MARS PALACE

1:1 Interactive Architecture Prototypes

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Puck Swildens, Koen Weber, Mattia Roggia

Contents

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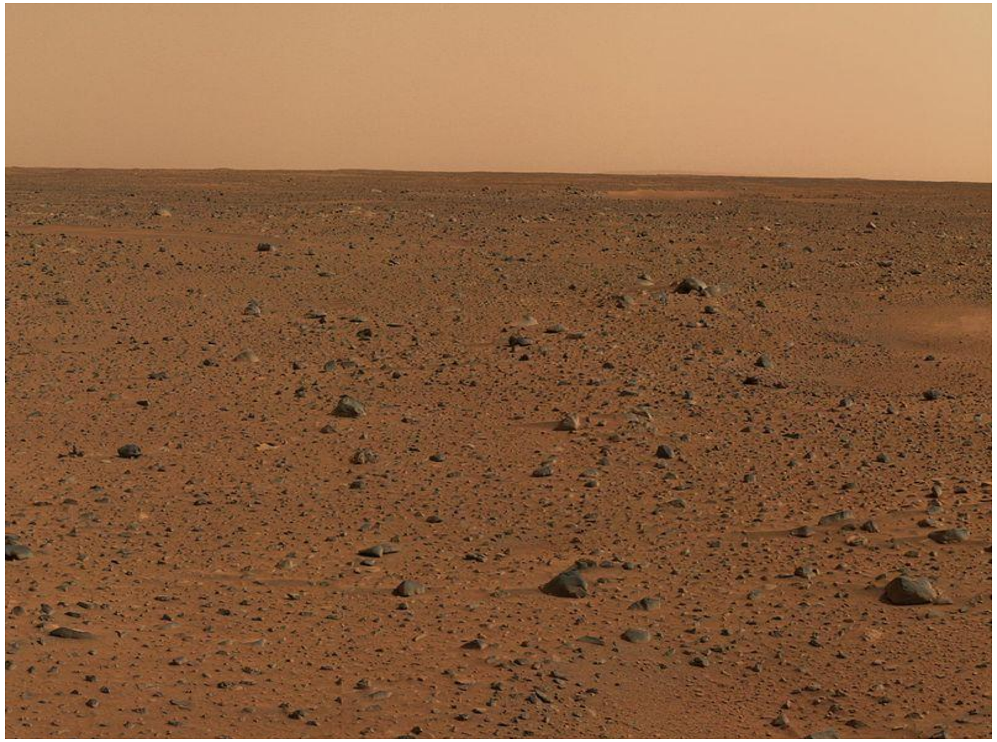
Site _ General

Local materials:
Abundance of basalt rocks, fine magnetic dust and rusty iron dust (regolith). Rocks are enriched with minerals such as phosphorus, sulfur, chlorine, bromine. Basaltic glass. Water-ice under surface of polar regions.

Climate conditions:
Seasons, active atmosphere with clouds and winds, spiraling dust storms (similar to tornadoes)

Geographical features:
Polar ice caps, (inactive) volcanoes, canyons



Source: Marspedia.org

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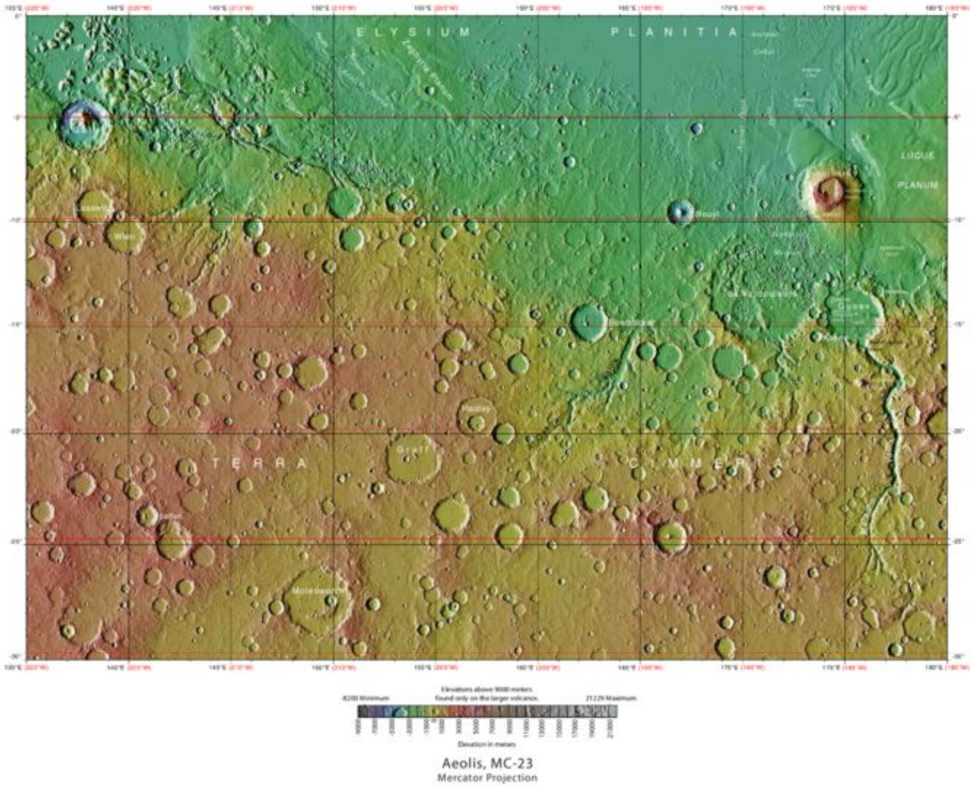
Site _ Location

Aeolis quadrangle:

180-225° W and 0-30° S

Named after the mythical island of Aiolos, the ruler of the winds, it is the famous site of two spacecraft landings (Spirit Rover, Curiosity Rover)

Here is located a large, ancient river valley (Ma'adim Vallis), and Gusev Crater – an ancient lake bed covered by a volcanic flow.



Source: Marspedia.org

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Site _ Comparison

	EARTH	MARS
TIME	**24 hours (day)** **365 days (year)**	**24,6 hours (day)** **687 days (year)**
GRAVITY	**9,81 m/s²**	**3,73 m/s2**
TEMPERATURE	**15ºC (average)** **-89ºC - 57ºC**	**-65ºC (average)** **-153ºC - 20ºC**
SUNLIGHT	**1361 W/m²**	**598 W/m² (56% less)**
ATMOSPHERE	**78 % N2** **21 % O2** **0,9% Ar**	**96 % CO2** **2,8 % N2** **2% Ar**
RADIATION	**0,5 - 0,6 rads**	**24-30 rads**

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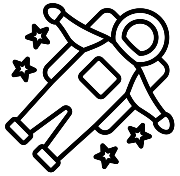
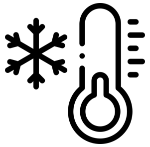
Design Considerations

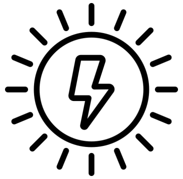
1. Site - Related



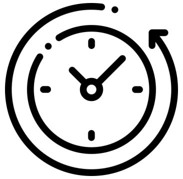
Low gravity
38 % of earth's
gravity (3,7 m/s2)



