

Moonshot+

Logbook

Robotic Lava Tube Mapping Mission

Sicily, Italy 18-24 November 2024



Full Logbook

Mission Team

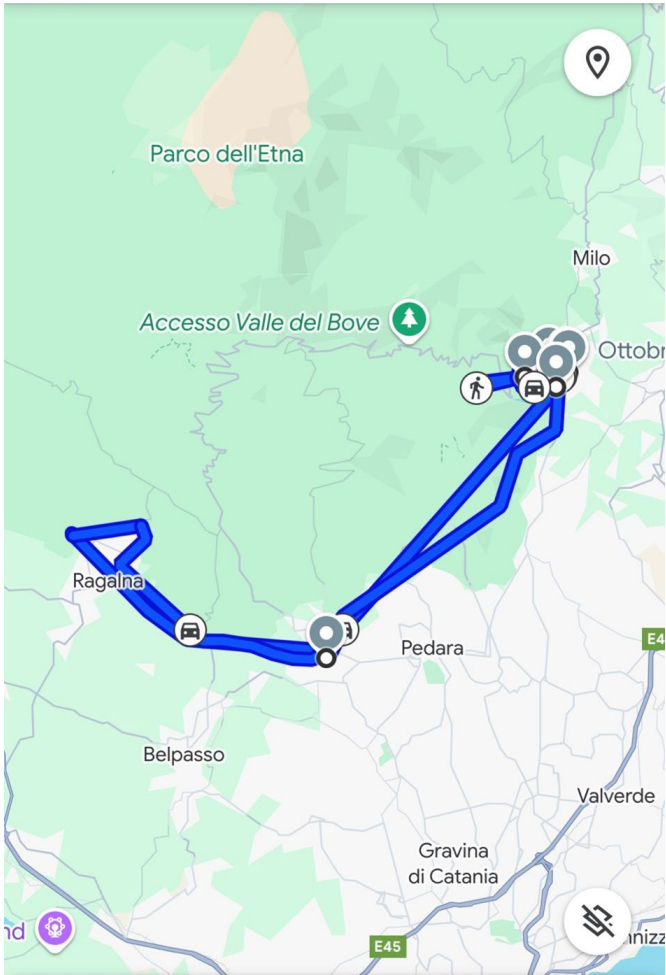
PhD/ MSc students: A.Hidding, A. Becoy, J. Jonathan, R.Tan, W. Chung (TU Delft); F. Romio (U. Ferrara); G. Calabrese (U D'Annunzio Pescara-Italy)

Tutors: H. Bier, A. Hidding, L. Peternel, R. Rajan (TU Delft)

Collaborators: G. Priolo (CAI Catania), S. Rotolo (U Palermo), A. Licciardello (AN Nebrodi)

Partners: TU Delft Moonshot, TU Delft Space and Robotics Institutes, ESA, Erasmus+

Day 1 (Monday, 18 November 2024)



Donna Peppina dal 1924

Via Roma, 220, 95019 Zafferana Etnea CT, It...

09:49 – 10:00

...

Driving

1,3 km · 7 min

10:00 – 10:07

...

Parco Tematico Sicilia in Miniatura

Via Cassone, 114, 95019 Zafferana Etnea CT,...

10:07 – 10:33

...

Walking

2,9 km · 2 hrs 1 min

10:33 – 12:34

...

Driving

3,4 km · 8 min

12:34 – 12:42

...

Etna Miele

Via Pietro Nenni, 2, 95019 Zafferana Etnea C...

12:42 – 12:52

...

Driving

19 km · 51 min

12:52 – 13:42

...

Missing visit

13:42 – 17:17

...

Driving

8,1 km · 18 min

17:17 – 17:35

...

PuntoICS Pizzeria Ristorante American ...

Via Etna, 93/95, 95030 Nicolosi CT, Italy

17:35 – 18:28

...

Missing travel

12 km · 33 min

18:28 – 19:00

...

+ Add travel

Via Eugenio Montale, 23

Via Eugenio Montale, 23, 95019 Zafferana Et...

19:00 – 20:15

...

Walking

550 m · 5 min

20:15 – 20:20

...

Visited Ottobrata Zafferanese?

Via Roma, 323, 95019 Zafferana Etnea CT, It...

20:20 – 21:08

...

✓ Yes

Edit

Route of Day 1 - Exploration of Lava Tubes



Moonshot+

TU Delft lava tube mission in Sicily | 18-24 November 2024



D2RP&A | Workshop 1 Documentation

Vertical Moonbase

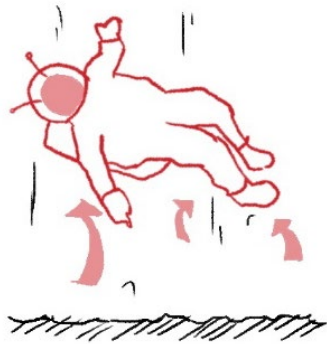
Vertical Living Habitats for Space Settlers

