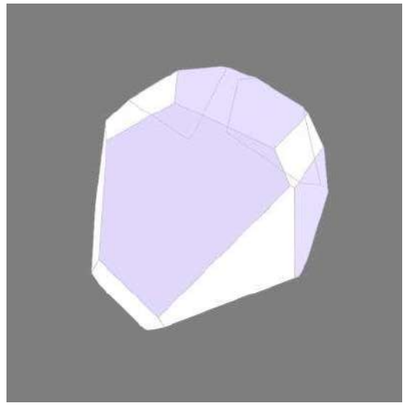
Select the cells with the same centers as the boxes

1



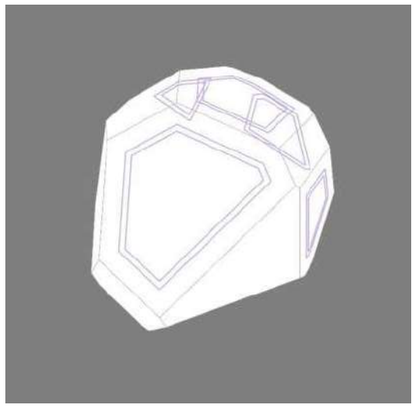
Input: selected cell representing the observatory

2



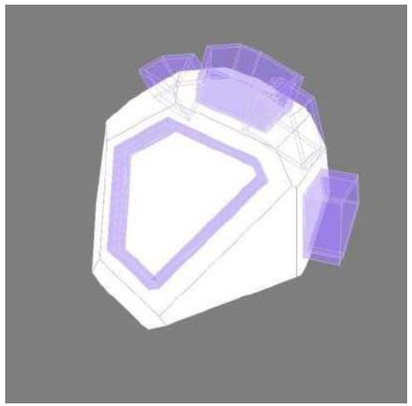
Select the faces that will have windows on them

3



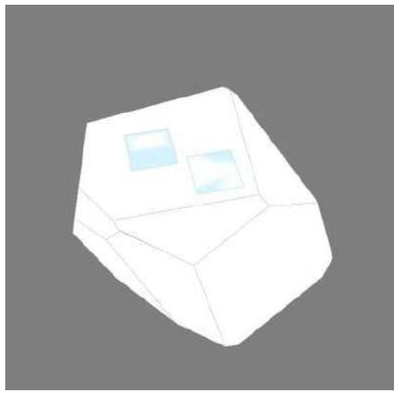
Offset the edge curve of the surface twice to create thickness

4



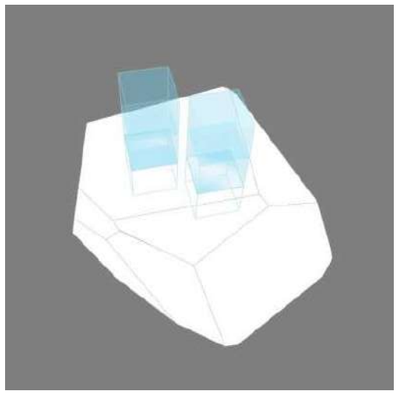
Loft the curves and extrude the surfaces to make window frames

1



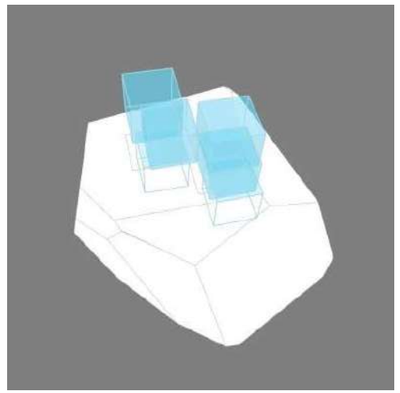
Input: rectangles drawn as the base of the skylight

2



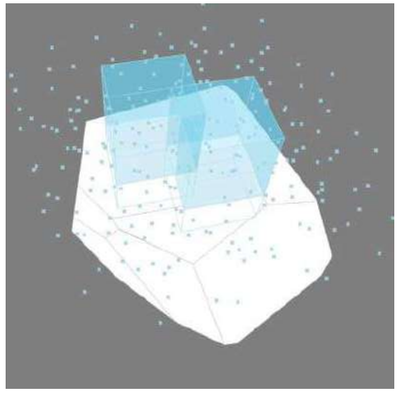
Three boxes on top of each other, one inside the cell

3



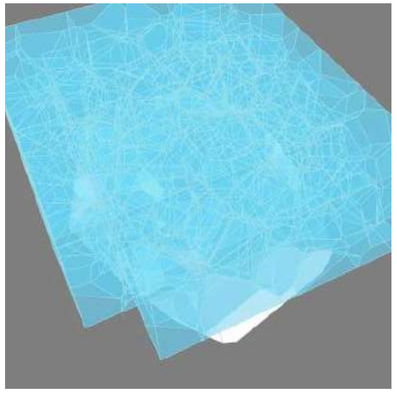
Slightly move the boxes by a random vector for irregularity

4



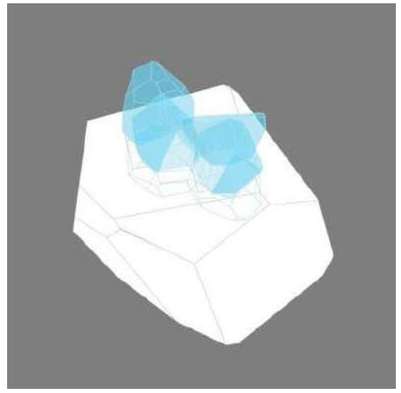
Offset the boxes and populate the volume outside of them

5

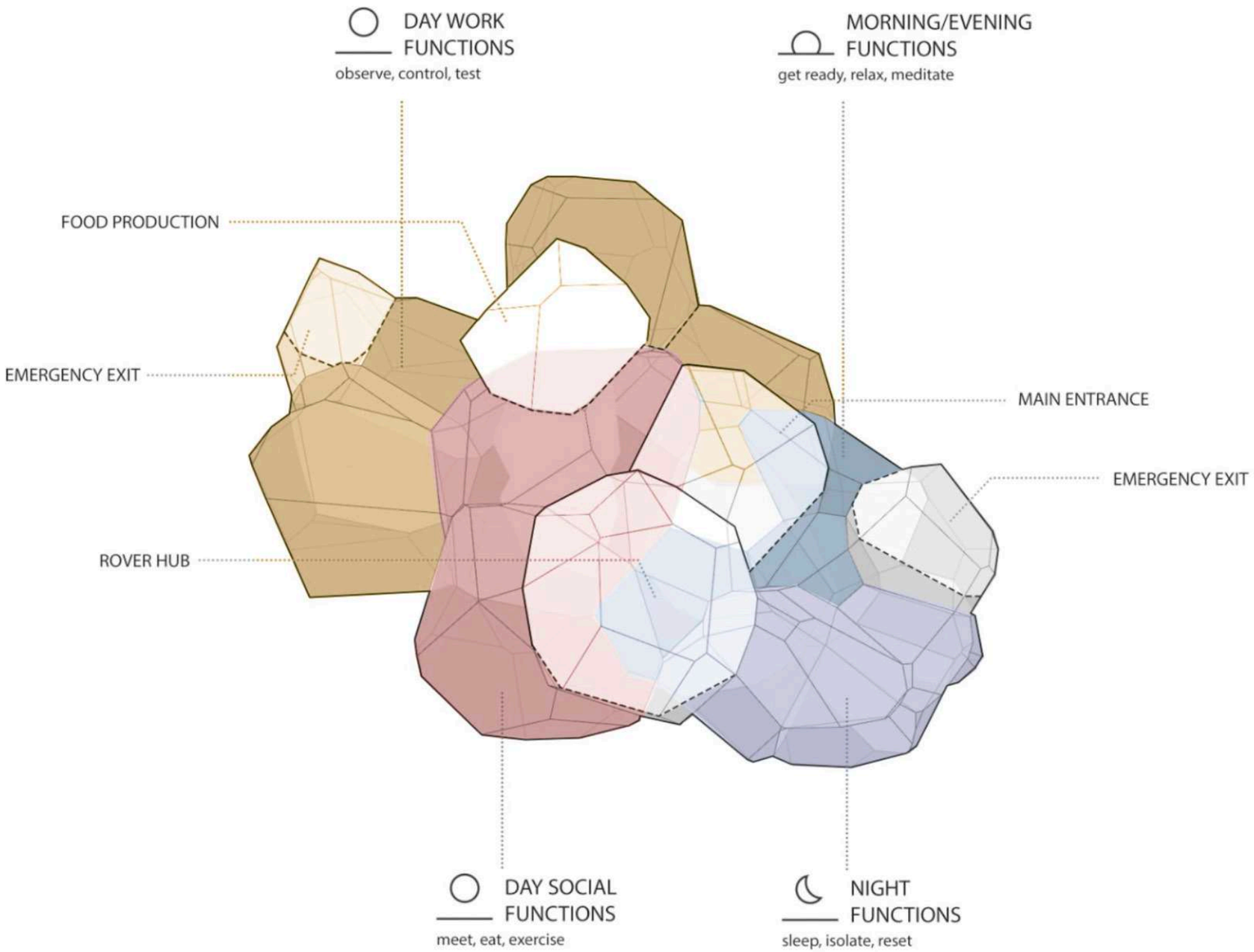


Voronoi 3d

6



Select cells with the same centers as the initial boxes



SIMULATING THE EARTH DAY CYCLE

EXTRUDED WINDOWFRAMES

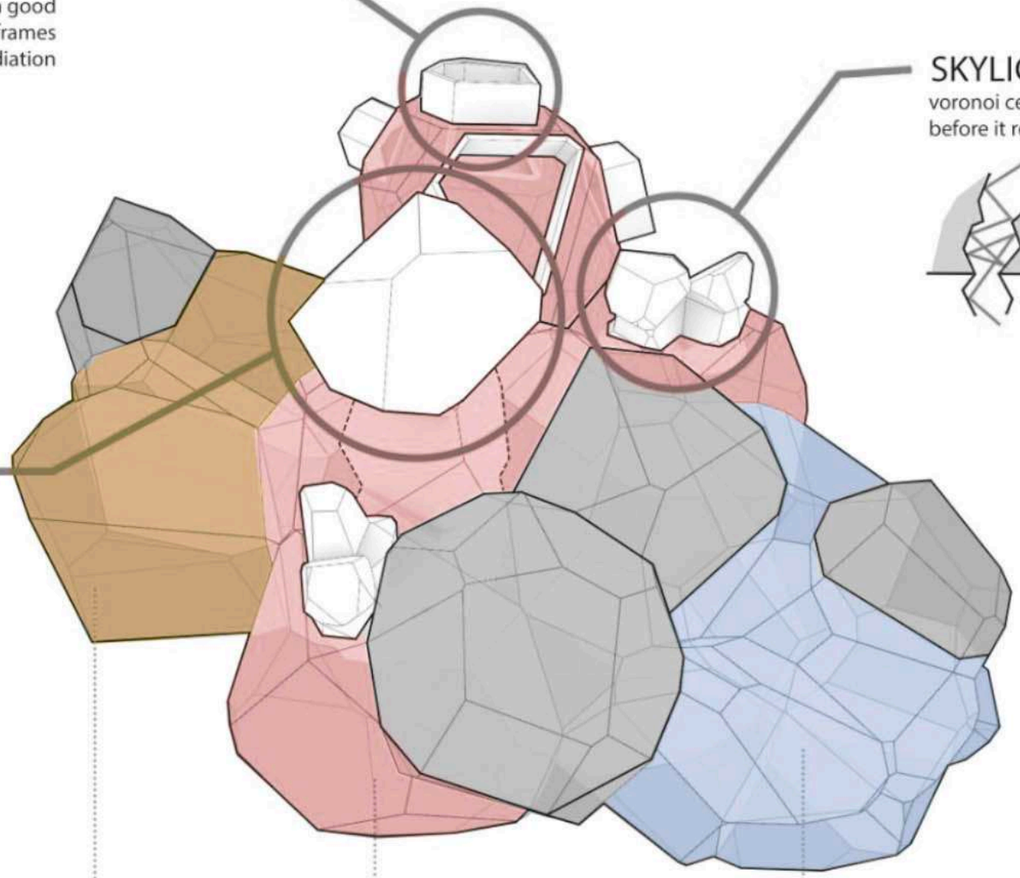
in the observatory, windows provide a good view and the extruded windowframes protect from excessive radiation

SKYLIGHTS

voronoi cells reflect the light several times before it reaches the room

TRANSLUCENT ATRIUM

light gets to the common room through a translucent atrium, where food is produced



