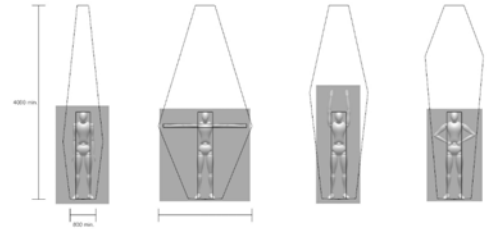
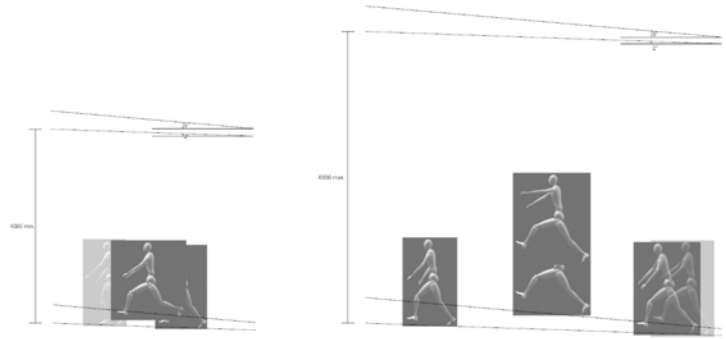
basic parameters
(single body movement and postures)

1:100

space width to influence
body speed and cautious level

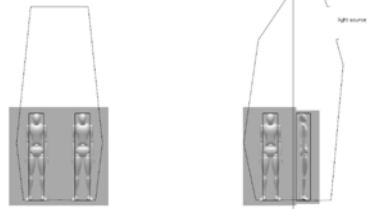


2m



low & slow loping (walk on earth) | lower capacity
2-5° inclination

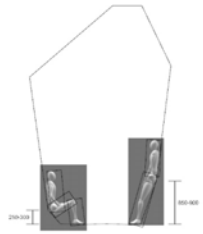
far & high loping | higher capacity
2-5° inclination



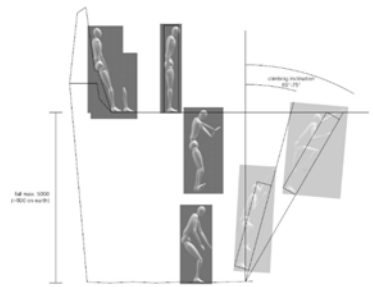
double width corridor

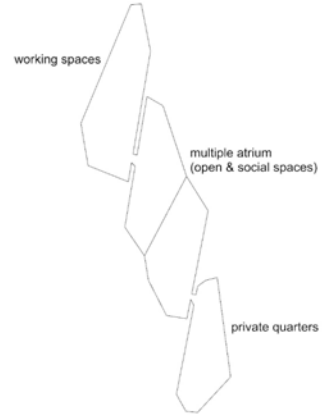
narrower top
to anticipate/
being cautious

wider top & light
to indicate
space above

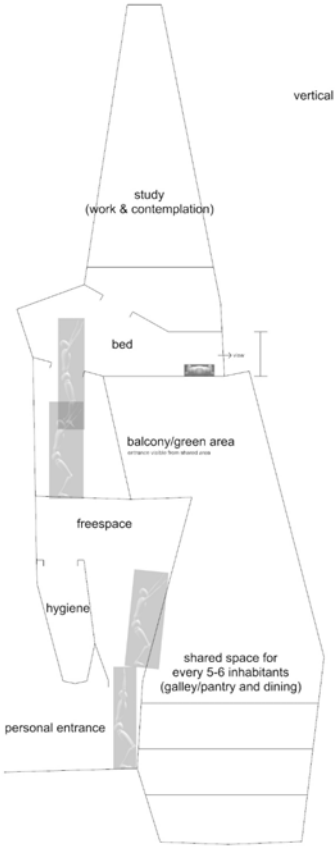


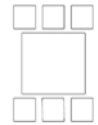
inclination to accommodate
stationary postures

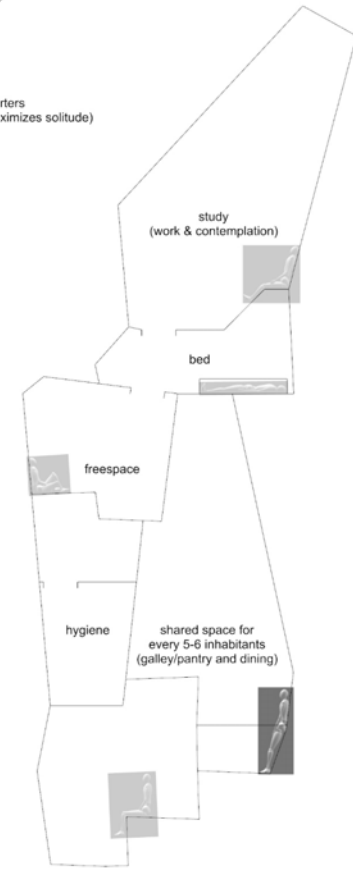




I. private quarters
vertical configuration (maximizes solitude)



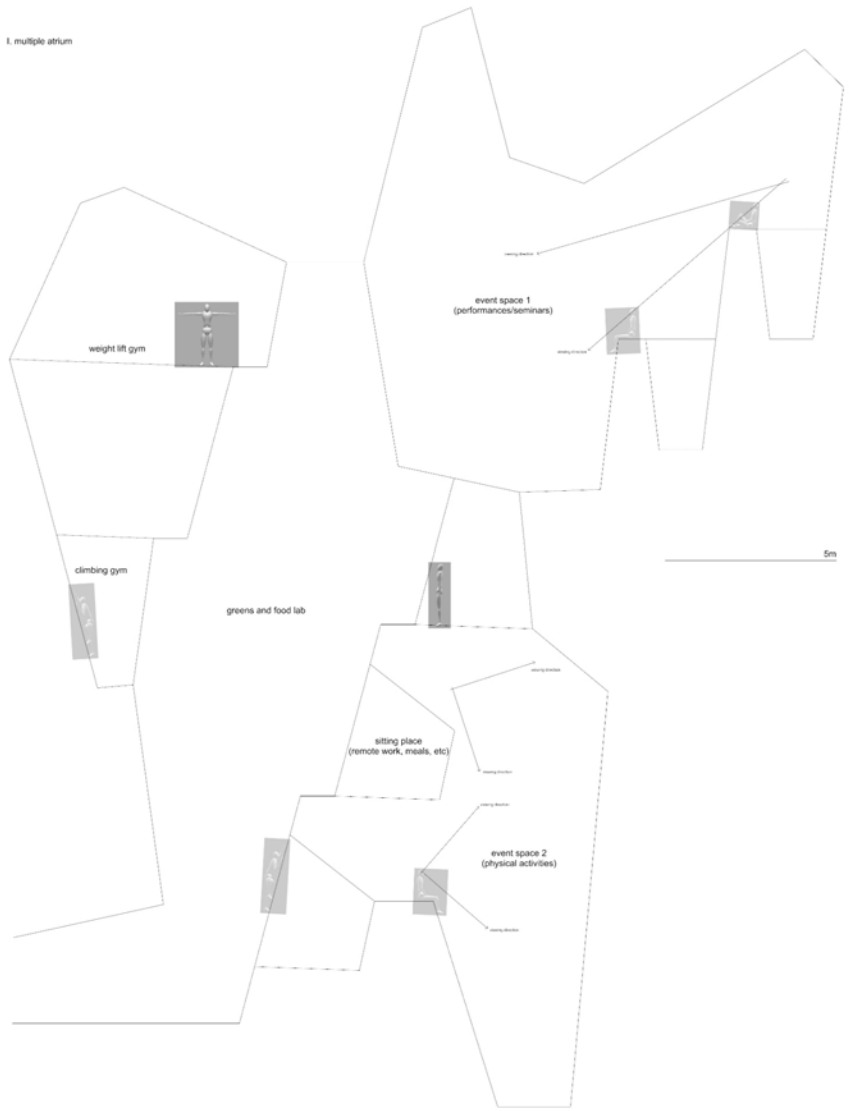




3m

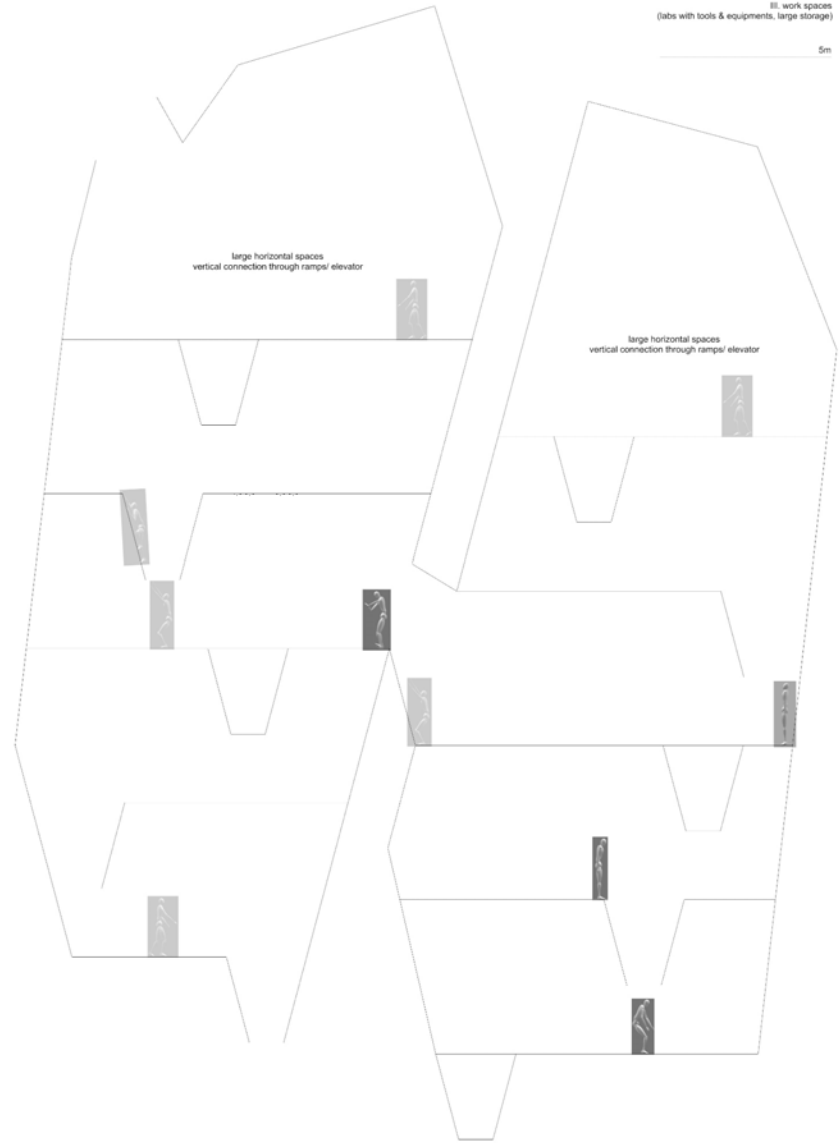
1:100

I. multiple atrium



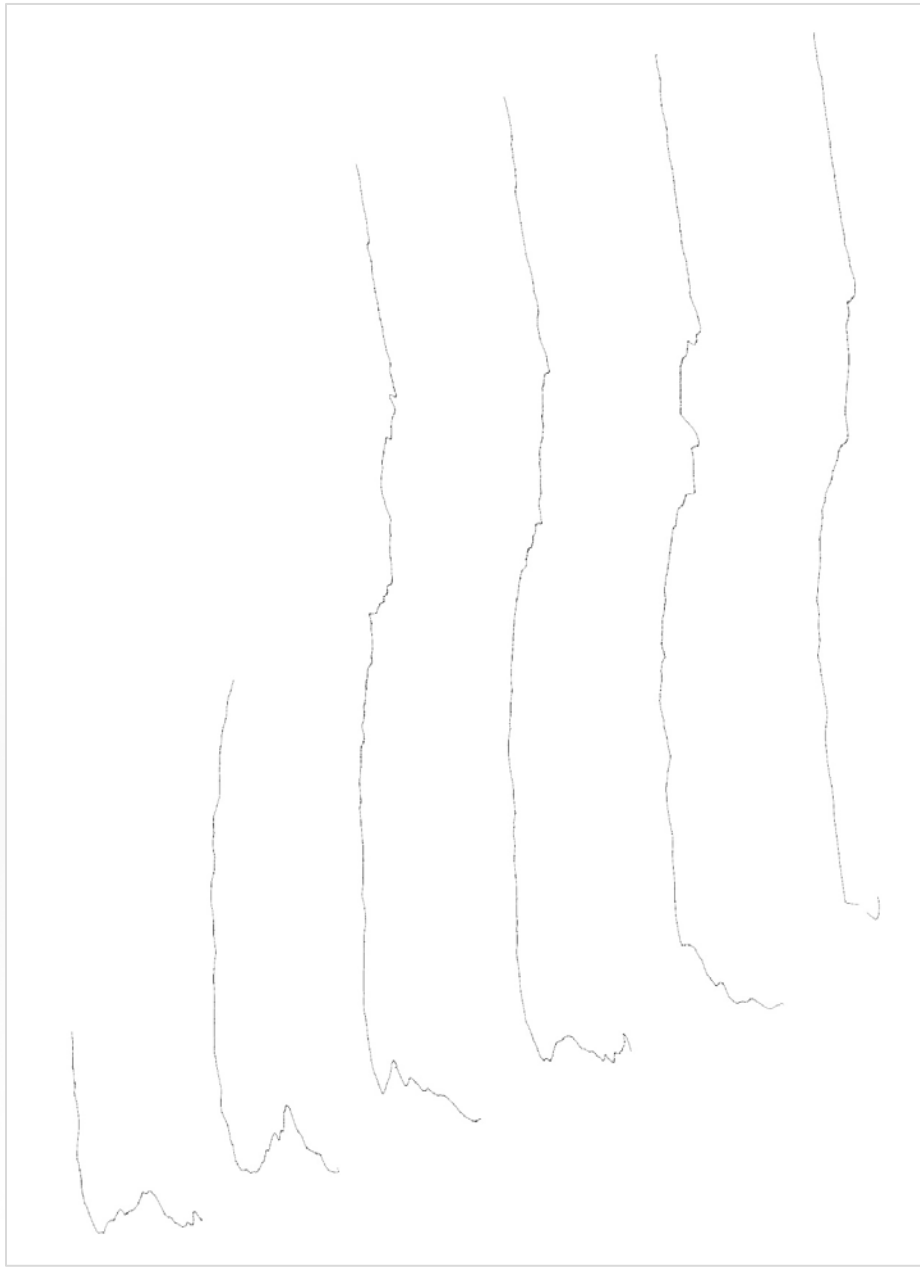
1:100

III. work spaces
(labs with tools & equipments, large storage)

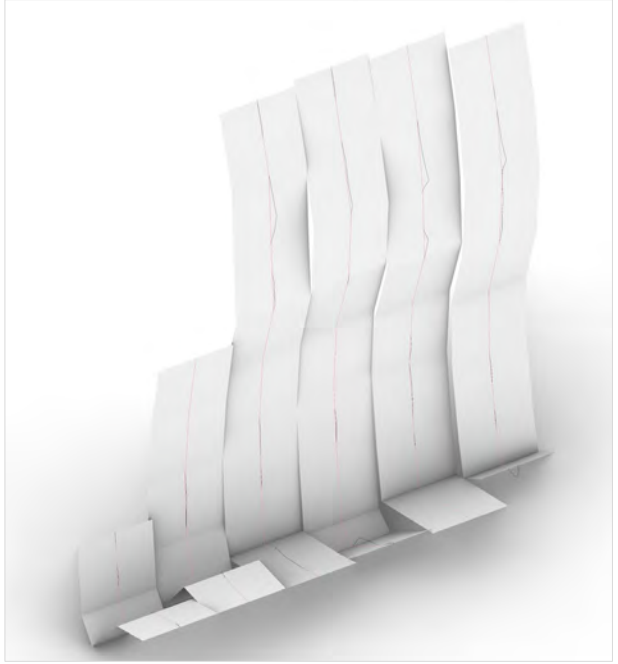


Body movement constantly adapts to *angled/ inclined planes*

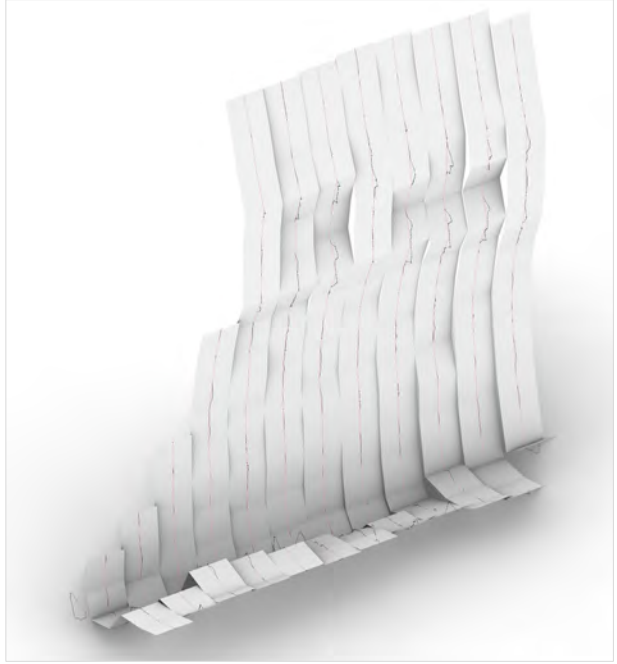
complex natural forms & surfaces –> brain processes to abstract walkable path –> stepping and holding surfaces to climb down



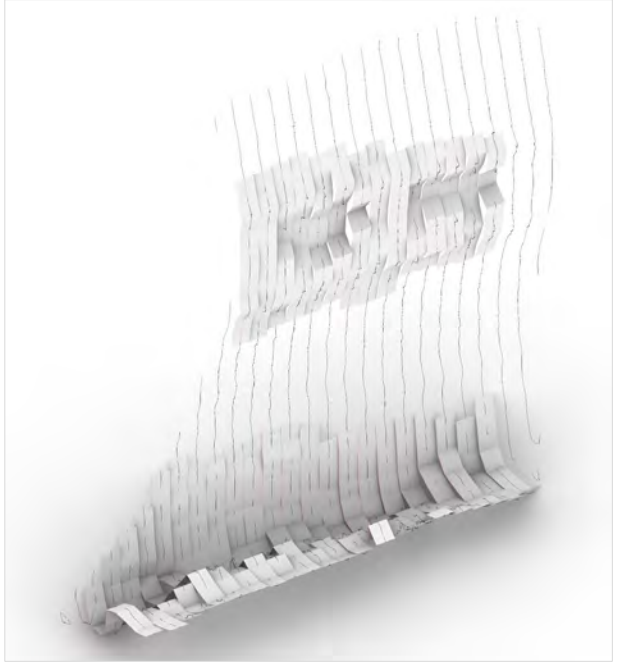
contouring of wall surface



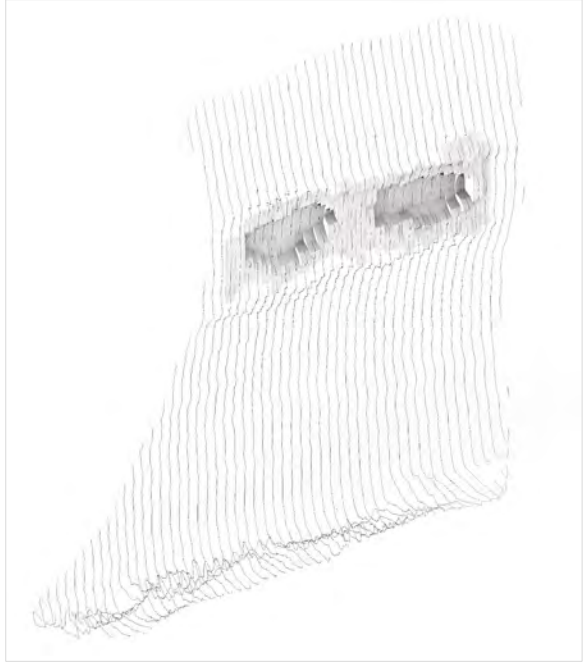
400x400 resolution
multiple people bodies