Student: Jonathan Jonathan, Walter Chung // Tutor: Henriette Bier, Arwin Hidding

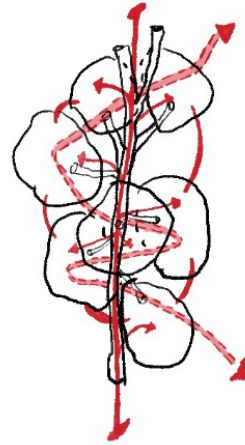
Form Logic



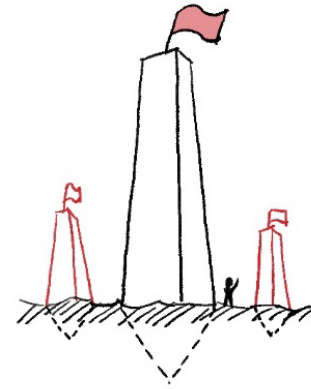
Vertical Structure



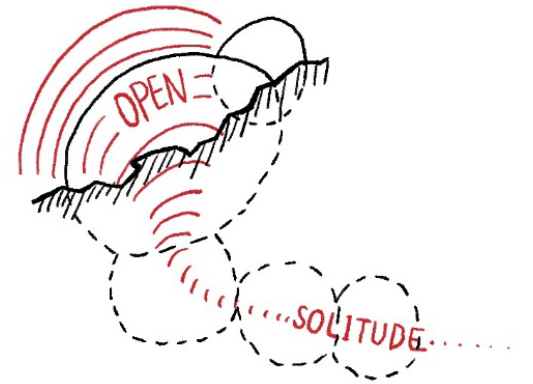
Micro Gravity



Central Core &
Spiral Configuration

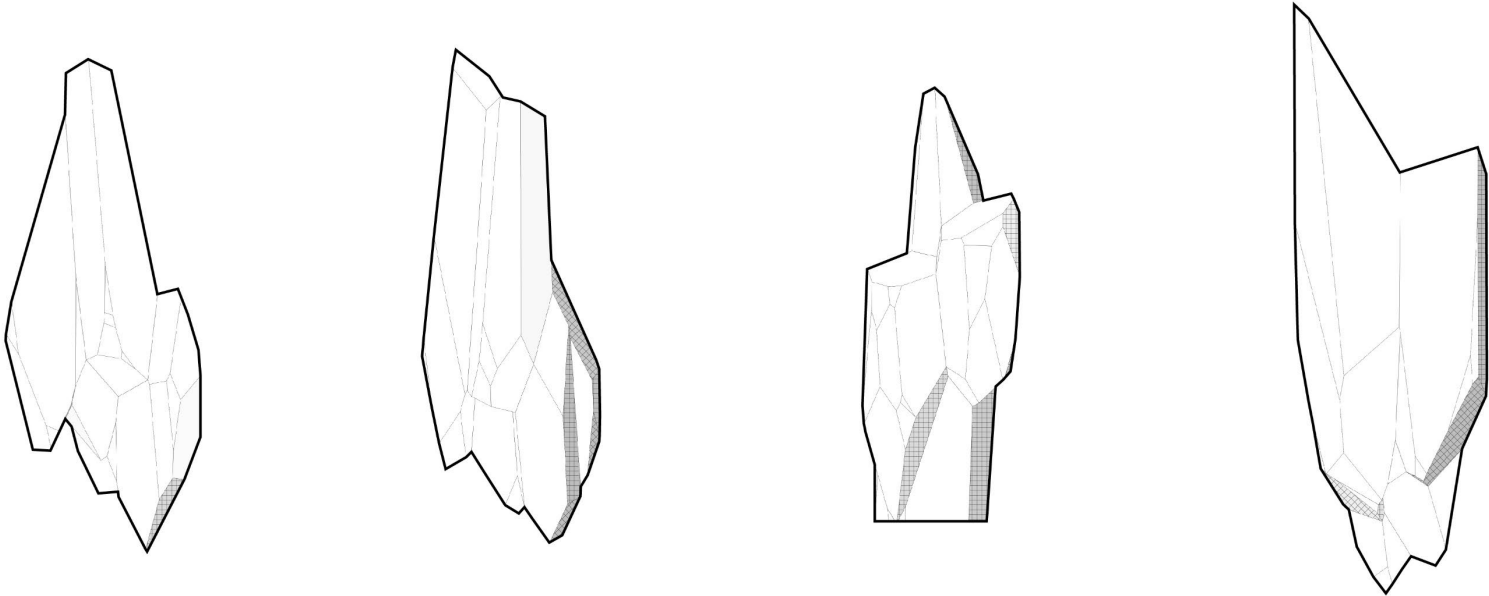


Monumentality of
Humanity Presence

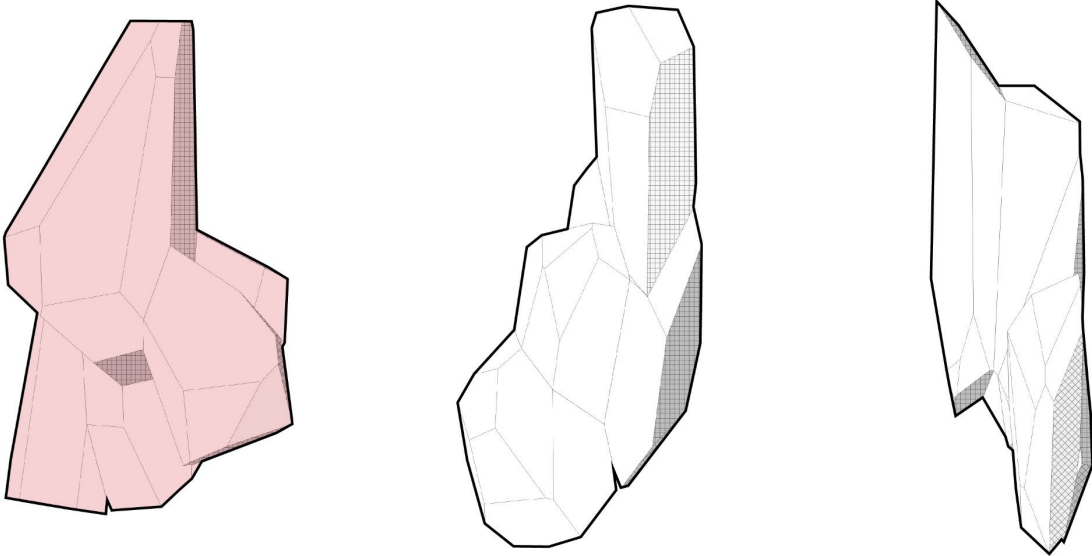


Levels = Privacy Degrees

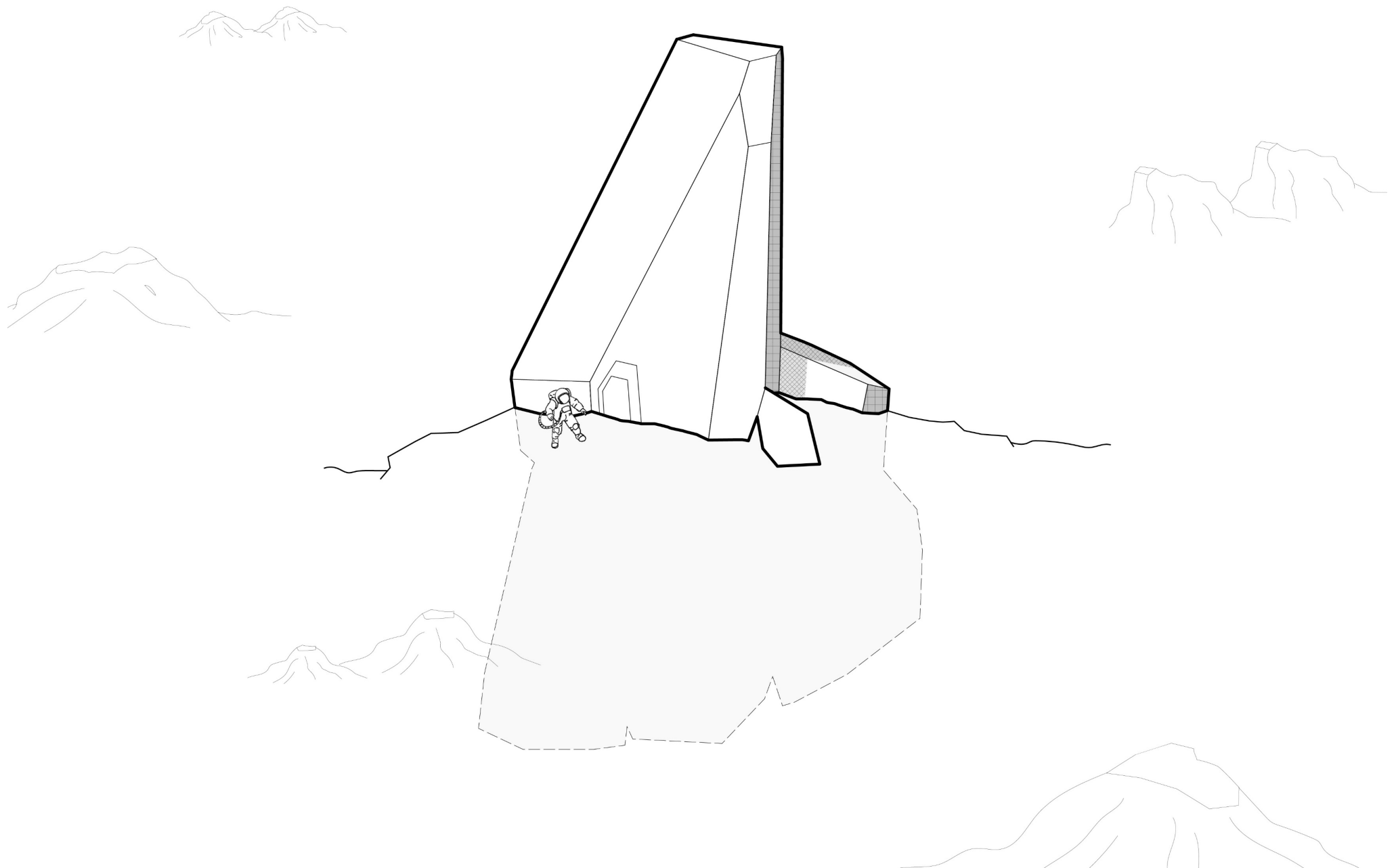
Overall Form Trials



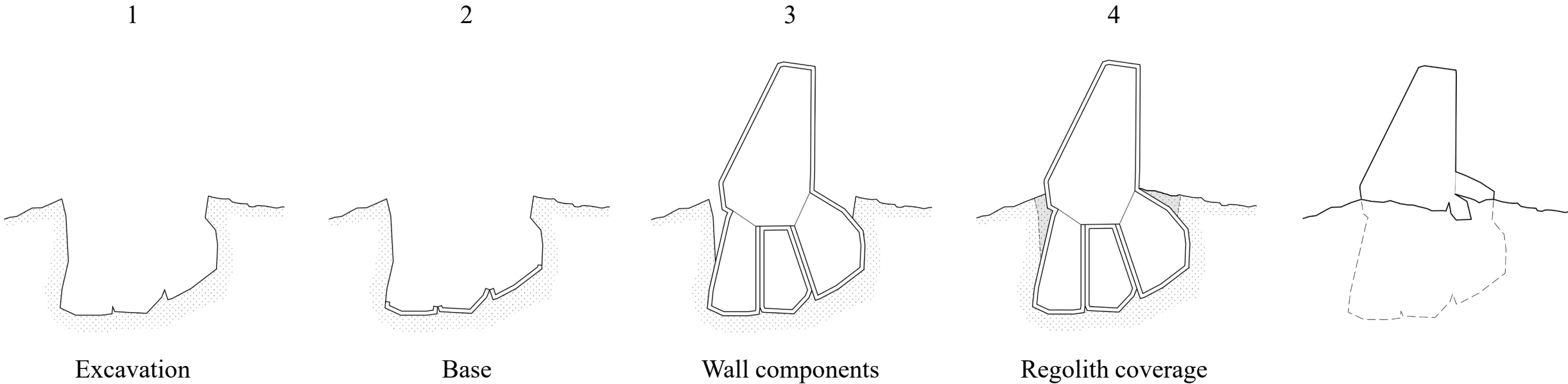
More habitable/ functional
area and composition