Extreme
temperature
fluctuation, average
temperature -62°C



High levels of
radiation (40-50
times earth
average)



Mars daily cycle is
longer than on
earth (24h 39m 35s)

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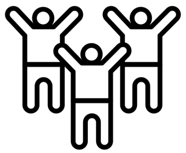
Design Considerations

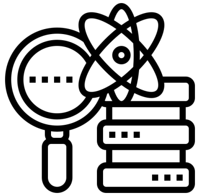
2. Human Needs

Private, spacious bedrooms



Shared facilities and recreational areas

Space to grow sufficient food



Research and communication space

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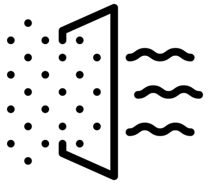
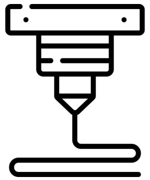
Design Considerations

3. Architectural Features

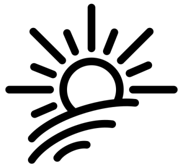


Airtight design



Construction in local material (Mars regolith)

Interlocking elements



Allow natural light while protecting against radiation

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Program

FUNCTION	NUMBER OF ROOMS	CAPACITY	PERCENTAGE
BEDROOM - personal	4	1	10%
BATHROOM - hygienic	2	2	5%
GYM - recreational	1	4	10%
OASIS - shared	1	4	20%
KITCHEN - food production	1	4	10%
LIVING ROOM - shared	1	4	15%
WORKSPACE/LAB - shared	1	4	15%
MEDICAL SPACE - common	1	4	10%
STORAGE - common	2	4	5%

combining functions in order to get more complex and fewer amount of elements

integrate storage functions

private spaces are protected

gain sunlight through upper windows (chimneys)

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Case Studies _ 1

LUNASCAPE (2024)

CONTEXT

in a crater - protected
slope of the terrain - suitable, safe
partially underground

VOLUMES

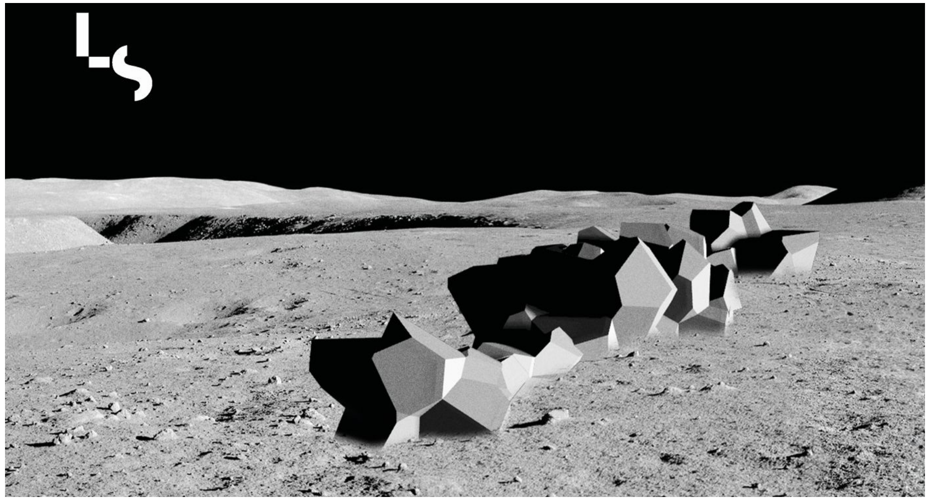
alternation of volumes
airlocks as corridors - linearity
membranes as spaces - centrality

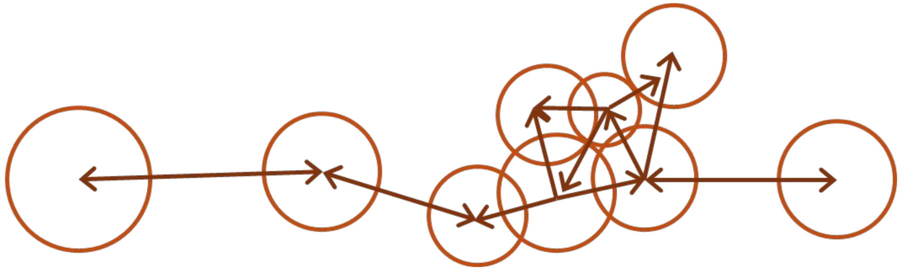
CIRCULATION

secondary spaces can be reached through main spaces - linearity
sleeping spaces in the center - exposed

HUMANITY

spaces protected from direct sunlight
common spaces above ground
recreational spaces



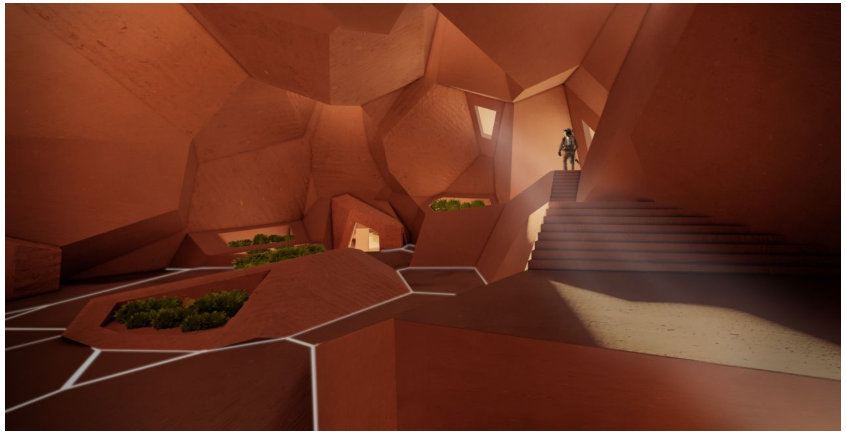


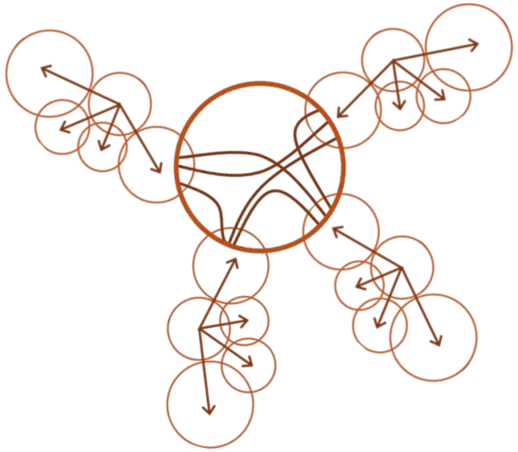
http://cpa.roboticbuilding.eu/index.php?title=Shared:WS2024MSc2SAG4Presentations

Case Studies _ 2

COMMUNAL HOUSING ON MARS (2023)

CONTEXT partially underground main space with most openings and light individual spaces are sheltered	**VOLUMES** separate living cells like housing modules, organized around a central courtyard
CIRCULATION connection of spaces are not clear community spaces concentrate in the middle	**HUMANITY** huge green area, inner garden for mental well-being and food production