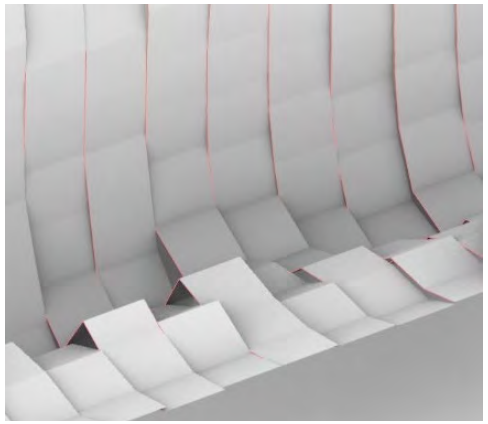
200x200 resolution
single person body

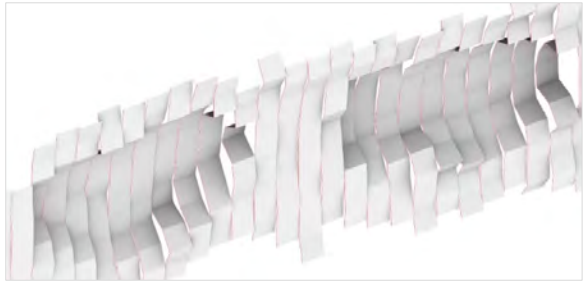


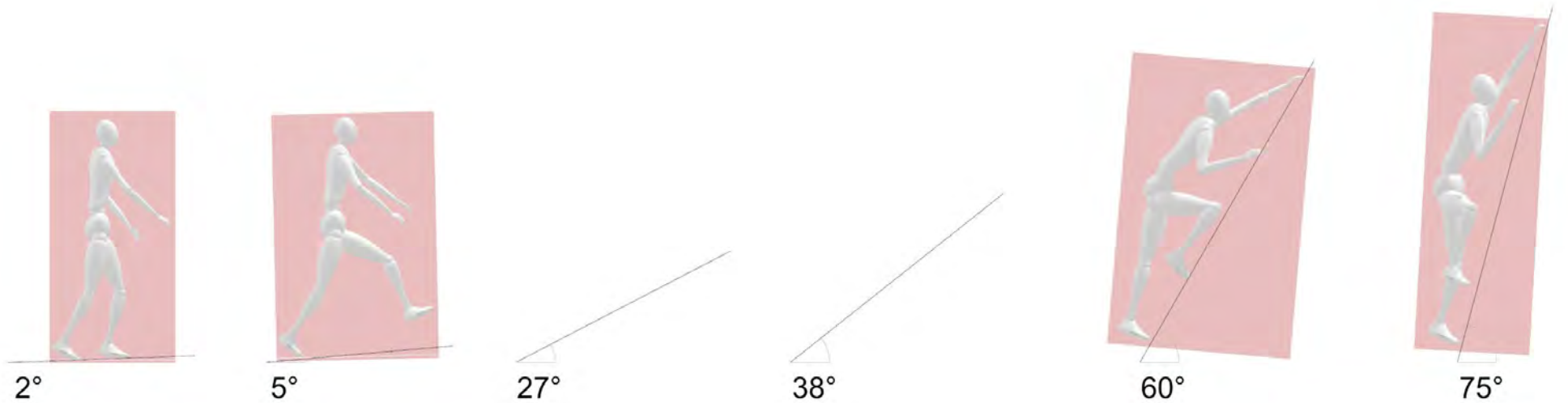
100x100 resolution
footstep

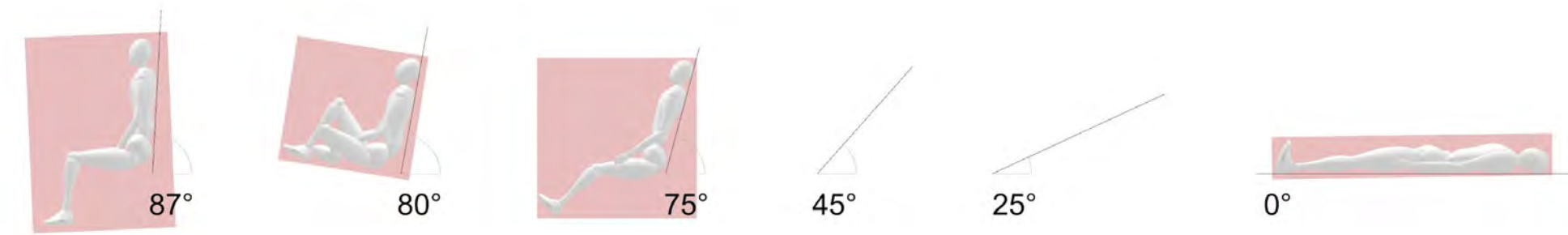


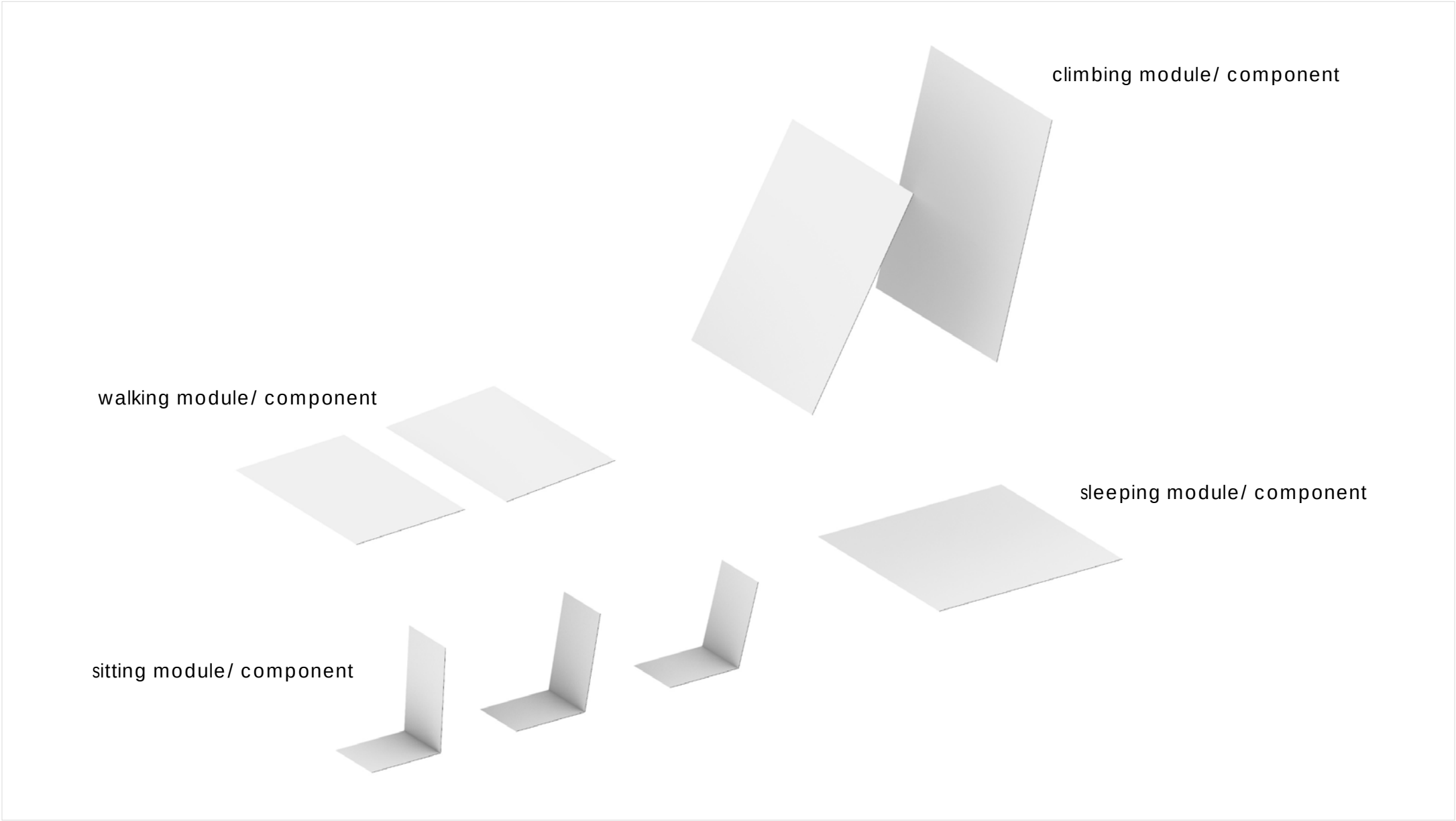
50x50 resolution
hand grab



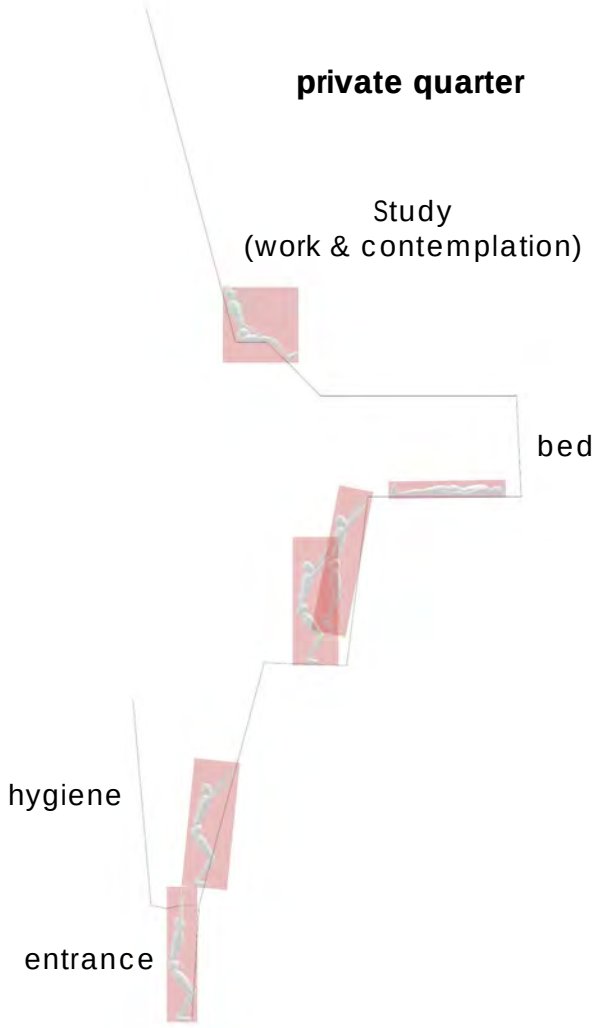



2°
5°
27°
38°
60°
75°

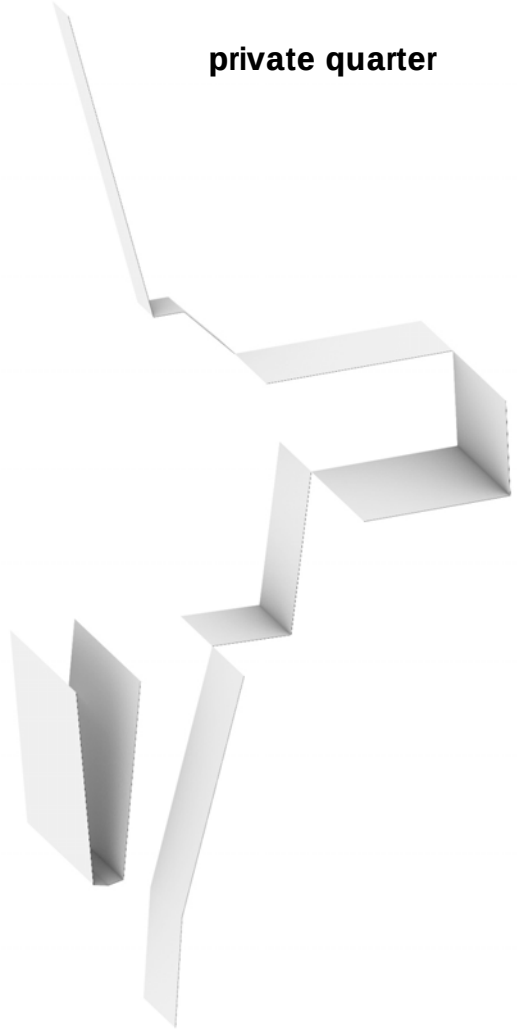

87°
80°
75°
45°
25°
0°



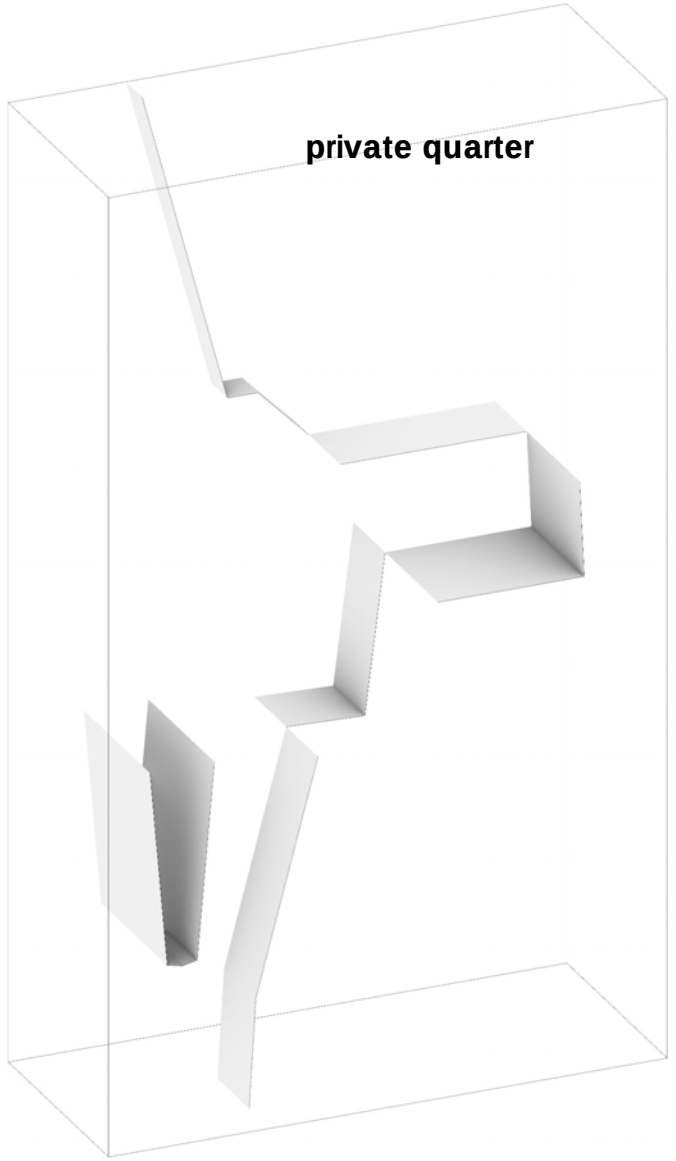
architectural module/ component generation