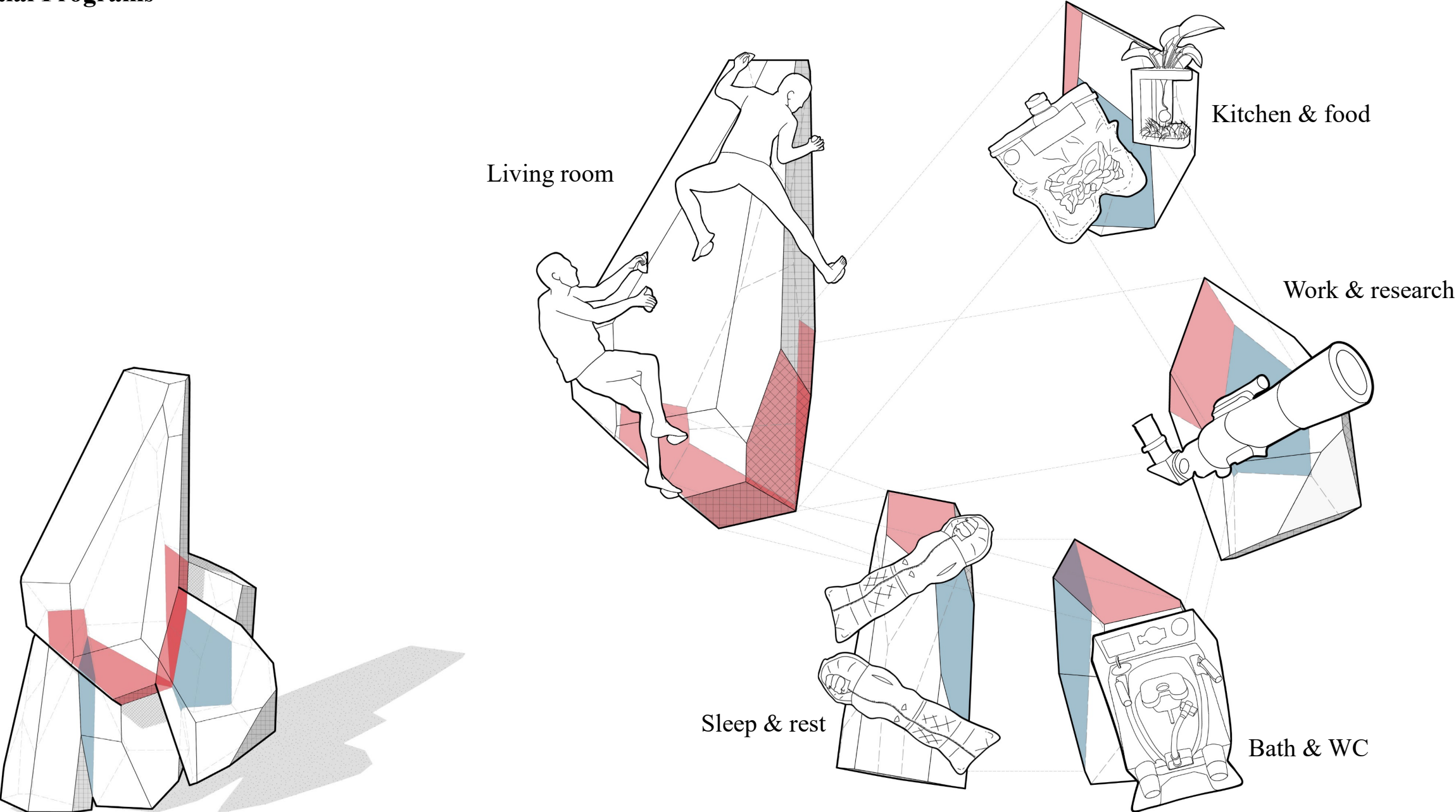
Building Tectonics



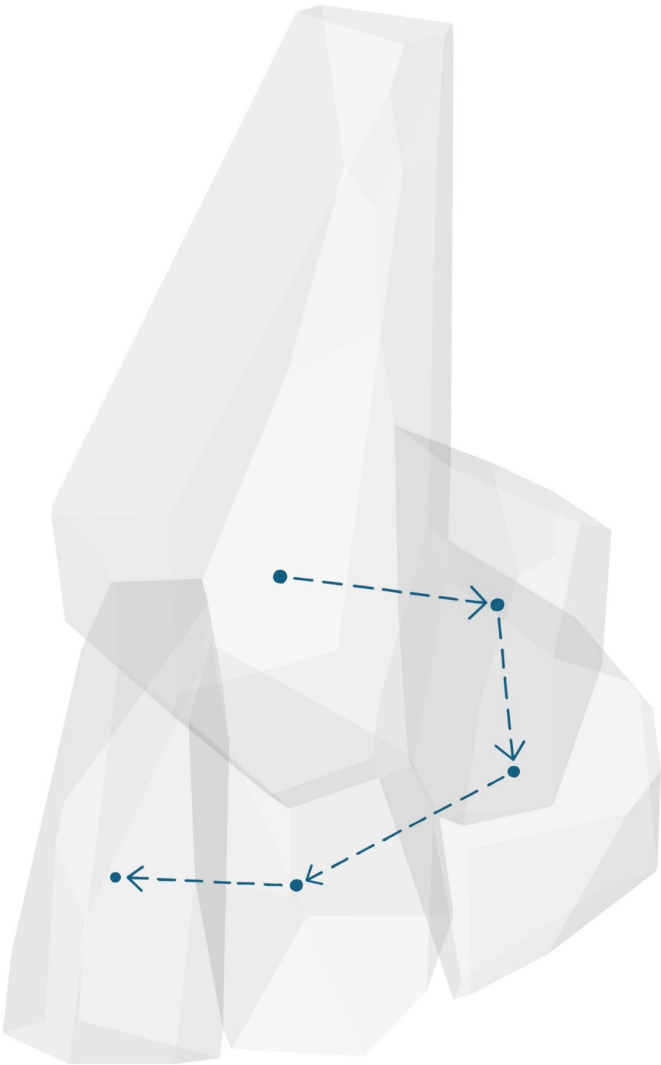
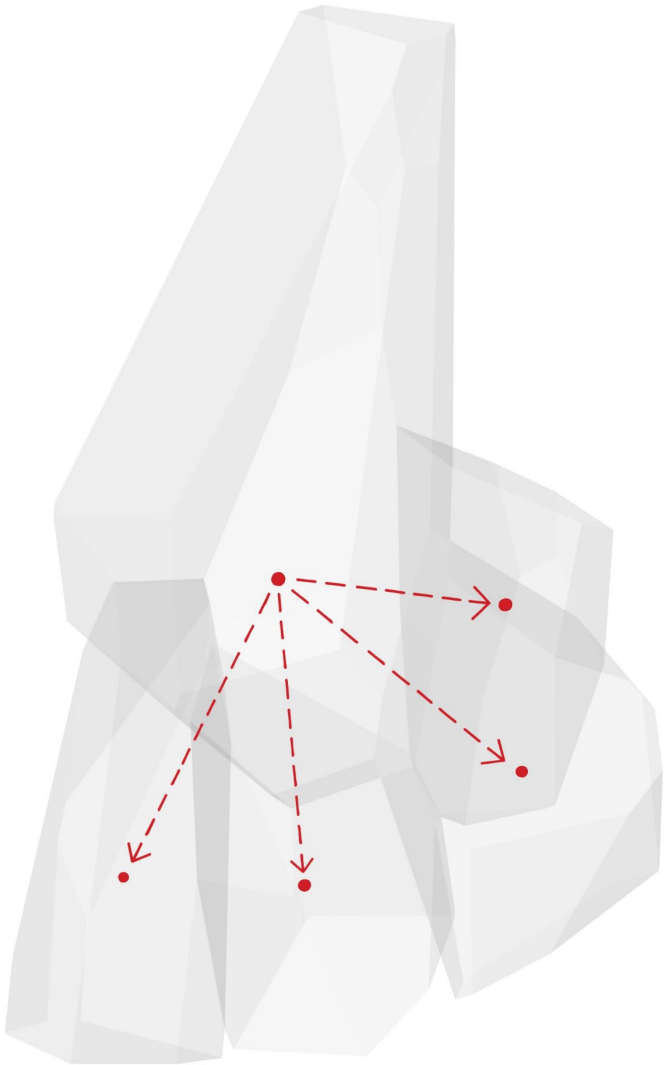
Building Tectonics