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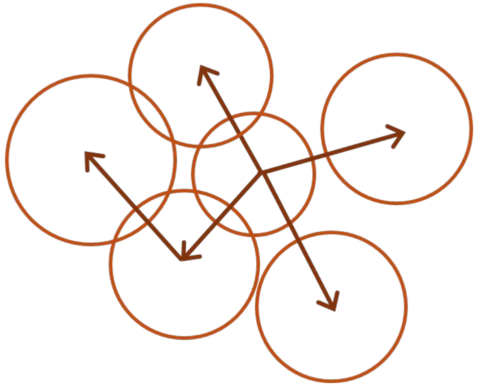
Case Studies _ 3

RED OASIS (2023)

CONTEXT	**VOLUMES**
completely above ground	working with fewer spaces bigger, less fragmented blocks
CIRCULATION	**HUMANITY**
cave-like design - not necessary (its above ground) lab in the center	plant production lack of recreational spaces and functions lack of openings



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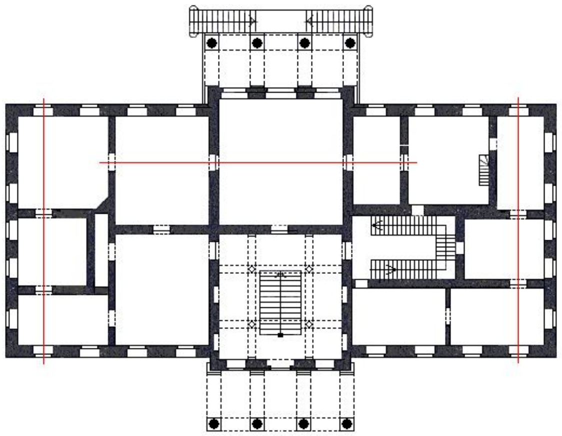
Design _ Concept

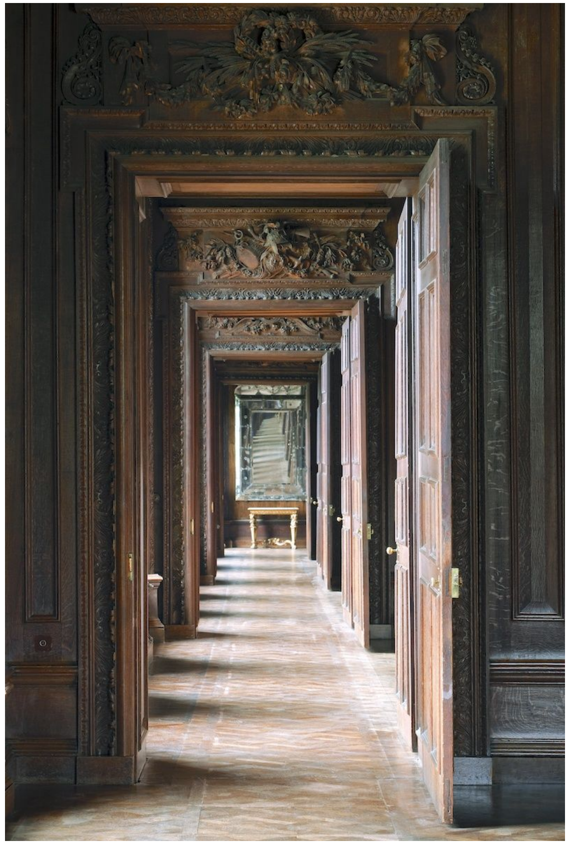
Enfilade: sequence of spaces, often in palaces or state buildings

Combining a classical concept with a futuristic one

Creating efficient movement through space and long sightlines



(Plan) New Castle, Czech Republic



(Photo) Chatsworth House, England

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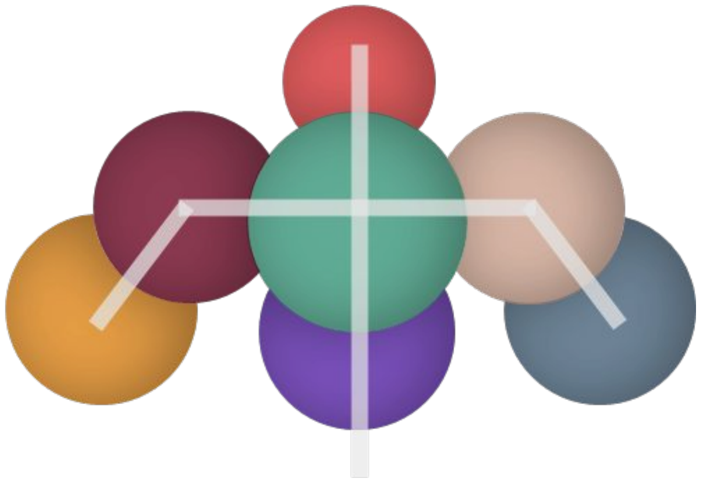
Design _ Diagram



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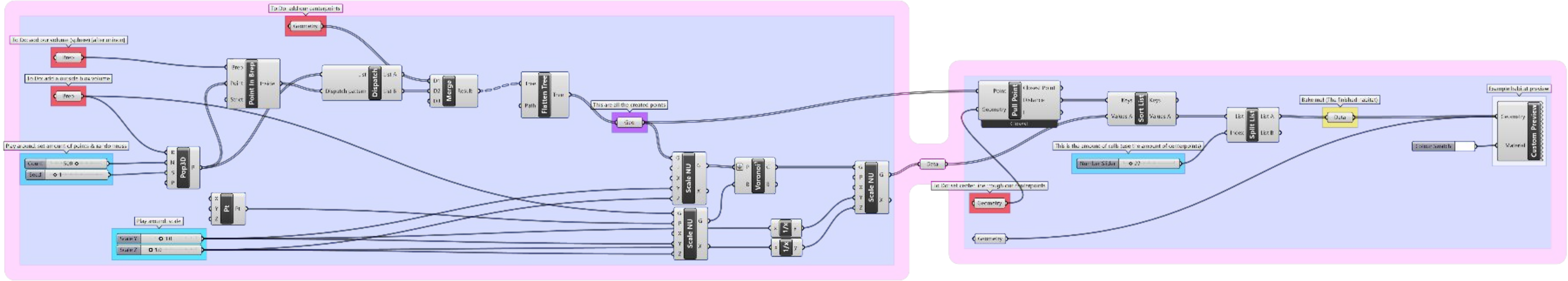
Voronoi - Generation