CONTROLLED DAYLIGHT

adjustable artificial light with full daylight spectrum

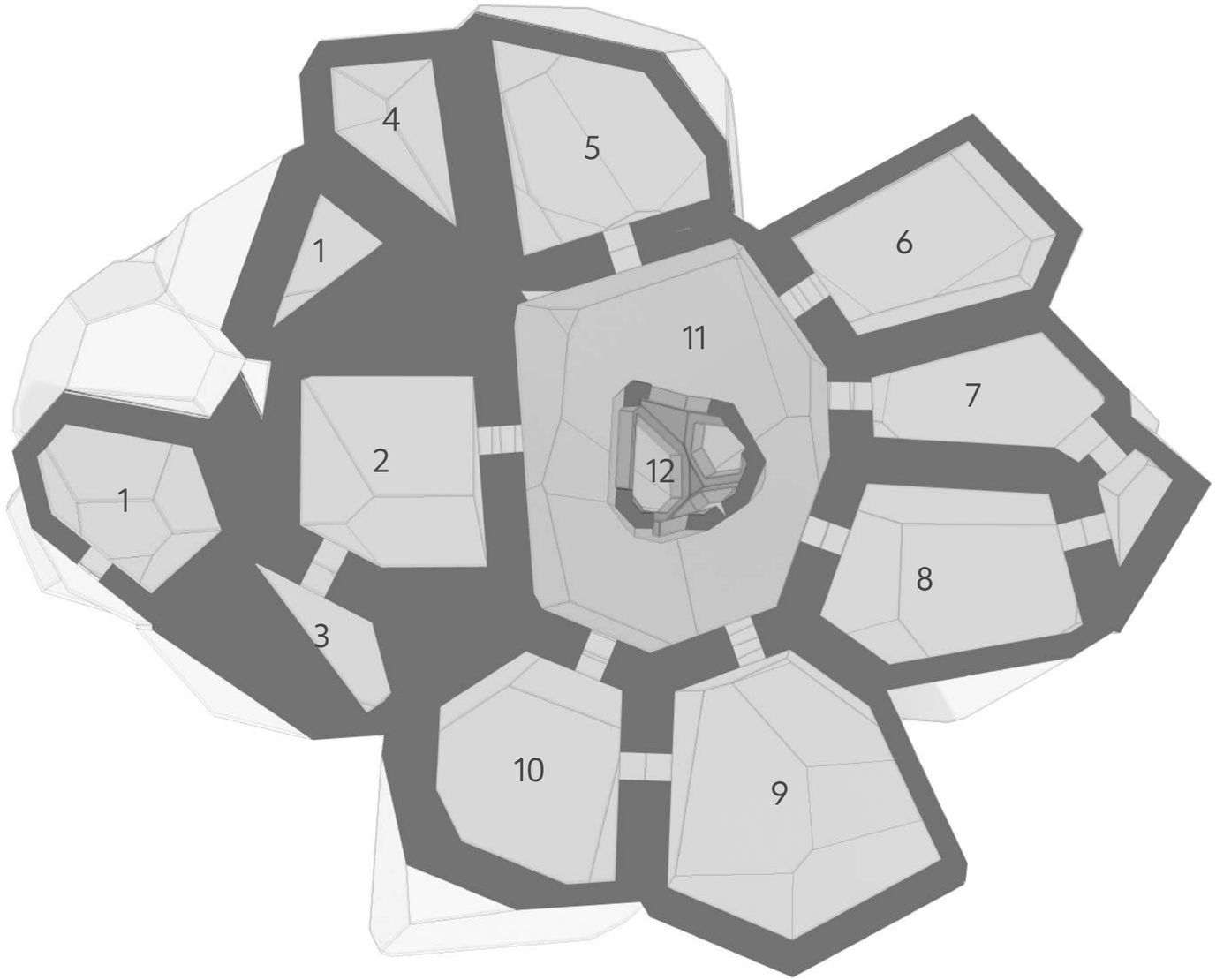
NATURAL LIGHT

natural indirect sunlight

EVENING DARKNESS

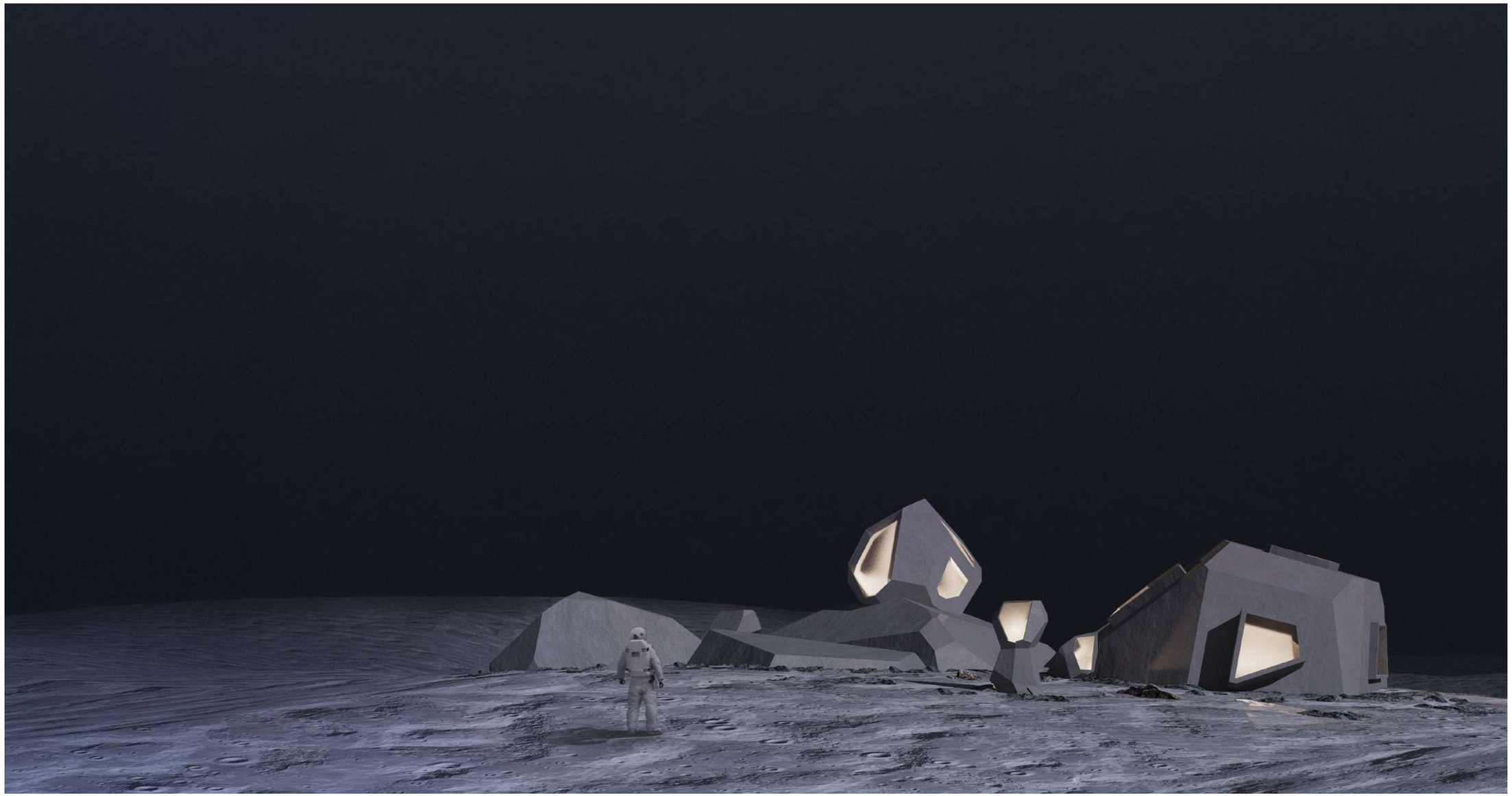
LEDs (red for evening, blue for morning), circadian panels in sleeping quarters

LIGHTING STRATEGIES

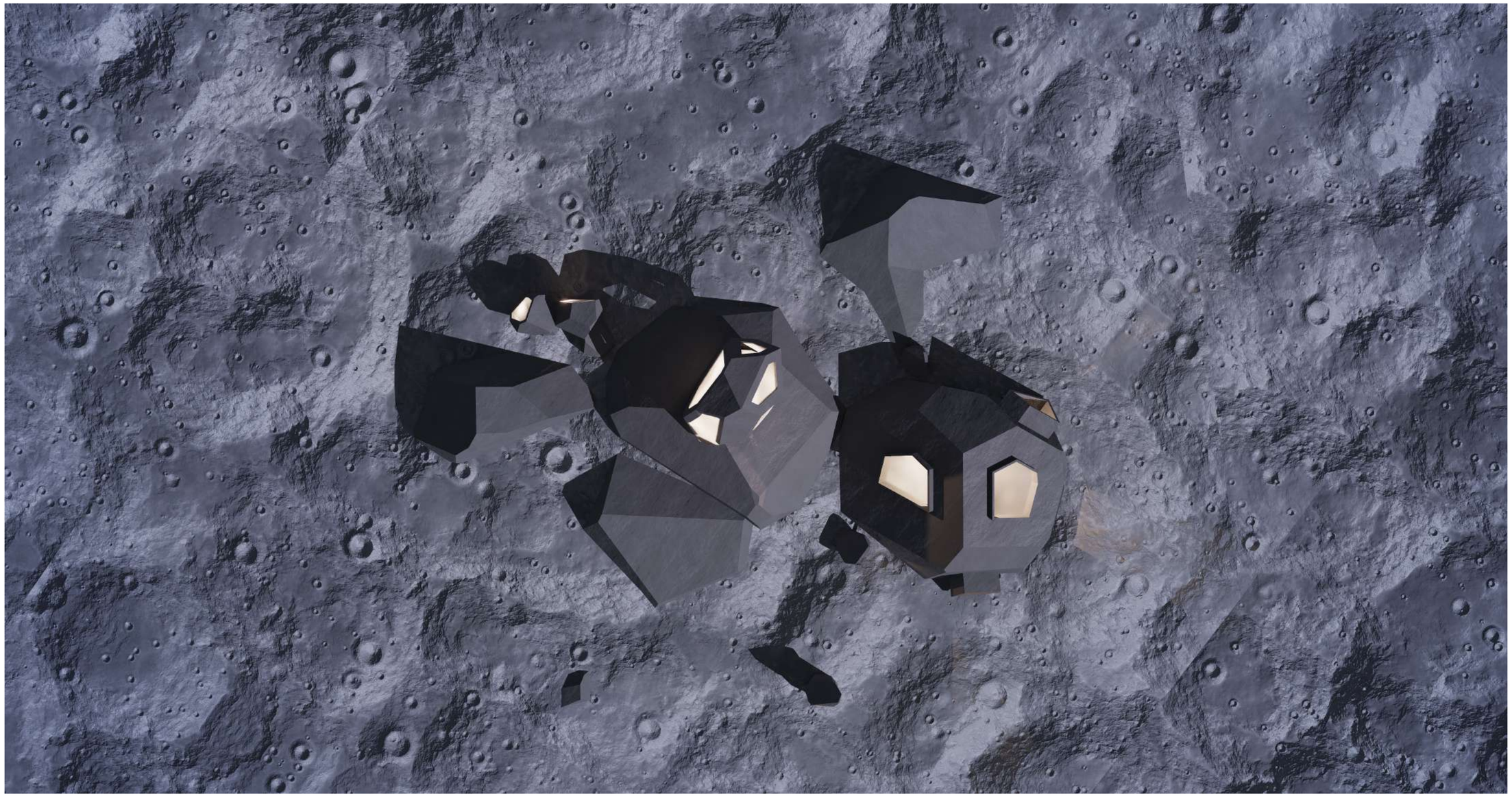


PLAN DRAWING

1. Sleeping spaces
2. Common Hallway
3. Gym
4. Bathroom
5. VR room
6. Laboratory
7. 3d printing
8. Computer room
9. Control room
10. Rover Hub
11. Common Hall
12. Atrium