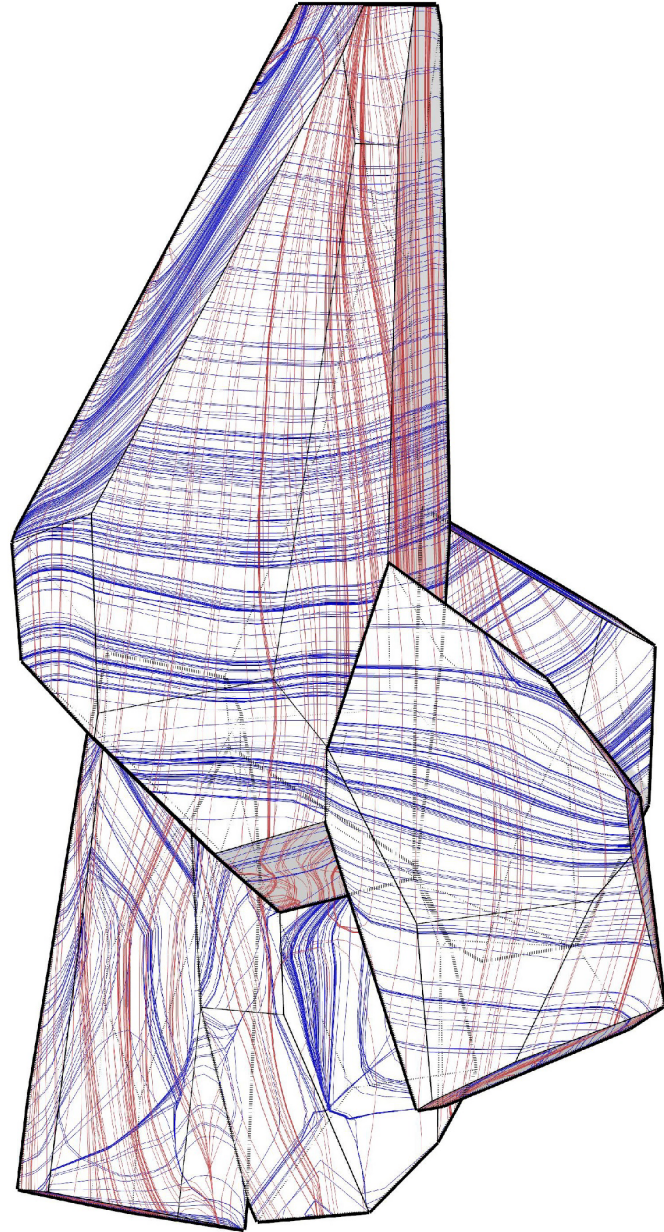
Spatial Programs



Spatial Connectivity

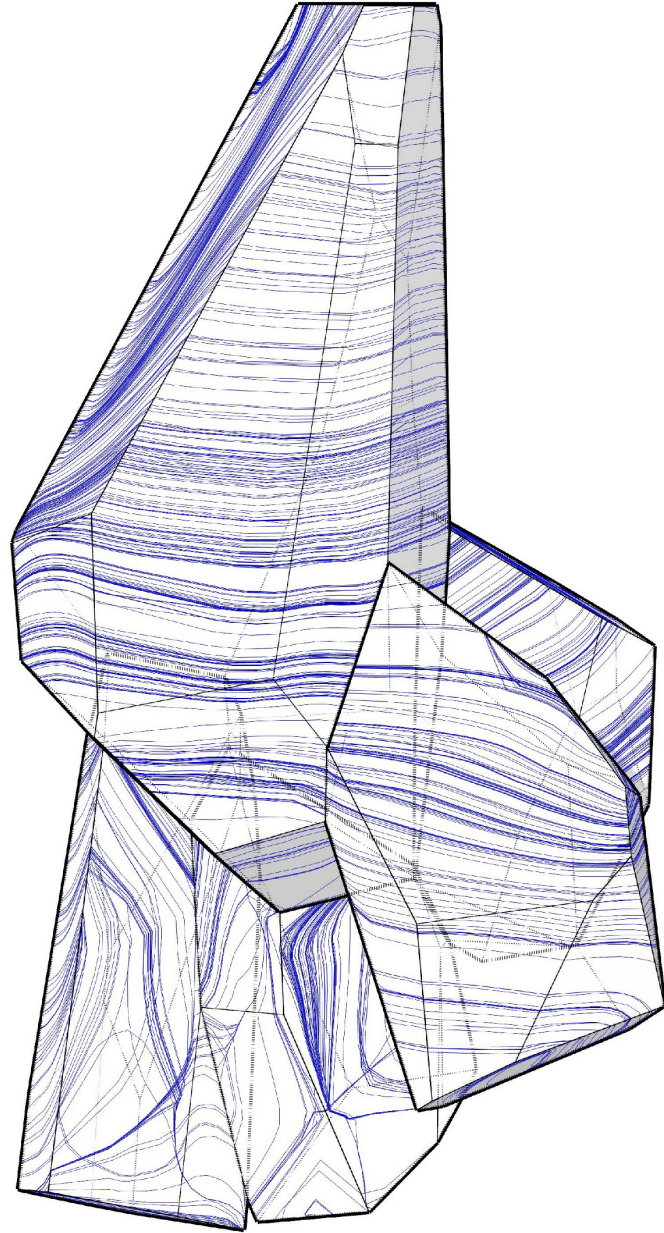


Stress Lines



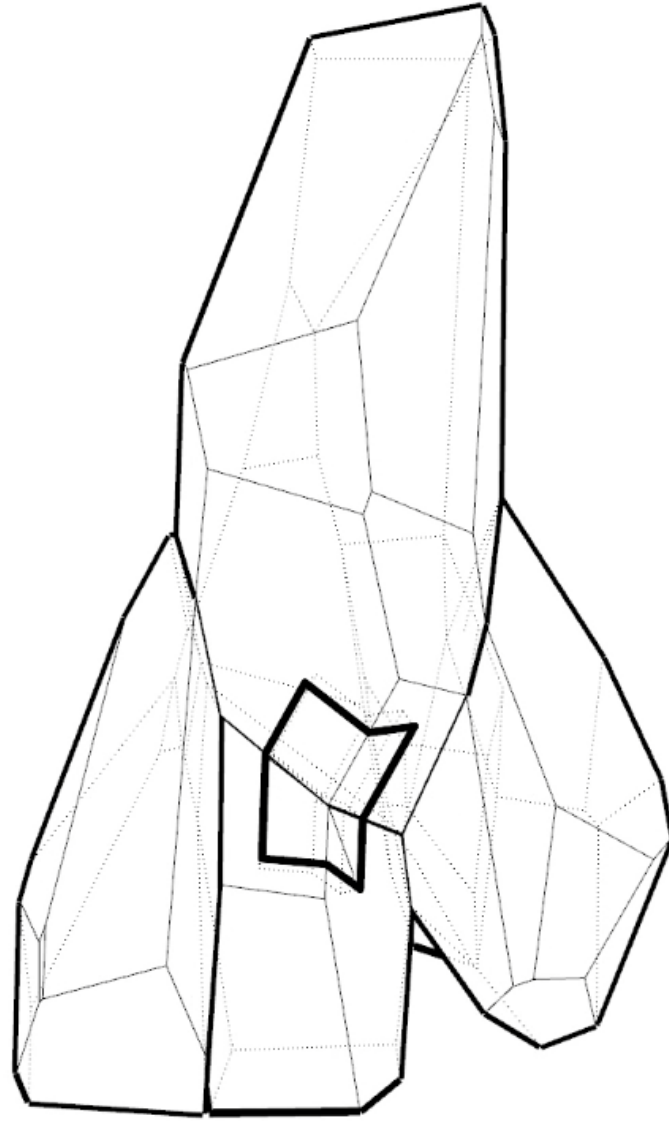
— Compression Lines
— Tension Lines

Tension Lines

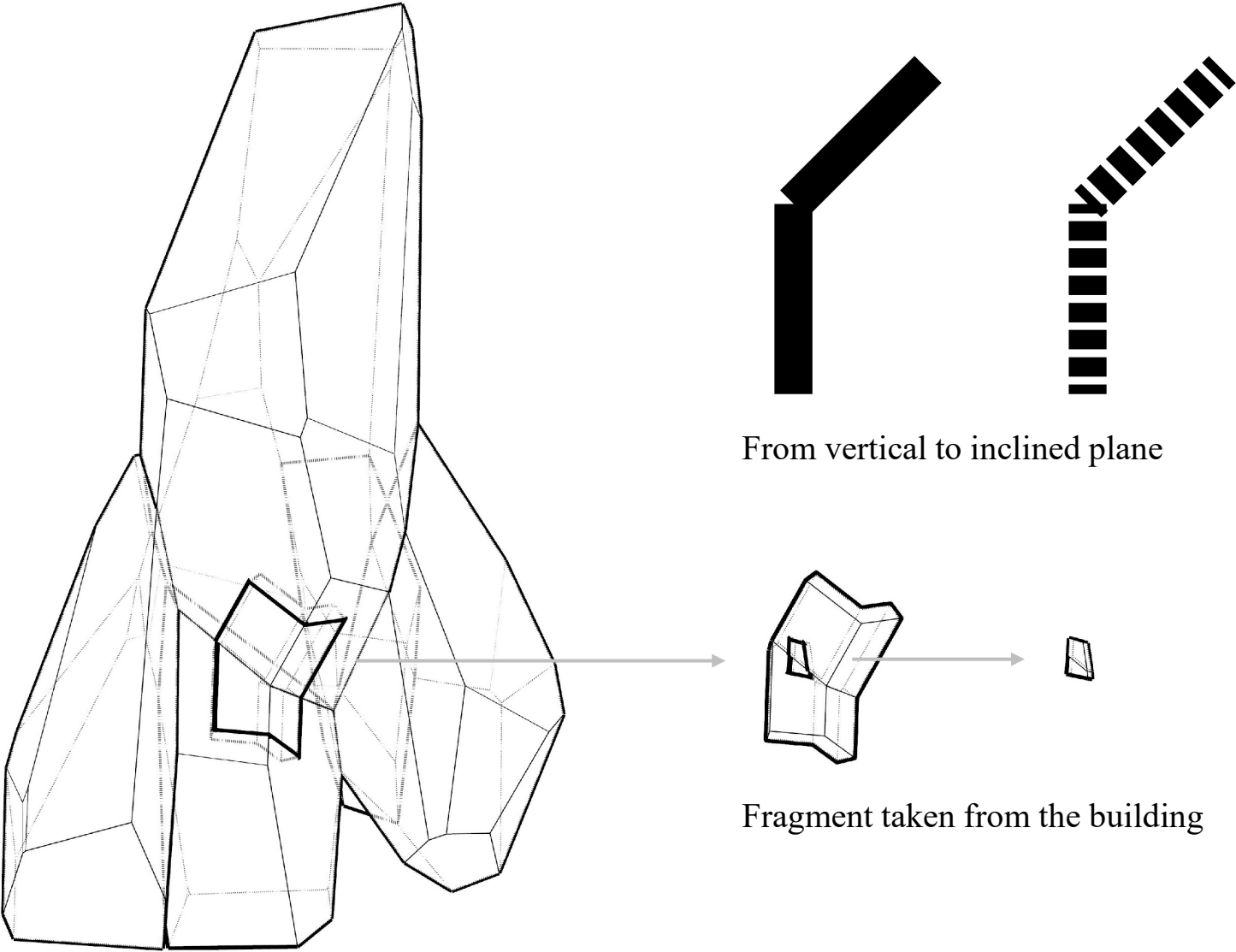