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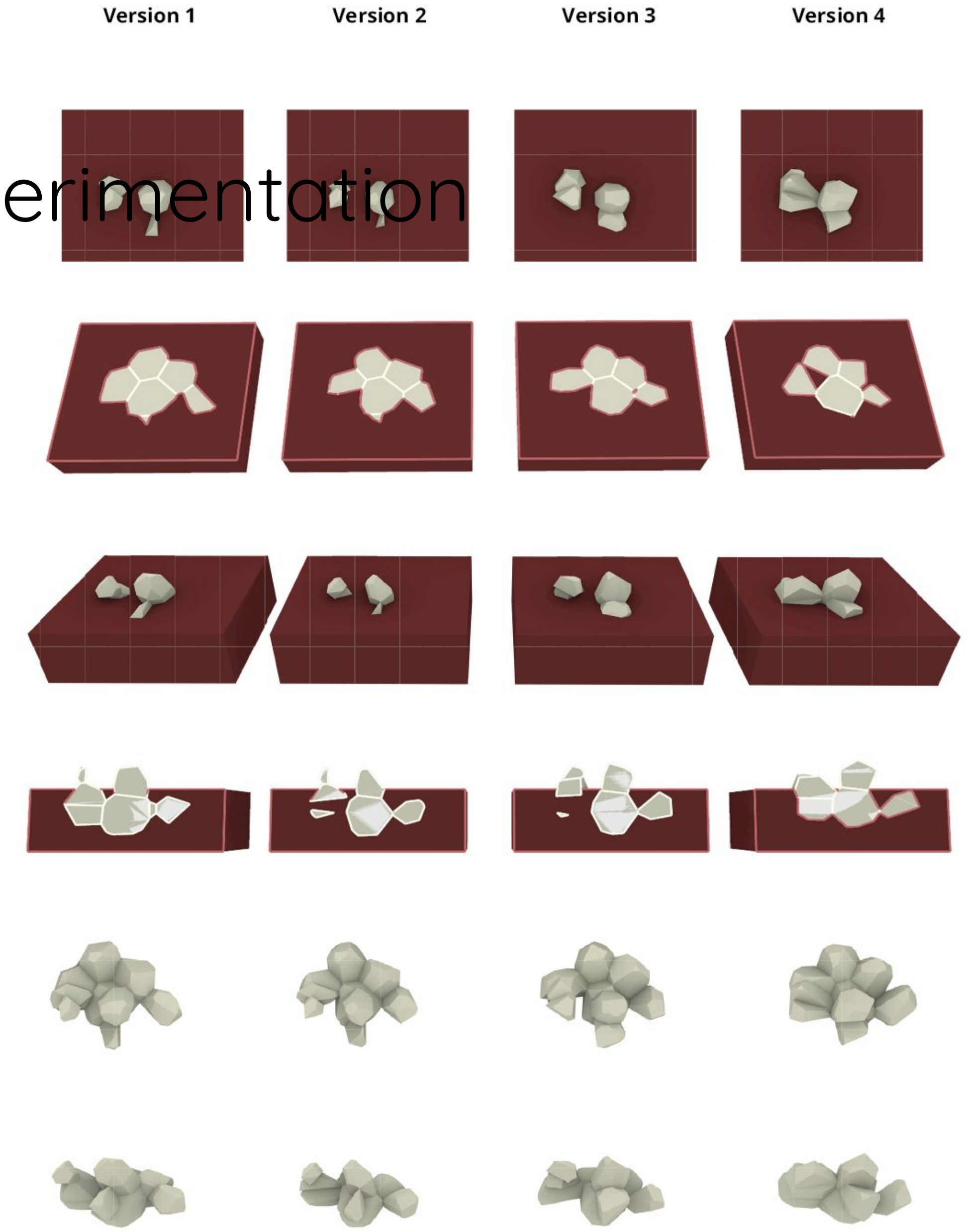
Voronoi _ Experimentation



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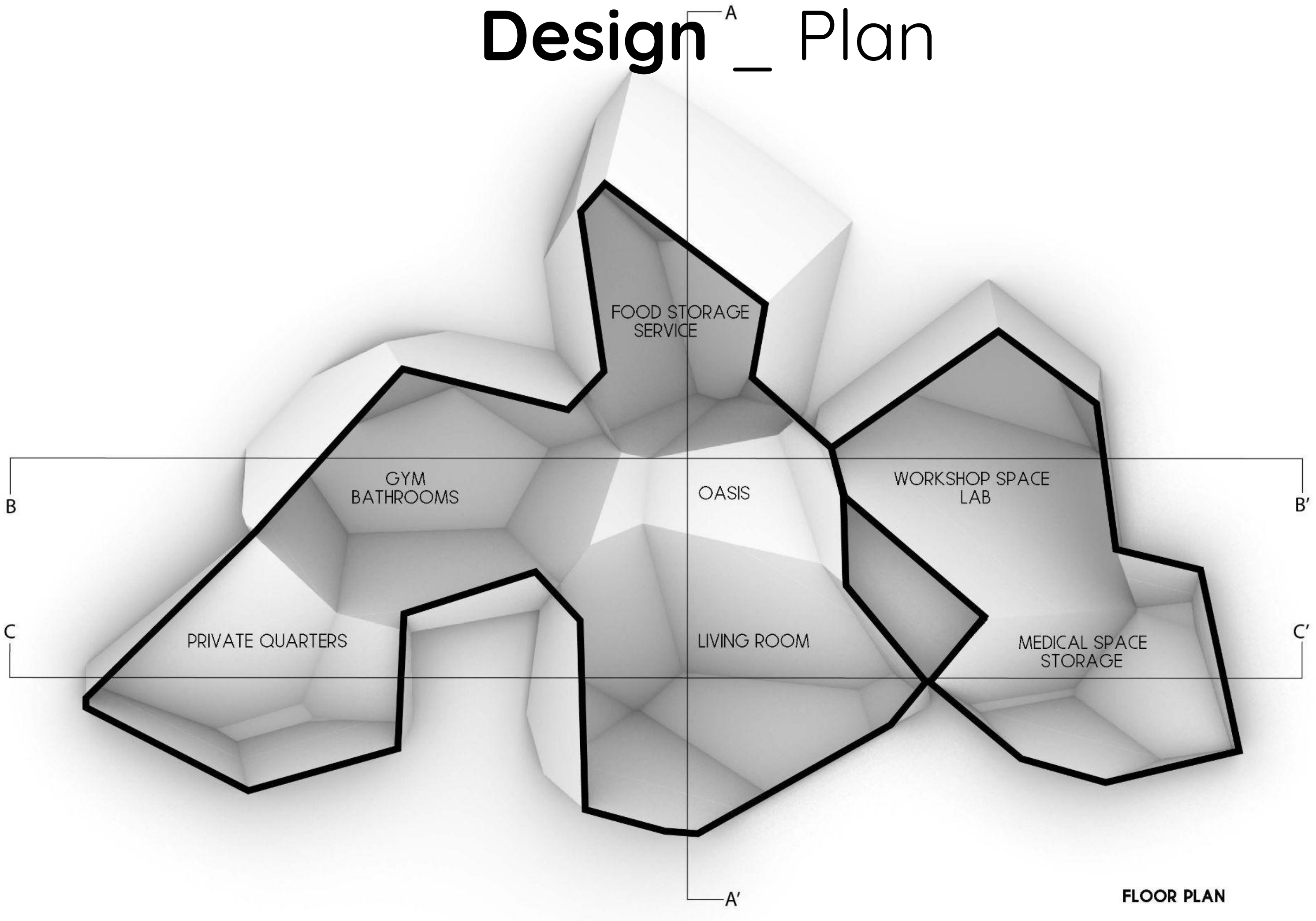
Design _ Plan