minimal function & circulation

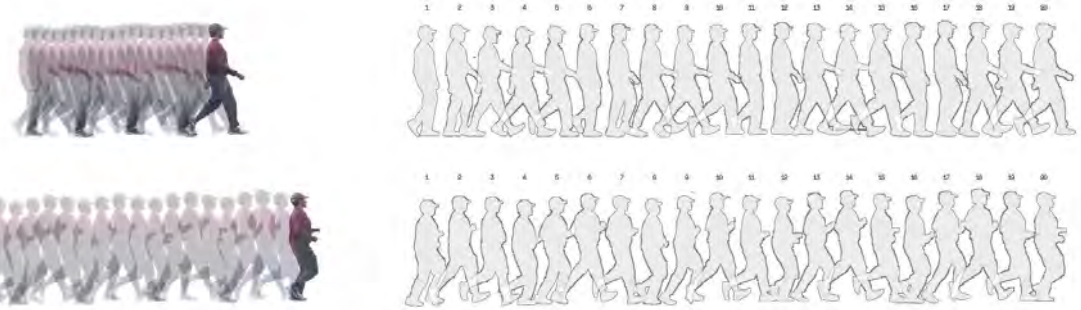


3D distribution

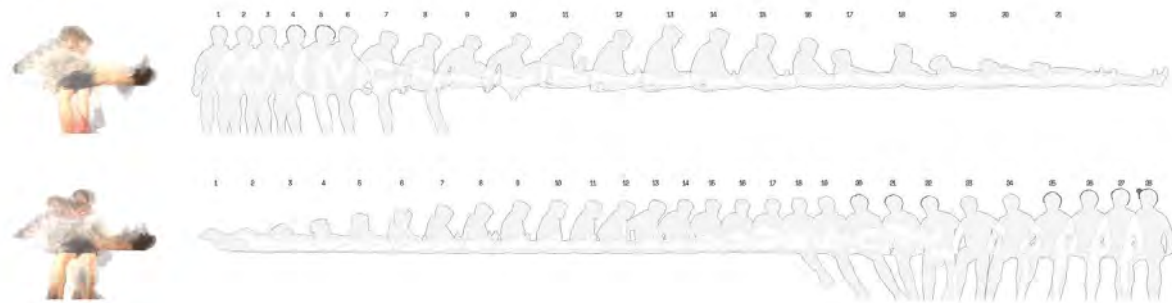


generating more inclined planes in void areas using computational rules

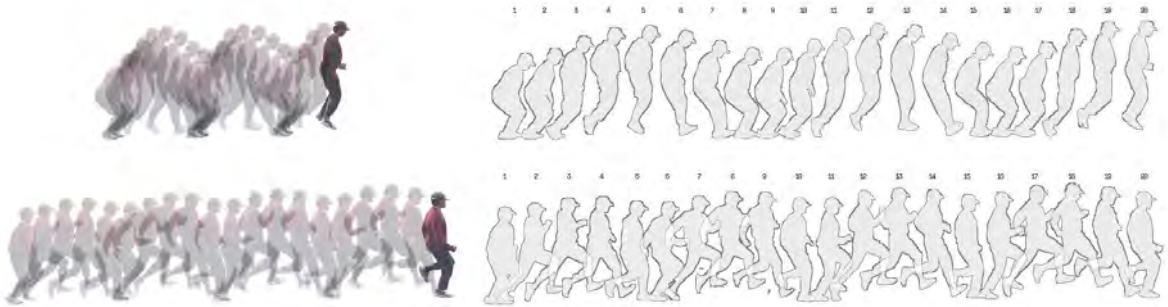
Walking and Running



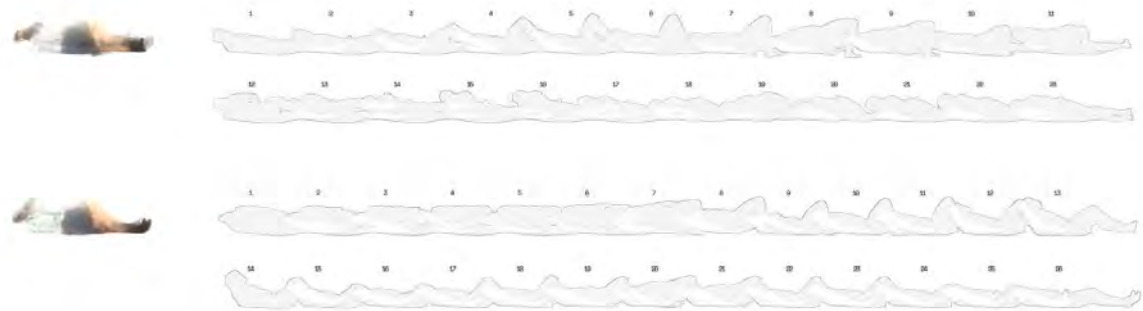
Sit and Sleep



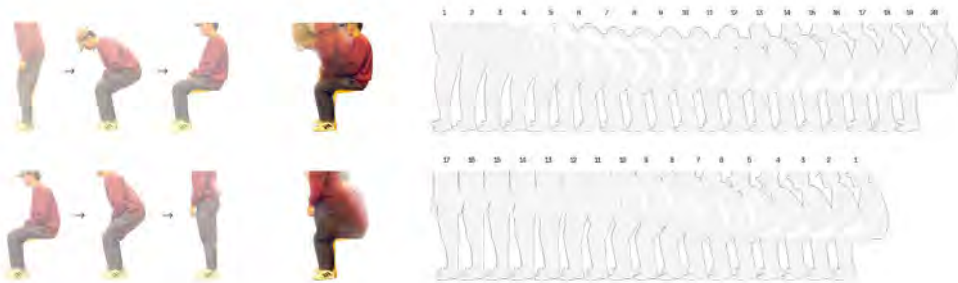
Hopping and Galloping/Leaping



Sleep and Turn

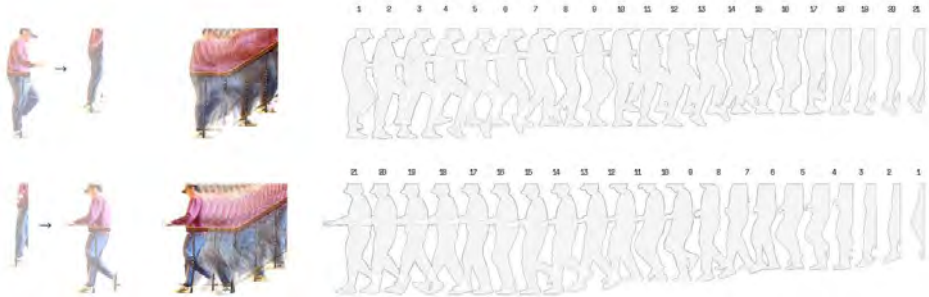


Sit Down

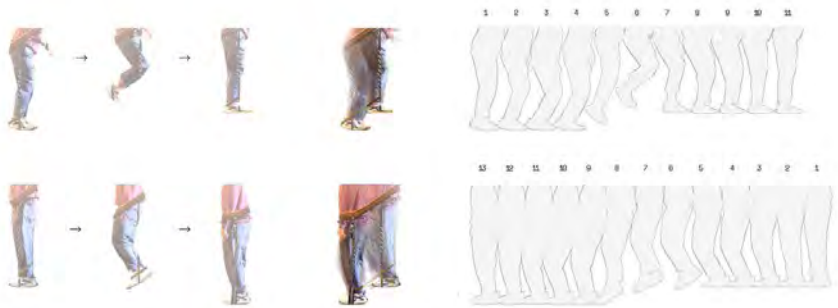


Small Hop

Climb Stairs

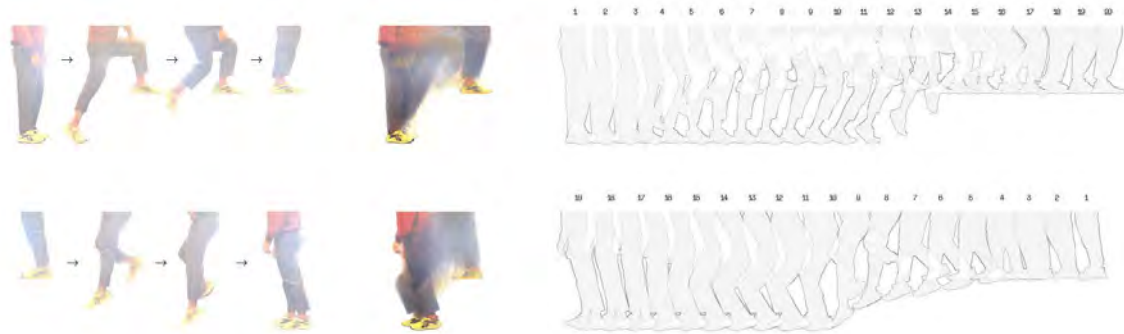


Stair Hop

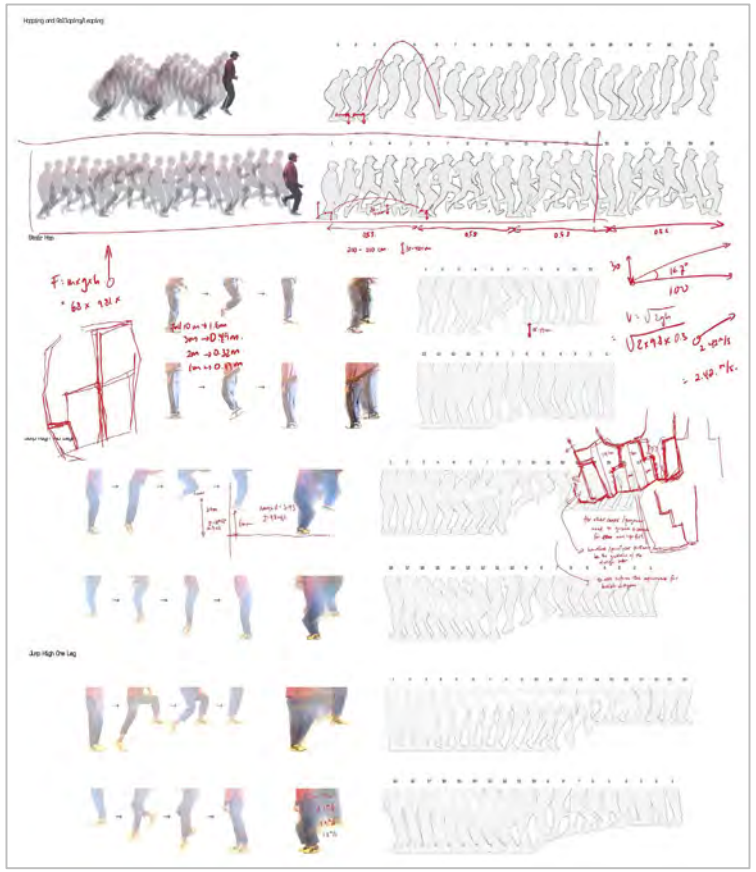


Climb Chairs

Jump High One Leg



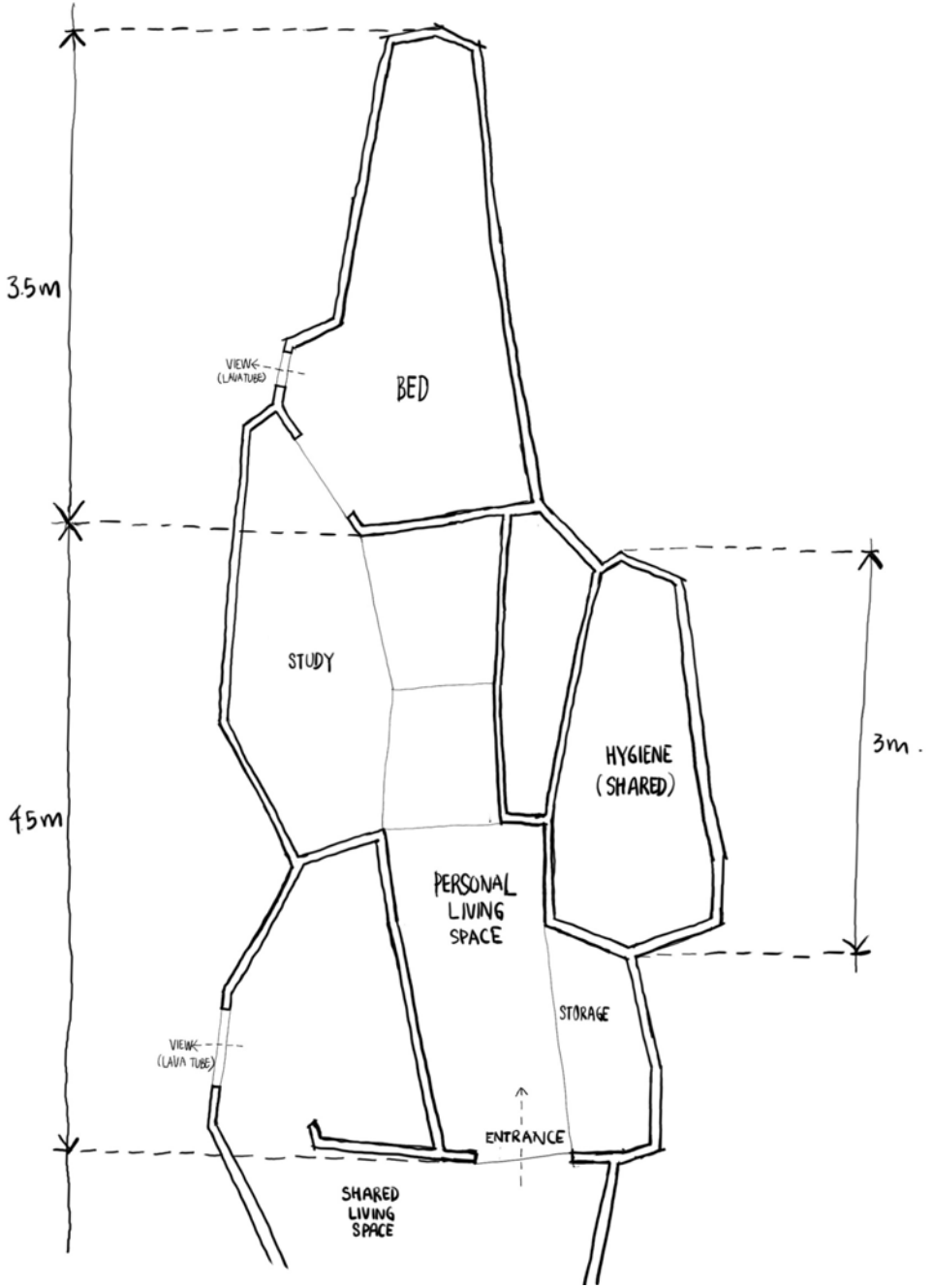
Jump High Two Legs



Body Movement Study

Catalog of several sections of main program?

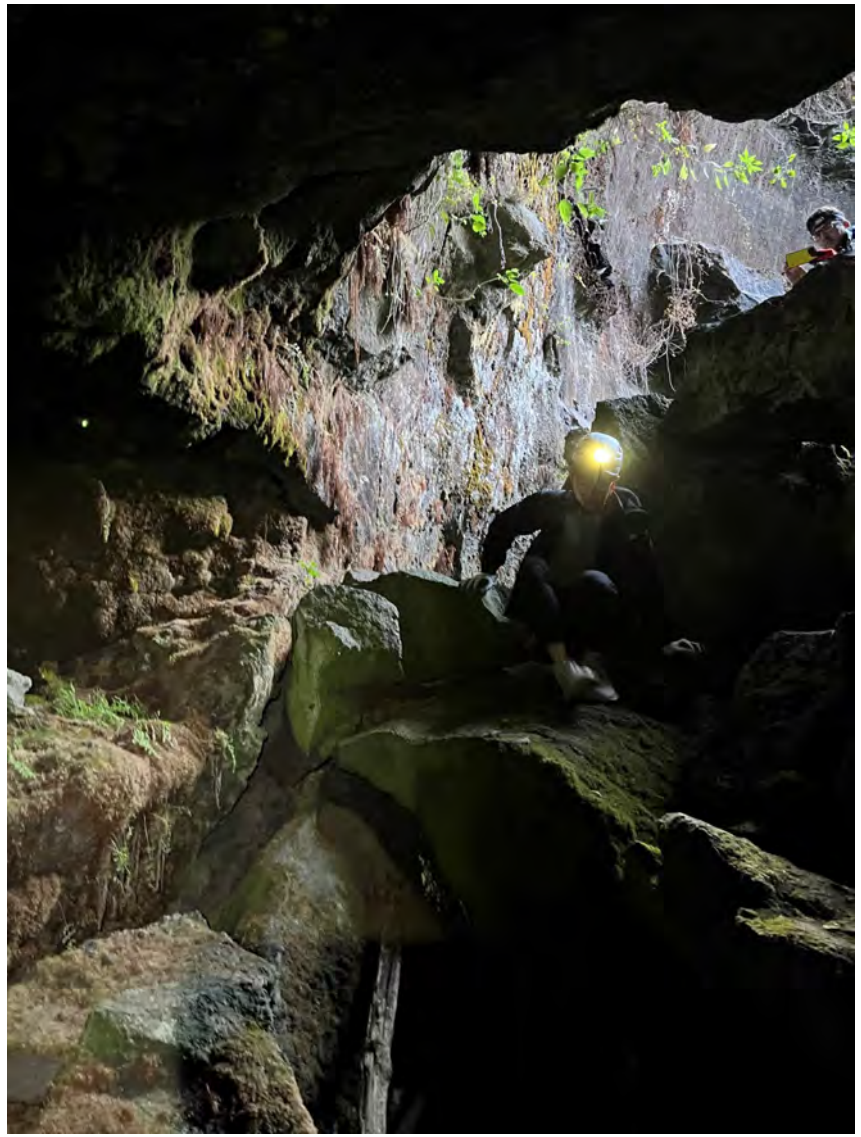
- Principles from Body Movement Study
- Setting up volumetric requirements of program specifically
- Transferrable to bubble diagram study