Assuming regolith-based 3D printing material has a similar structural performance to concrete

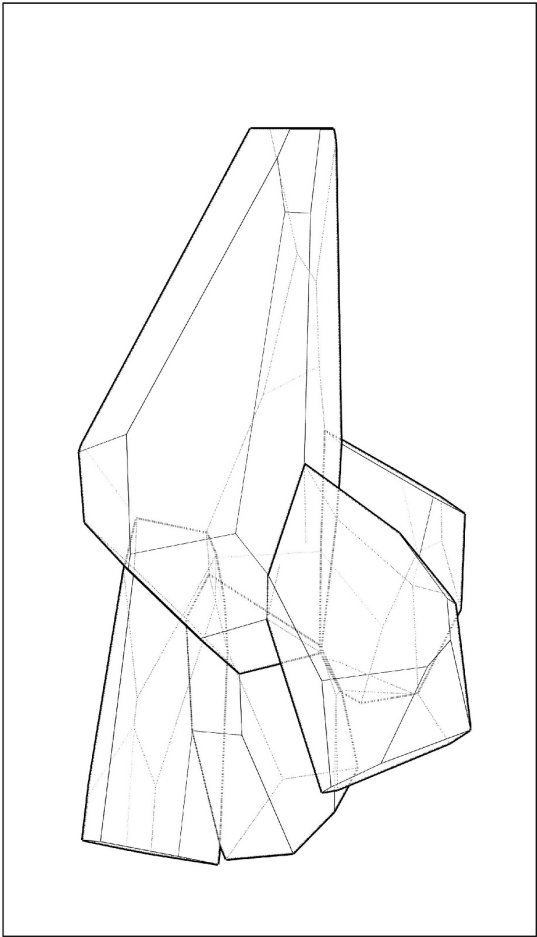
Fragment



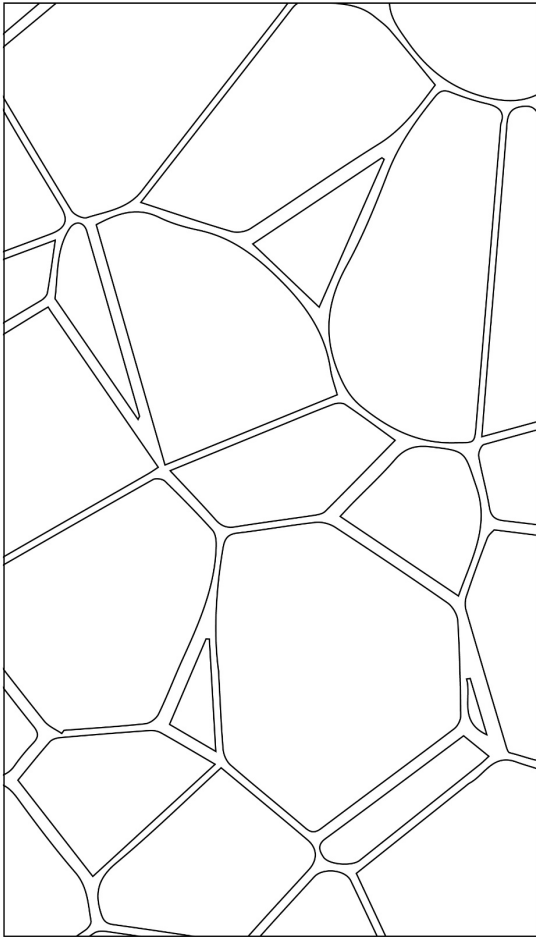
Fragment



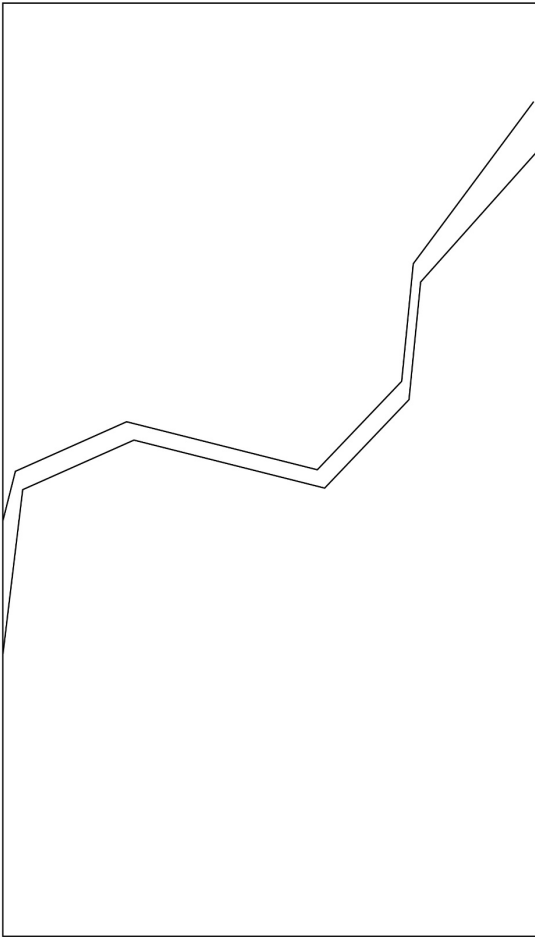
Why Voronoi?