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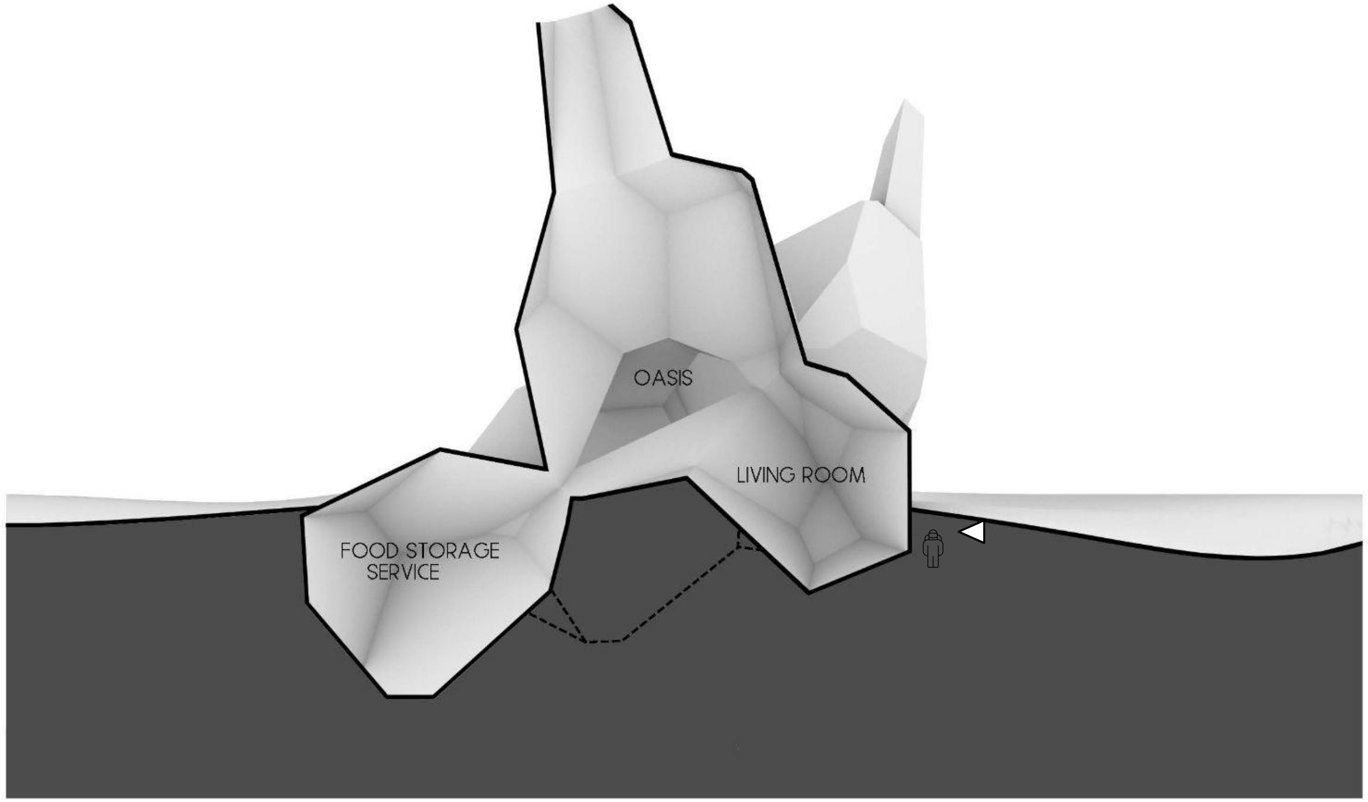
Design _ Section



SECTION A-A'

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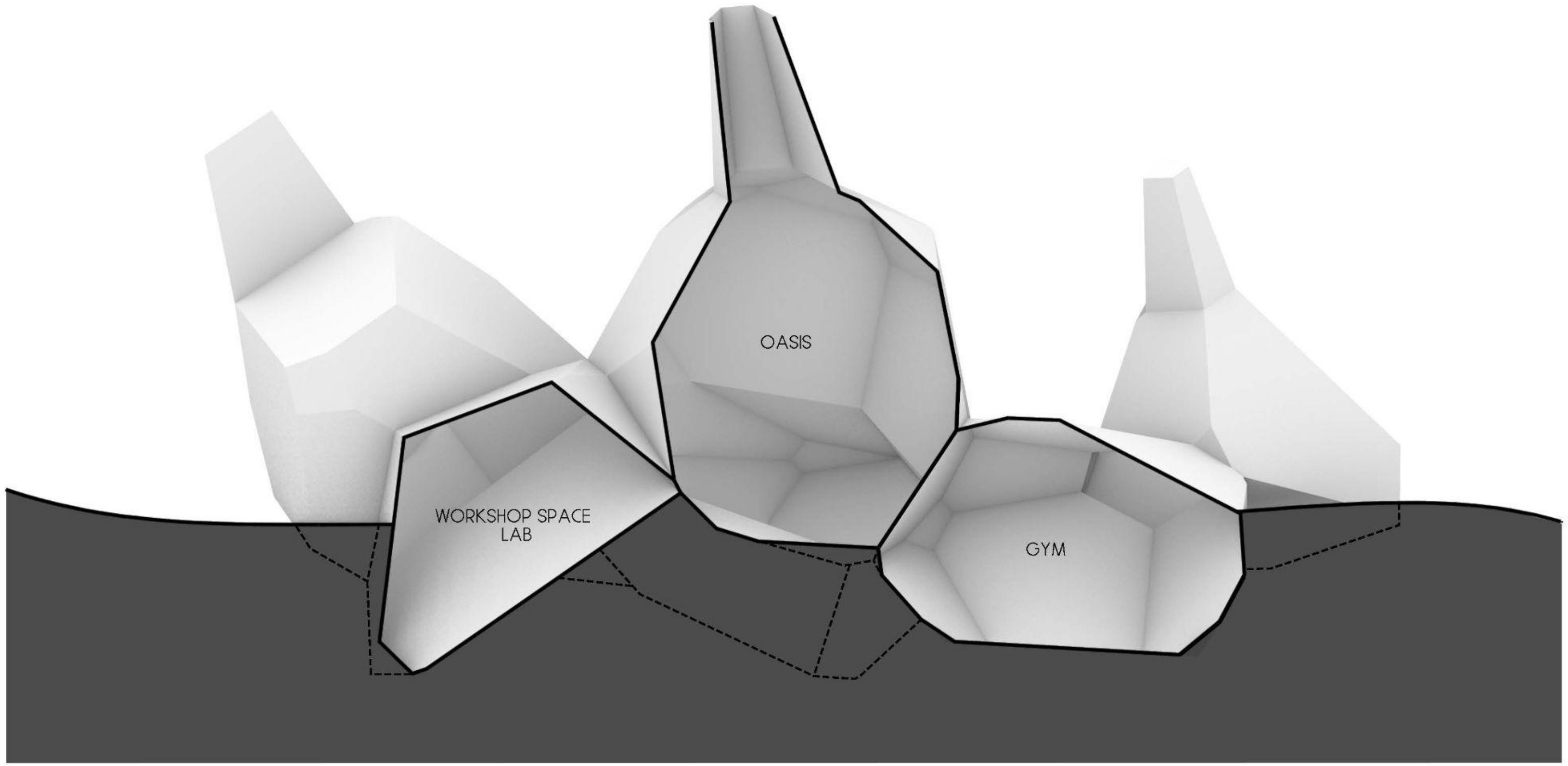
Design _ Section



SECTION B-B'

