



Royal College of Art

CARVED TOPOGRAPHIES

a generative approach to vernacular architecture

SCENARIO

PART I

THE HUMAN

PART II

THE ALGORITHM

PART III

THE SPACE

SCENARIO

2024	Unprecedented climate events, including heatwaves, wildfires, floods, and rapidly melting polar ice
2027	Deceleration of the North Atlantic Current.
2028	Development of subterranean test centres in the Scottish Highlands.
2030	Collapse of the North Atlantic Current.
2032	Recording of the first significant cooling effect.
2034	First major migration wave towards the equator.
2035	Acceleration of cooling leads to the onset of artificial ice. Funding of the System ceases following a finance crash.
2040	Global governance shifts to decentralised city-states and autonomous zones.



2045

The collapse of the North Atlantic current has caused a sudden cooling of the Northern Hemisphere and induced the artificial ice age. The average global temperature has dropped to -35°C . Ice-free summers are increasingly rare, limited to geothermal areas and equatorial regions.

Without sunlight, crops failed, and the cold settled deep into the soil. The surface became a hostile place. To survive, humans retreated to the Systems, a network of underground shelters in the Scottish Highlands. Yet, despite continuous developments, only a few were granted access, while others took it upon themselves to enter.

SYSTEM

The System, established in 2028 under the Ministry of Research. In 2030, the first system in the north of Scotland became operational as a test centre, gaining significance with the onset of the ice age. Until 2035 the Systems were funded by the government, after the government collapse the systems established themselves as autonomous authorities within the jurisdiction of their Zones and beyond.



PART I

THE HUMAN



SURFACE

CLANS

Only a few nomadic clans cross the Scottish Highlands on documented paths connecting the remaining cities and shelters. Nomadic societies emerged as survival strategies for displaced populations.

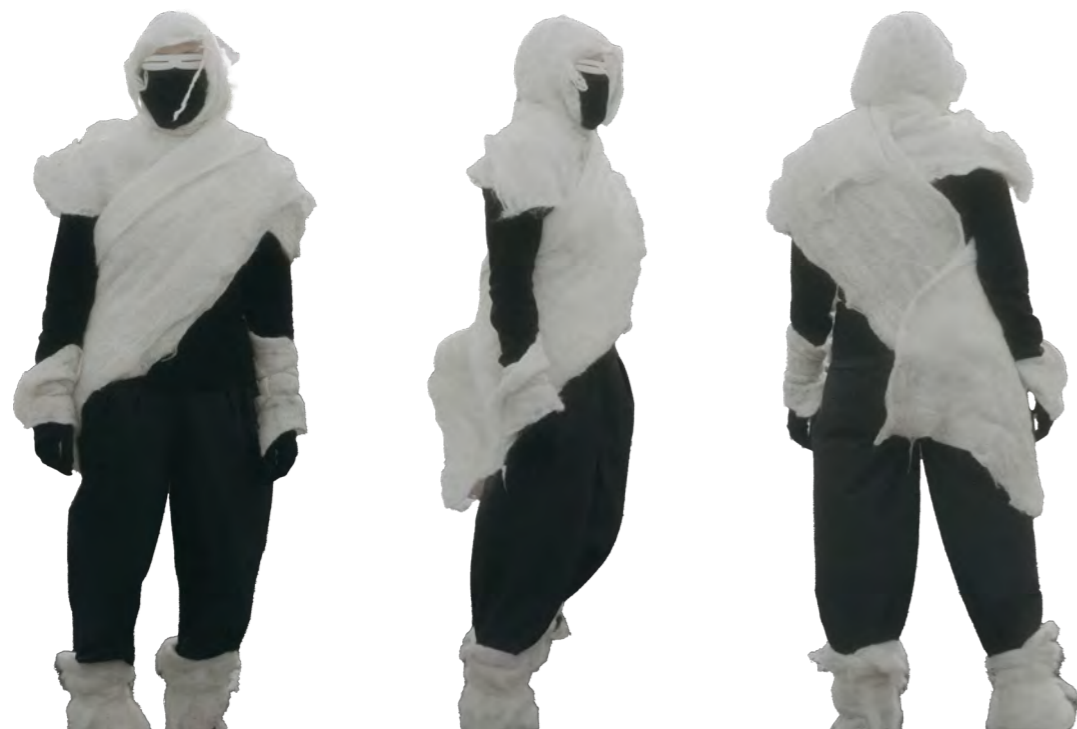




FIBRES

To withstand the cold, humans wrap themselves in layers of felted wool. The wool is harvested from genetically modified sheep and felted into textiles. Despite its dense structure, the fibers regulate the body temperature. The breathability ensures that any

moisture can evaporate keeping the wearer dry and comfortable. This is particularly beneficial in cold environments, as dampness can significantly decrease body temperature and lead to discomfort or even hypothermia.



SURFACE



MATERIALS
Felt
Cashmere
Leather



TOOLS

Fog shields with integrated artificial intelligence allow for orientation and communication. The use of shields spread in the beginning of the ice age when people started adapting to their surroundings and prevalent resource scarcity using available materials to carve the protective eyewear.