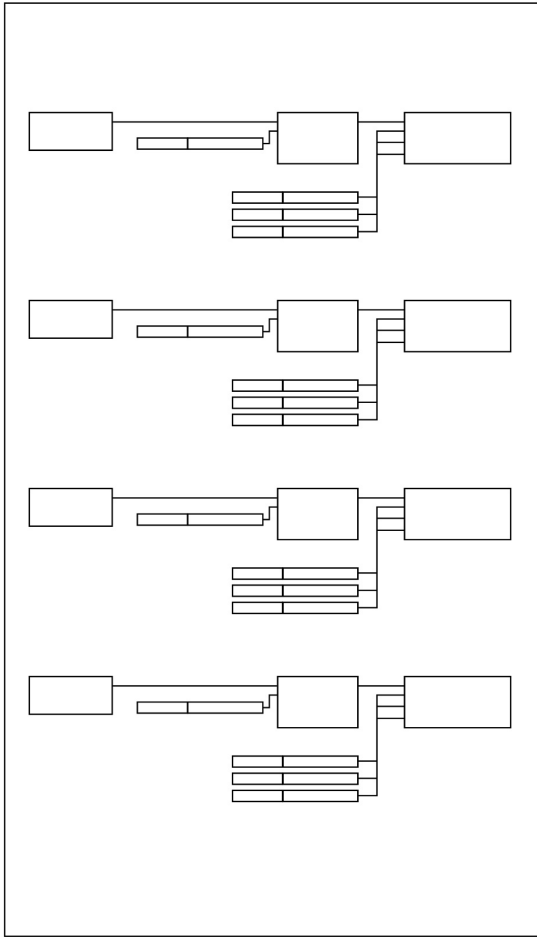
Design language consistency



Resemblance to nature

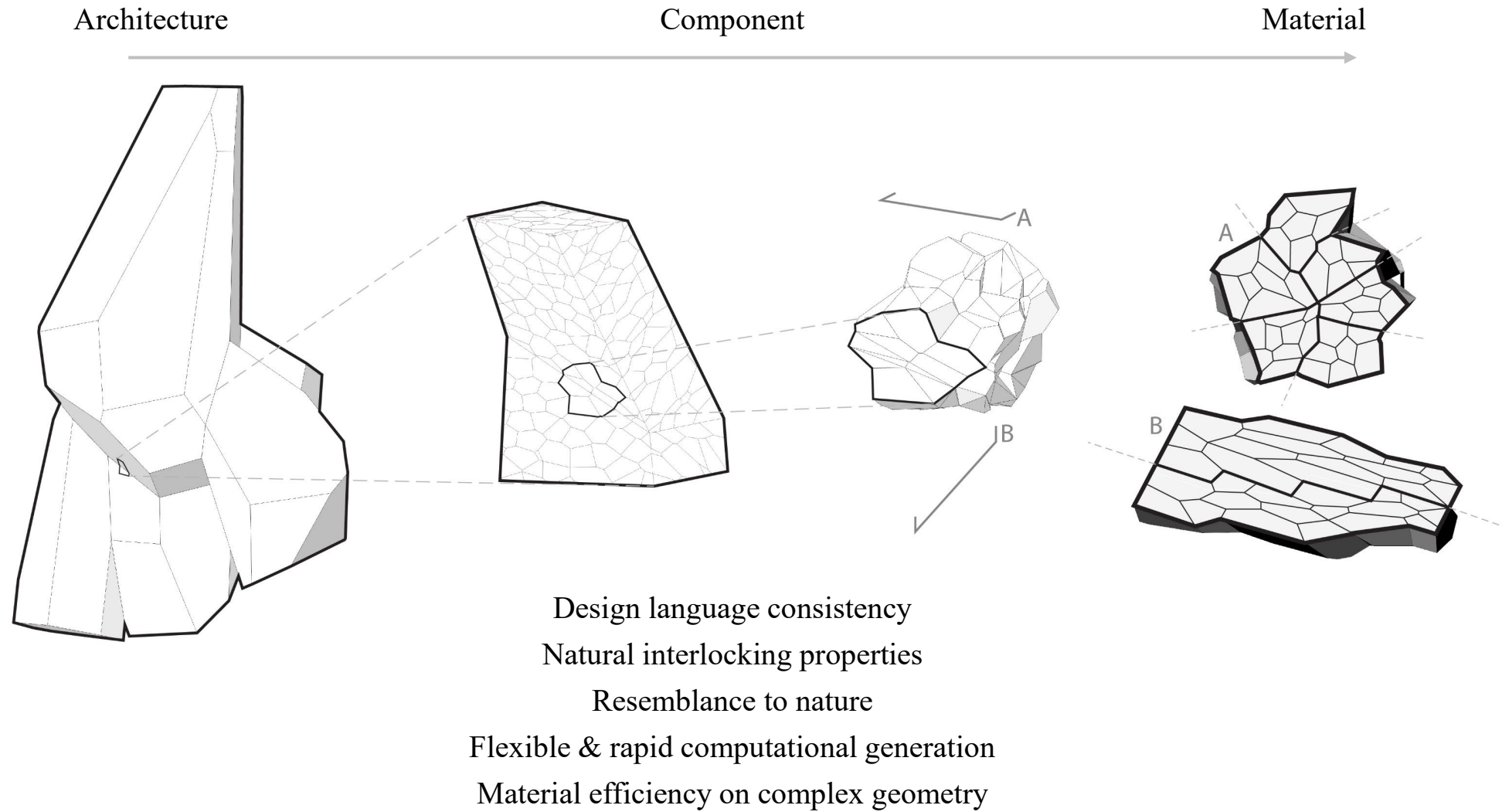


Natural interlocking properties

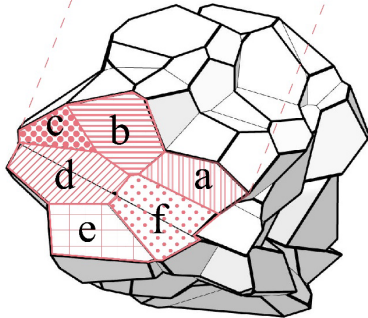
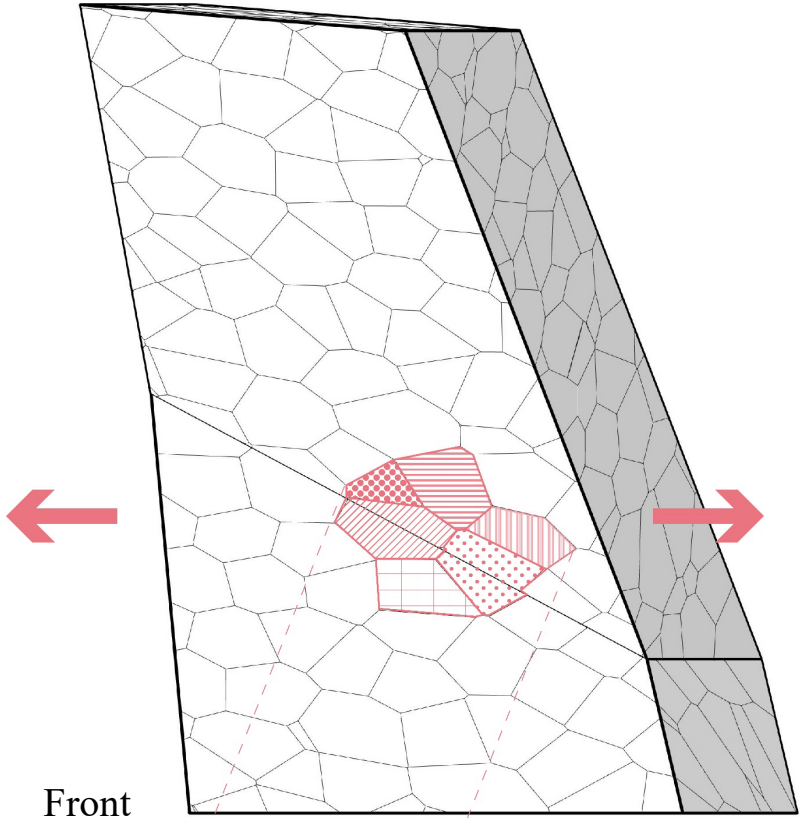
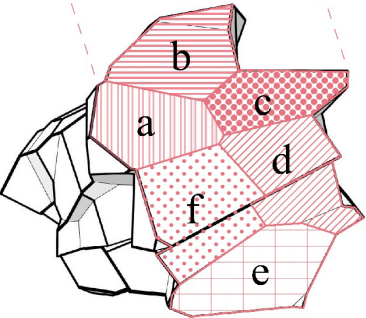
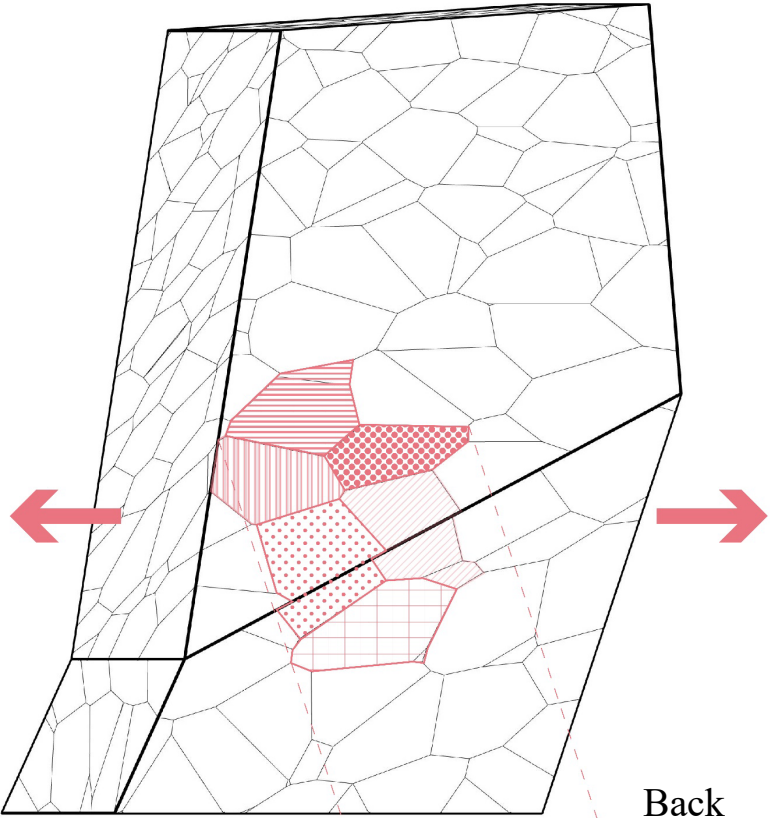