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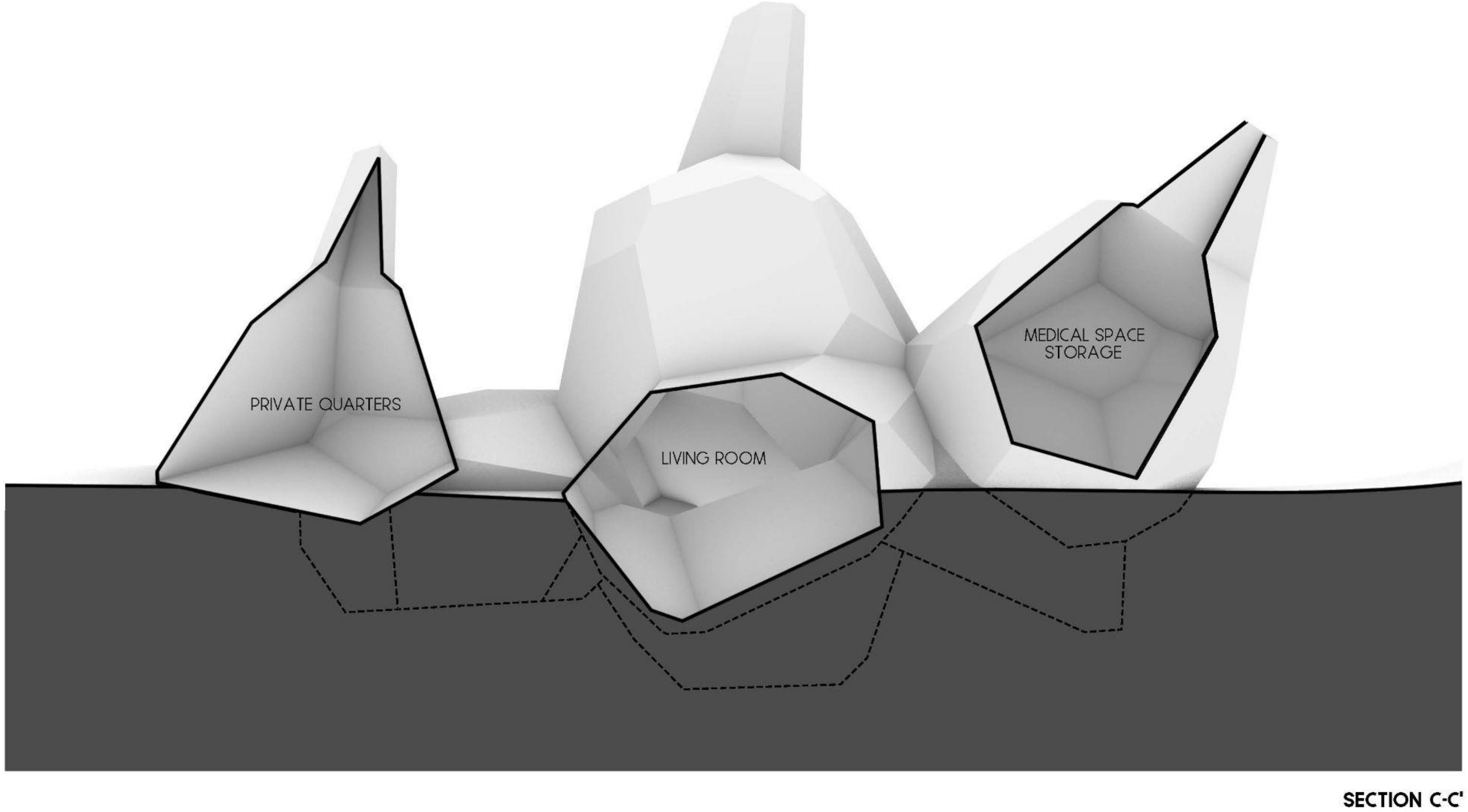
Design _ Section



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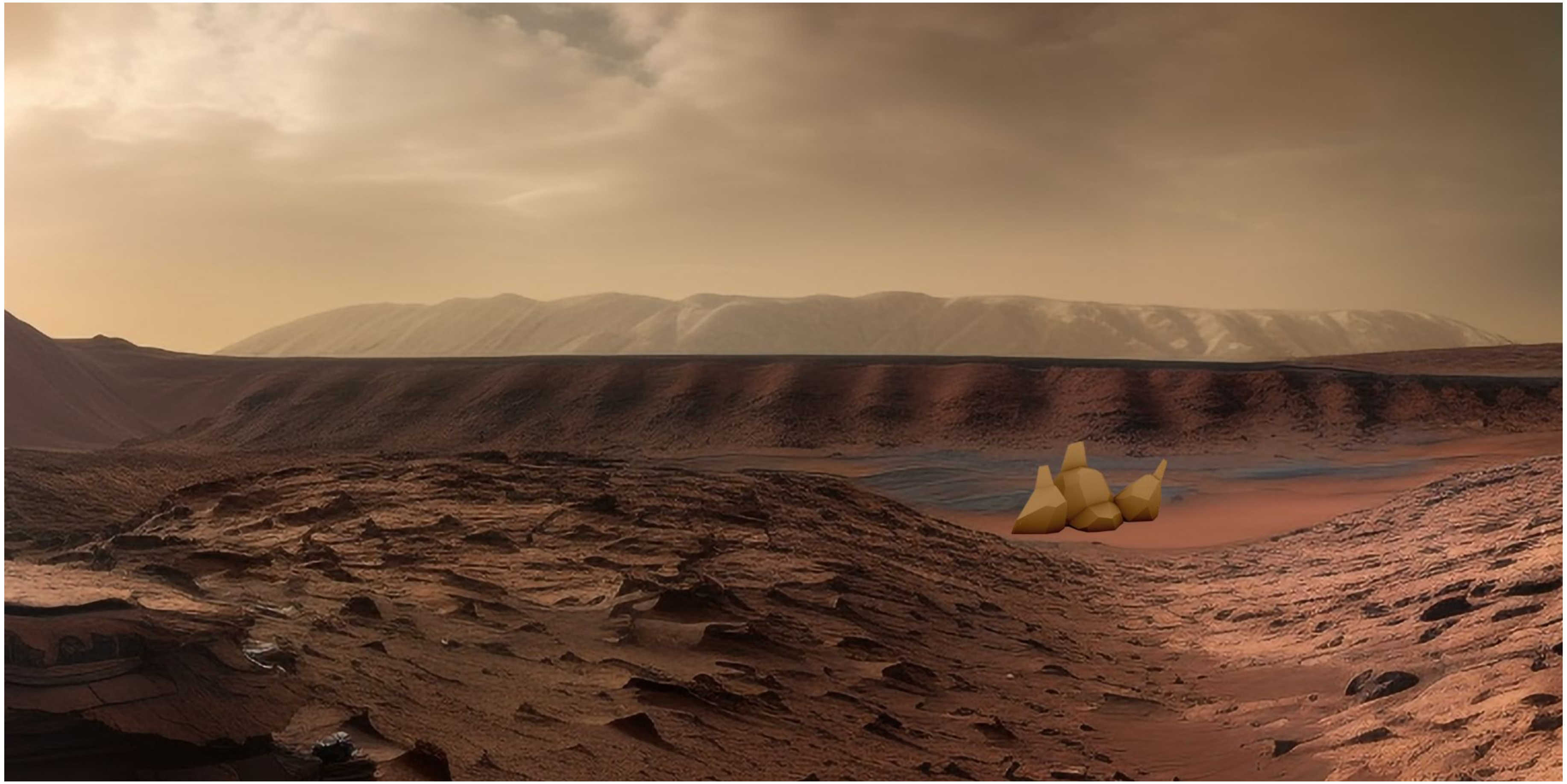
Design _ Impression