SURFACE



- MATERIALS
- 1. Bone
 - 2. Bone
 - 3. Lime wood



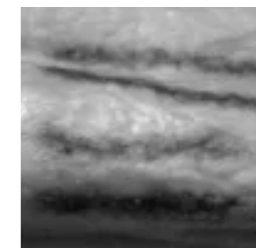
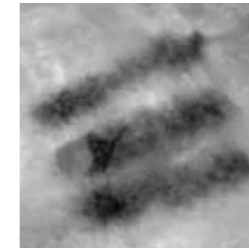
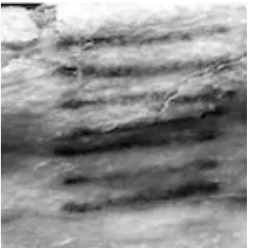
The fog shields are typically carved from animal bones or driftwood, however, trader clans popularised fog shields made from materials provided by the Anthills such as farmed or repurposed wood.

RITUAL CARVINGS

Symbols and carvings are used amongst nomad clans to communicate experiences and hierarchies. They are often worn directly on the body, as traditional tattoos or carved into their fog shields.

The ritual of shield carving is often practiced in ceremonies; shields are seen as an extension of the self and part of one's identity. If the shields break beyond repair, their wearer goes through a process of ceremonial grief lasting ten days before making or acquiring a new pair.

The shields' fragments are handled according to clan tradition. Some might keep them as fragments of the soul, some release them back to nature and some to family members.



THE ORIGINS



*Anavik at Banks Peninsula, 1916
Rudolph Martin Anderson*

Snow goggles or ilgaak are a type of eye wear traditionally used by the Inuit and the Yupik peoples of the Arctic to prevent snow blindness and protect the eyes from harmful ultraviolet radiation.

The goggles date back to 800 years ago and are traditionally made of spruce, bone or walrus ivory. The piece is carved to fit the wearer's face, so that the only light entering is through the slits.



SURFACE

While nomad clans have adapted to the harsh surroundings, some still yearn for protection and warmth in the shelters underground. Although difficult to access, some taking it upon themselves to enter.



UNDERGROUND

SYSTEMS



UNDERGROUND

The sandstone ravines of the Systems are busy. At a depth of 2500 metres, there is no sign of the cold of the Scottish ice desert on the surface. The inhabitants of the system in Zone I wrap themselves in lavish linen robes as they make their way to ceremony.



DEVICES

Functional forms.
The devices respond to voice and gesture commands and allow silent spoken word communication over an encrypted frequency, ensuring privacy in the systems and helps reducing noise within the vast caves.

Sensors are integrated into the device.



A FILM BY LISA LAUDIERI



starring

story
camera
editing
visual effects
costumes

sid MADLEEN LEIMER
khai JASMIN LEIMER + LISA LAUDIERI
dog FLASH

LISA LAUDIERI
LISA LAUDIERI + JASMIN LEIMER
LISA LAUDIERI + MADLEEN LEIMER
LISA LAUDIERI
LISA LAUDIERI

THE SCRIPT

Two individuals find themselves disoriented in the fog trying to reach the System. On the verge of exhaustion, they resign themselves to their fate. Approaching hypothermia, they are discovered and rescued by a patrol of the Defence Unit on the border of Zone I. They are allowed to stay in the system after providing a stolen access key. While one wants to stay, the other one is eager to leave immediately, ahead of discovering their crime. Their situation gets more complicated as the remains of two applicants are discovered within Zone I's jurisdiction.

SCRIPT

Wind

1. EXT. BLACK SCREEN

KHAI (VO)

Ten years ago, the gulf stream collapsed. The disruption of the atlantic ocean current caused a sudden cooling of the Northern Hemisphere and induced the artificial ice age. Fog veiled the sky as the temperatures dropped. Without sunlight, crops failed and the cold settled deep into the soil. The surface became a hostile place. Those who can, retreat to the Systems, a network of underground shelters in the Scottish Highlands. But despite continuous developments, only a few are granted access.

2. EXT. SCOTTISH HIGHLANDS - ZONE I - MORNING

Scottish Highlands covered by a thick ice cap, surrounded by heavy fog, seen from above.

Slow cello

Two poachers try to make their way through the ice desert but the fresh snow and the dense fog makes progress almost impossible.

Titles:

2045

Scottish Highlands

Autonomous Zone I

Sid is leading their way, Khai is following a few steps behind. Through the narrow slits of the shields it is almost impossible to recognise anything. The shields lose signal. Disorientated, they wander through the ice desert

Close to exhaustion, Khai sinks to her knees. Sid is walking a few steps ahead of her, fighting against the wind. She is breathing heavily

KHAI

Hey, wait a minute!

Sid stops and slowly turns around, recognising Khai kneeling on the ground.

SID

What's wrong?

Khai doesn't answer right away.

SID

Come on, we are almost there.

With a subtle head gesture she urges Khai to continue. Sid turns back again and trudges on, staggering a little. Meanwhile, Khai tries to get to her feet but is unable to do so. Resigned, she shakes her head barely noticeable and pulls the shields off her face. Sid stops again and stares into the distance. Shadows appear in front of them in the fog. She clutches the access card.

DEFENCE UNIT OFFICER (VO)

We've got two trespassers in Zone I, southern entrance.

Valid key. Access cleared.

3. EXT. SOUTHERN ENTRANCE - ZONE I - AFTERNOON

The entrance and air vents to the Anthill seen from above.

4. INT. DEFENSE SECTOR - SYSTEM I - AFTERNOON

The tunnels are calm, a person in a flowing robe is walking along the platform.