Flexibility on rapid computational generation

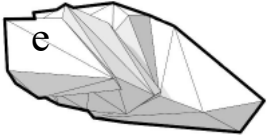
Sub-fragment



Sub-fragment



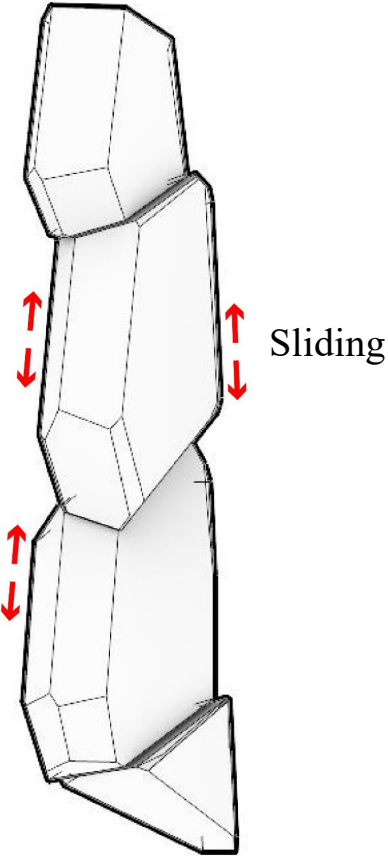
- Processing components to fabrication
1. Scaled models
 2. 1:1 prototype



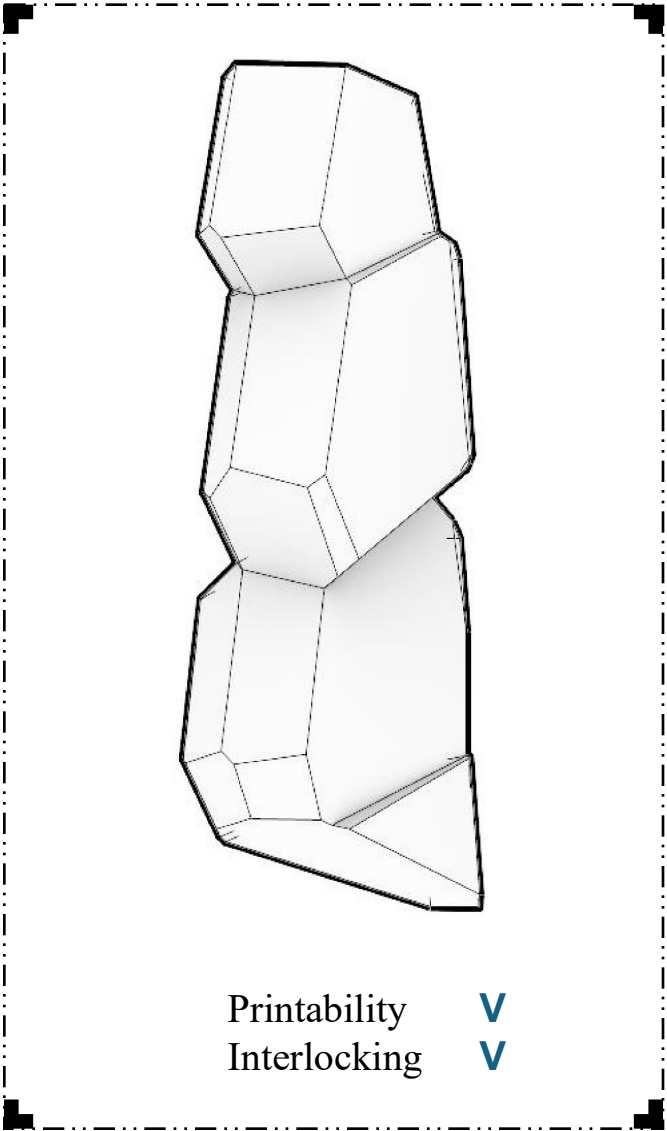
Sub-fragment

More stretching

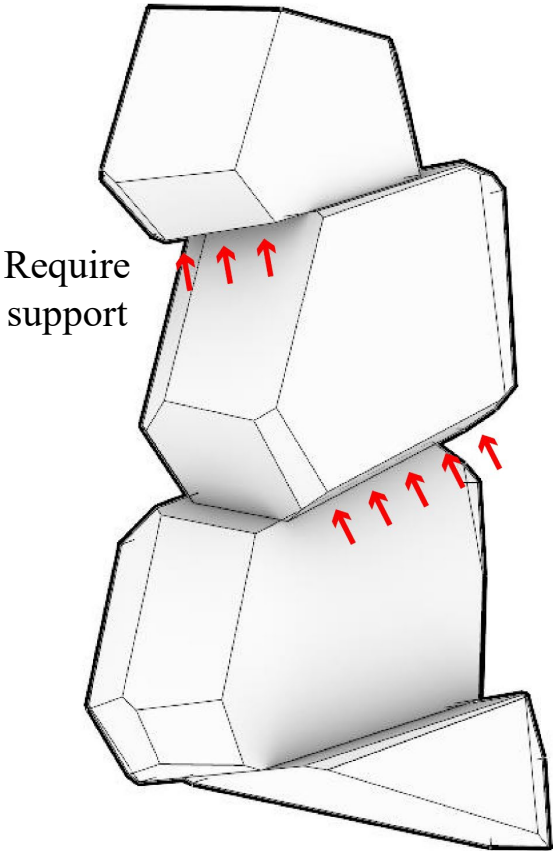
Less stretching



Printability ✓
Interlocking ✗



Printability ✓
Interlocking ✓



Printability ✗
Interlocking ✓

Interlocking Optimisation with 3D Print



Trial 1 (1:10 model)



Trial 2 (1:10 model)