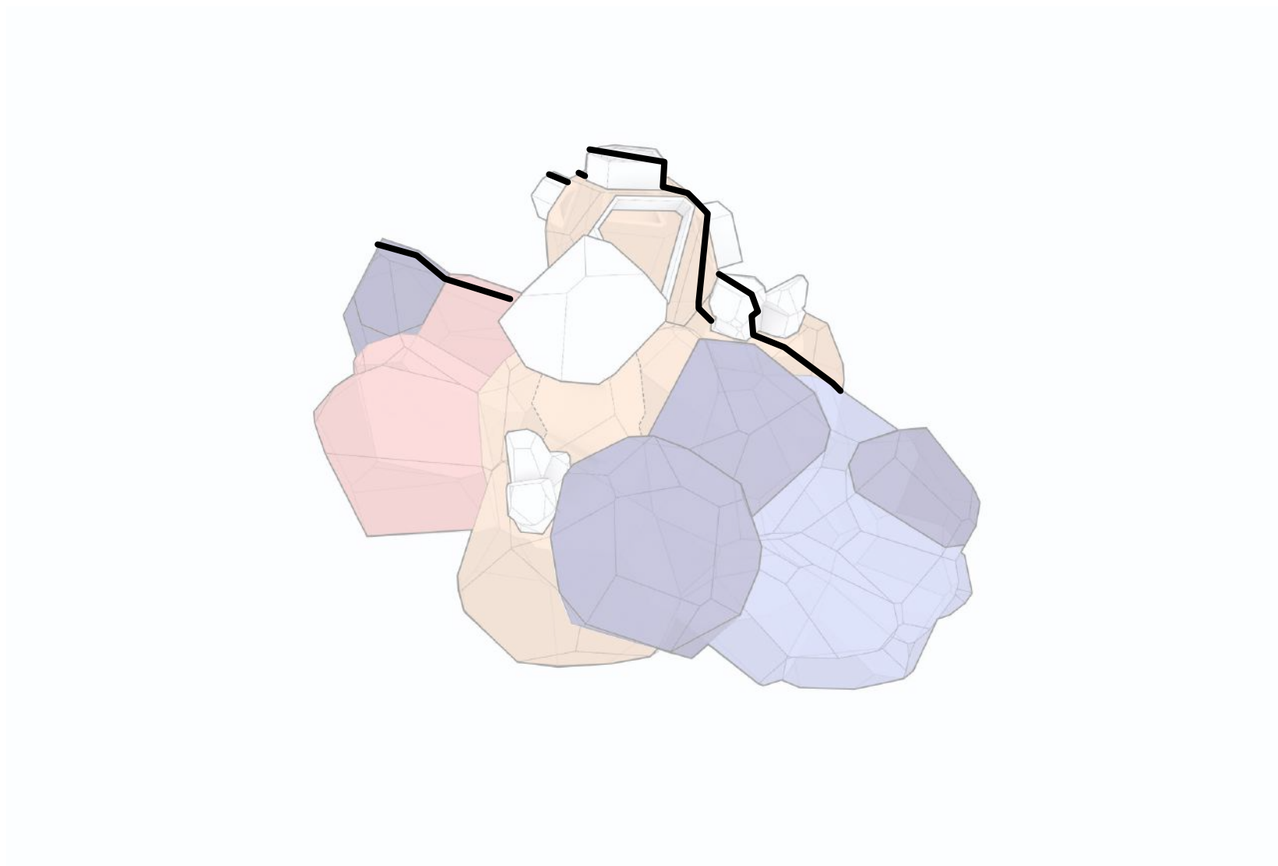


EXTERIOR VIEWS

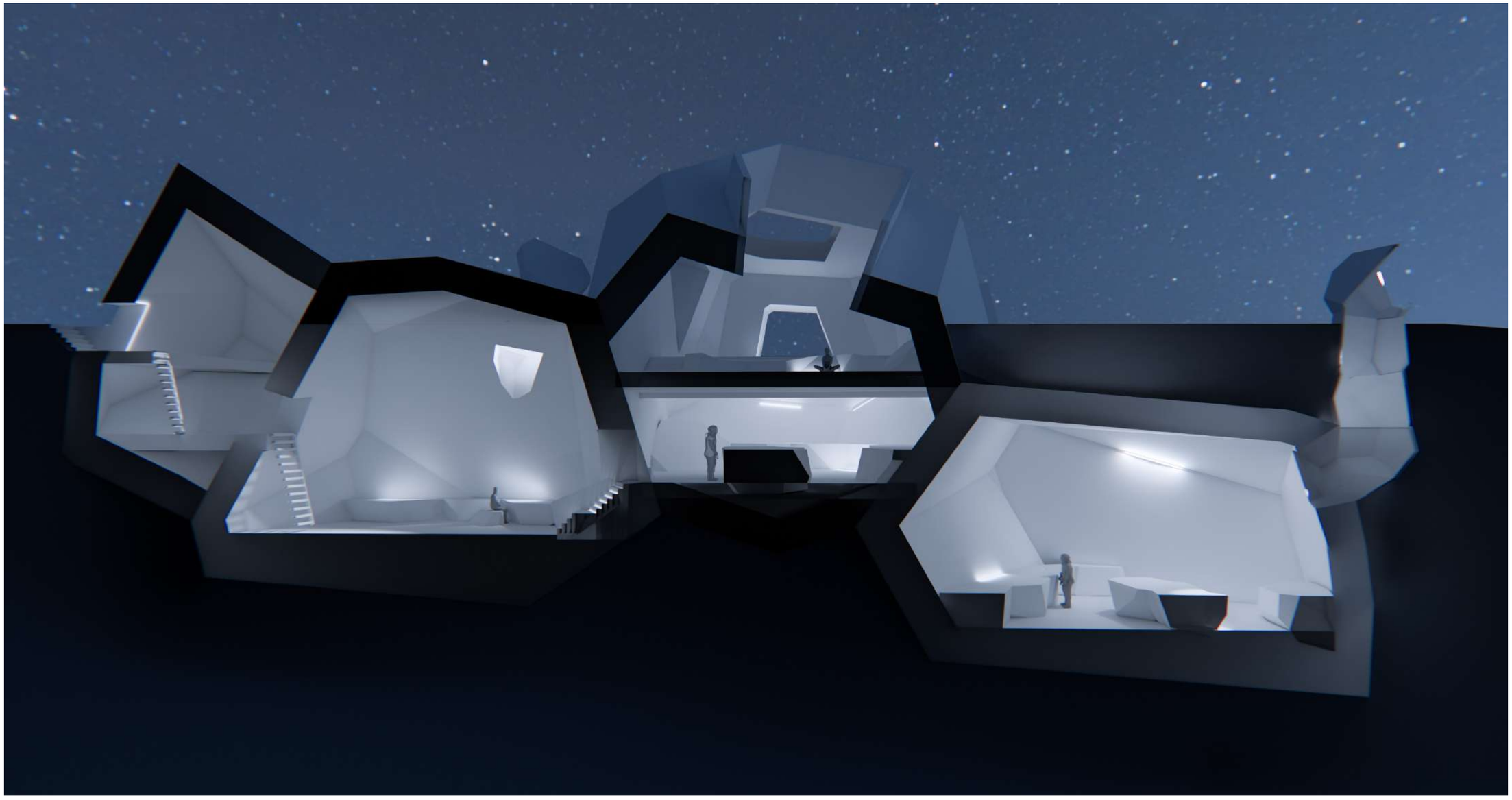


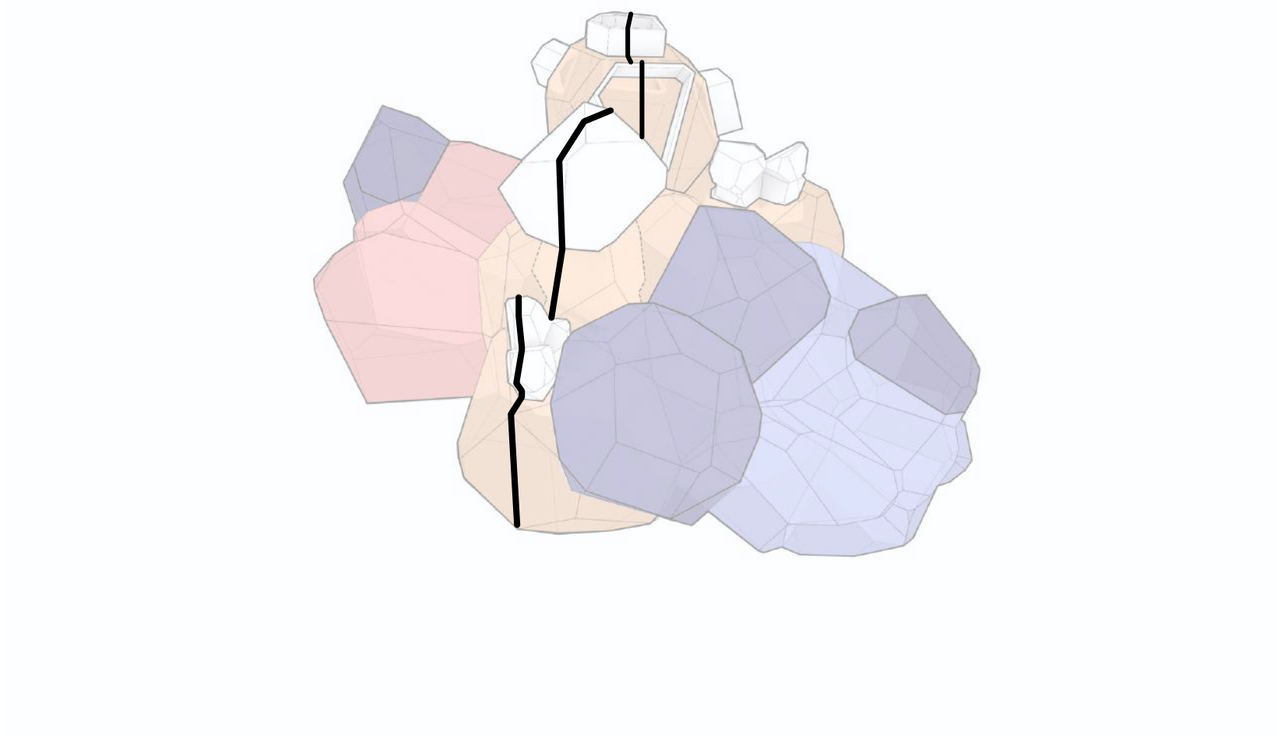
MASTERPLAN

HUMAN HABITAT IN RELATION TO THE CRATER

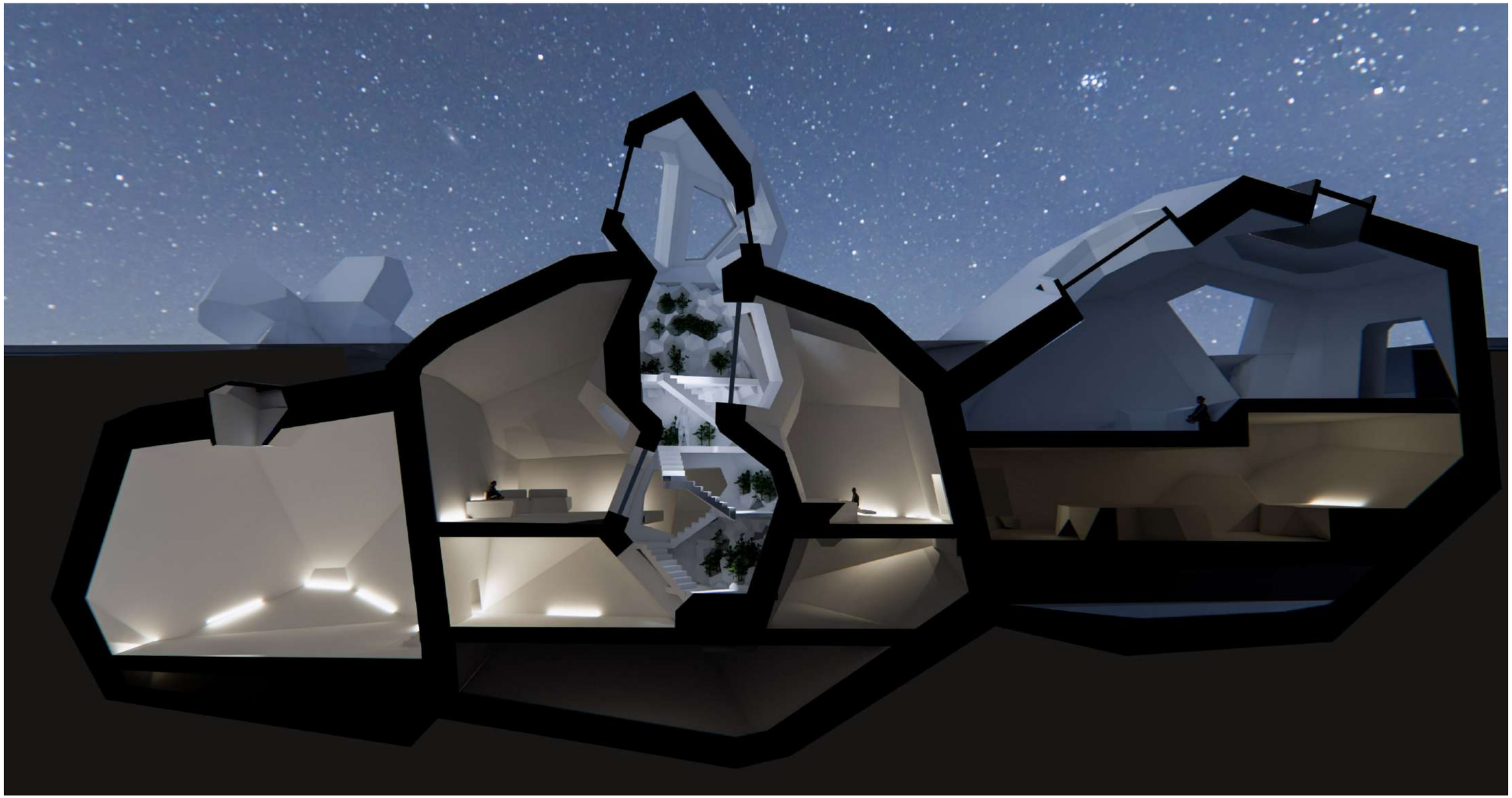


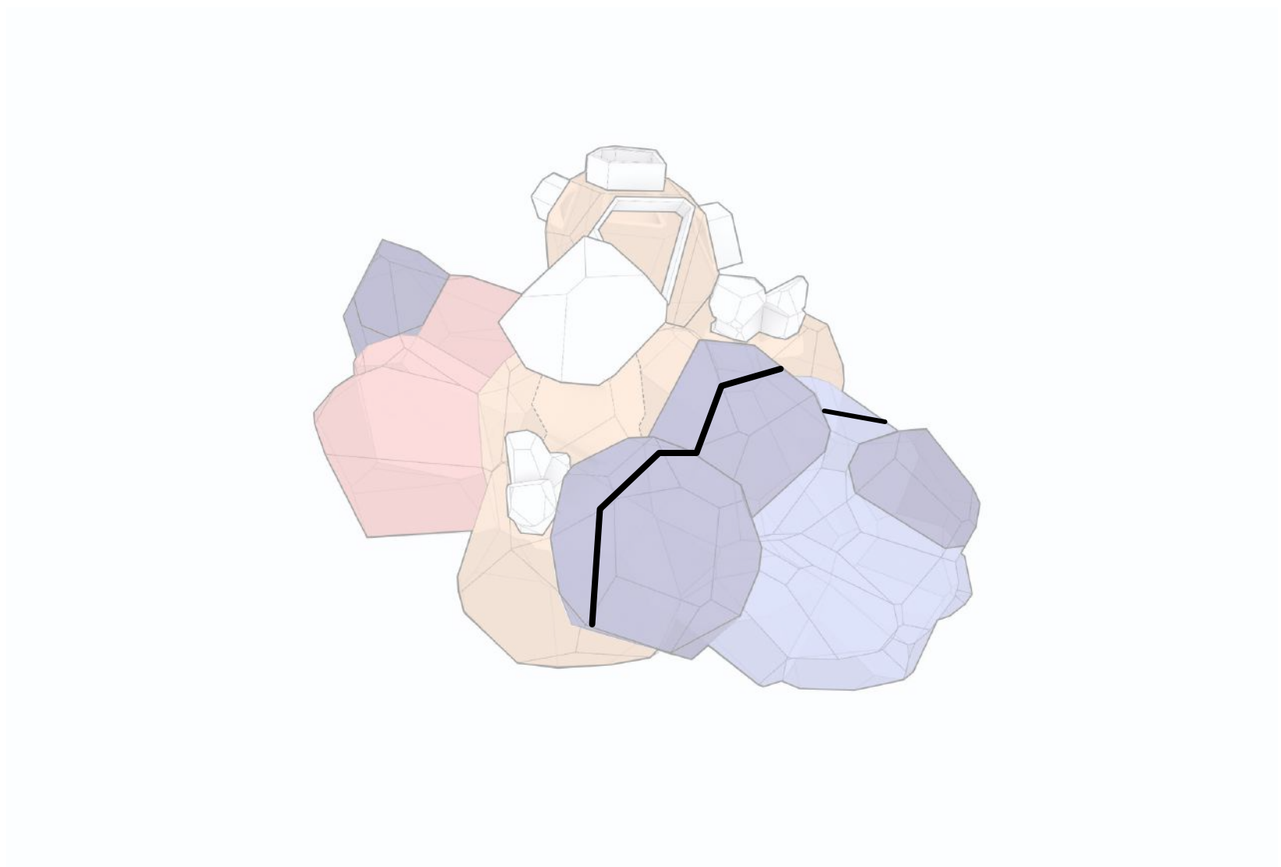
DAY
WORK SPACES





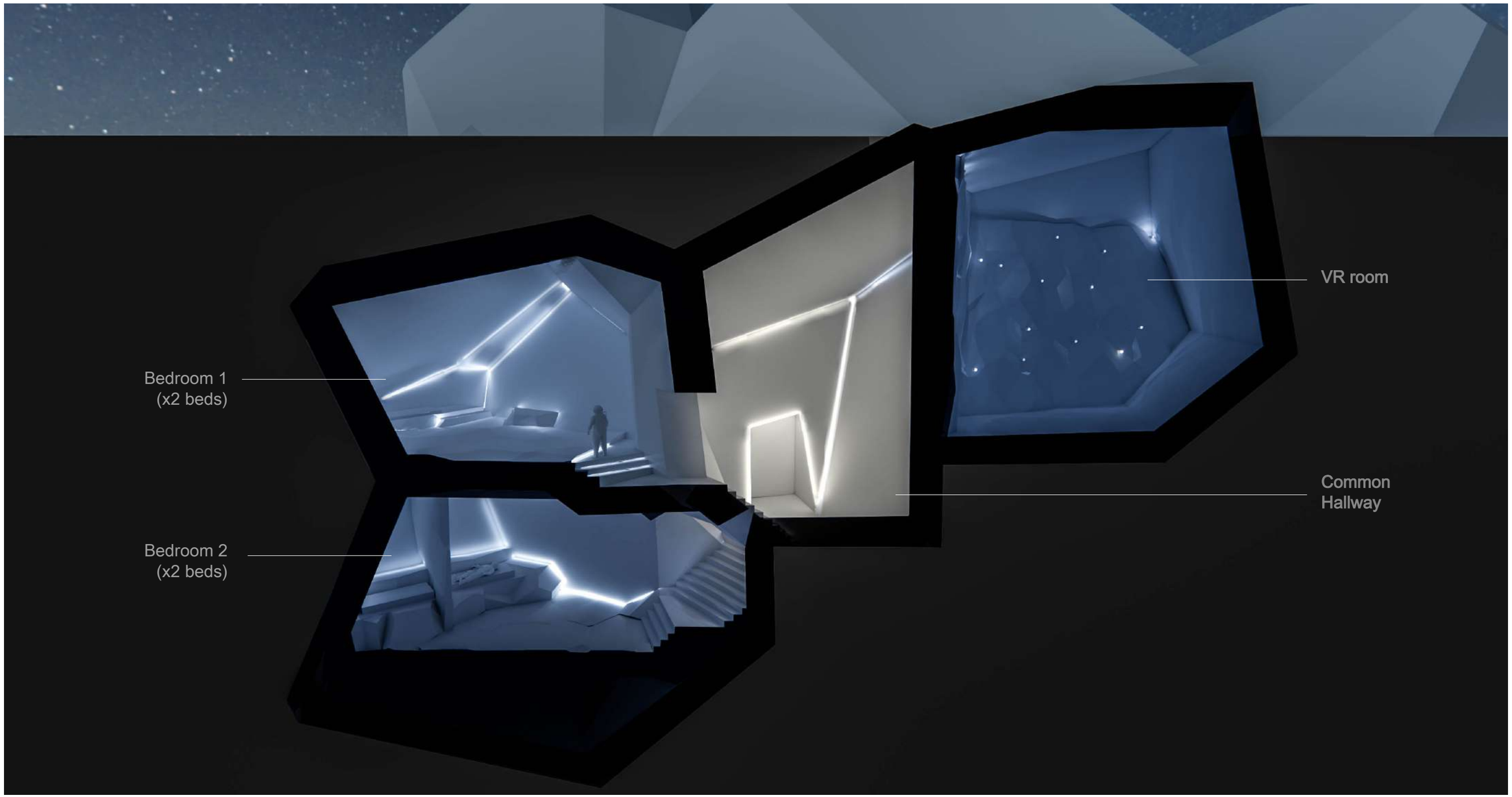