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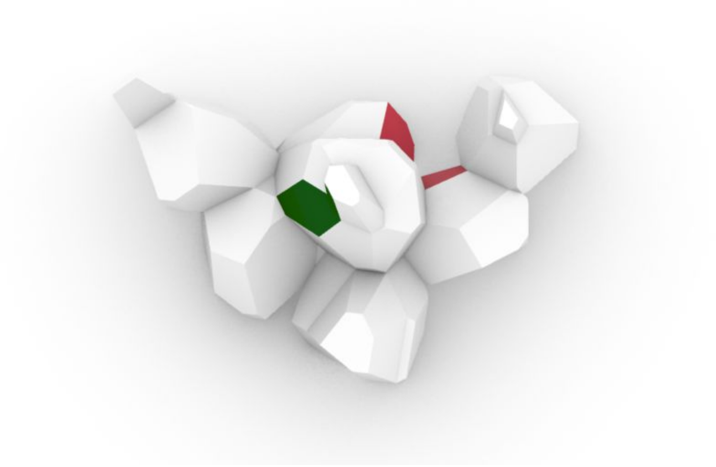
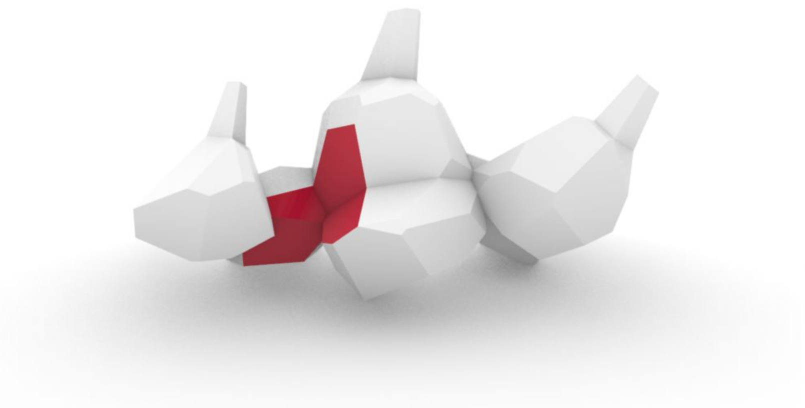
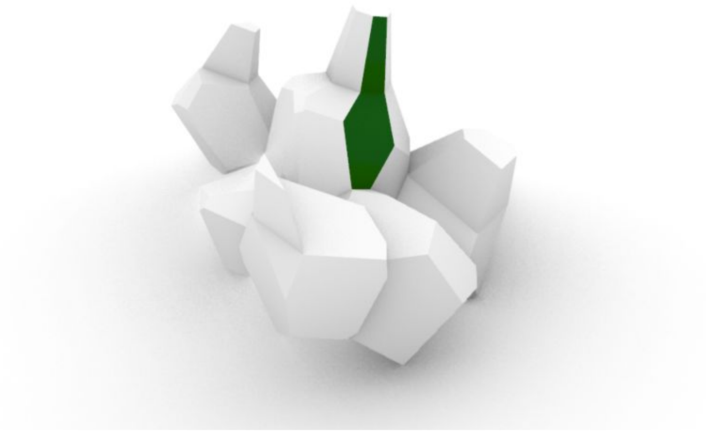
Fragment _ Selection







For the purpose of testing the script we will choose the green fragment (fragment 2) as it is less complex

For the end product we want to use the red fragment (fragment 1)

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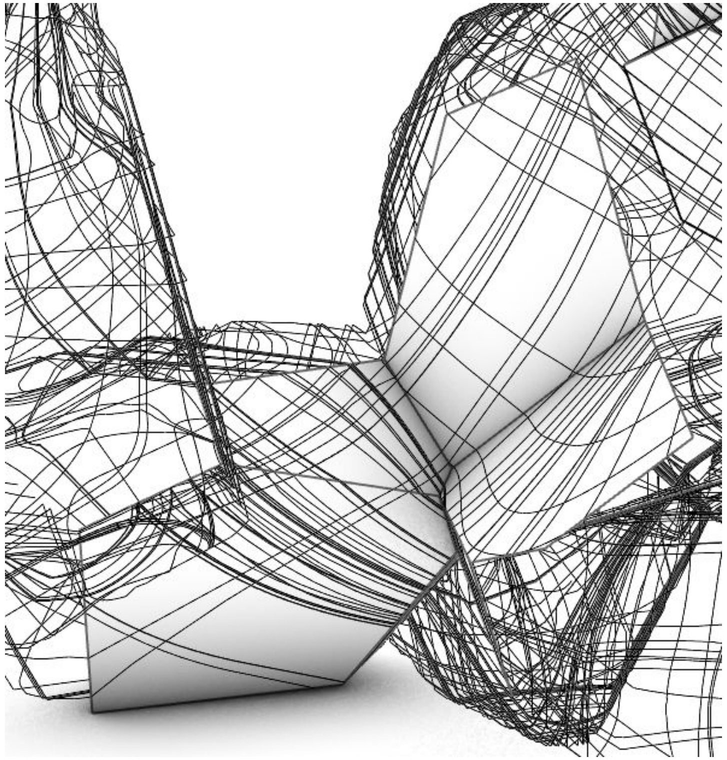
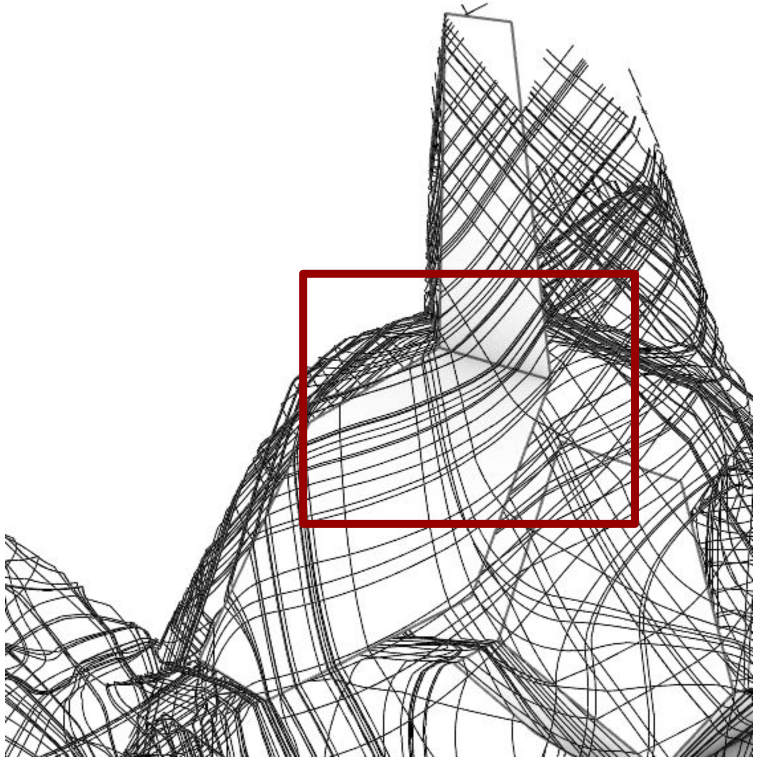
Fragment _ Stress Simulation