youtube: Giovanni Liota

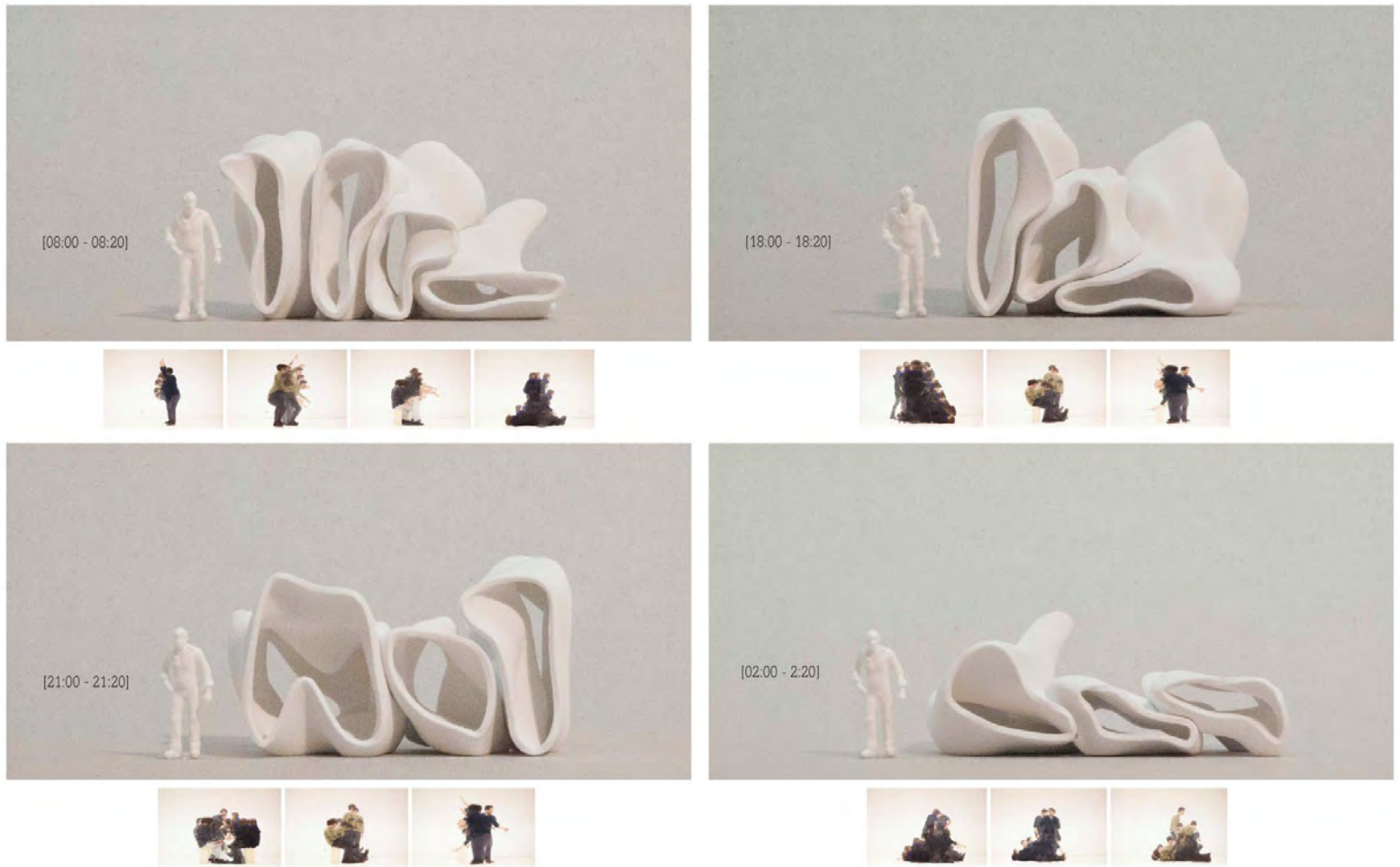
Grotta Intraleo in Sicily, Italy

Grotto Catanese, Spatially formed as stage

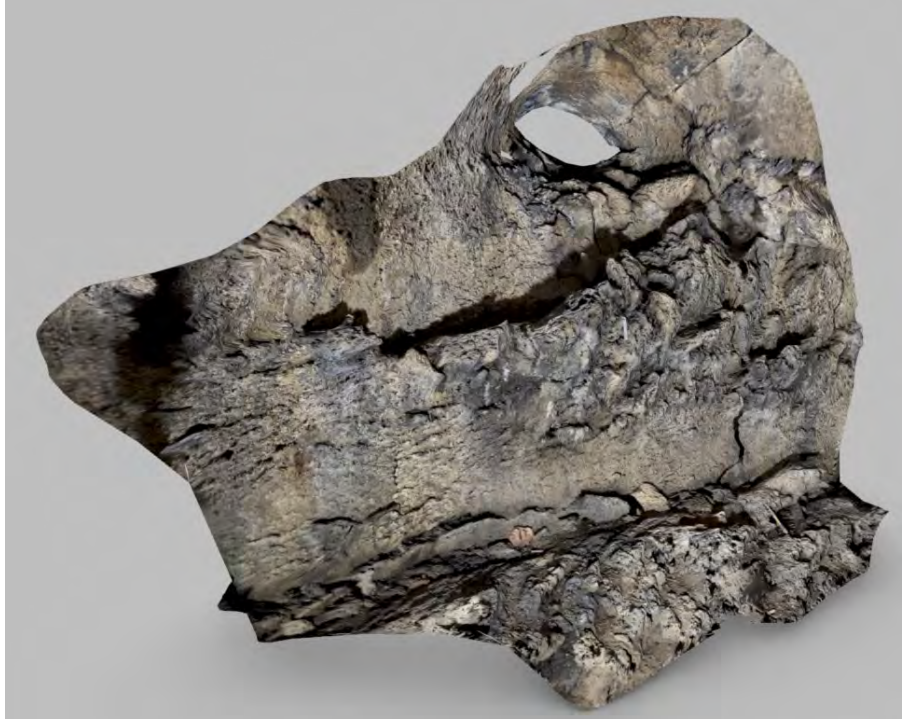



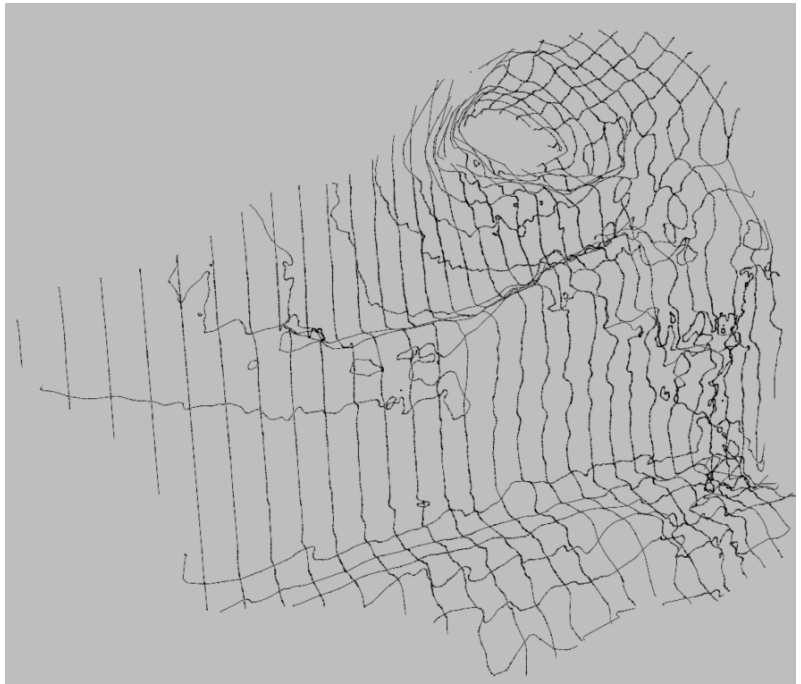

Holding surfaces to climb down

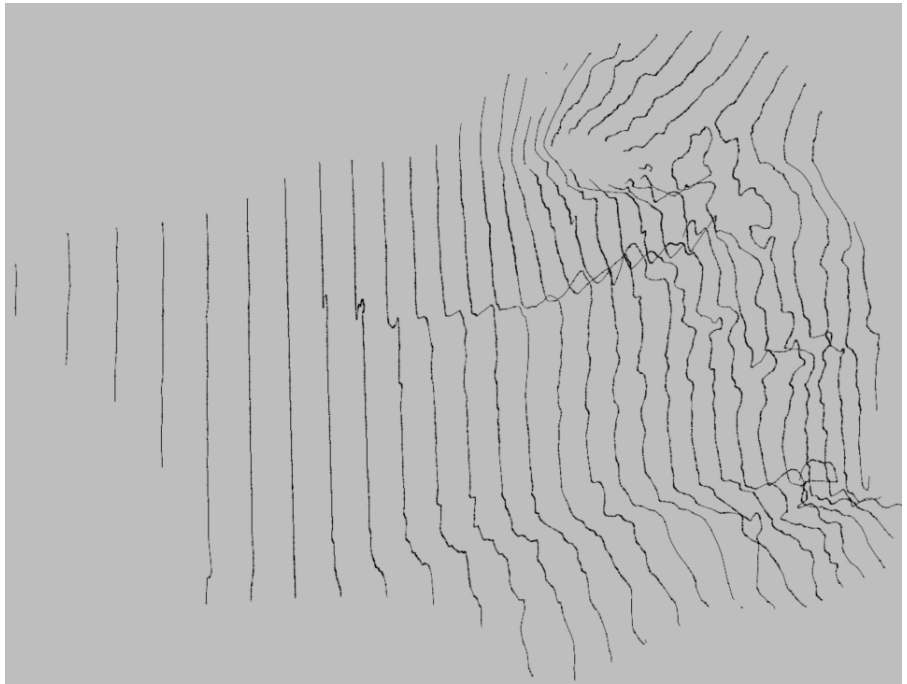
Stavros Gargaretas from Why Factory TU Delft

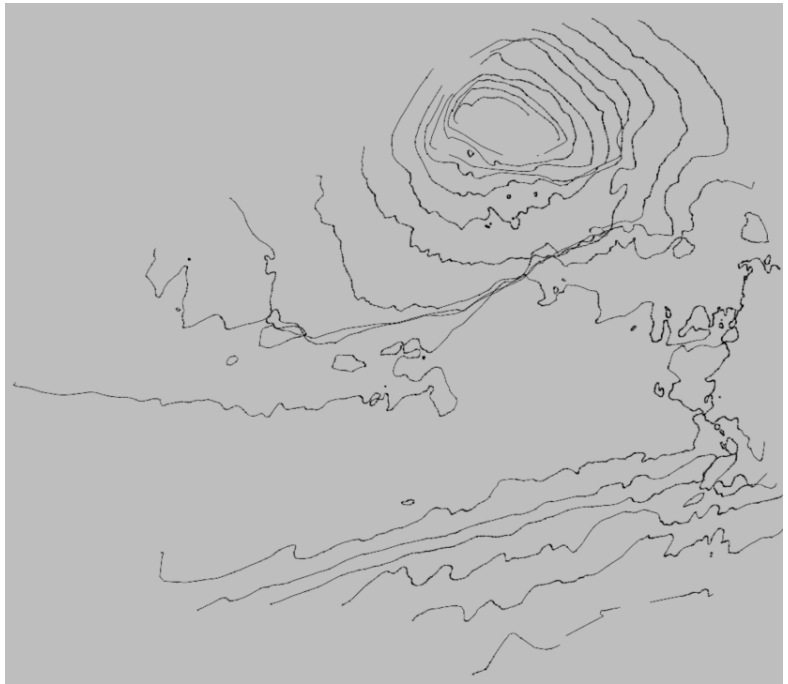


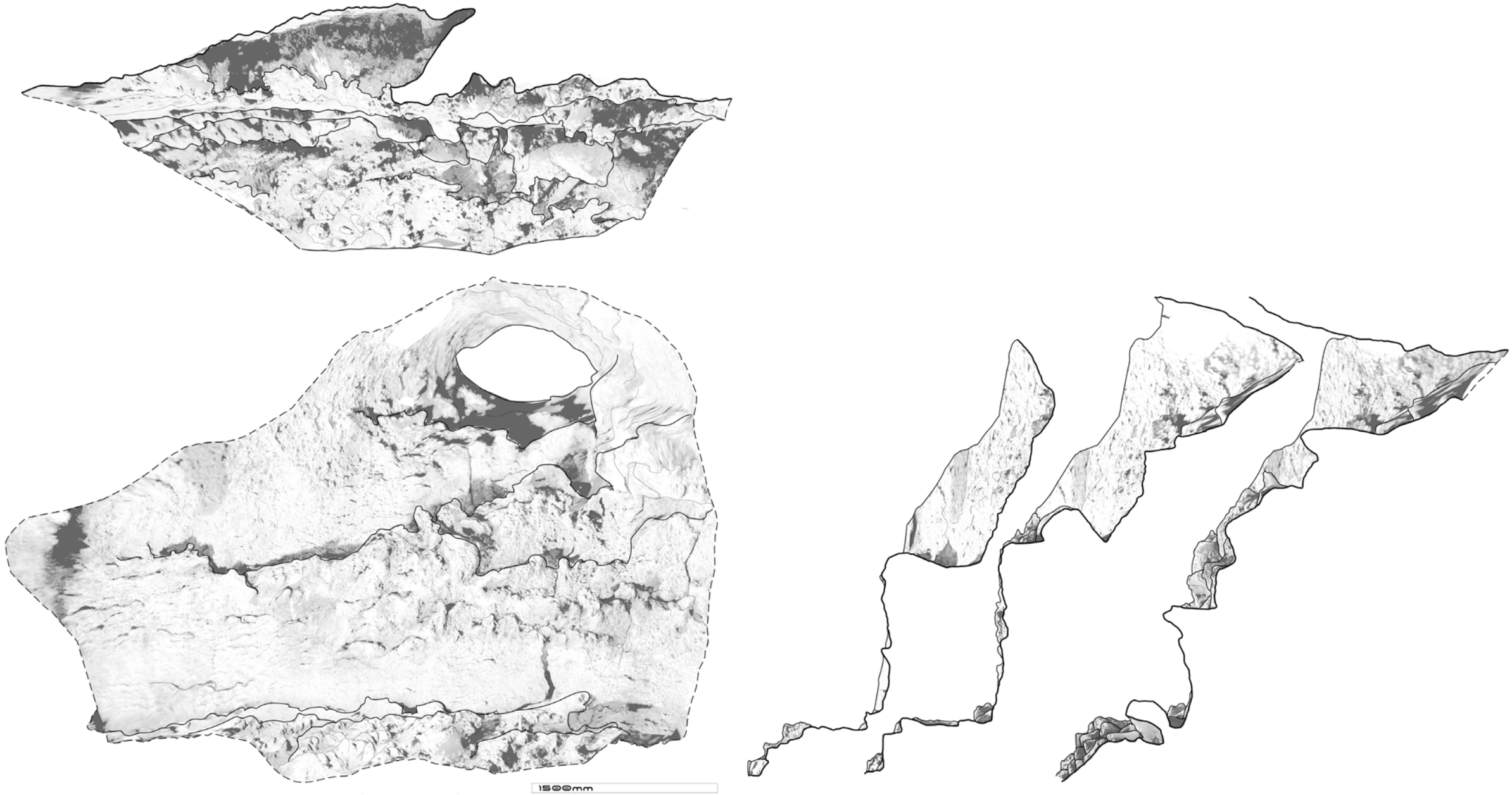
4 time frames in the life of a 4 person family