Construction

CORRIDOR TO RECOVERY CELLS

Curtains are blowing in a soft breeze along the corridor carved into the mountain. Soft light shines through a slit in the wall and a few drops of water fall from the ceiling.

Waterdrops

RECOVERY CELLS

Sid and Khai are resting in one of the recovery cells. Khai is sitting and shows no intention to leave, she is petting a dog. Sid is standing, eager to leave.

KHAI (VO)

Why would you ever want to go up there again?

SID

(...)

Sid says nothing for a long time and stares into the nothingness.

KHAI

Since we arrived it seems like you can't wait to leave. Now that we finally found a way in.

She keeps petting the dog.

SID

We can't stay here.

5. INT. BLACK SCREEN

SID (VO)

We can't stay here.

It's only a matter of time until they find out what we did.

6. EXT. SURFACE - ICE DESERT - EARLY MORNING

Gunshot

The bone shields are covered in blood splatters. The poachers clothes are soaked with blood.

SID (VO)

Search their bags.

Sid stands in the background, while Khai looks for the access card in the fur coat. The access card lies on the ground, slipped from the hand of their victim.

LOCATION REPORT

The area is easily accessible by car, to reach the top it is necessary to take the chairlift. During low season, parking space is widely available, only few people are around.

The opening times of the chairlift vary and are subject to weather and snow conditions. The chairlift doesn't open when it's stormy. The weather conditions are unpredictable and often very windy and cold. Not ideal for drone shots.

Equipment and props have to be packed efficiently to avoid too much baggage. Waterproof covers in case of rain or snow.

Glencoe and Creag Dhubh, Scotland
56.620545, -4.848042



SHORT FILM

MAKING



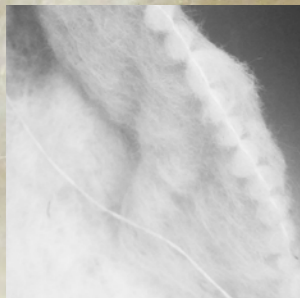
2.



3.



4.



5.

1.

1. The raw fleece is sourced from a local sheep farm in Scotland. The fleece is washed to remove dirt, lanolin, and other impurities, and brushed to align the fibres and then dried thoroughly.

2. To initiate the felting process, the fleece is treated with soap, which helps the fibres adhere to each other when rolled and thrown. The process significantly shrinks the surface area of the wool.

3. Once the felt is made, the fleece is rinsed with water and vinegar to remove any remaining residue and to balance the pH levels.

4. Then the fleece is dried again.

5. If necessary, the material may be cut into shape and hand sewn together.



1. Stage: Silicone mockup



2. Stage: 3D Print

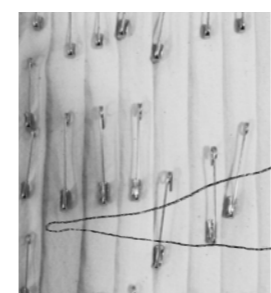
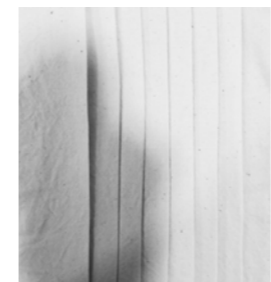


3. Stage: CNC



1.

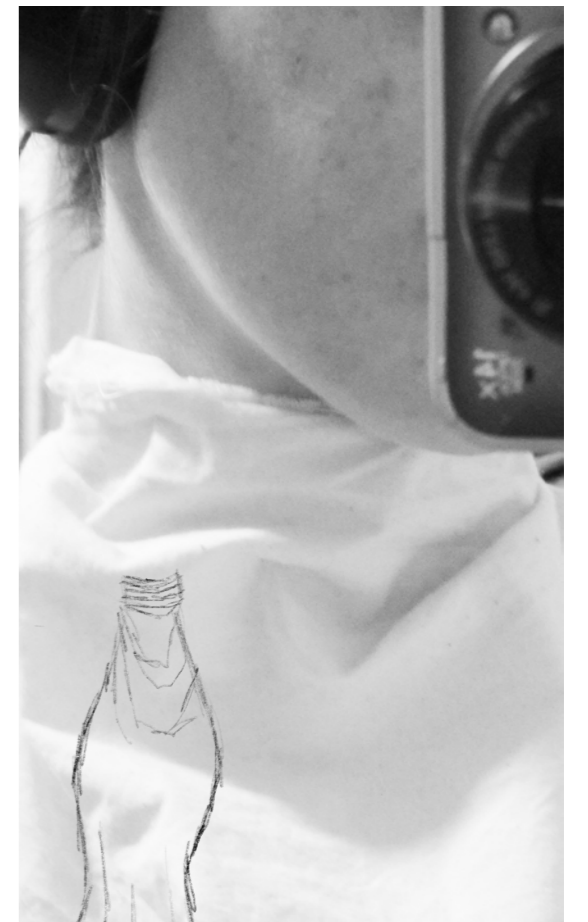
- 1. Draping the fabrics
- 2. Playing with pleats
- 3. Sketches for robe variations
- 4. Collar experimentations



2.



3.



4.