EVENING
SOCIAL SPACES





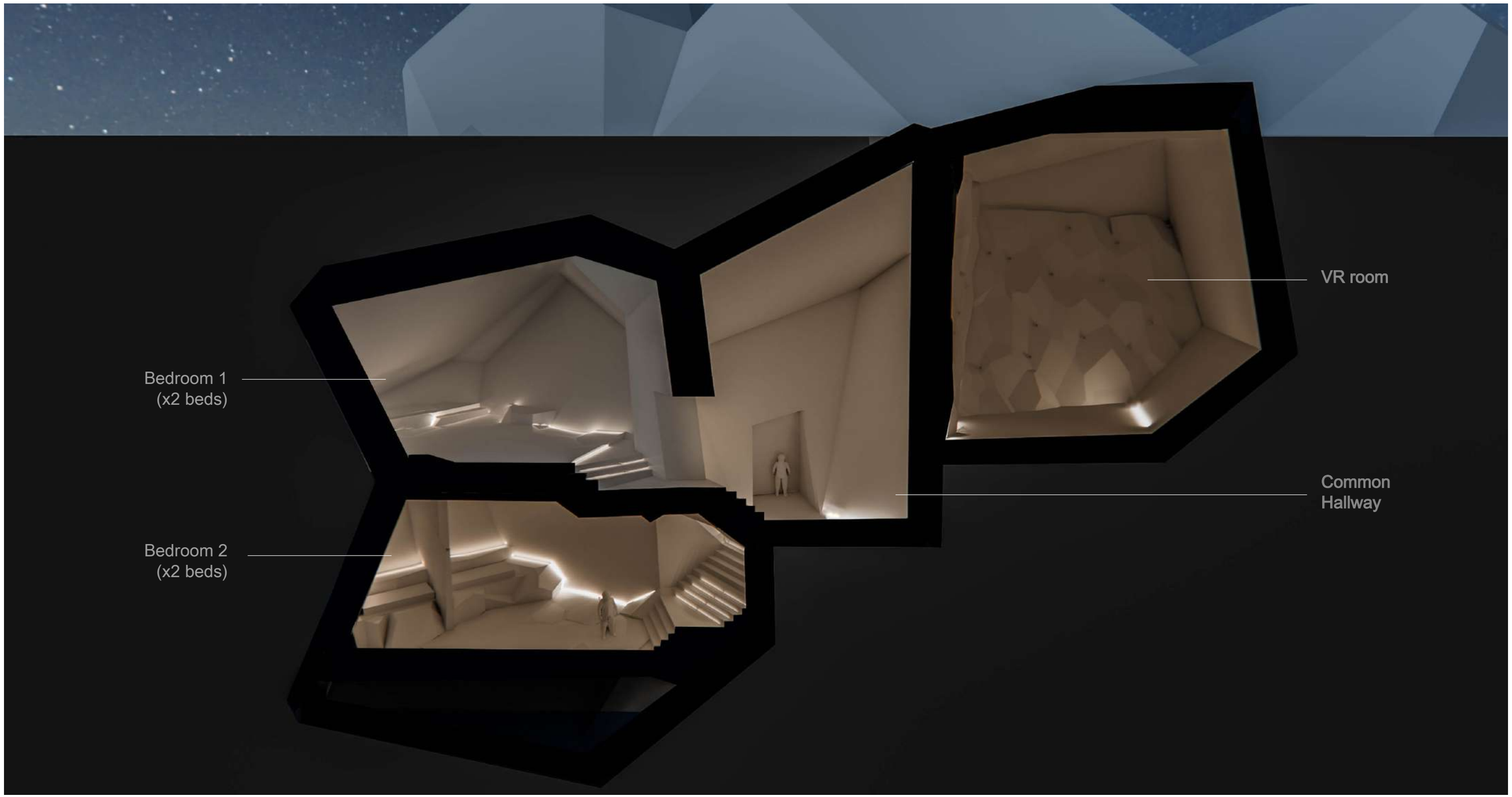
NIGHT
RELAX SPACES

NIGHT



REST AREAS

EVENING

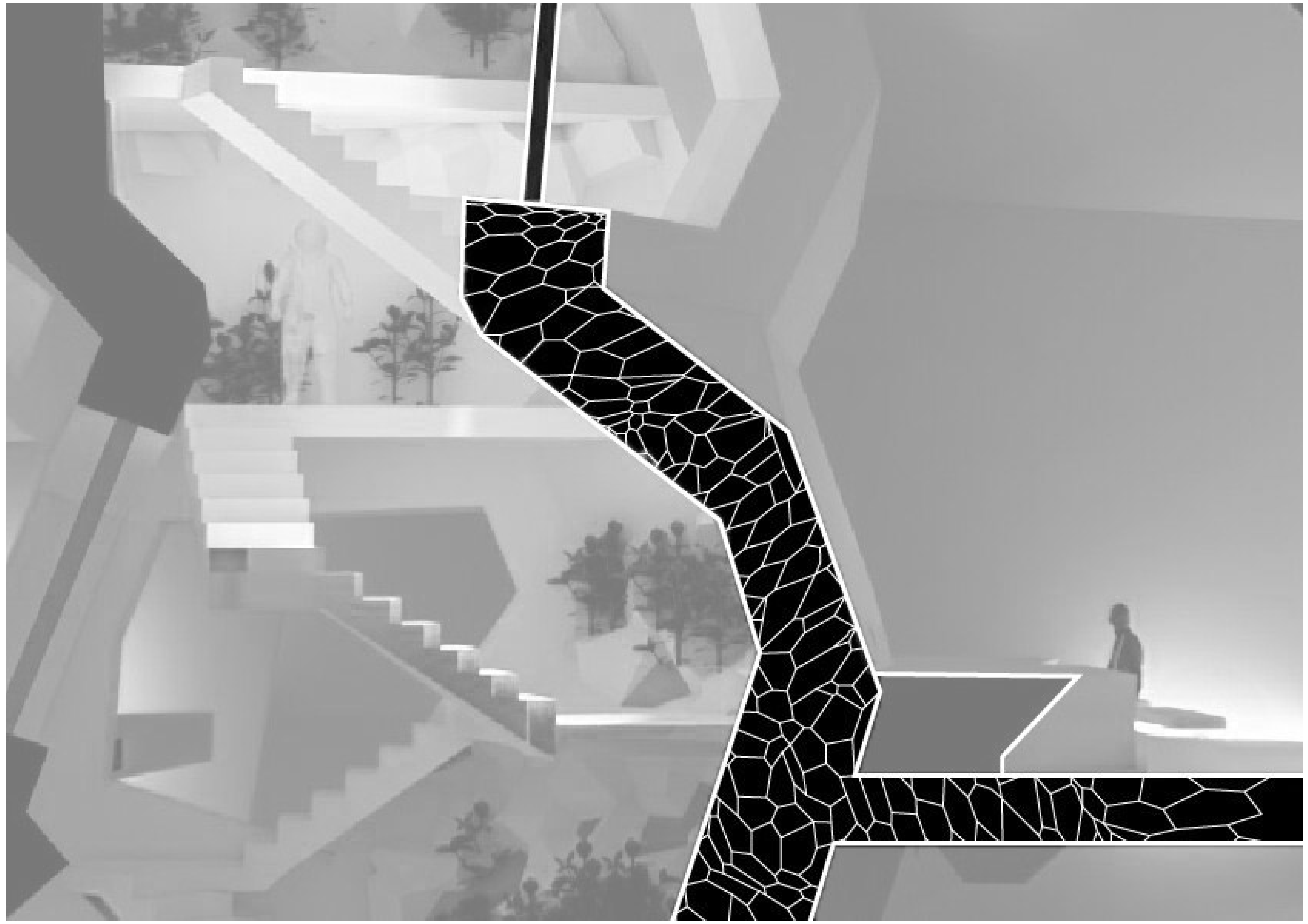


REST AREAS

DAY

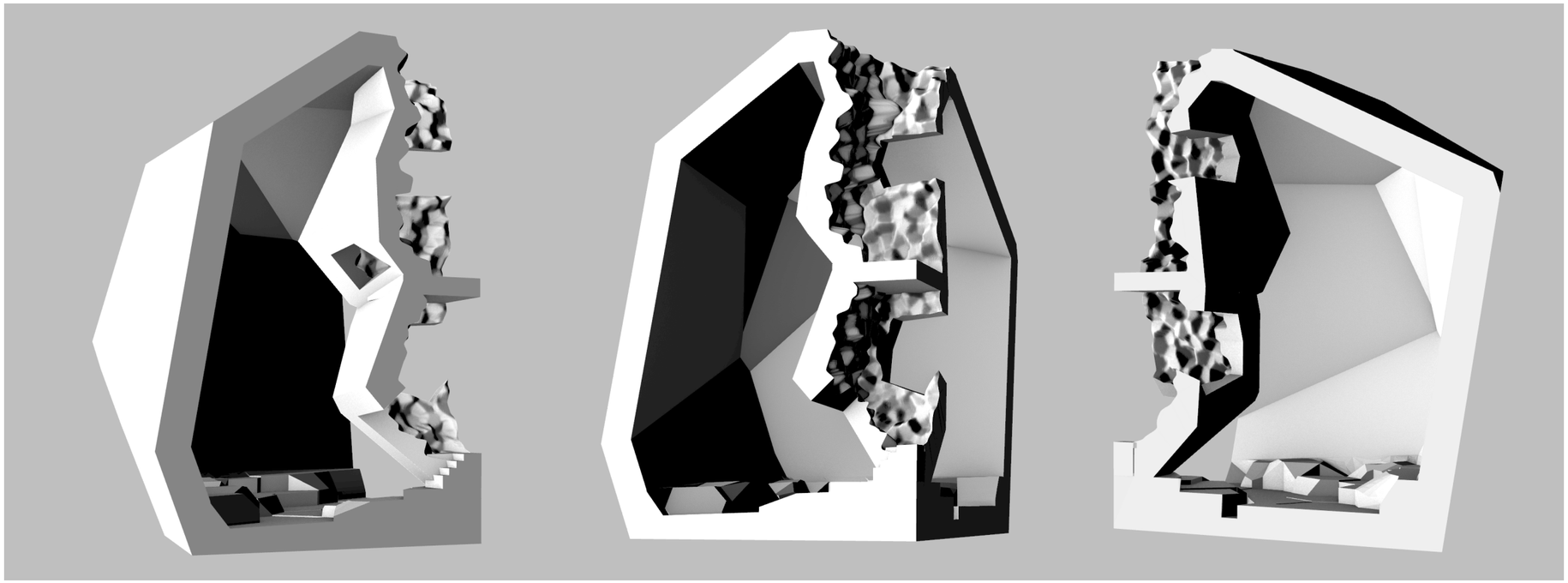
REST AREAS

COMMON HALL AND FOOD PRODUCTION SPACE



DETAIL SECTION – TYPICAL STRUCTURAL STRATEGY