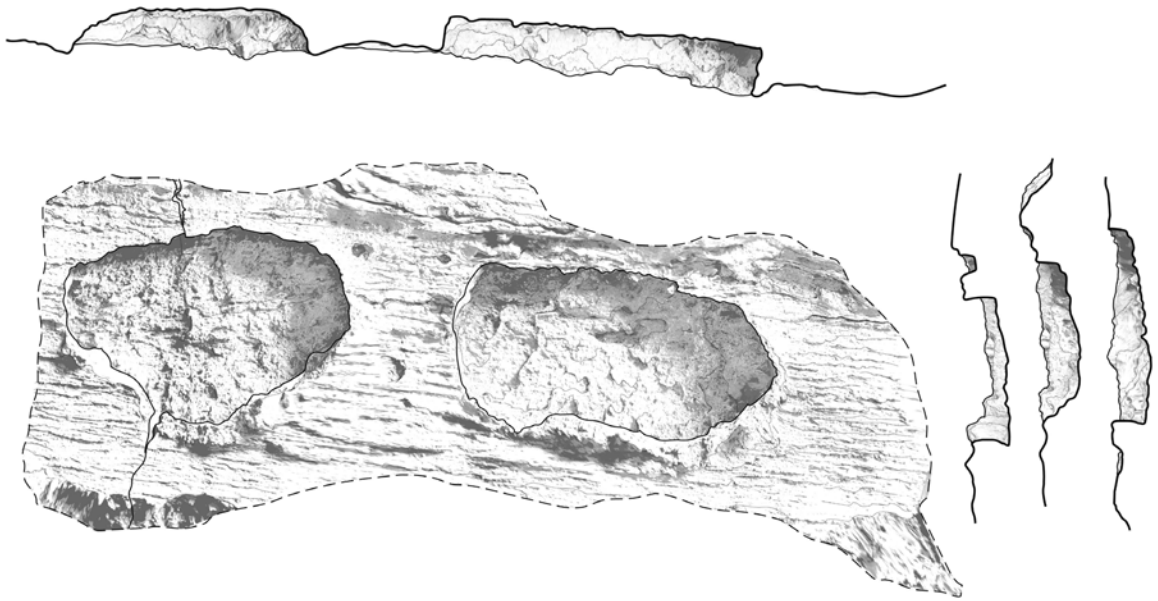


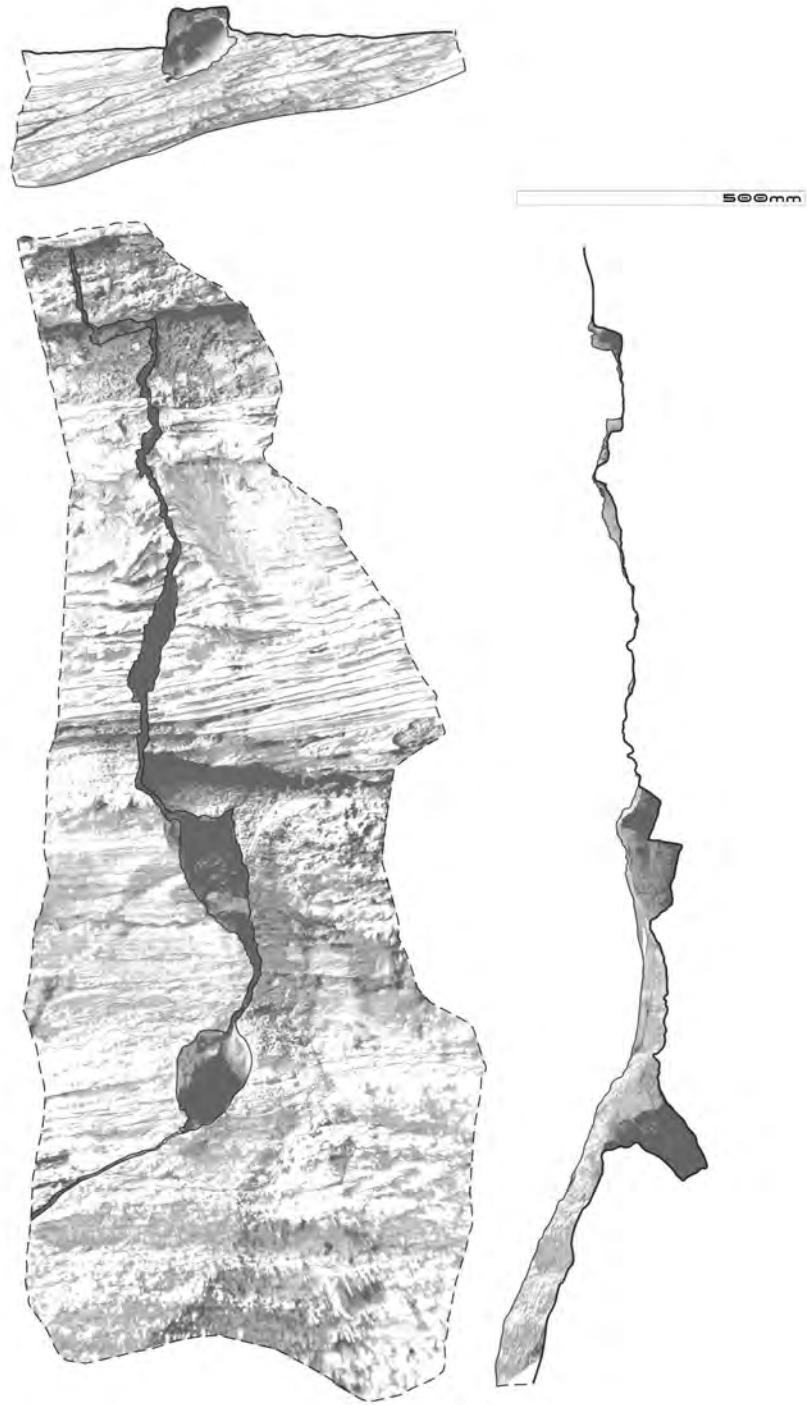


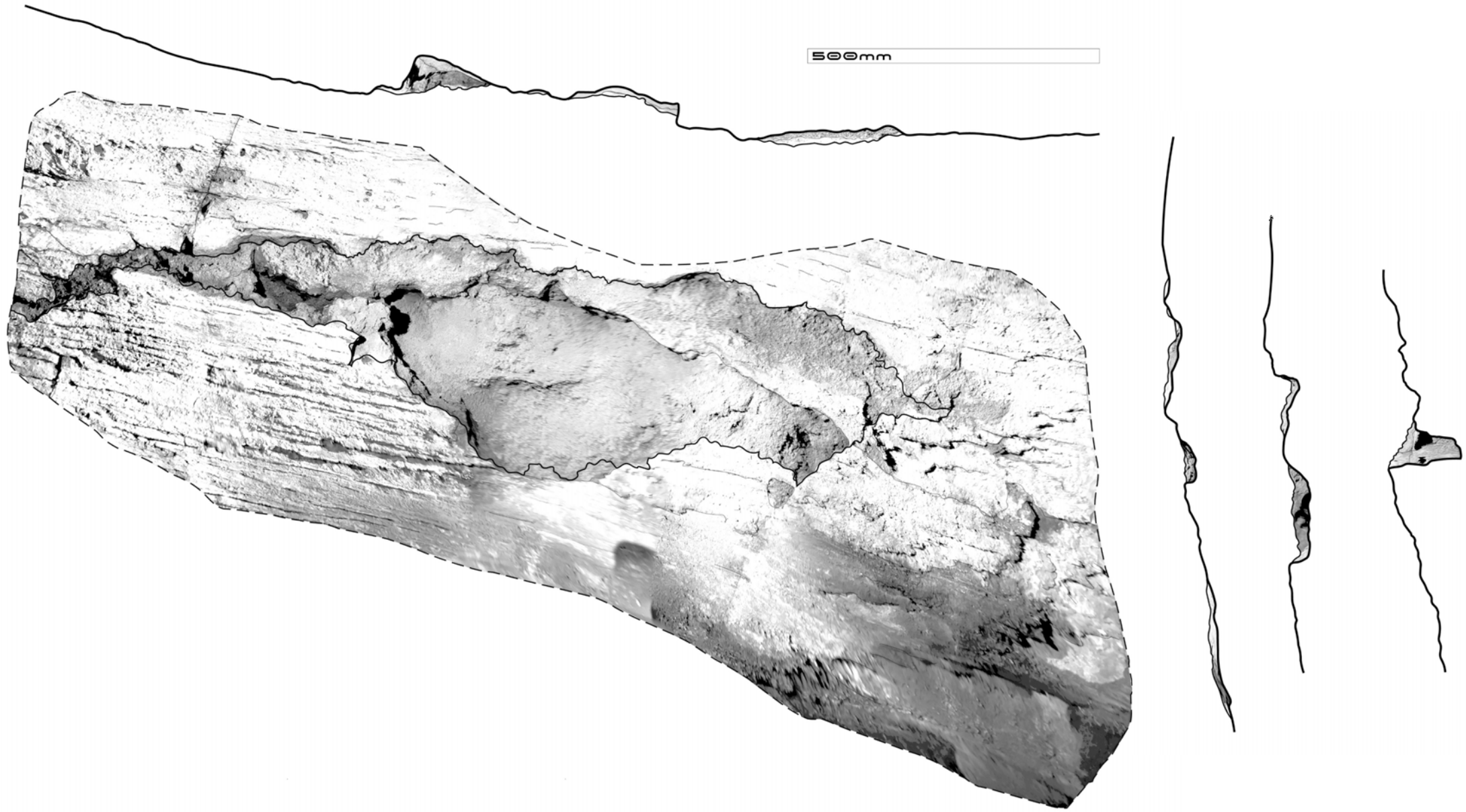


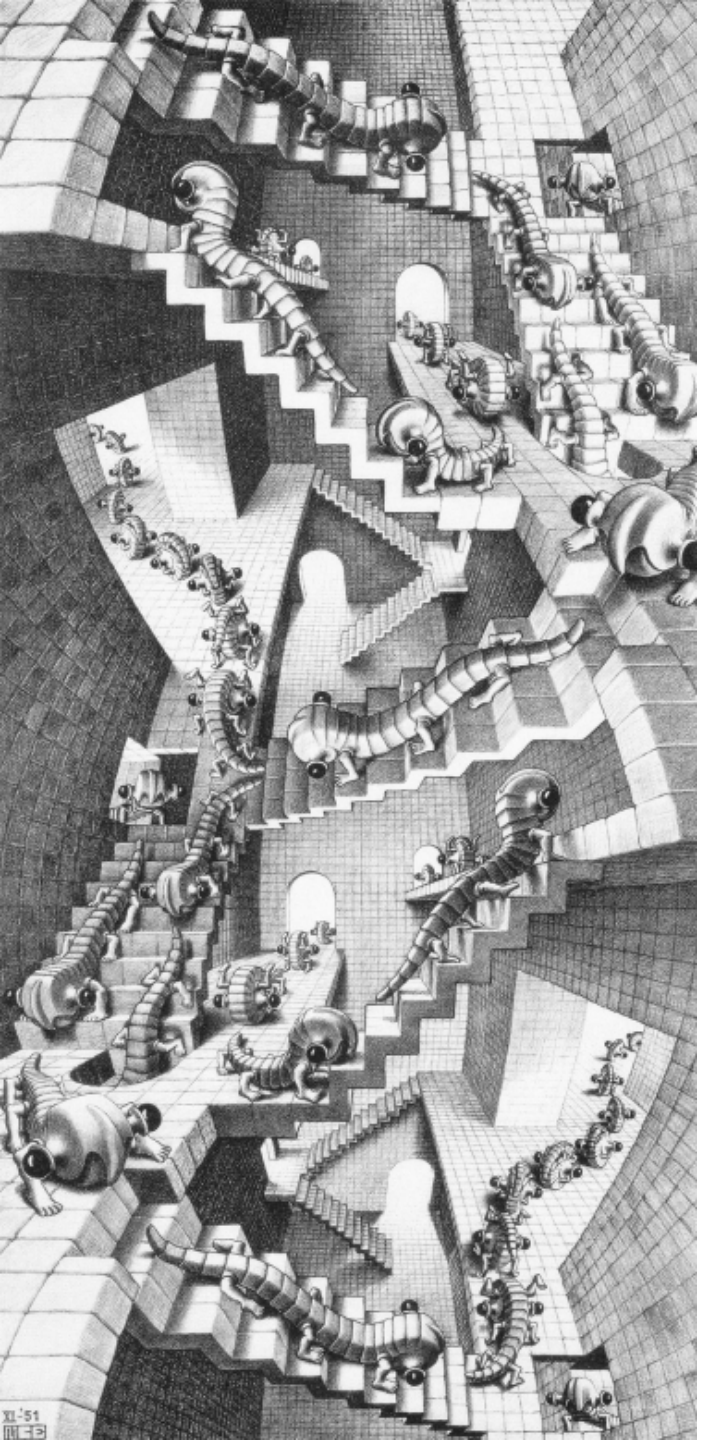


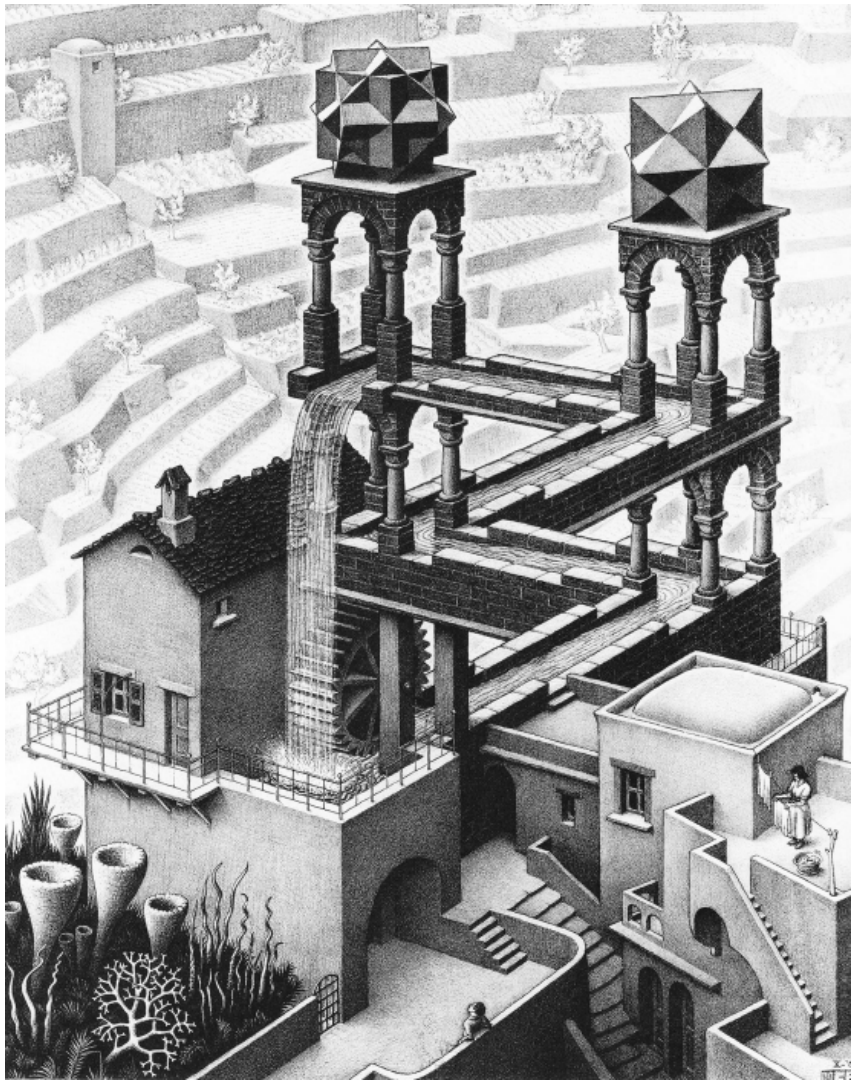

1500mm

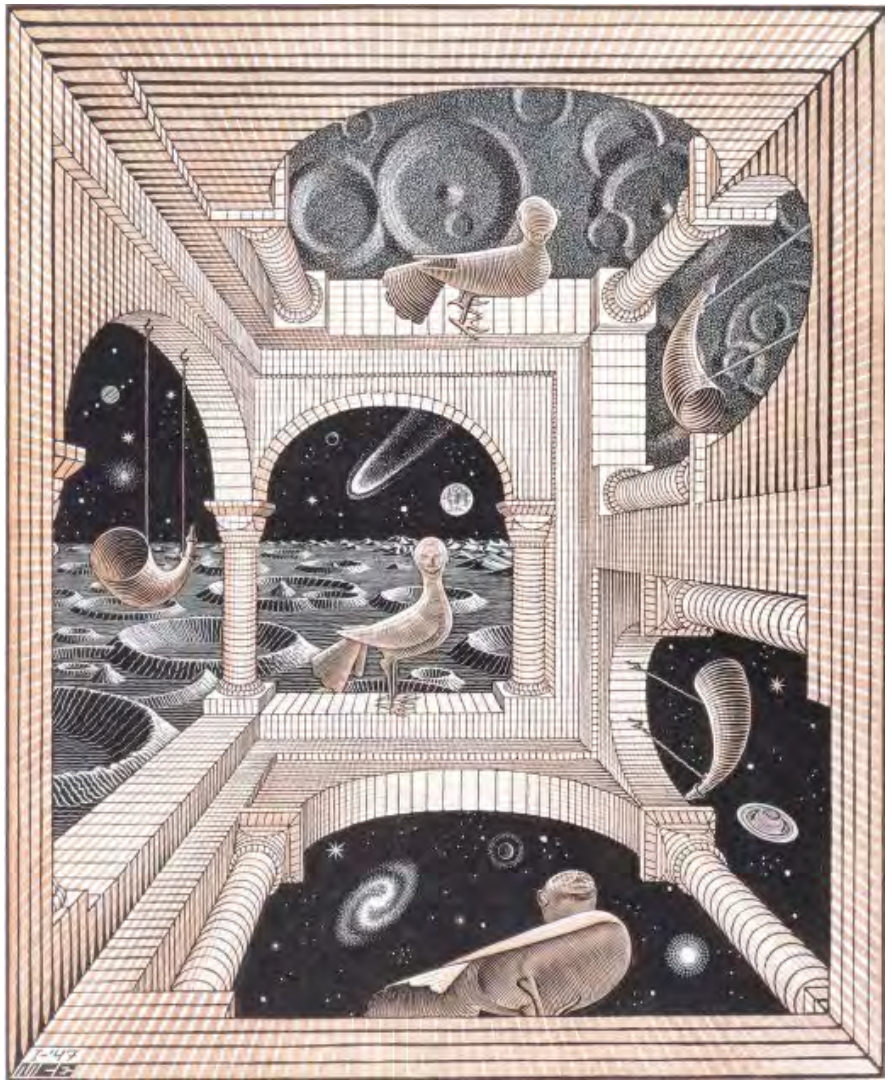



500mm

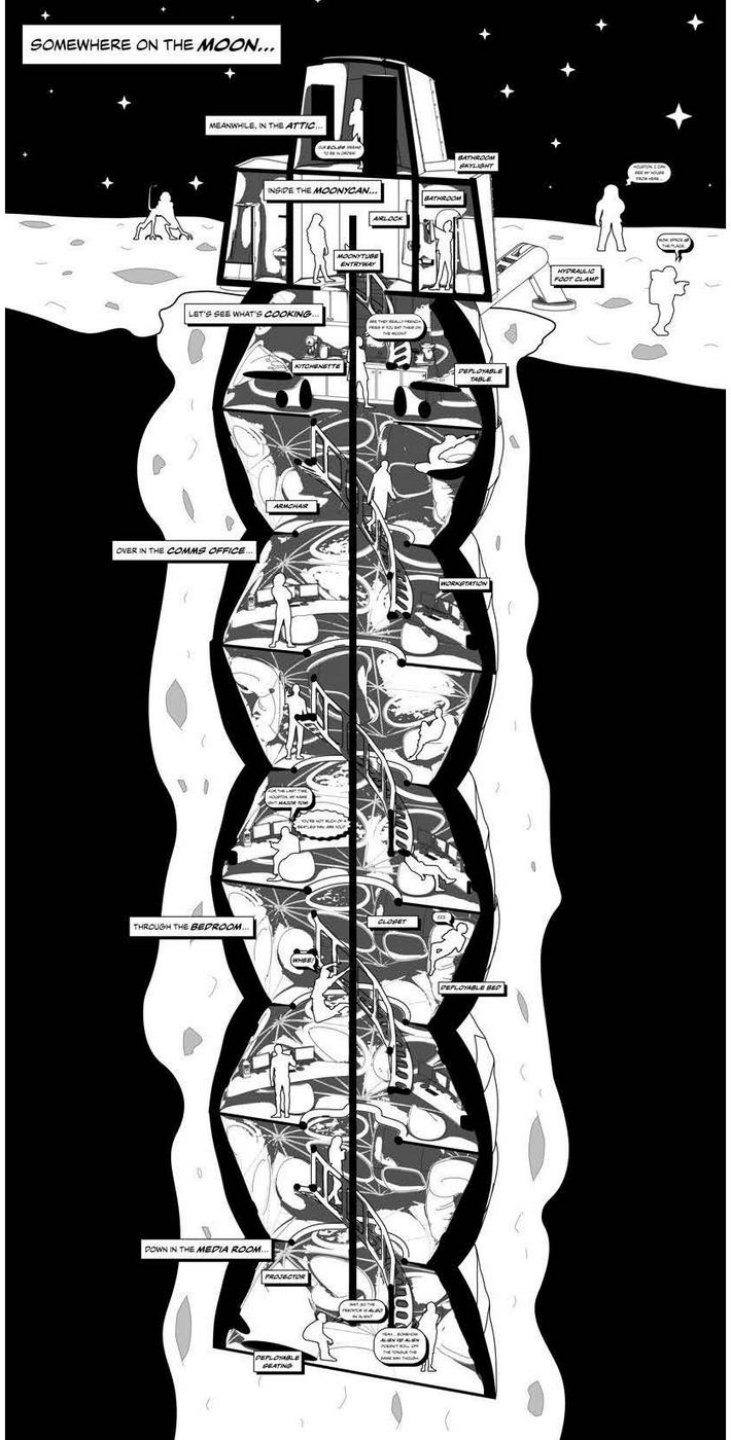

500mm





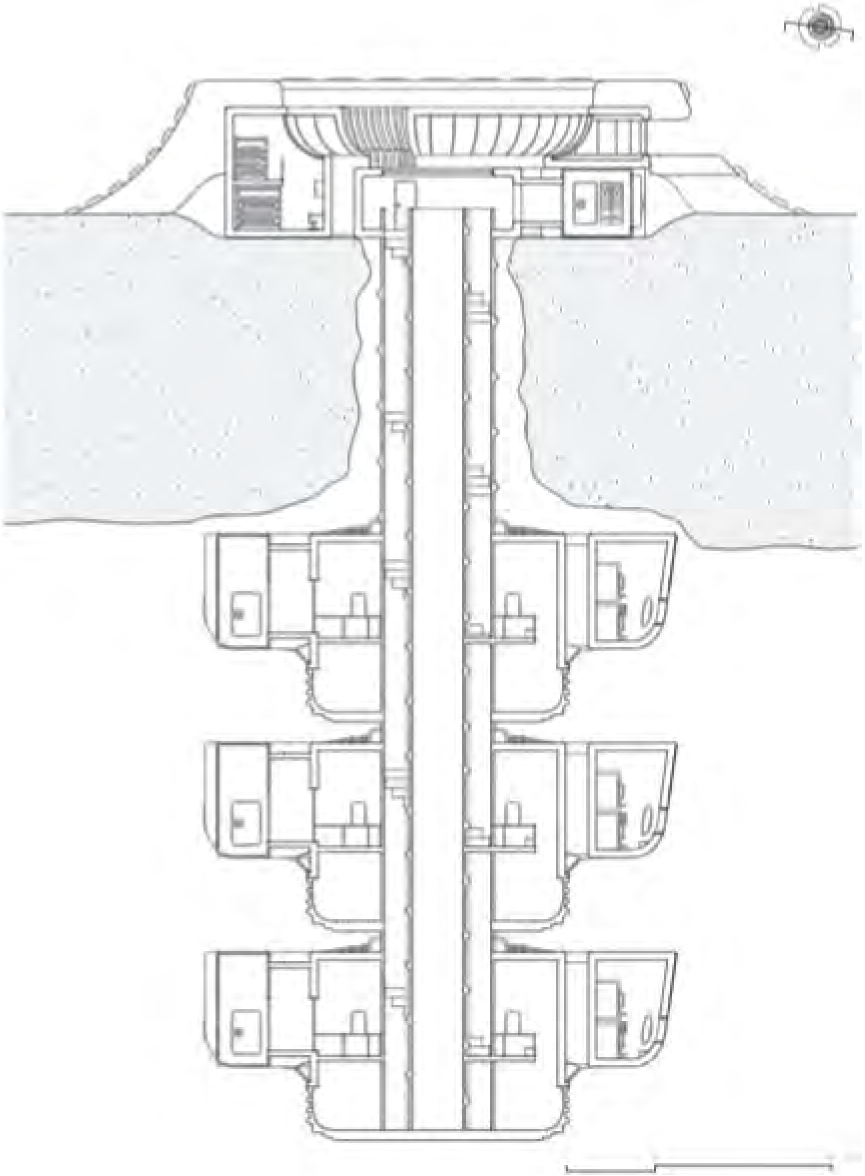


Works of M.C. Escher



Moony Tubes by MIT Space Exploration Initiative (student project)

The Blooming by Team_SH (Competition)

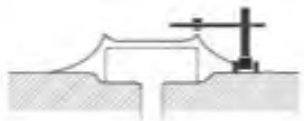


PROCESS

LANDING

The transport rocket arrives on the moon and uses robots to prepare the ground.

3D PRINTING

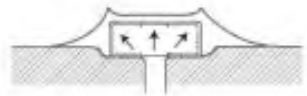


Solid shells in the shape of a lunar crater is created using process.

HABITAT

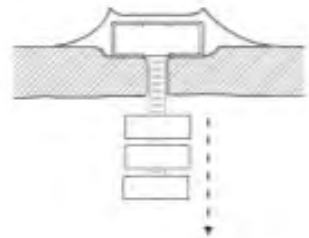
Pre-fabricated units with expandable walls are brought inside the shell.

BLOOM



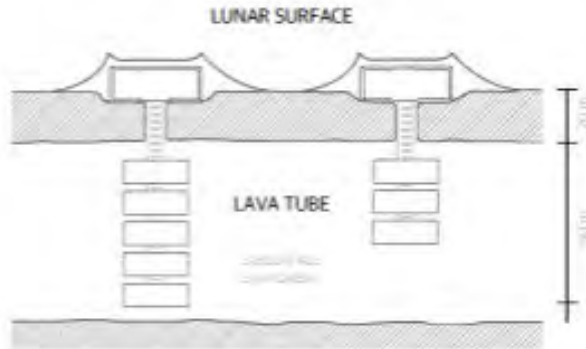
After inflating the units, human enter and finalize the space.