RESEARCH QUESTION

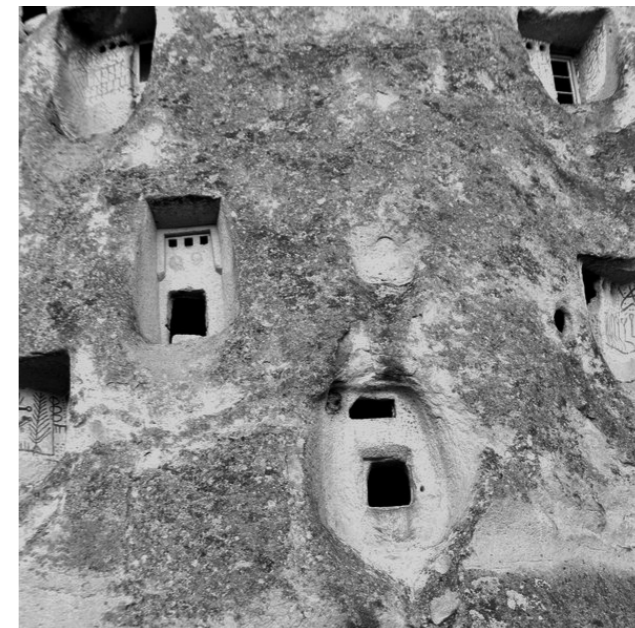
To what extent is the **development of habitable space** predictable through **algorithmic data analysis**?