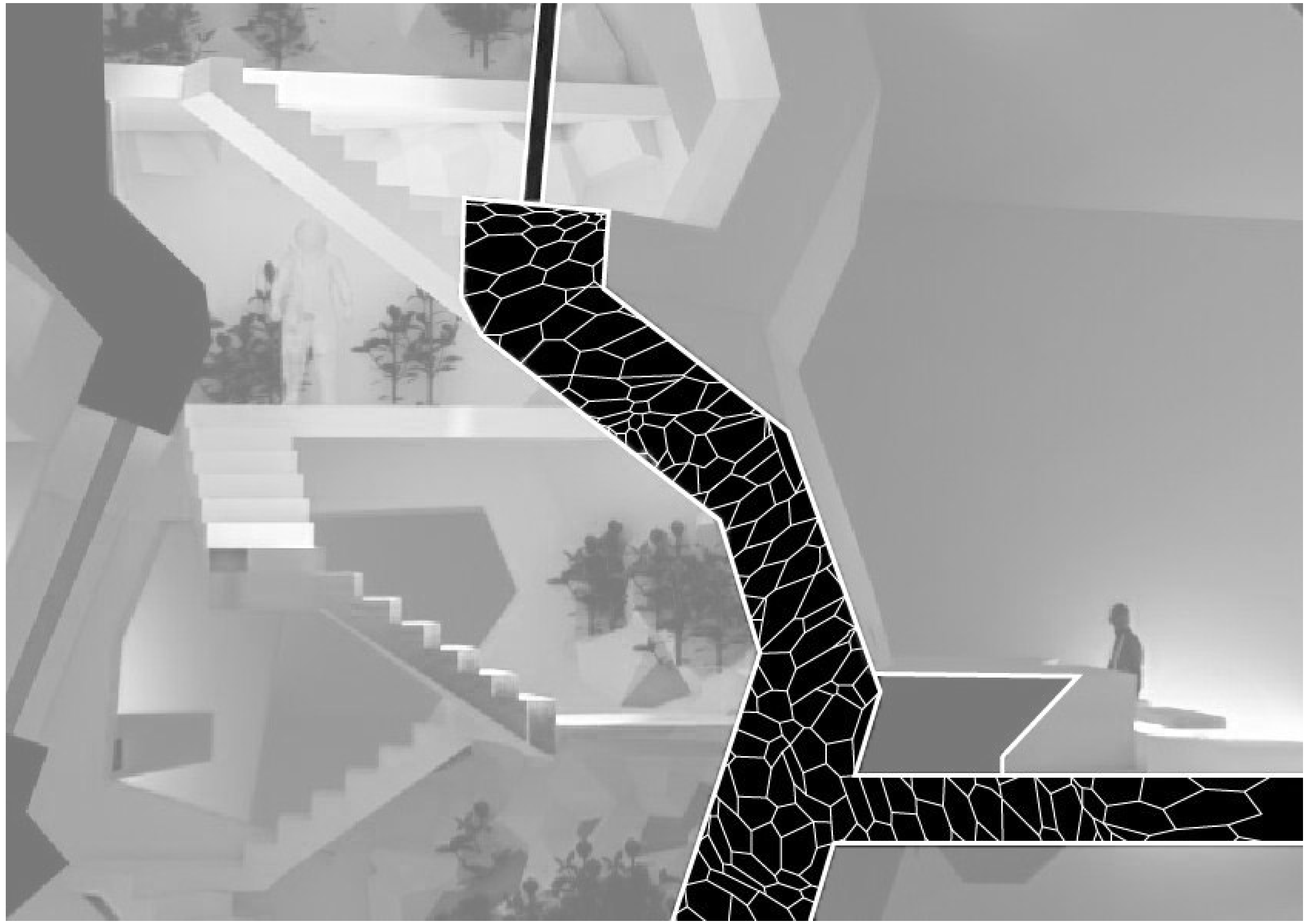
MESO



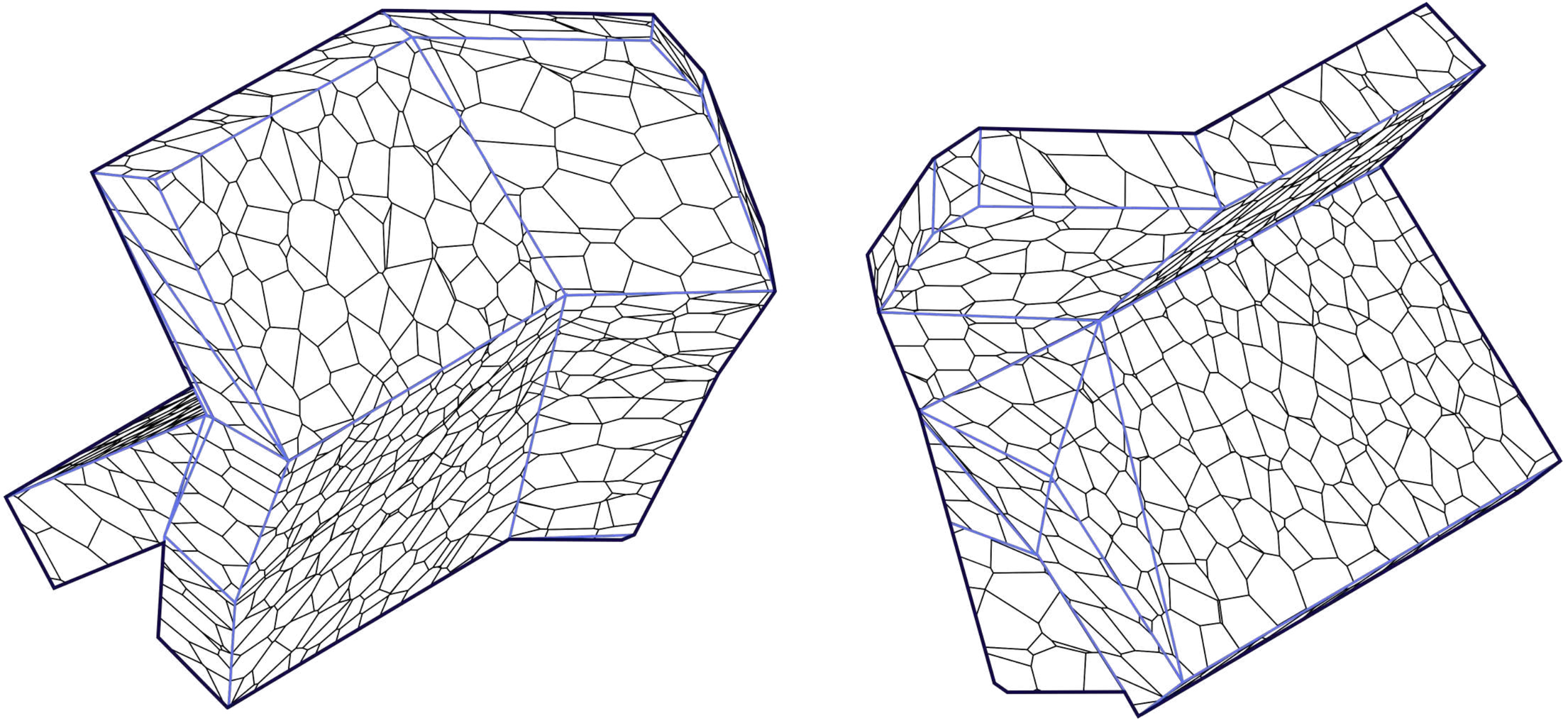
COMMON ROOM AND ATRIUM FRAGMENT

COMMON ROOM AND ATRIUM FRAGMENT - 3D PRINTED MODEL

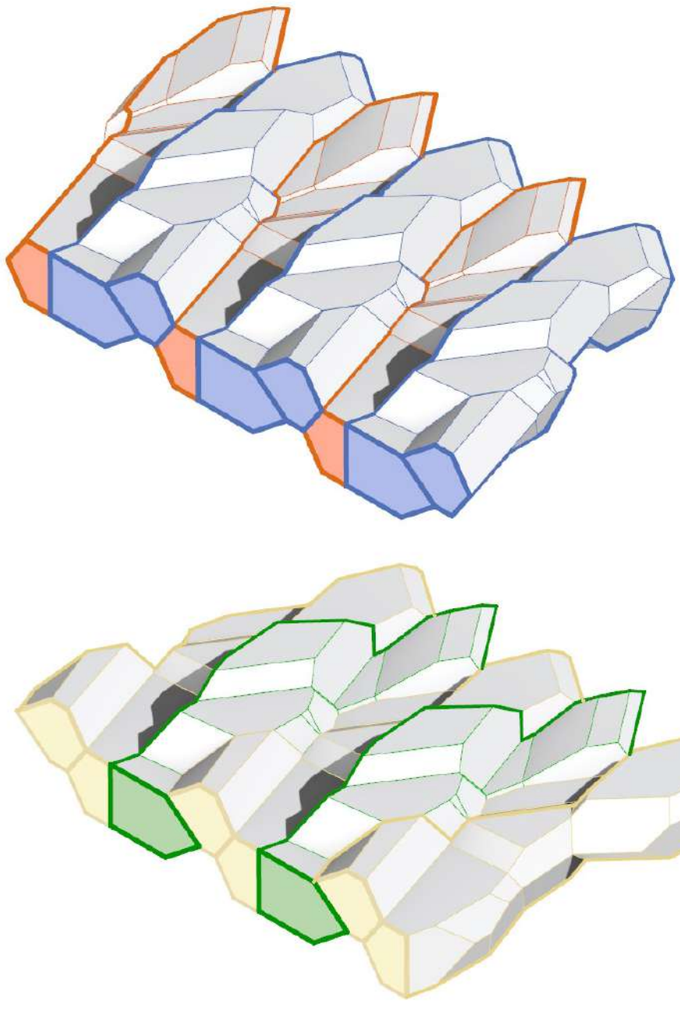
MICRO

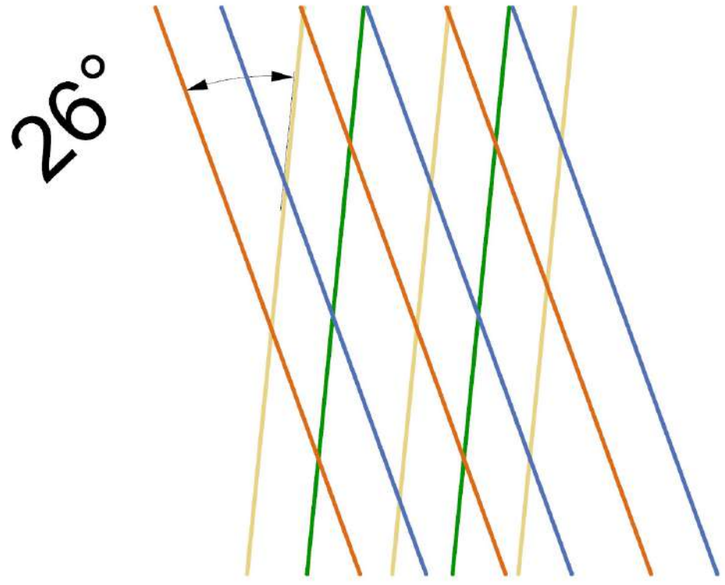


DETAIL SECTION – TYPICAL STRUCTURAL STRATEGY

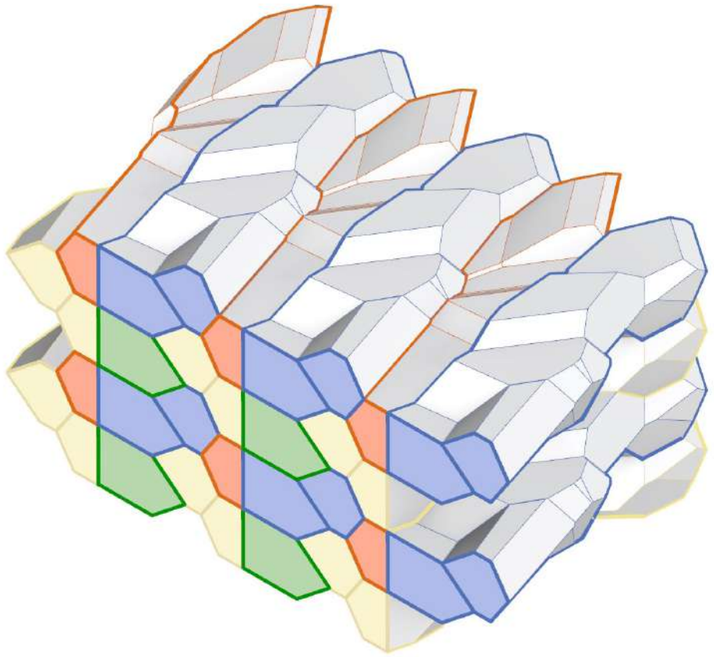