EXPANSION

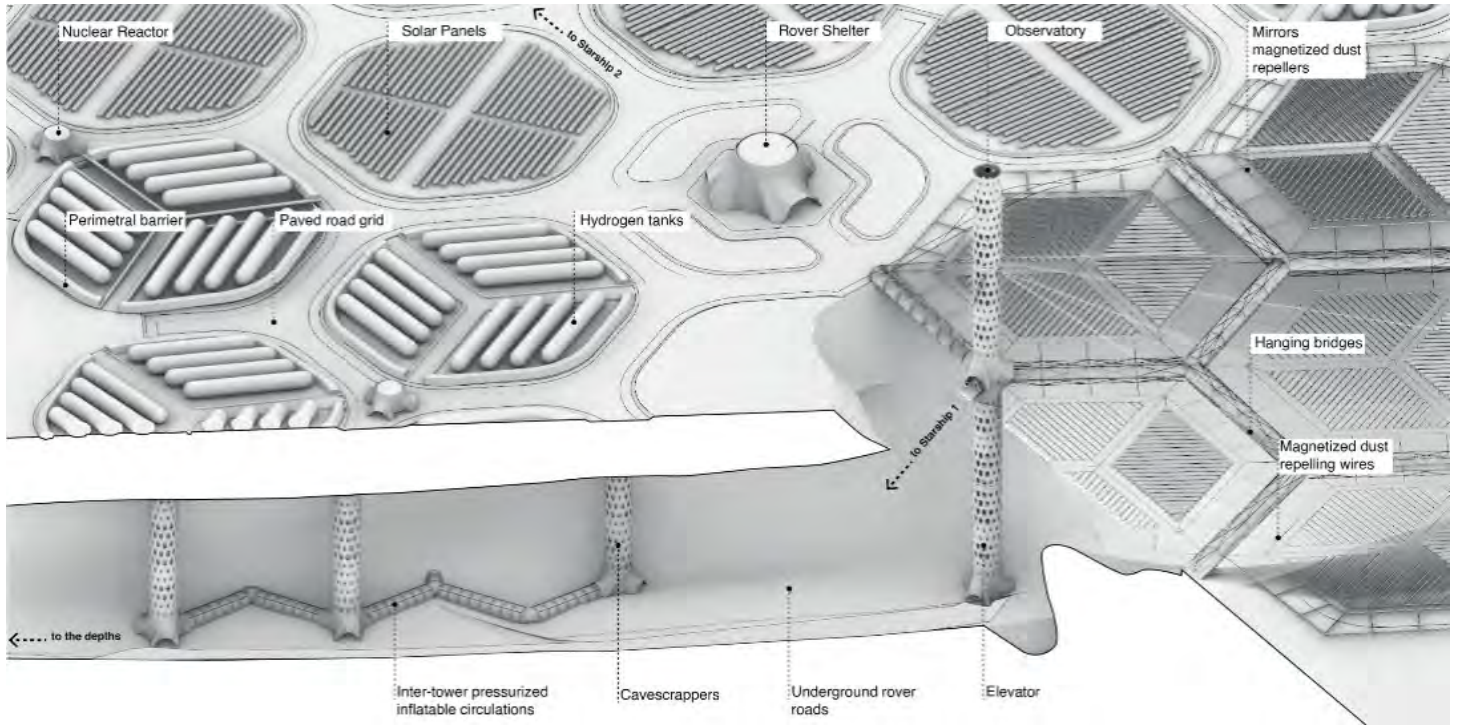


The underground units multiply through the main core in the holes.

COLONIZATION



As more people enter "The Blooming" it expands progressively along the Lava Tube.



Moonhive by Wandering Dwarves (Competition)

Shell

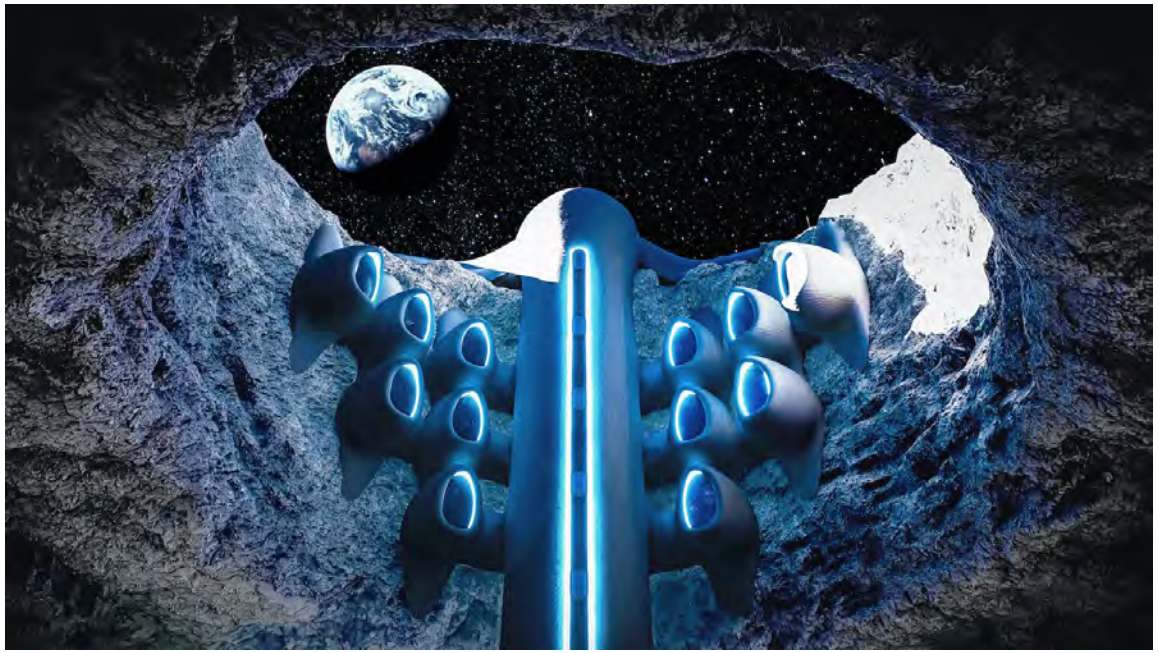
Lunarcrete 3d-Printed Outer shell.Attractor points, derived from the desired aperture intentions of the different floor plans, set the opening size of each hexagon.

Bubble

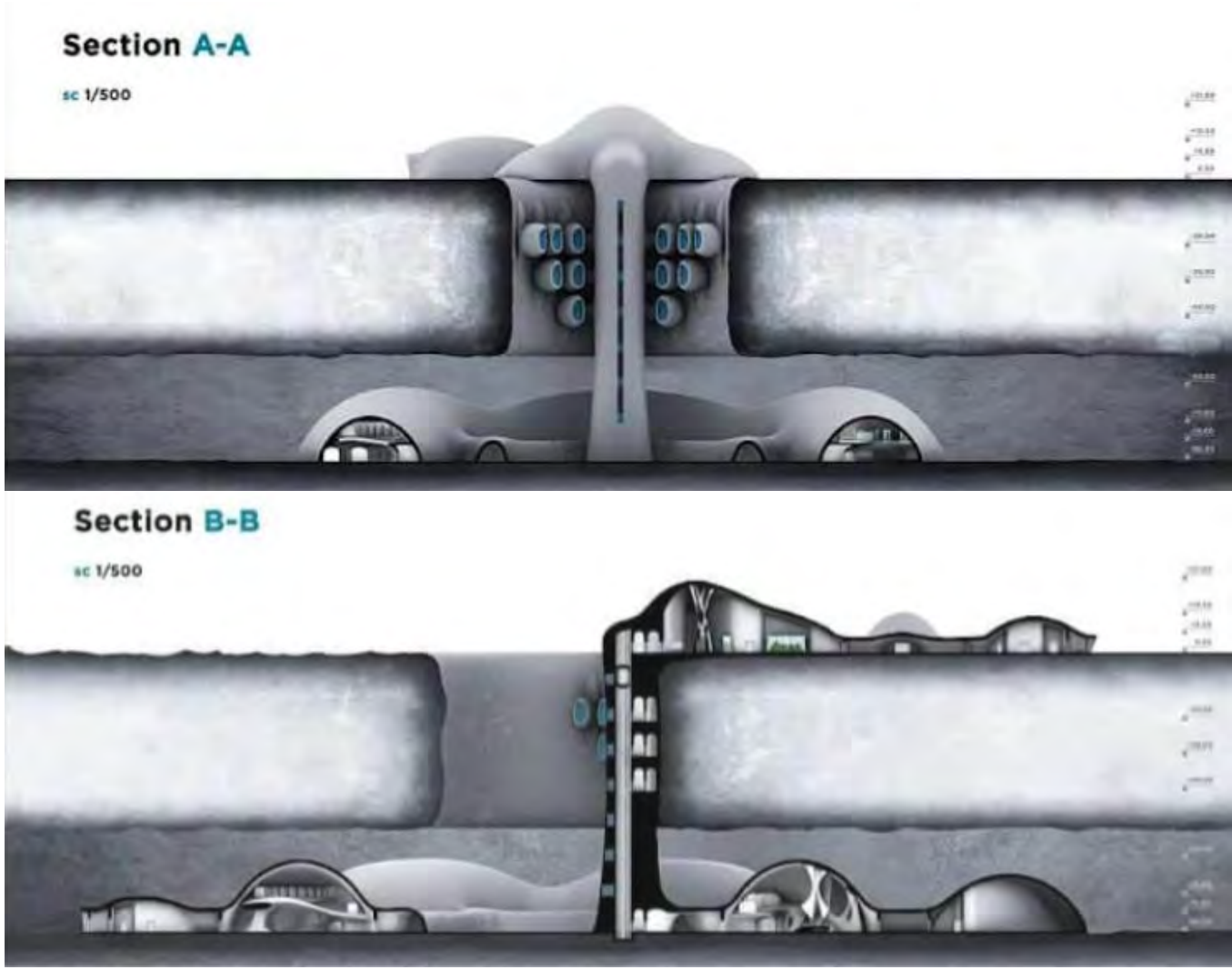
Self deploying inflatable habitat, with Earth-checked hermeticity, shipped within a compact pile of equipped slabs. This layer will grant the breathable environment.

Habitat

The inner slabs have been designed with a diameter that will allow them to be shipped inside the Starship folded one on to the other, and will be extended upwards as the towers gain height, unfolding most of the equipment.



ROMA by Mahdi Eghbali (concept design)



DESIGN PROGRAM

Find the breeched lava tube skylight and analyze the site and check the conditions of the area

Landing in the right position and preparing construction robots

Prepare the landing pad for the rest of the robots and humans to land in the future

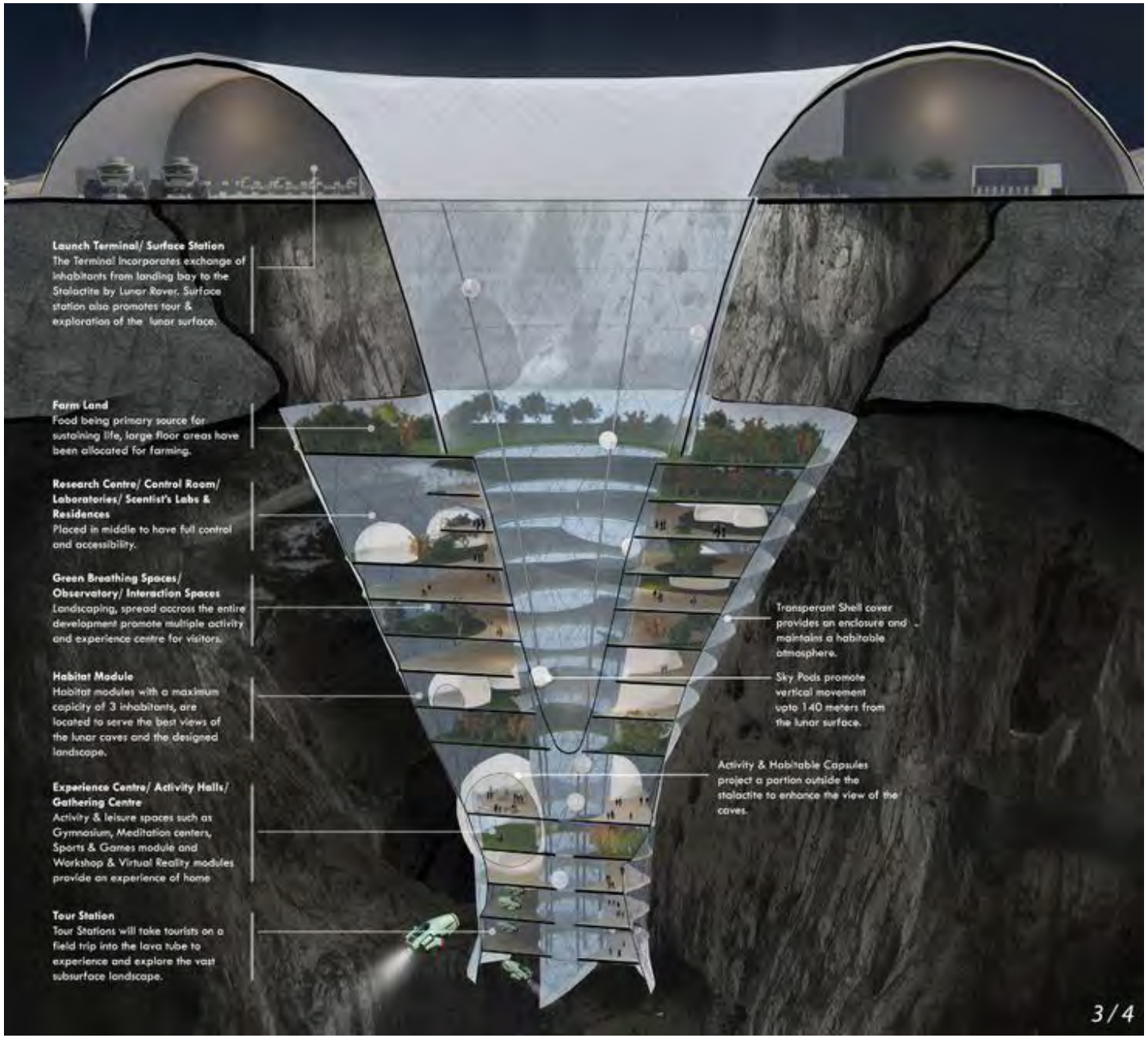
Construction of entrance and facilities and the upper part

Add vertical access to reach the lava tube and build the elevator

Construction of accommodation for human habitation

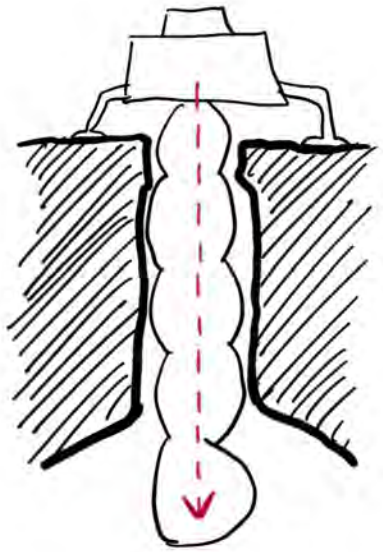
Construction of units located in the skylight wall

Add the final details and finish building the dome

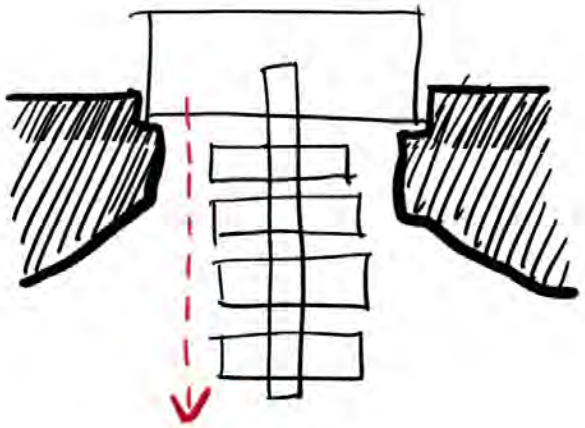


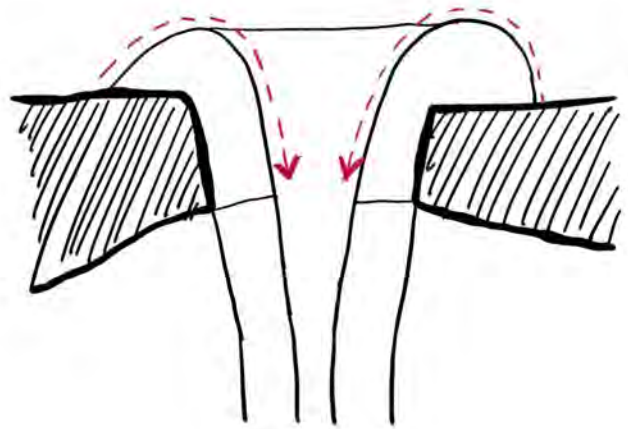
Lunar Stalactite (competition)