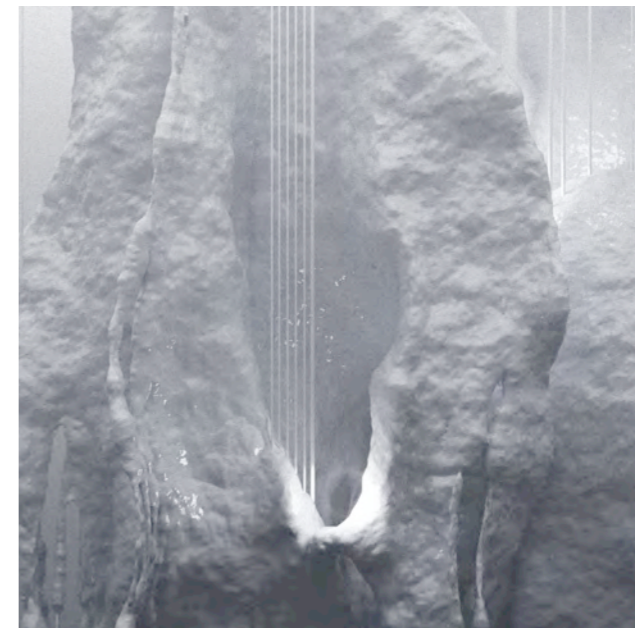
PART II

THE ALGORITHM

Learning from the vernacular

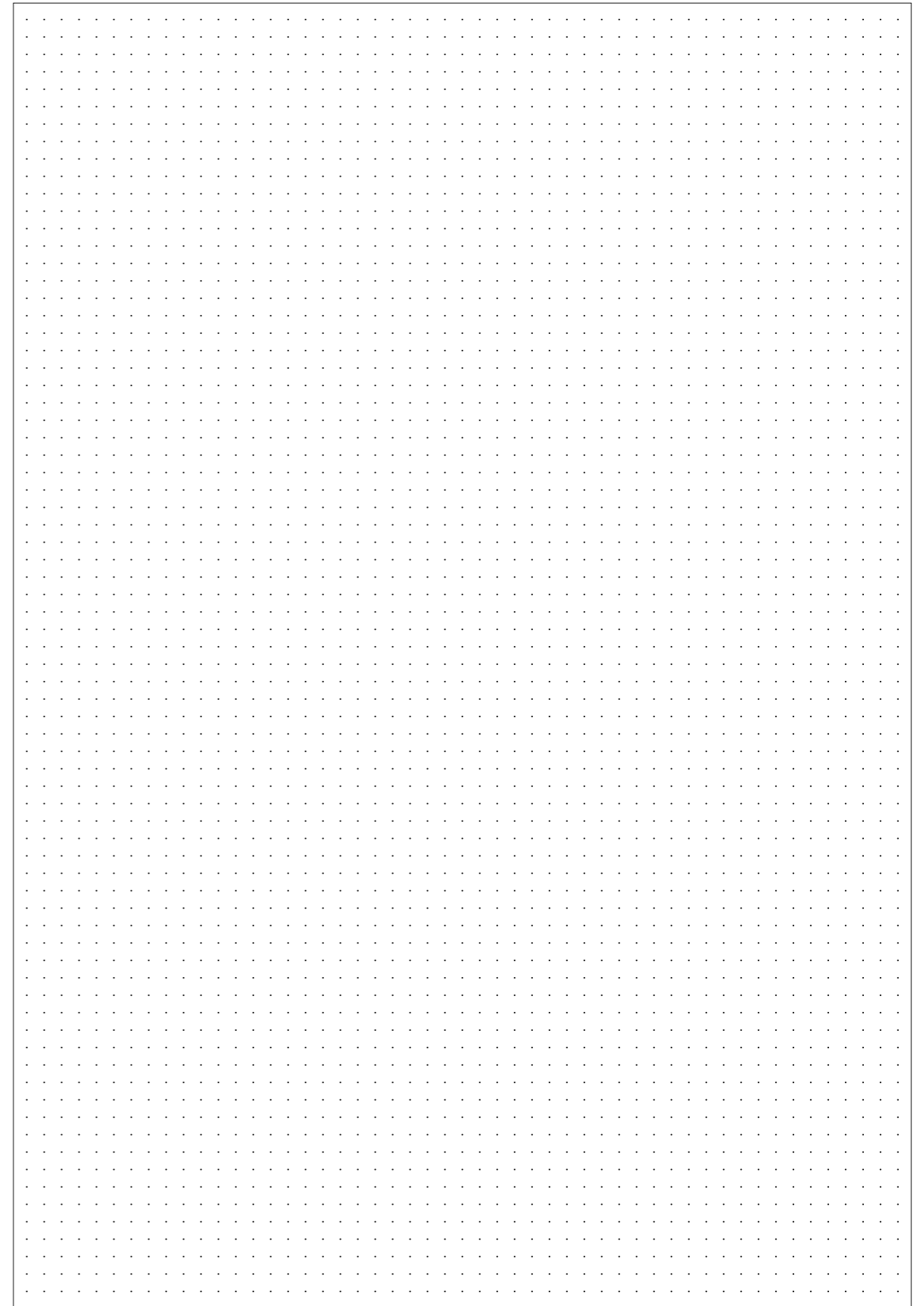


The generative vernacular relies on an algorithm - a set of instructions designed to imitate and optimize the vernacular.