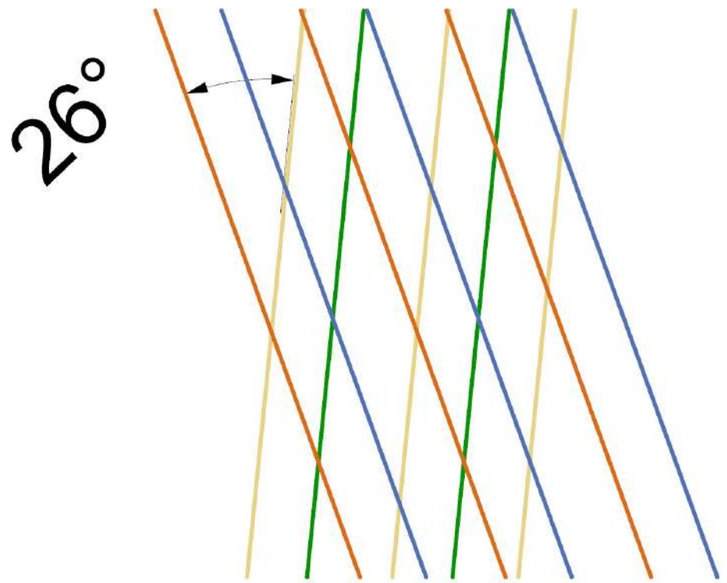
SELECTED FRAGMENT FOR DETAIL DEVELOPMENT



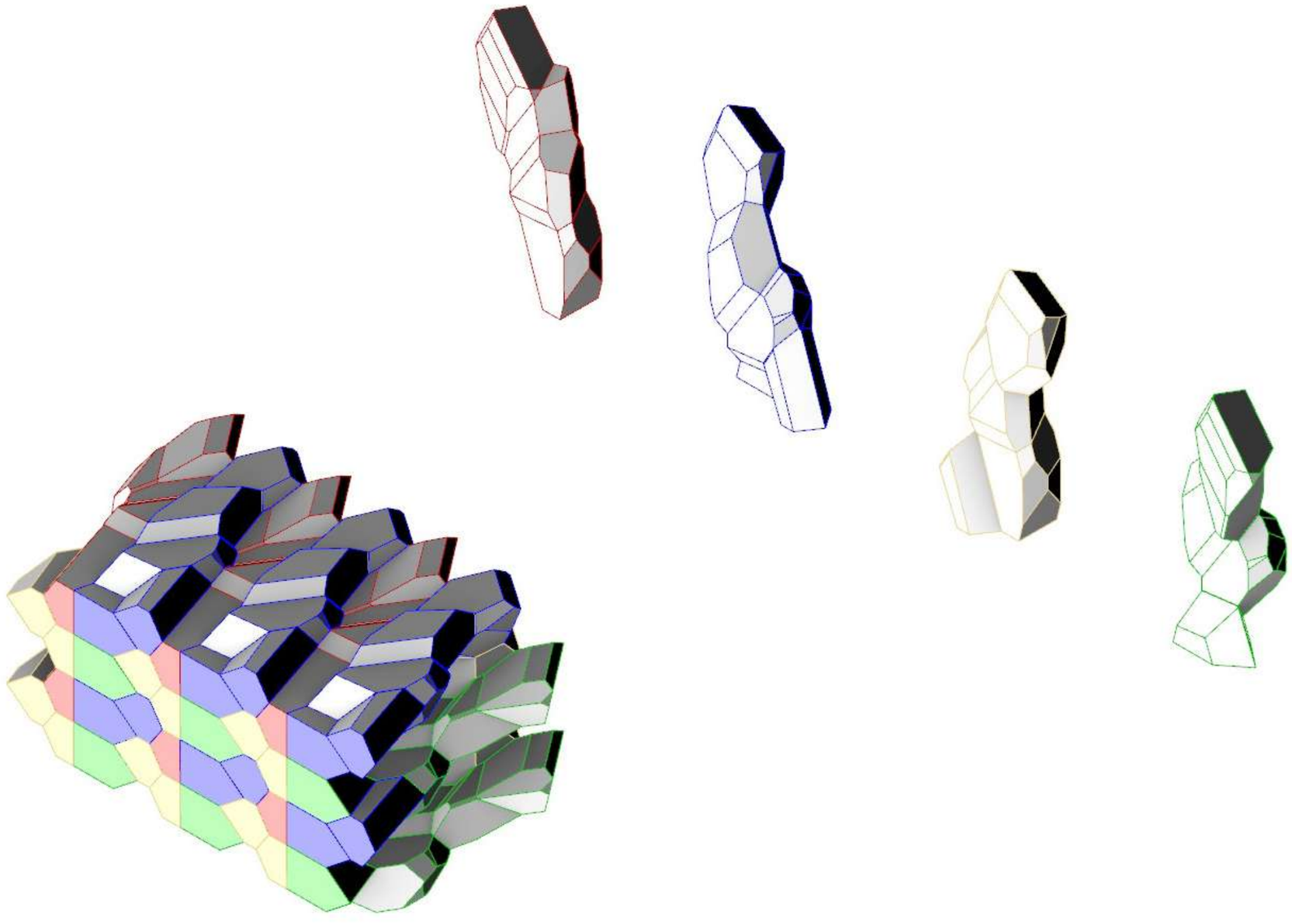


SELECTED DETAIL FRAGMENT - ASSEMBLY STRATEGY

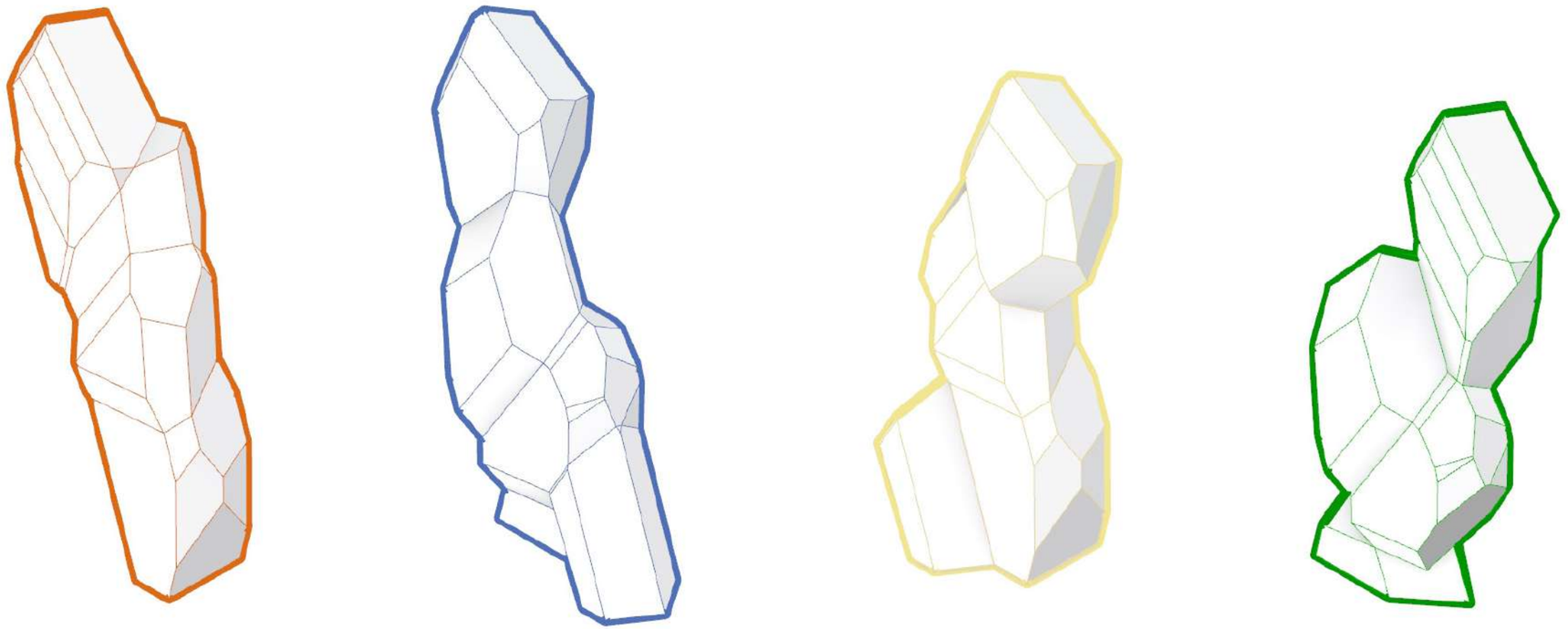




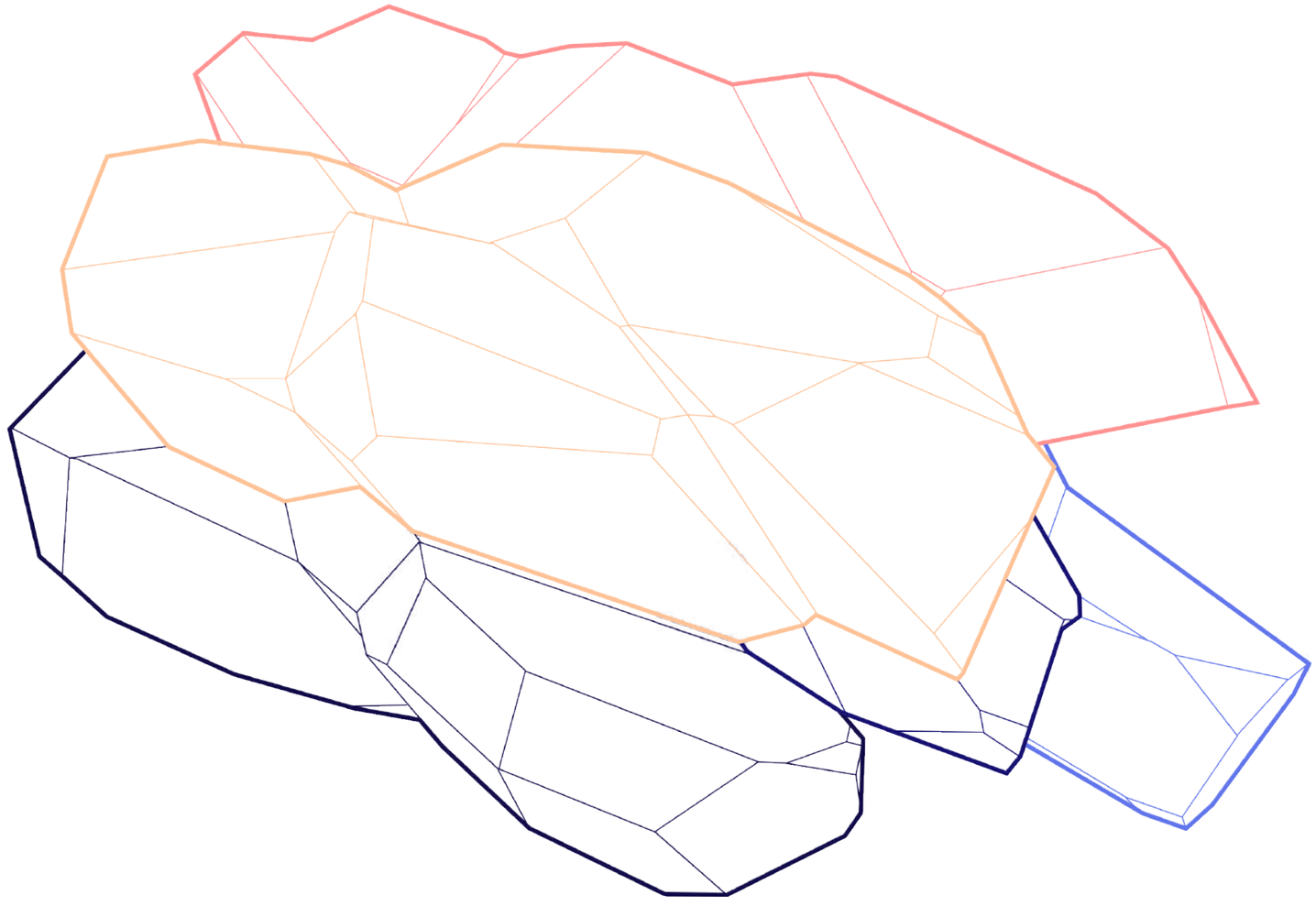
SELECTED DETAIL FRAGMENT - ASSEMBLY STRATEGY



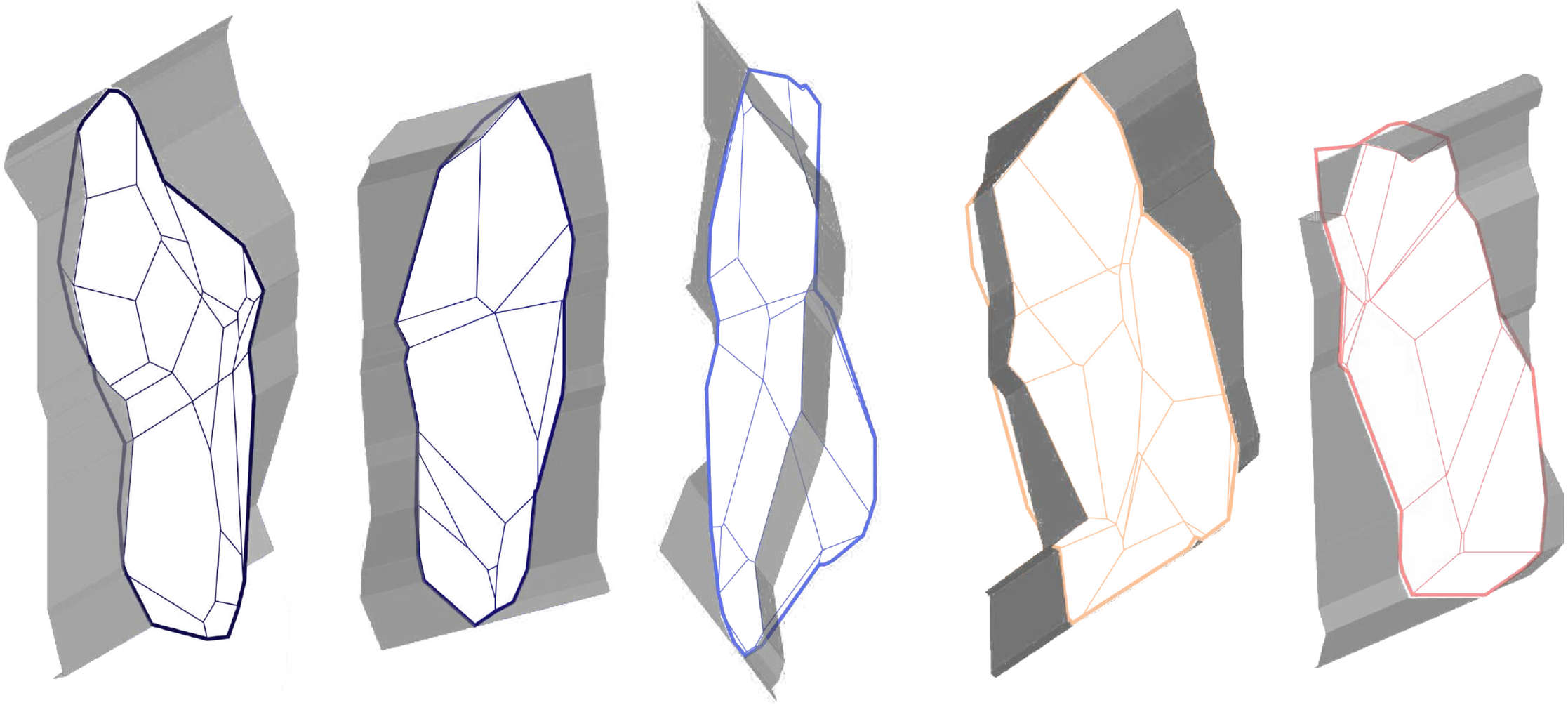