Tension/ Hanging



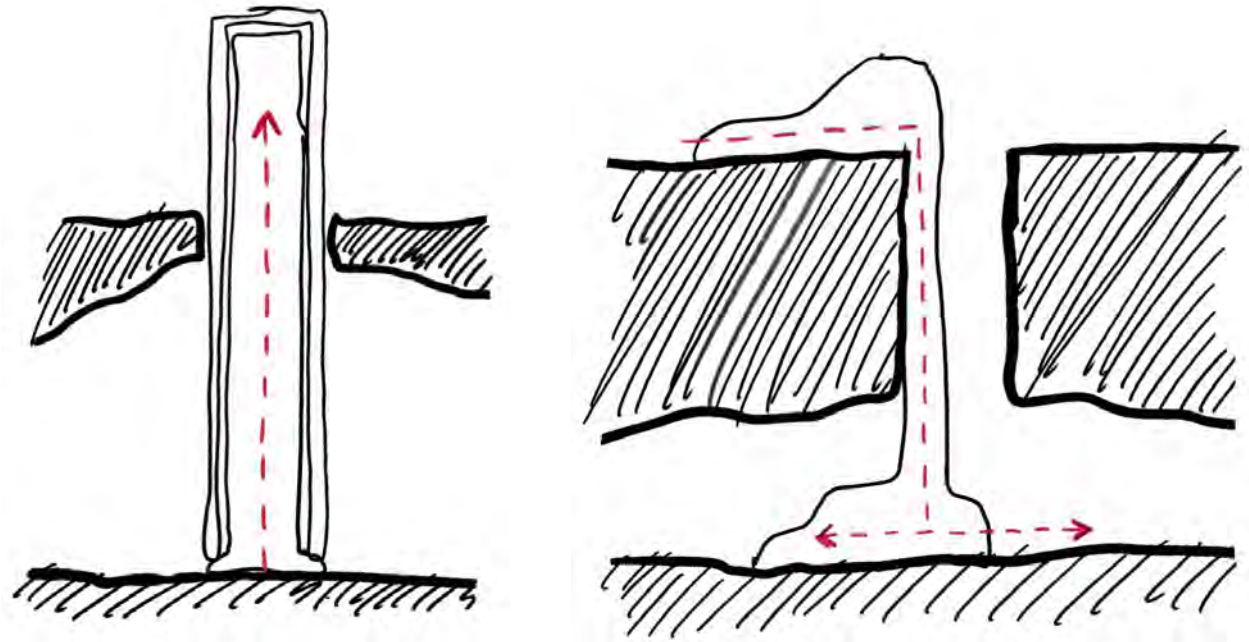
On-earth fabrication

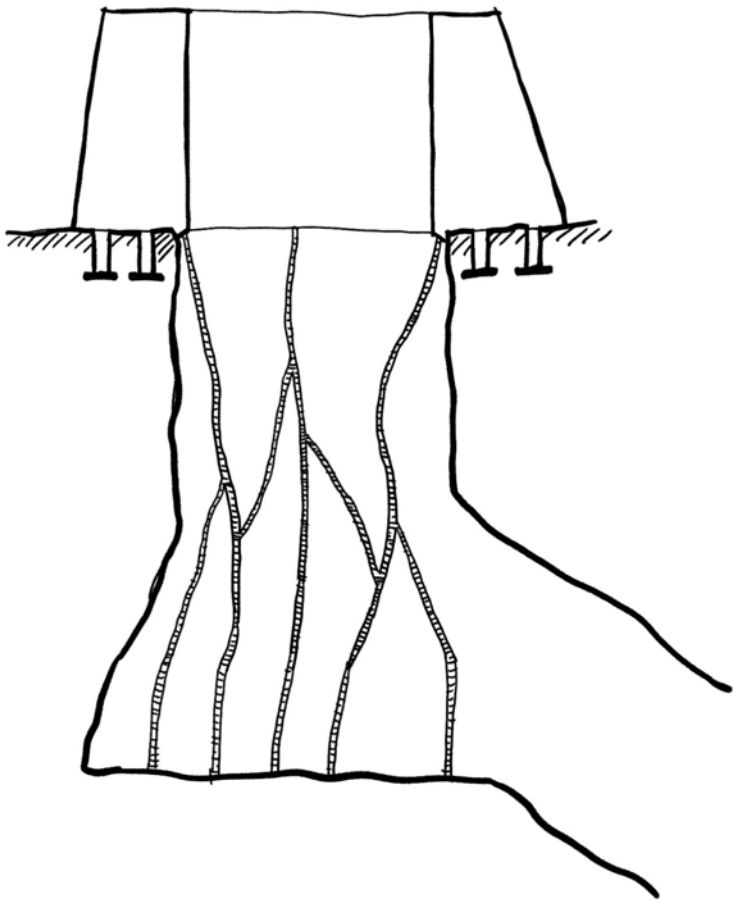




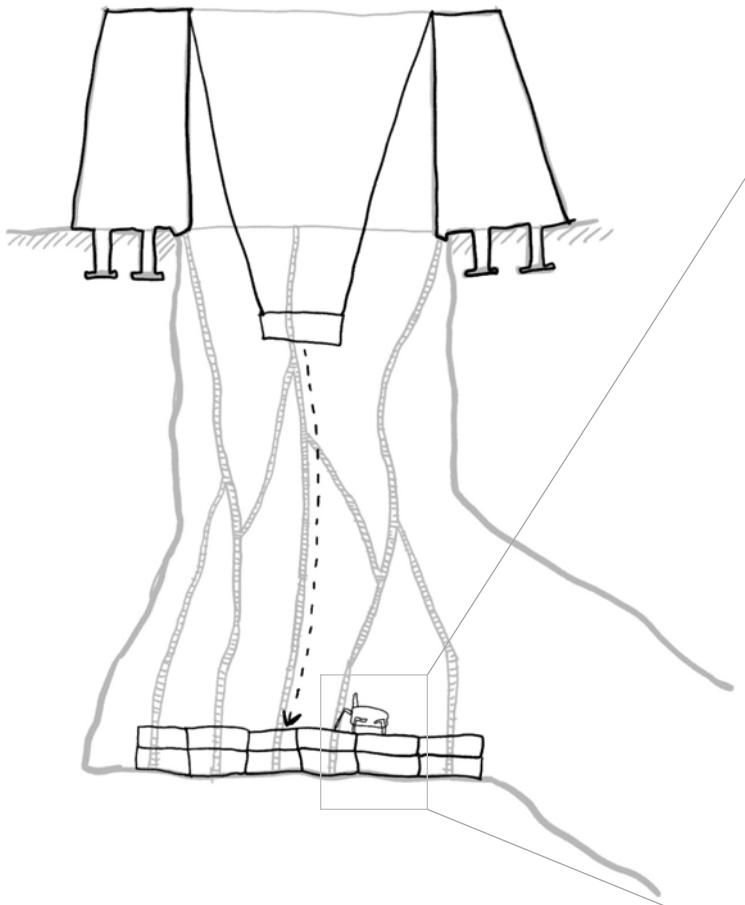
In situ resources

Compression

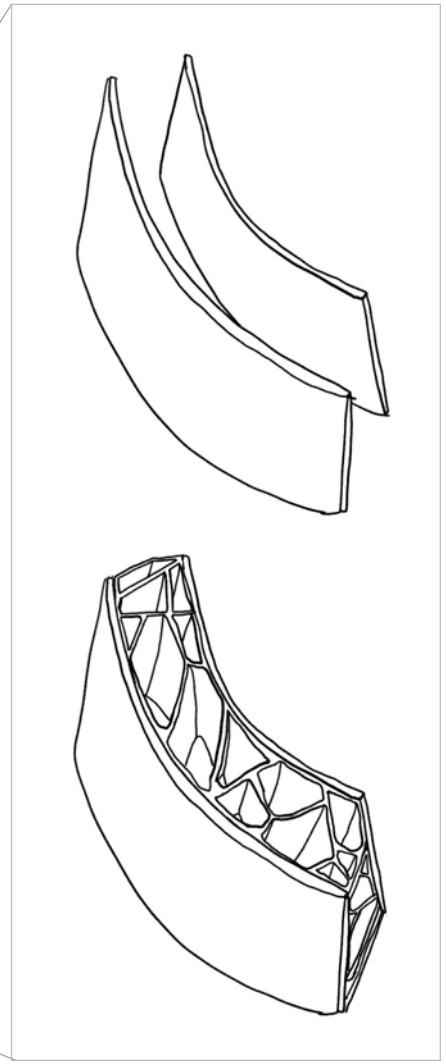




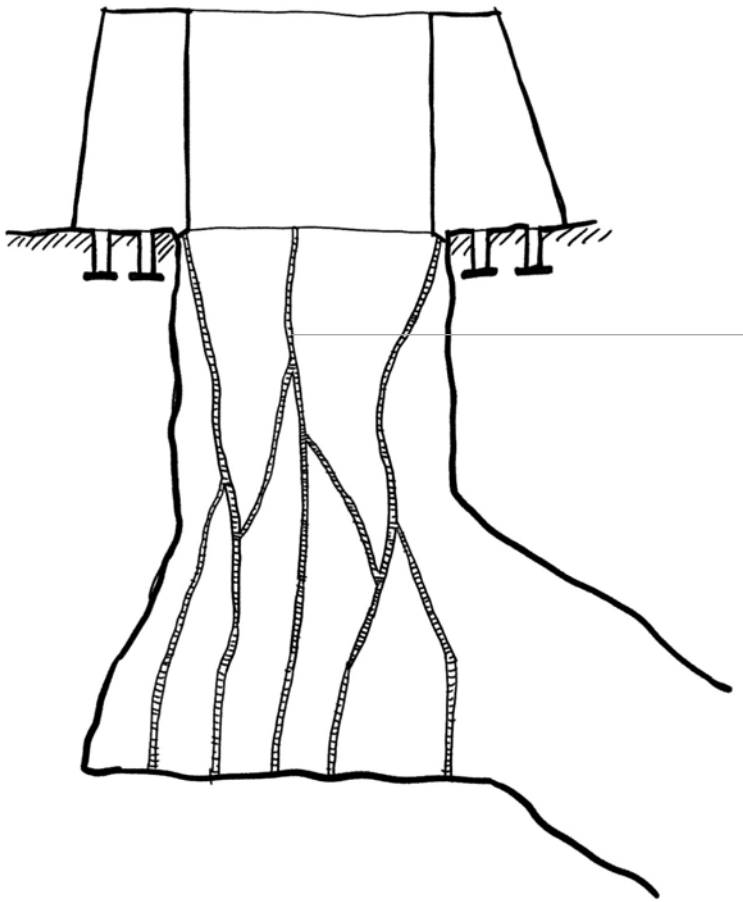
- Lava tube surface scanning
- Construction of structure on surface
- Construction of rail according to the scanning result



- Thin slabs of shells are transported with guide of rails



- Thin slabs are filled by mobile 3d robots



Rails -> the only mechanical part of the building:

- Construction method
- Logistics
- Emergencies
- Configuration of public spaces

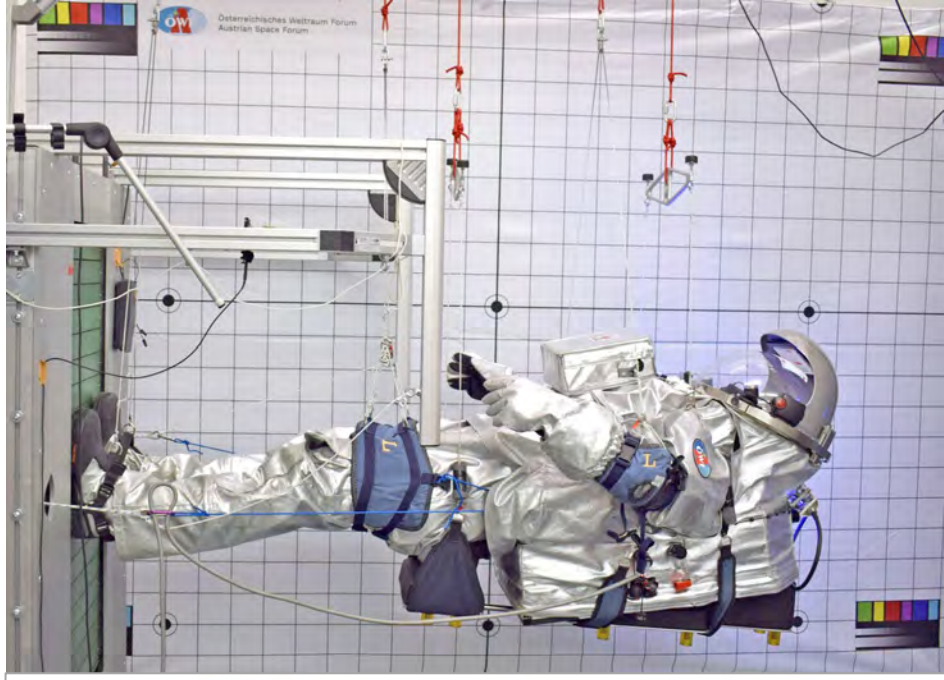
Deep dive

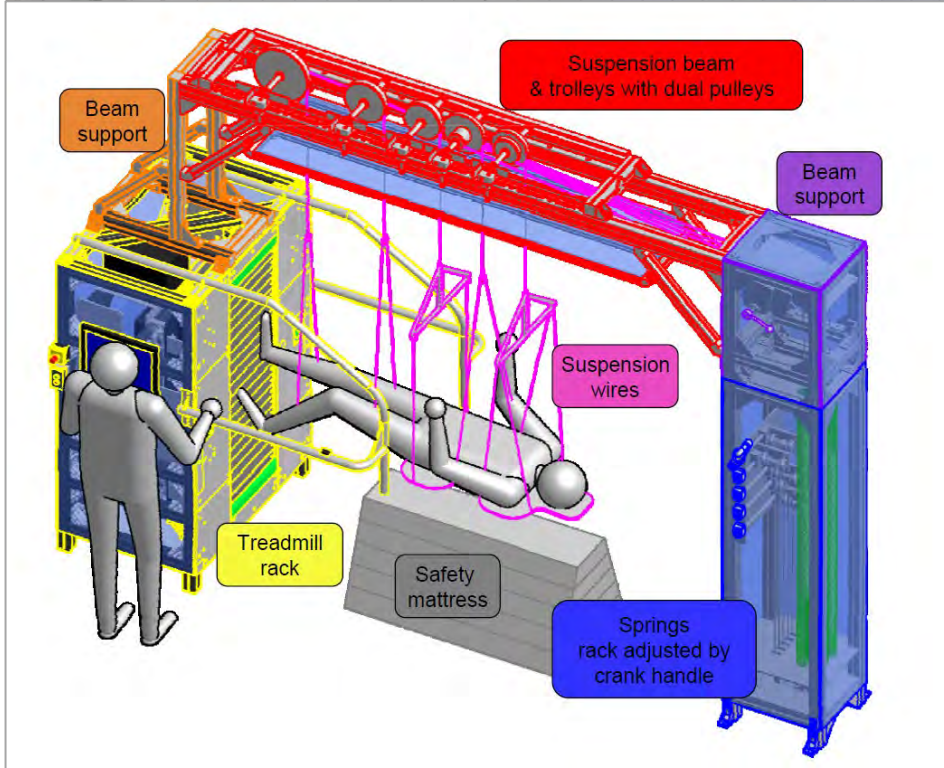
Parabolic Flights -> ESA (flight)
Neutral Buoyancy Lab -> NASA (swimming pool)

The puppet show -> ESA in Milan

Vertical treadmill at envihab -> ESA in Italy

https://oewf.org/en/vertical-treadmill/





NASA TECHNICAL NOTE NASA TN D-3363

NASA TN D-3363

COMPARATIVE MEASUREMENTS OF MAN'S WALKING AND RUNNING GAITS IN EARTH AND SIMULATED LUNAR GRAVITY

by Donald E. Hewes, Amos A. Spady, Jr., and Randall L. Harris
Langley Research Center
Langley Station, Hampton, Va.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • JUNE 1966

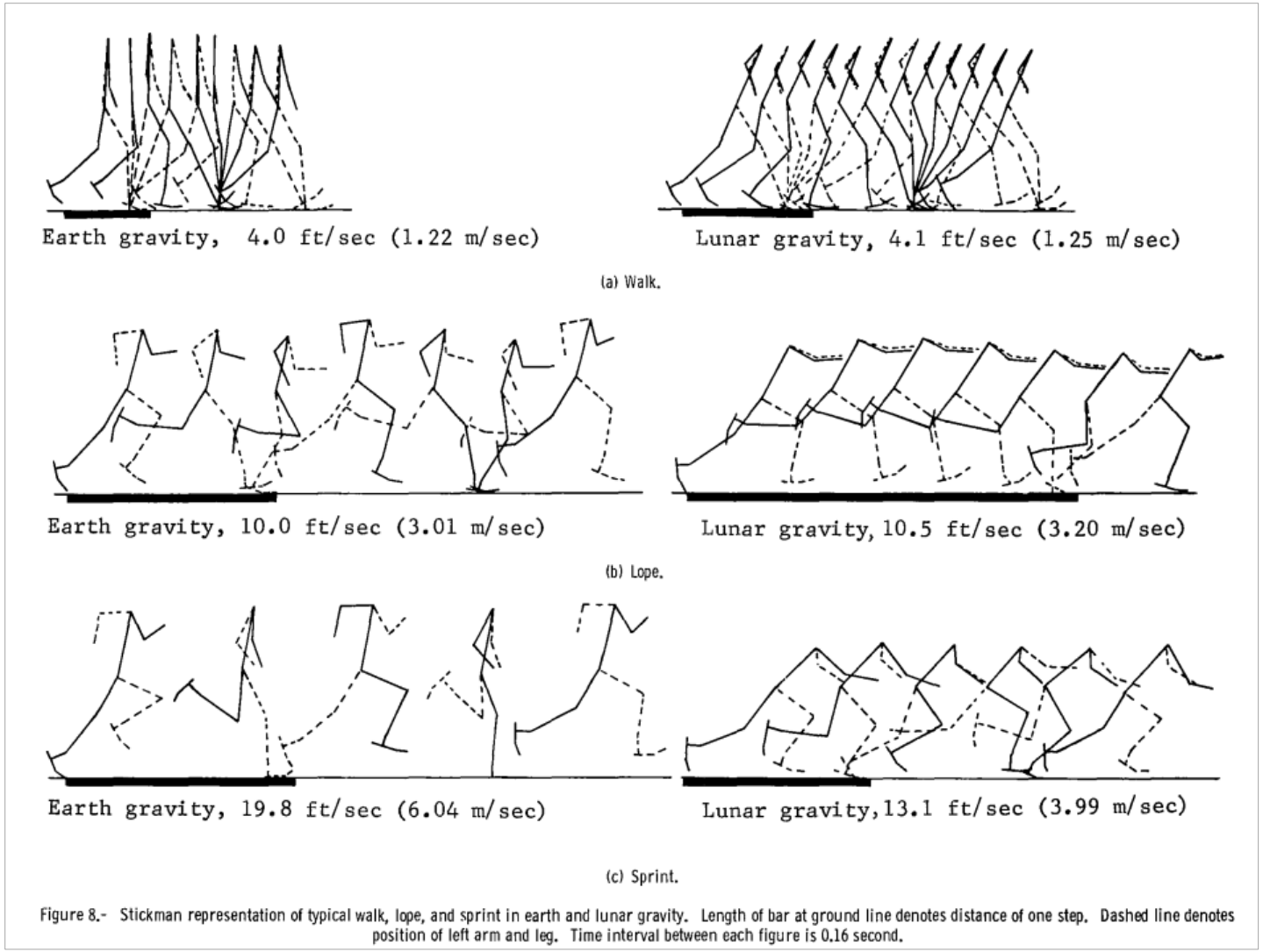
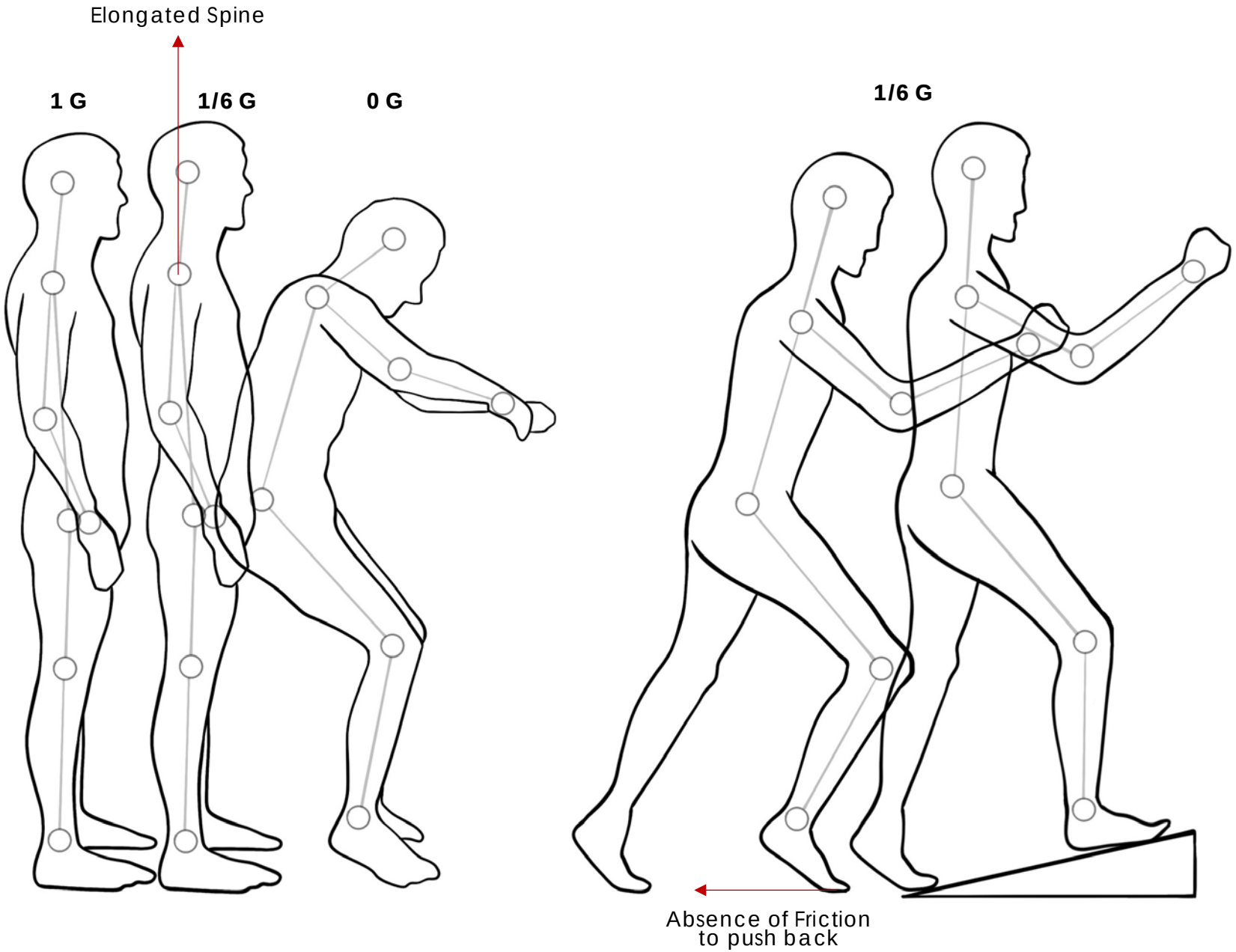


Figure 8.- Stickman representation of typical walk, lope, and sprint in earth and lunar gravity. Length of bar at ground line denotes distance of one step. Dashed line denotes position of left arm and leg. Time interval between each figure is 0.16 second.