Fragment 1



Fragment 2

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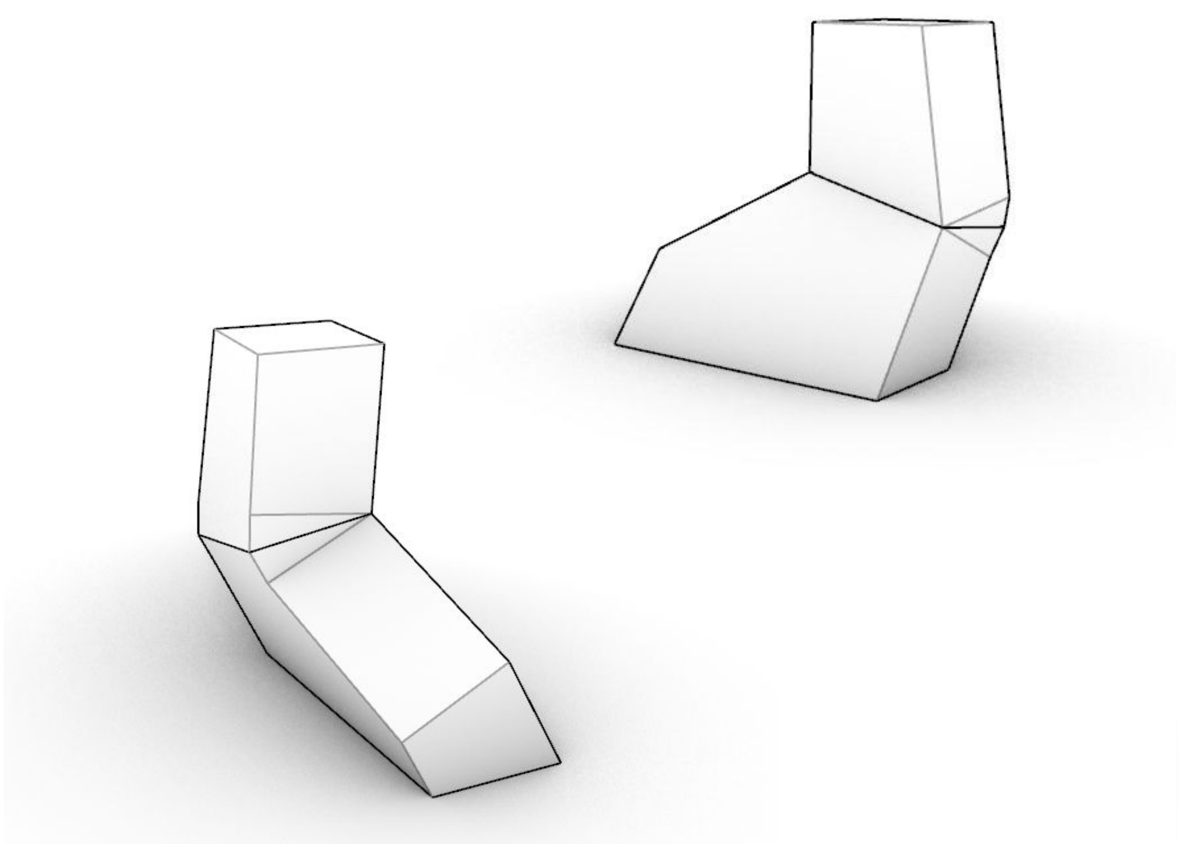
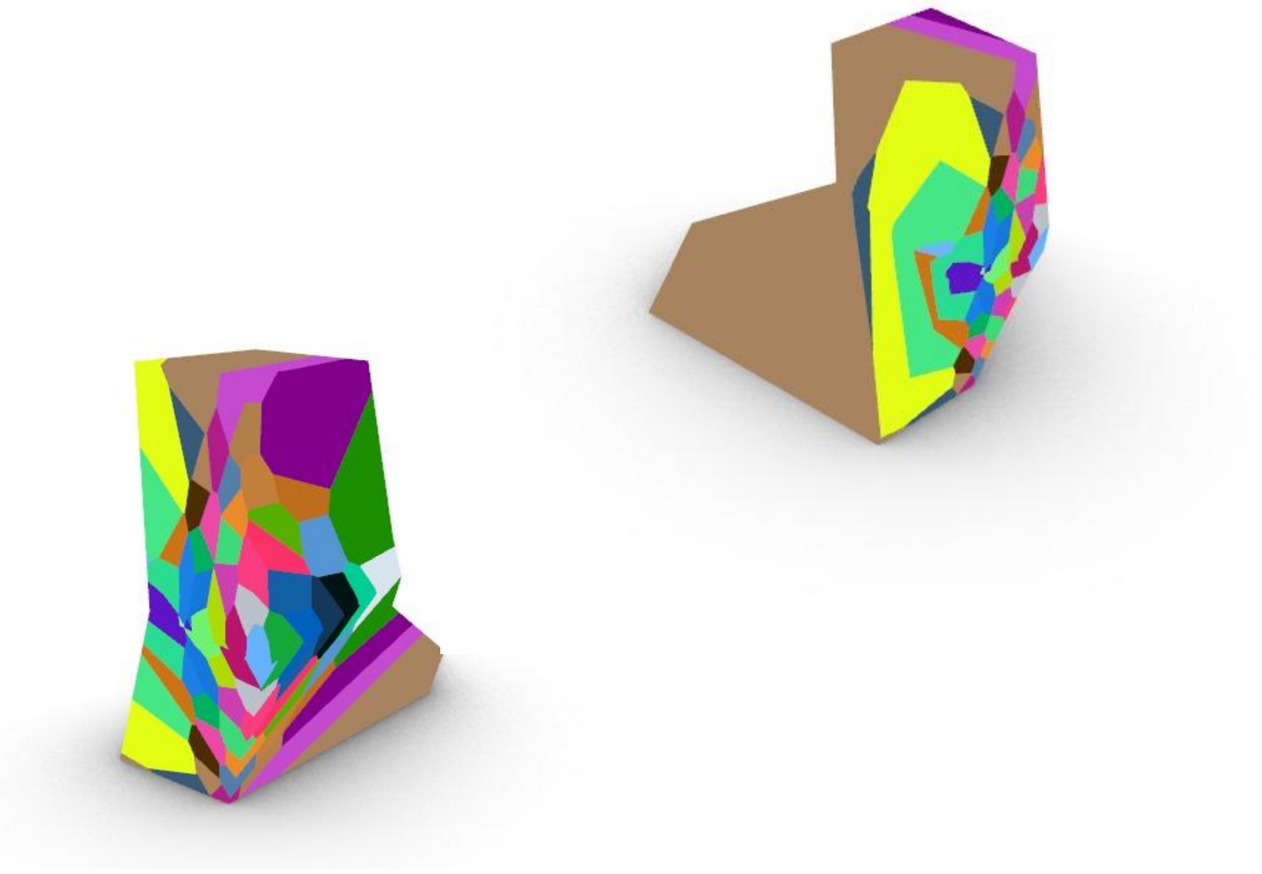
Fragment _ Kinked Voronoi Elements



Fragment 2



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