SELECTED VORONOI COMPONENTS



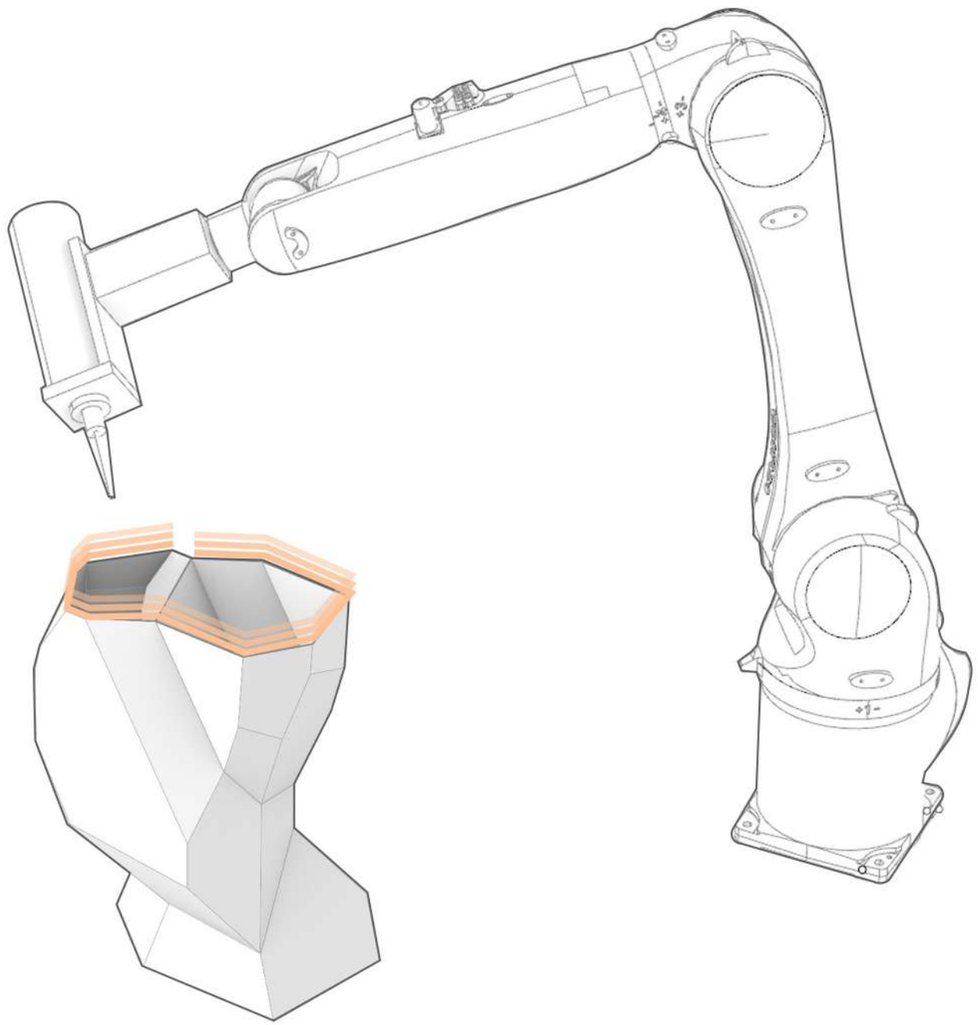
SELECTED VORONOI COMPONENTS



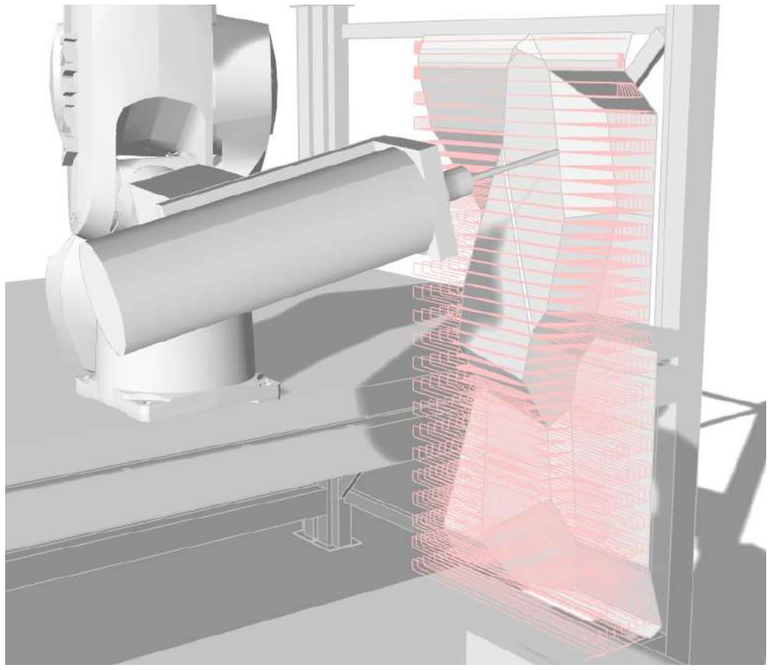
INTERLOCKING VORONOI COMPONENTS



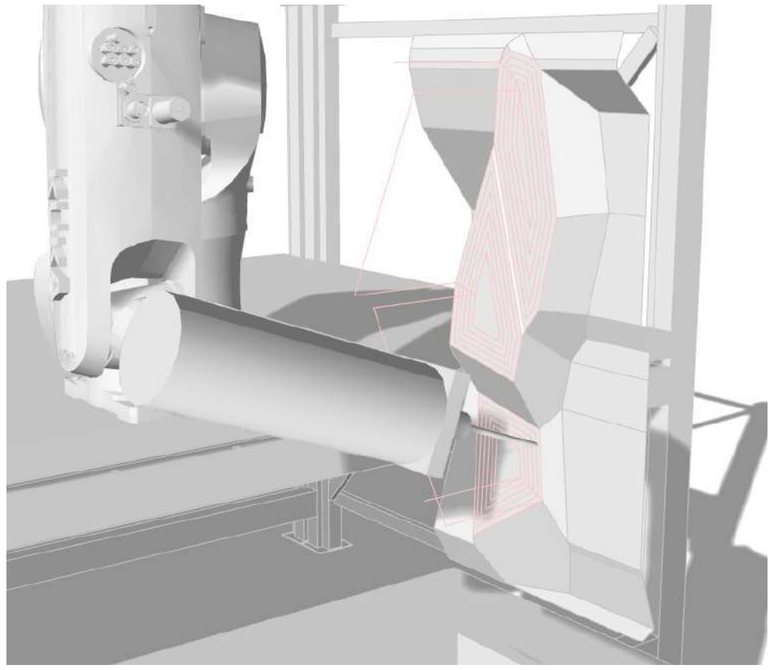
FINAL VORONOI COMPONENTS CHOSEN FOR PRODUCTION
& SURFACE DIVIDING THE MILLING PROCESS IN TWO SIDES