Moon: Max 4 m/s of running speed on a flat track
Earth: Max 6 m/s of running speed on a flat track


Elongated Spine
1 G
1/6 G
0 G
1/6 G
Absence of Friction
to push back

G (m/s2)

earth	moon
9.8	1.6

Fall from 1m

0.45 sec 1.1 sec

v= 4.4m/s v= 1.8m/s

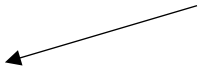
v= 1.8m/s

0.17m

Fall from 2m

0.64 sec 1.6 sec

v= 6.26m/s v= 2.5m/s



v= 2.5m/s

0.32m

Fall from 3m

0.78 sec 1.9 sec

v= 7.7m/s v= 3.1m/s

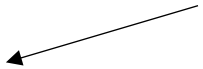
v= 3.1m/s

0.49m

Fall from 5m

1 sec 2.5 sec

v= 9.9m/s v= 4m/s



v= 4m/s

0.82m

Fall from 10m

1.43 sec 3.54 sec

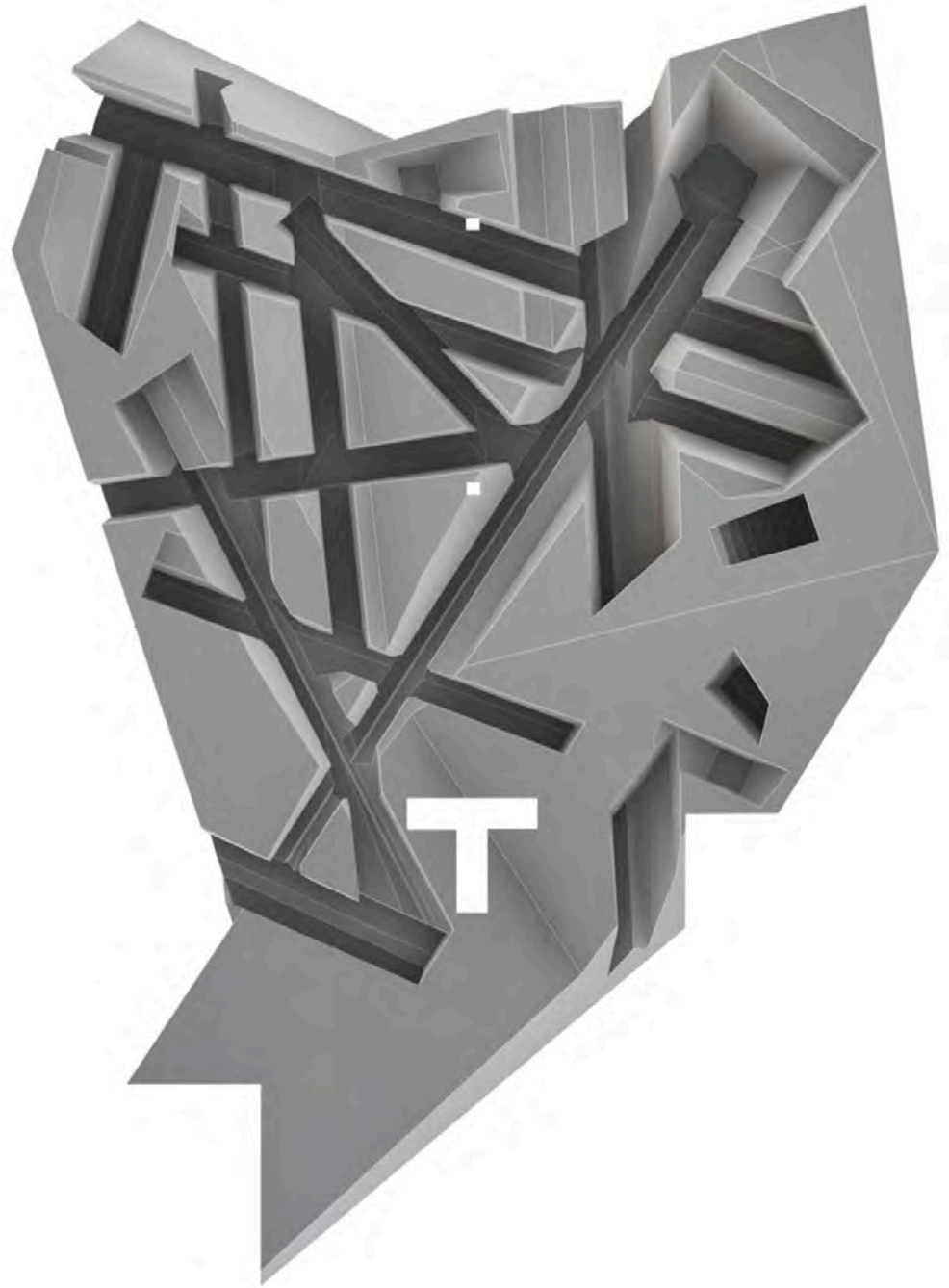
v= 14m/s v= 5.6m/s

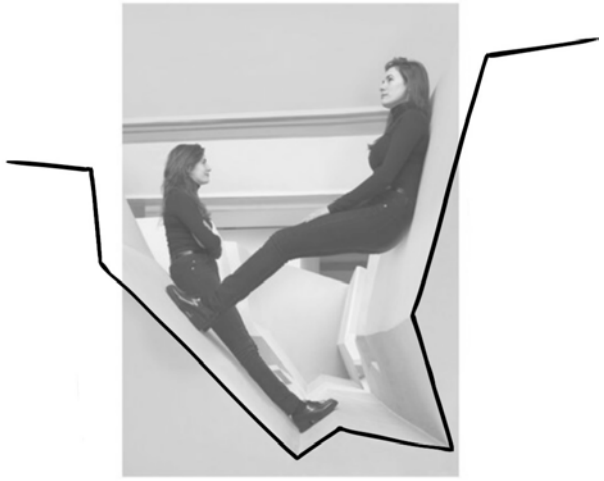
v= 5.6m/s

1.6m

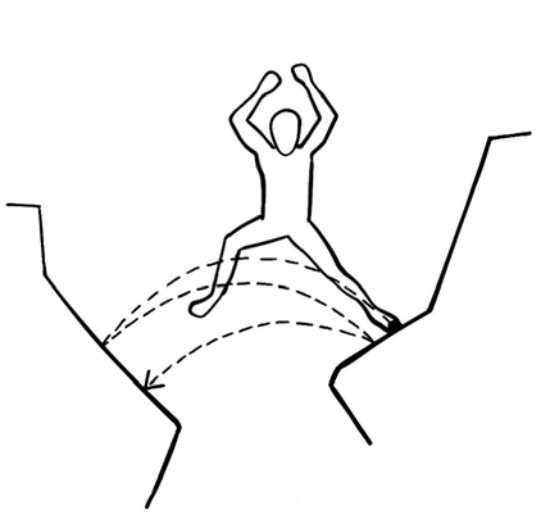
Jump from ground

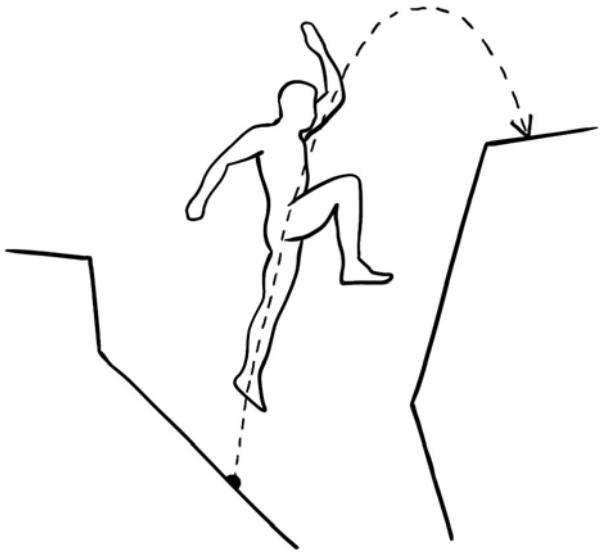
0.5 m	2.7 m

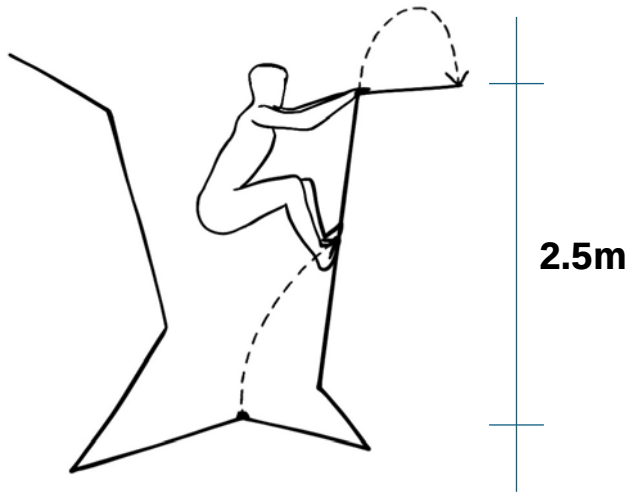




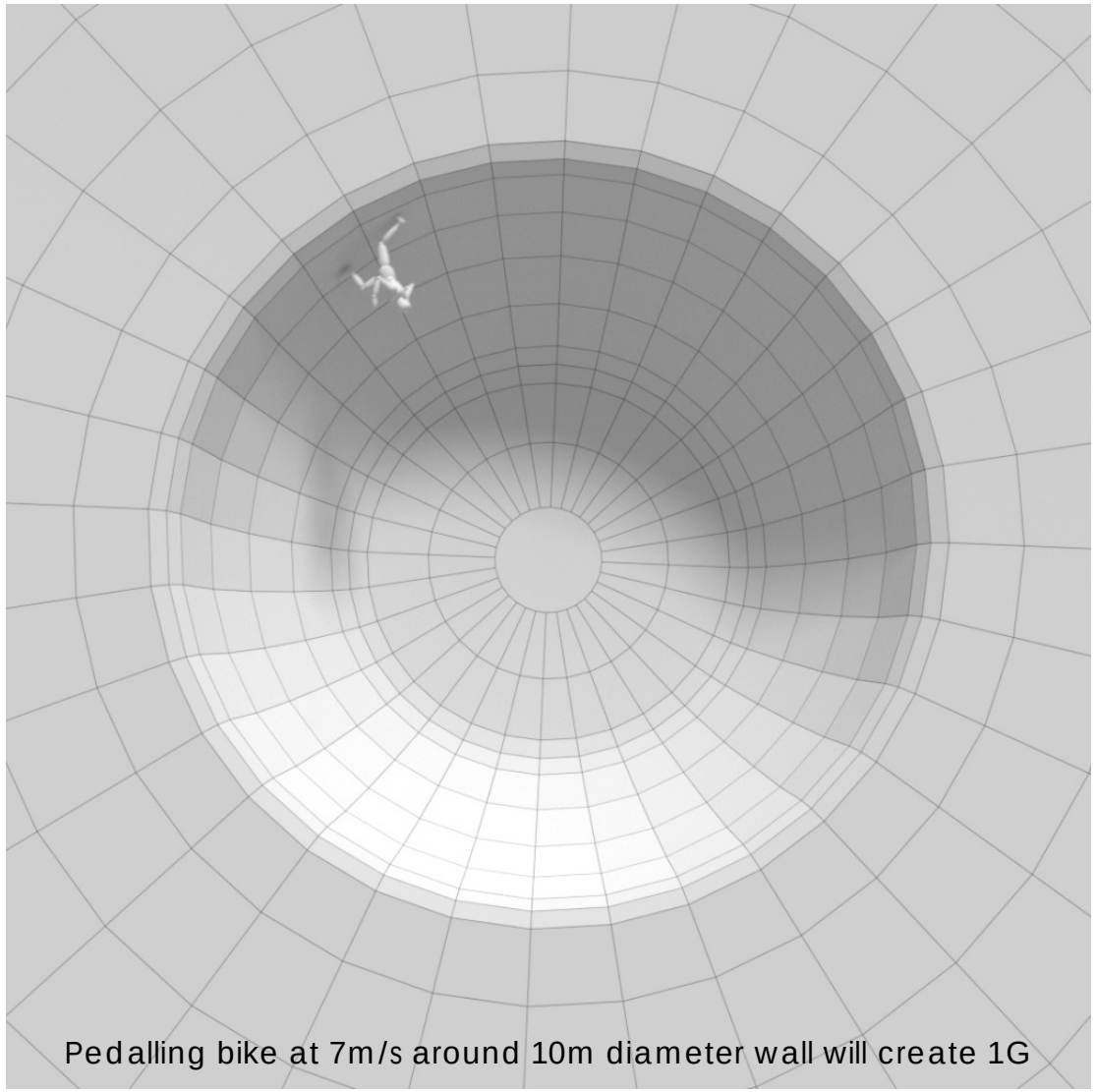
Application on Earth (1G)







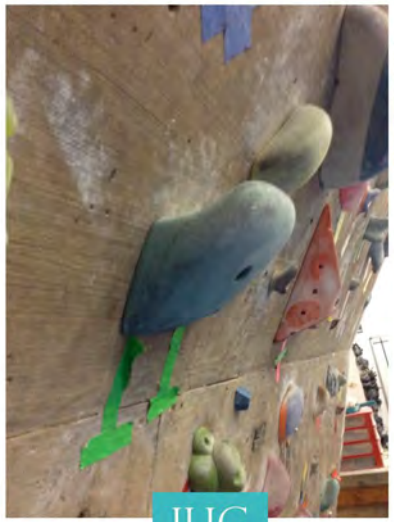
Application on Moon (1/6G)

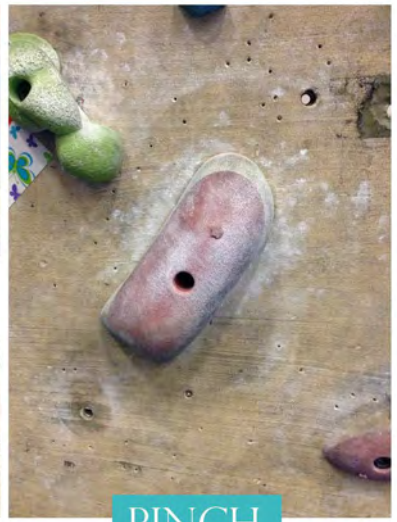


Pedalling bike at 7m/s around 10m diameter wall will create 1G

Source: news.sky.com

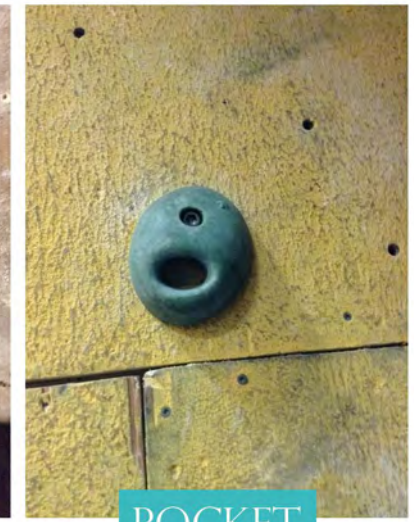
"just **twice a day, for three or four laps** would be enough to keep astronauts' muscles and bones healthy on the moon"
-Professor Alberto Minetti, University of Milan


JUG

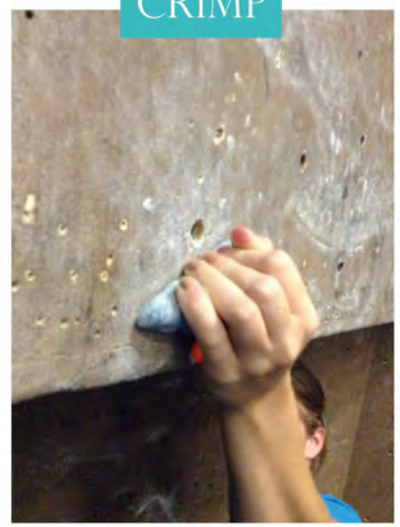

PINCH

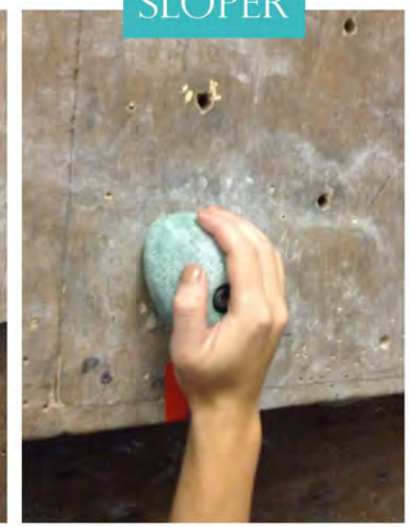

CRIMP

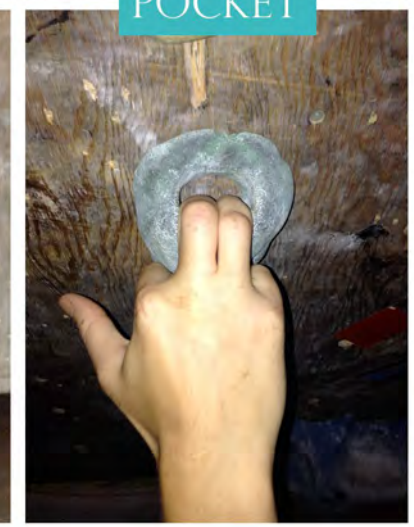

SLOPER


POCKET


JIB








MONO