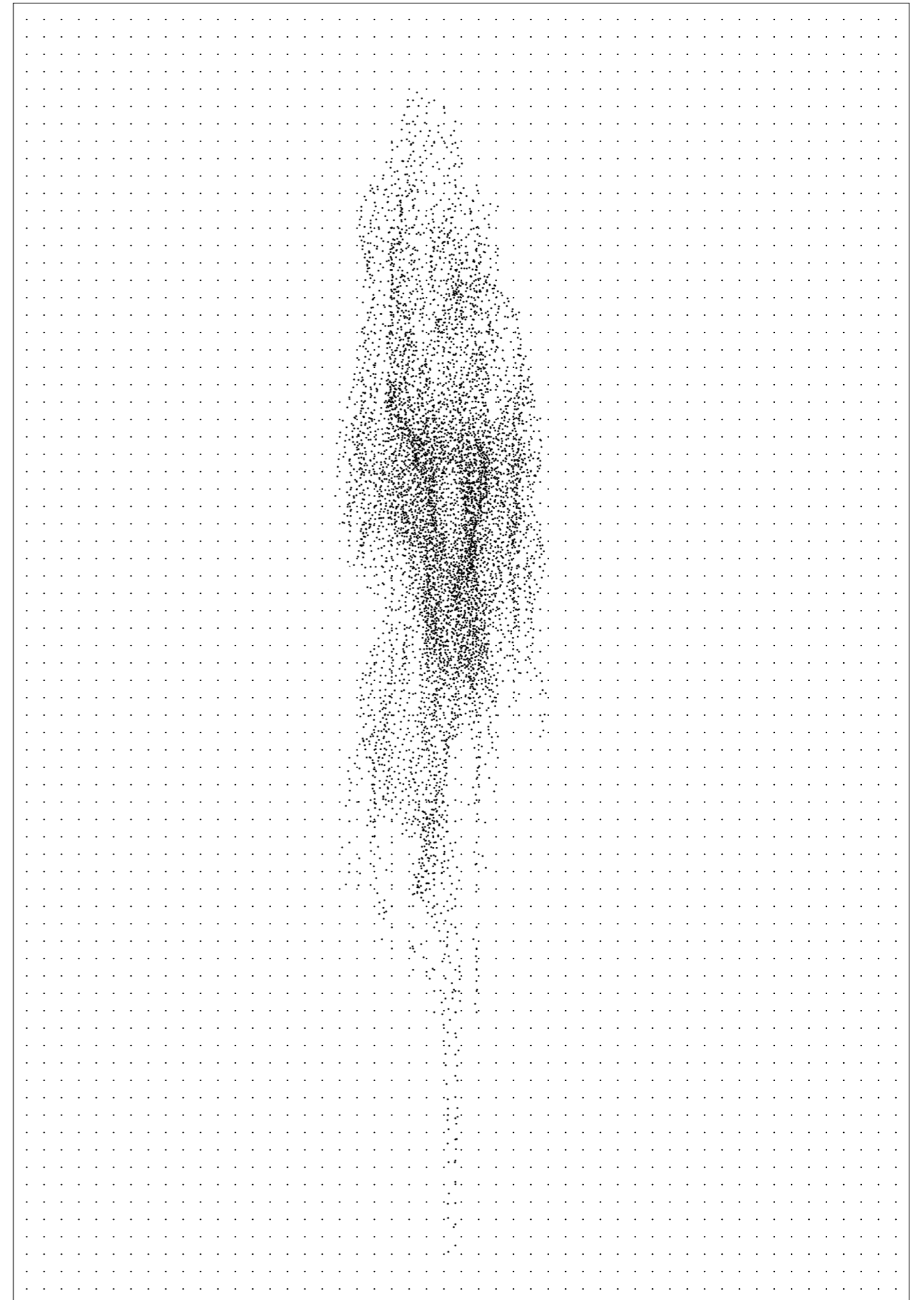
	p(x)	p(y)	p(z)	age	life	p-1(x)	p-1(y)	p-1(z)	sourceprim	source uv	x source uv	y/v (x)	v (y)	v (z)
0	-0.63	-295134,00	575898,00	13542,00	136074,00	-0,65	-196457,00	574826,00	182,00	0,29	0,88	0,42	-107735,00	0,26
1	-0.64	-23432,00	260337,00	134456,00	134932,00	-0,64	-155904,00	259815,00	83,00	0,77	0,50	0,00	-11449,00	0,13
2	-0.62	-235008,00	236007,00	133773,00	136775,00	-0,62	-156389,00	235543,00	76,00	0,20	0,14	0,06	-102057,00	0,11
3	100022,00	-243284,00	407426,00	133404,00	135866,00	0,99	-161978,00	407895,00	177,00	0,54	0,09	0,20	-0,76	-0,06
4	0,14	-24663,00	241725,00	13,34	134821,00	0,14	-164106,00	24214,00	47,00	0,54	0,49	-0,18	-112885,00	-0,10
5	-0.66	-251341,00	278811,00	133025,00	134218,00	-0,64	-167096,00	277835,00	133,00	0,62	0,02	-0,28	-16735,00	0,28
6	-0.86	-269205,00	244383,00	133212,00	134814,00	-0,87	-179332,00	244139,00	222,00	0,71	0,91	0,19	-0,50	0,06
7	-0.60	-265964,00	316398,00	132569,00	134593,00	-0,61	-176827,00	315148,00	223,00	0,28	0,98	0,20	-173761,00	0,30
8	-0.85	-276232,00	587375,00	132504,00	135848,00	-0,85	-183817,00	587499,00	160,00	0,63	0,81	-0,11	-121633,00	-0,03
9	0,86	-243078,00	438096,00	132576,00	136454,00	0,84	-161703,00	43817,00	230,00	0,86	0,85	0,40	-125838,00	-0,02
10	104023,00	-29,74	274469,00	132606,00	134261,00	103154,00	-197932,00	274856,00	262,00	0,38	0,21	0,21	-151035,00	-0,09
11	-0.86	-269928,00	33215,00	132353,00	135282,00	-0,87	-179461,00	332148,00	181,00	0,27	0,08	0,17	-177024,00	0,00
12	23893,00	-222128,00	406204,00	132378,00	133735,00	239061,00	-14801,00	405028,00	93,00	0,64	0,04	-0,03	-0,27	0,28
13	184002,00	-22858,00	-0,10	131774,00	133965,00	184962,00	-152062,00	-0,12	98,00	0,90	0,85	-0,23	-117106,00	0,29
14	-264219,00	-220931,00	169449,00	13153,00	132491,00	-263381,00	-146969,00	170432,00	155,00	0,02	0,65	-0,20	-114745,00	-0,24
15	-0.46	-234128,00	287956,00	131241,00	135463,00	-0,46	-155873,00	287719,00	134,00	0,71	0,76	-0,06	-0,77	0,06
16	-0.39	-238295,00	289009,00	130717,00	135178,00	-0,39	-158708,00	289587,00	111,00	0,52	0,11	-0,10	-0,56	-0,14
17	0,09	-241917,00	255582,00	130775,00	132493,00	0,09	-161005,00	256801,00	71,00	0,85	0,28	0,02	-0,98	-0,29
18	0,27	-235832,00	249209,00	130548,00	131611,00	0,28	-156975,00	249218,00	45,00	0,48	0,15	-0,12	-0,89	0,00
19	-0.68	-267066,00	281625,00	129295,00	130107,00	-0,69	-177984,00	281349,00	242,00	0,70	0,31	0,10	-0,22	0,07
20	0,32	-256899,00	121359,00	128813,00	132637,00	0,31	-170903,00	120932,00	220,00	0,17	0,91	0,10	-130634,00	0,10
21	0,17	-22089,00	350394,00	128854,00	136543,00	0,17	-146998,00	349947,00	35,00	0,22	0,41	-0,05	-0,94	0,11
22	-0.35	-256318,00	272322,00	128513,00	134849,00	-0,33	-170538,00	270613,00	165,00	0,86	0,69	-0,59	-122764,00	0,41
23	-0.40	-202407,00	181422,00	128507,00	130974,00	-0,40	-134578,00	181985,00	32,00	0,74	0,18	0,02	-129472,00	-0,14
24	270002,00	-255264,00	432518,00	128235,00	134821,00	268928,00	-16982,00	431961,00	139,00	0,29	0,37	0,26	-128134,00	0,13
25	0,93	-261913,00	208405,00	127515,00	136855,00	0,92	-174404,00	207257,00	144,00	0,22	0,47	0,14	-0,74	0,28
26	0,28	-269638,00	128663,00	127717,00	128966,00	0,28	-17937,00	130774,00	221,00	0,59	0,72	-0,02	-139842,00	-0,51
27	163415,00	-250112,00	0,02	127322,00	135429,00	164624,00	-166525,00	0,02	125,00	0,14	0,31	-0,29	-0,78	-0,02
28	19683,00	-246041,00	0,01	127388,00	136154,00	195818,00	-163571,00	0,00	170,00	0,52	0,25	0,24	-164271,00	0,22
29	238887,00	-228534,00	431329,00	127306,00	132332,00	238936,00	-152107,00	430247,00	188,00	0,15	0,03	-0,01	-0,90	-0,26
30	0,55	-267888,00	108647,00	127113,00	133834,00	0,54	-178259,00	109838,00	197,00	0,36	0,40	0,18	-119824,00	-0,09
31	0,37	-240832,00	245169,00	126783,00	131944,00	0,37	-160223,00	24506,00	49,00	0,67	0,05	-0,01	-119363,00	0,03
32	0,85	-253456,00	210717,00	12691,00	135384,00	0,84	-168651,00	213018,00	169,00	0,68	0,69	0,32	-115002,00	-0,55
33	-0.54	-226783,00	256732,00	01,12,1968	136322,00	-0,52	-150839,00	256278,00	61,00	0,63	0,56	-0,46	-125934,00	0,11
34	0,86	-271346,00	225749,00	12689,00	136843,00	0,87	-180598,00	22518,00	217,00	0,75	0,36	-0,08	-107778,00	0,14