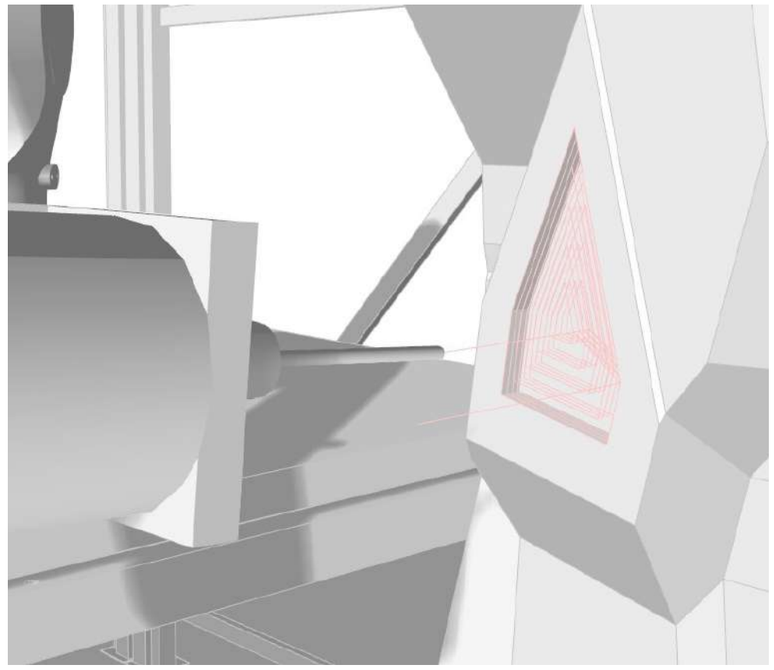
MILLING PRODUCTION



MATERIAL REMOVAL

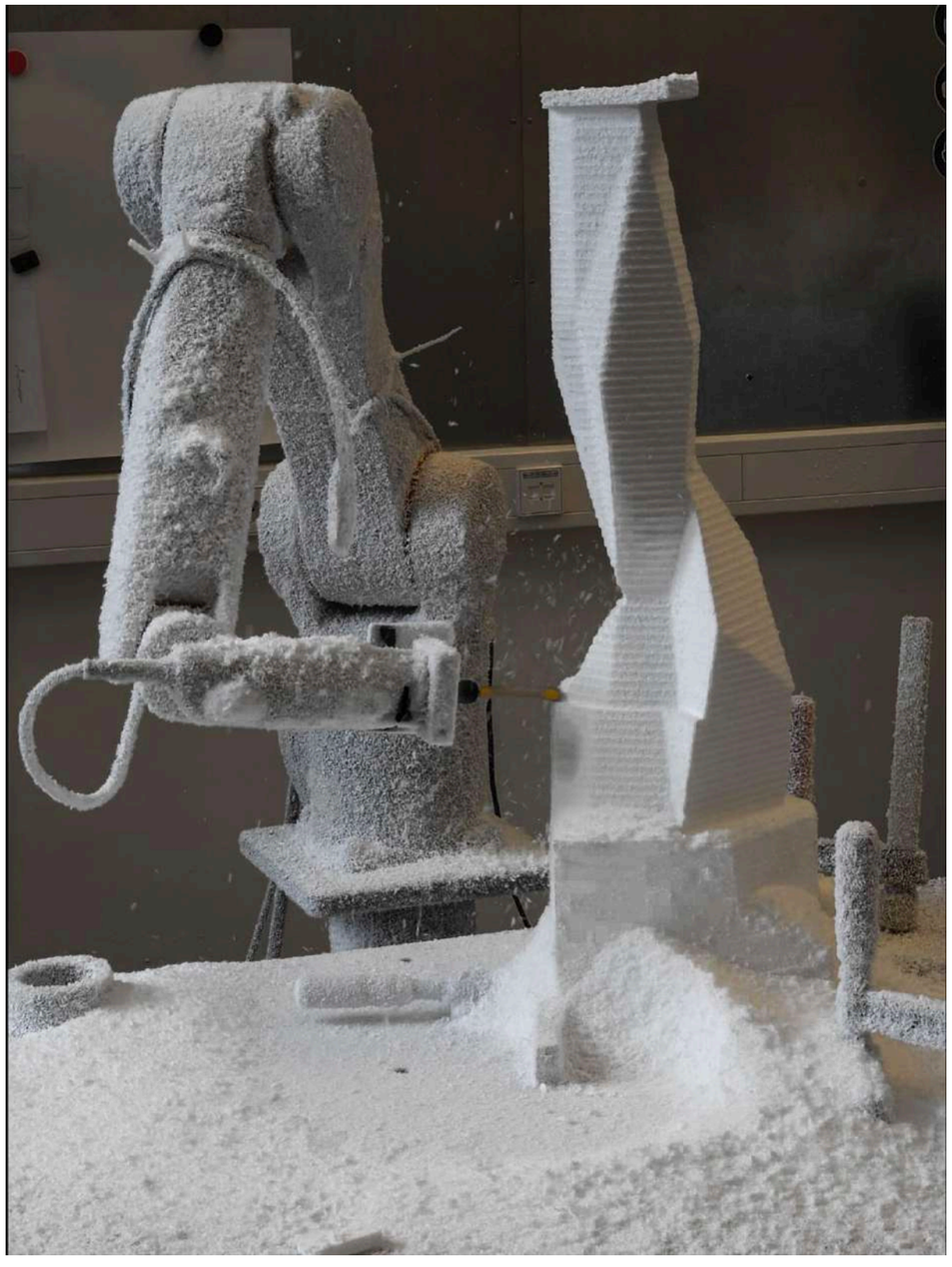


SMOOTHING THE SURFACES

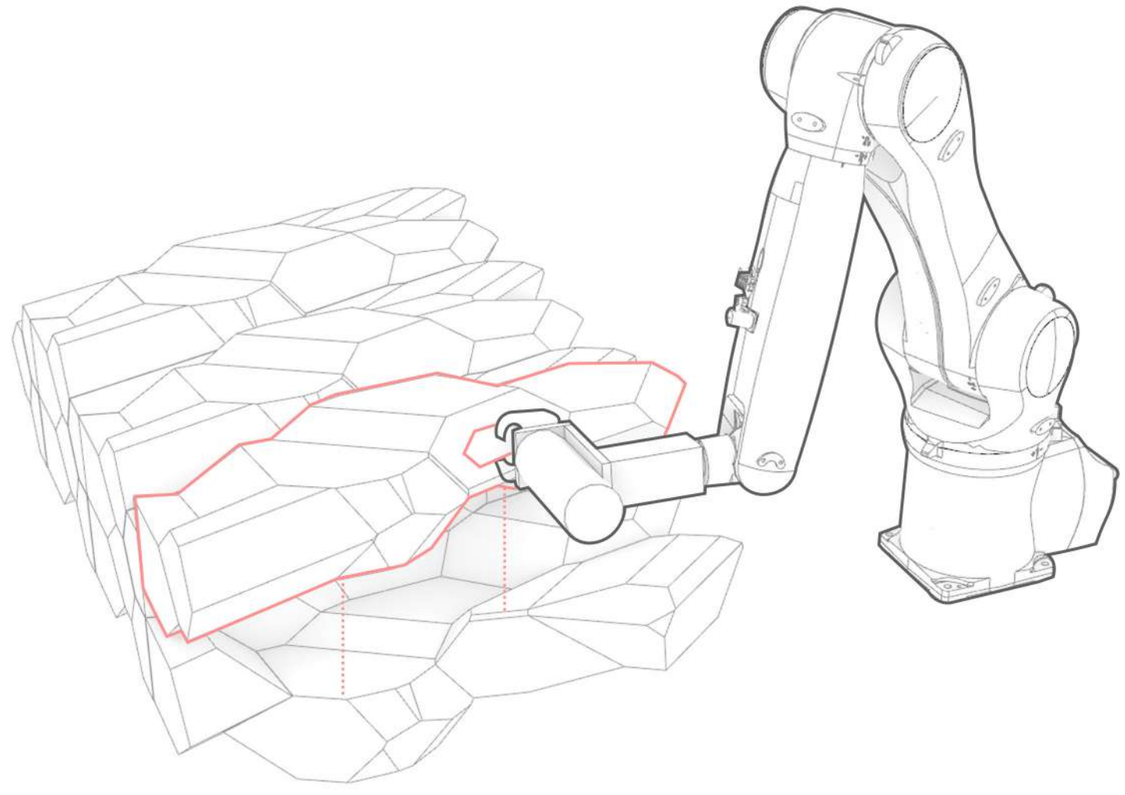


GRABBING HOLE

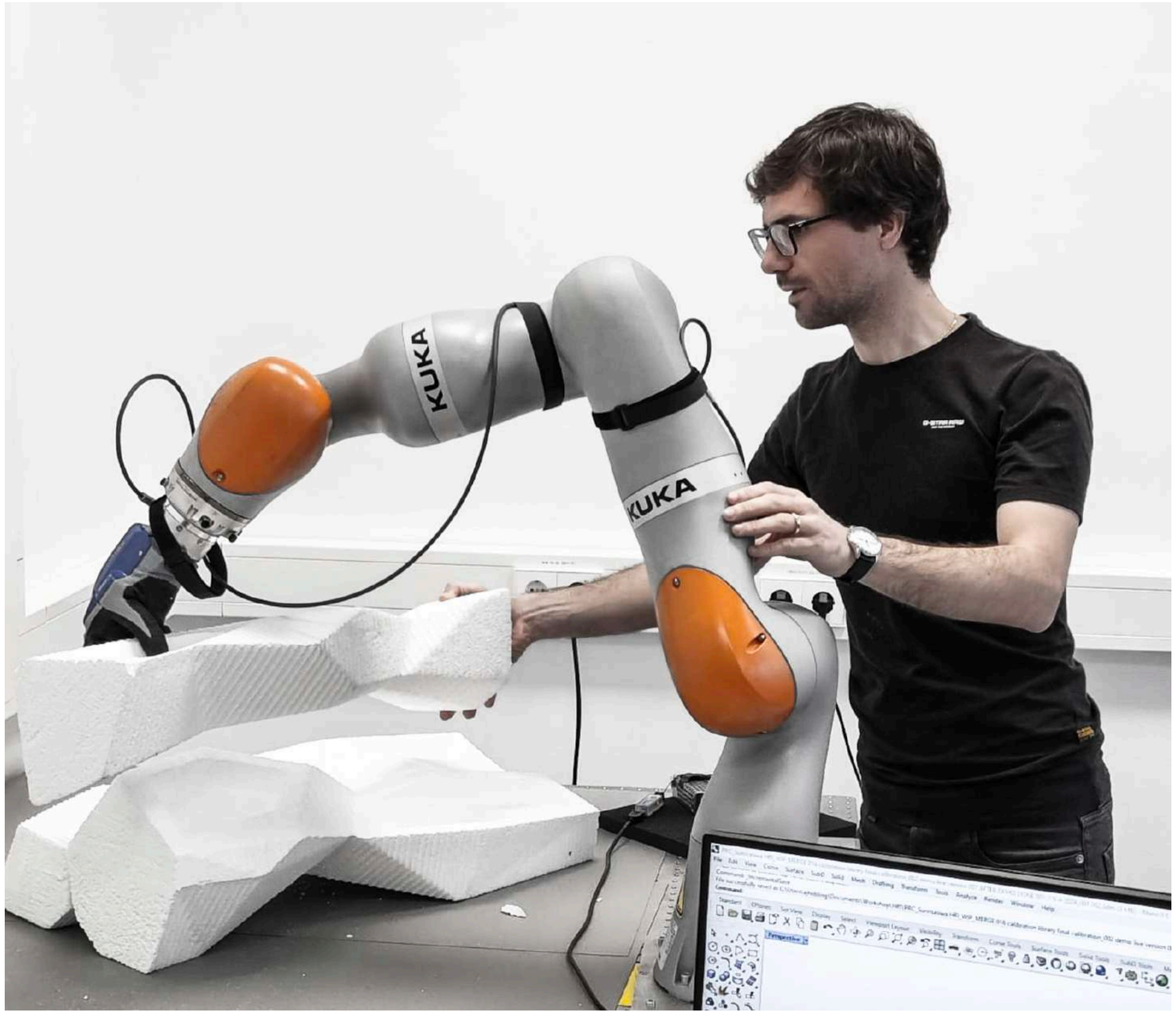
MILLING PRODUCTION



MILLING PROCESS



HRI ASSEMBLY



HRI ASSEMBLY PROCESS