Fabrication: Milling

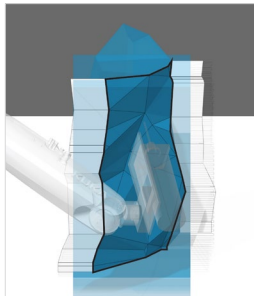
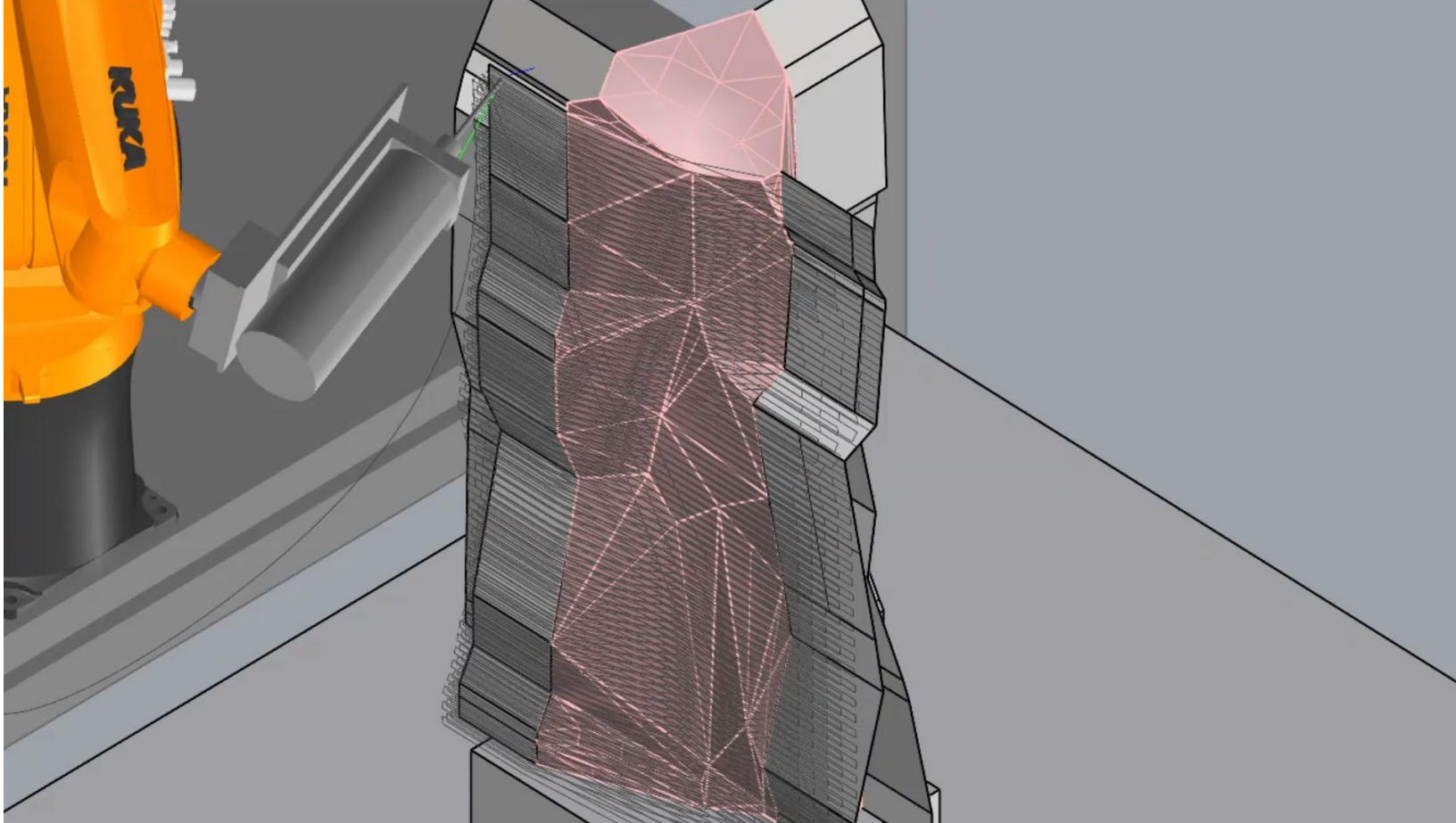


Subtractive method on foam
using drill & robotic hand

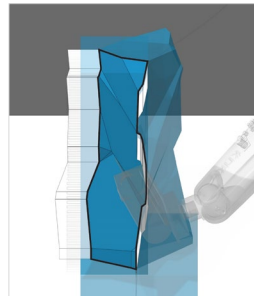


Result (1:1 prototype)

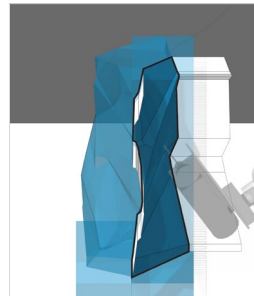
Fabrication: Milling Process



Side A



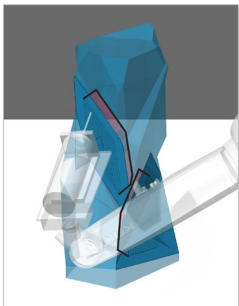
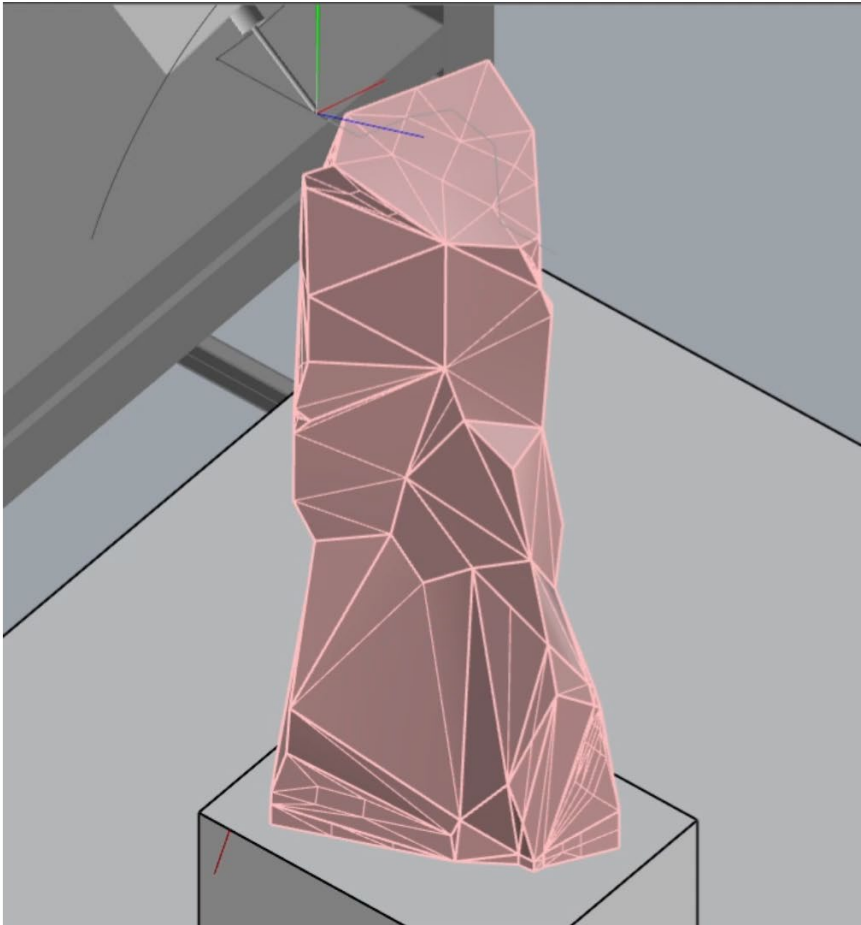
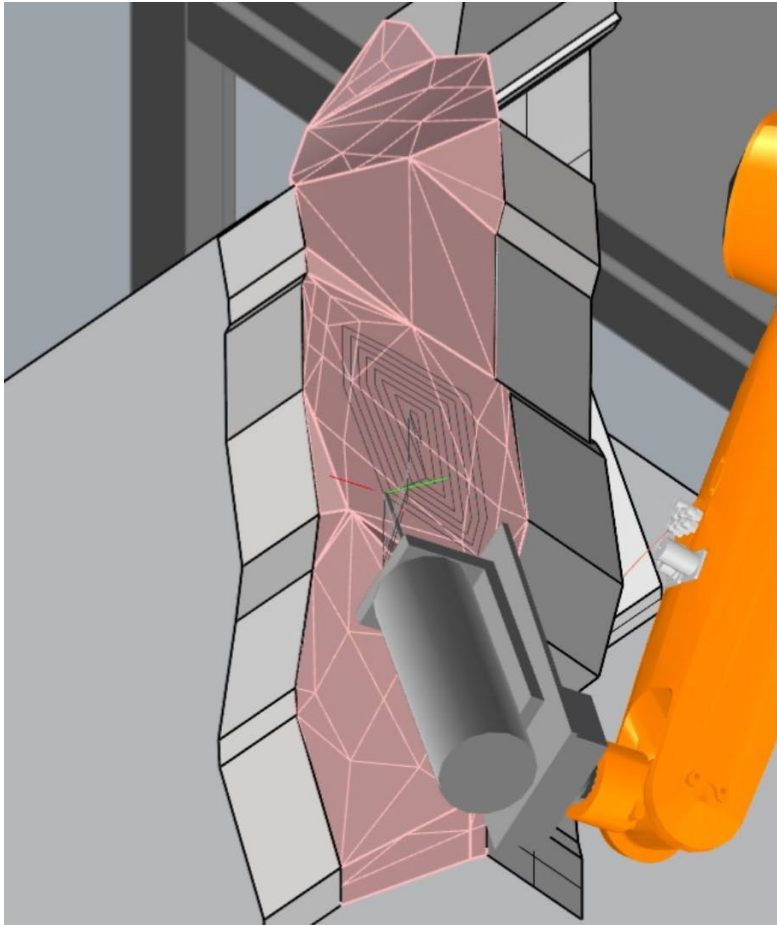
Side B



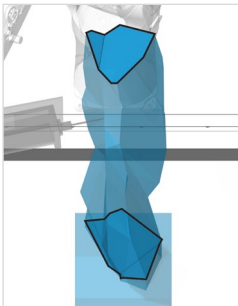
Side C



Fabrication: Milling Process



Holding holes



Top & bottom



Fabrication: Result