35	-0.46	-271913,00	301775,00	126564,00	130905,00	-0,48	-181015,00	302048,00	189,00	0,65	0,99	0,32	-0,94	-0,07
36	-0.04	-237291,00	104291,00	126255,00	134271,00	-0,06	-157822,00	105101,00	55,00	0,94	0,43	0,47	-133883,00	-0,19
37	0,96	-270865,00	437671,00	126119,00	135401,00	0,98	-180264,00	437282,00	210,00	0,50	0,53	-0,30	-112693,00	0,09
38	-0.18	-234608,00	210831,00	126051,00	135695,00	-0,20	-156154,00	210796,00	128,00	0,35	0,87	0,29	-0,91	0,01
39	0,42	-229391,00	429049,00	126125,00	132883,00	0,41	-152582,00	42875,00	228,00	0,56	0,43	0,28	-124105,00	0,07
40	125559,00	-297719,00	0,81	125818,00	132455,00	125235,00	-197992,00	0,82	196,00	0,03	0,63	0,08	-175477,00	-0,13
41	0,75	-239615,00	431519,00	12566,00	132464,00	0,73	-159423,00	430903,00	182,00	0,62	0,61	0,49	-115263,00	0,15
42	0,41	-236188,00	244208,00	125726,00	01,12,1966	0,41	-157203,00	244112,00	49,00	0,66	0,58	-0,09	-0,92	0,02
43	-0.65	-254558,00	515137,00	12478,00	131458,00	-0,65	-169347,00	514986,00	158,00	0,78	0,99	0,02	-128965,00	0,04
44	0,46	-23383,00	245271,00	124887,00	130534,00	0,46	-156885,00	245418,00	50,00	0,43	0,44	-0,16	-0,73	-0,04
45	0,22	-234781,00	25577,00	124957,00	133106,00	0,22	-156288,00	255731,00	19,00	0,18	0,79	-0,21	-0,84	0,01
46	-0.64	-233466,00	257634,00	124548,00	136625,00	-0,64	-15533,00	257071,00	83,00	0,98	0,21	0,01	-112864,00	0,14
47	-0.60	-264428,00	296443,00	124548,00	135518,00	-0,60	-175924,00	29505,00	166,00	0,12	0,44	-0,05	-129981,00	0,33
48	-0.64	-227054,00	213078,00	123997,00	134362,00	-0,65	-151146,00	213061,00	74,00	0,32	0,97	0,14	-0,80	0,00
49	234444,00	-233517,00	443468,00	124097,00	125083,00	23493,00	-155327,00	44299,00	187,00	0,35	0,60	-0,12	-126163,00	0,11
50	109436,00	-261239,00	425927,00	124005,00	133769,00	110076,00	-173992,00	424567,00	235,00	0,36	0,97	-0,15	-0,60	0,33
51	-0.63	-26841,00	26603,00	123918,00	136899,00	-0,64	-179171,00	266488,00	201,00	0,35	0,98	0,27	0,83	-0,11
52	173092,00	-187906,00	-0,57	123554,00	129434,00	17199,00	-125185,00	-0,58	123,00	0,26	0,57	0,26	-0,31	0,17
53	151553,00	-251974,00	0,02	123577,00	136919,00	153504,00	-167775,00	0,02	123,00	0,74	0,65	-0,47	-0,75	-0,04
54	-0.56	-232162,00	225215,00	12354,00	133709,00	-0,57	-154531,00	22481,00	121,00	0,23	0,14	0,30	-0,88	0,10
55	-277118,00	-261424,00	160051,00	123298,00	123753,00	-277524,00	-173855,00	161604,00	178,00	0,02	0,43	0,10	-154062,00	-0,37
56	-0.11	-218558,00	404006,00	123076,00	134052,00	-0,11	-145704,00	403504,00	137,00	0,09	0,78	0,05	0,00	0,12
57	-30658,00	-272767,00	16548,00	123146,00	126444,00	-3071,00	-181452,00	166125,00	178,00	0,57	0,81	0,12	-141479,00	0,15
58	-0.41	-273435,00	300724,00	122995,00	133739,00	-0,42	-18201,00	300992,00	214,00	0,16	0,58	0,34	-100868,00	-0,06
59	193254,00	-22349,00	-0,25	122704,00	128706,00	193071,00	-148502,00	-0,25	172,00	0,67	0,19	0,04	-17687,00	0,01
60	256627,00	-215381,00	399433,00	122487,00	131968,00	256865,00	-143466,00	398825,00	93,00	0,96	0,15	-0,06	-0,44	0,15
61	-0.17	-219854,00	379908,00	122325,00	135707,00	-0,17	-14653,00	379537,00	88,00	0,14	0,44	0,11	-0,14	0,09
62	-0.64	-23287,00	256645,00	122281,00	136361,00	-0,64	-15493,00	256056,00	129,00	0,20	0,74	0,01	-113928,00	0,14
63	-0.46	-234562,00	223817,00	122164,00	128775,00	-0,46	-156109,00	223466,00	152,00	0,02	0,89	0,14	-0,96	0,08
64	-0.17	-281758,00	298236,00	122257,00	127297,00	-0,18	-187495,00	297741,00	237,00	0,38	0,10	0,29	-123705,00	0,12
65	-0.25	-234443,00	143448,00	12188,00	128647,00	-0,26	-155929,00	143424,00	152,00	0,87	0,32	0,24	-131869,00	0,01
66	-0.29	-254941,00	266094,00	121778,00	133104,00	-0,27	-169643,00	264531,00	143,00	0,46	0,17	-0,54	-114356,00	0,38
67	-0.44	-223815,00	193188,00	121417,00	125777,00	-0,44	-14894,00	193054,00	73,00	0,92	0,86	-0,01	-0,97	0,03
68	0,34	-23371,00	246987,00	121331,00	126944,00	0,35	-155595,00	24698,00	24,00	0,89	0,30	-0,15	-0,76	0,00
69	0,24	-223329,00	42478,00	121028,00	128968,00	0,22	-148662,00	424456,00	228,00	0,47	0,45	0,33	-0,81	0,08
70	-0.71	-241393,00	248946,00	120511,00	131606,00	-0,71	-16065,00							

2
The datasets are translated into spatial parameters and embedded within a grid system.

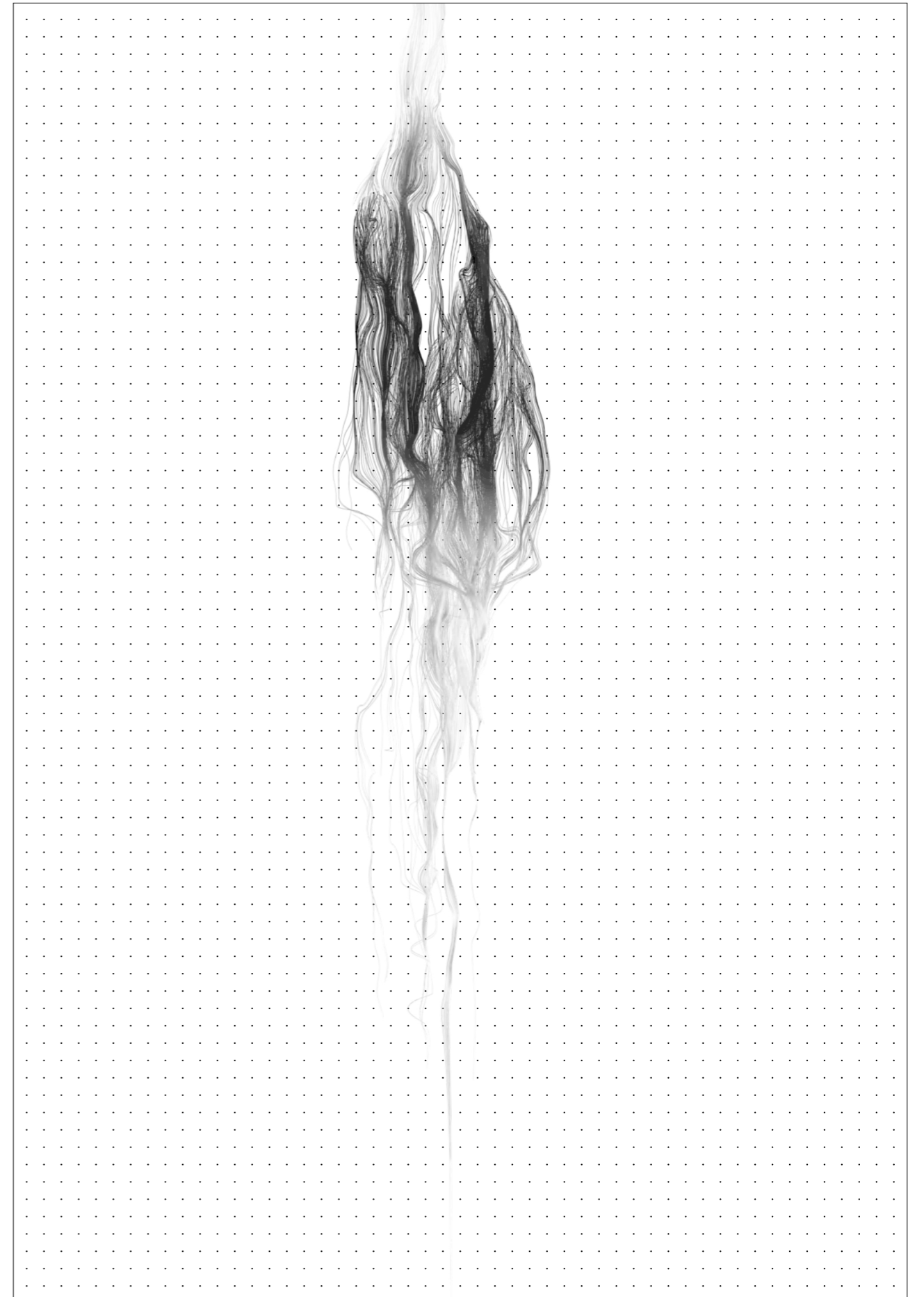


3

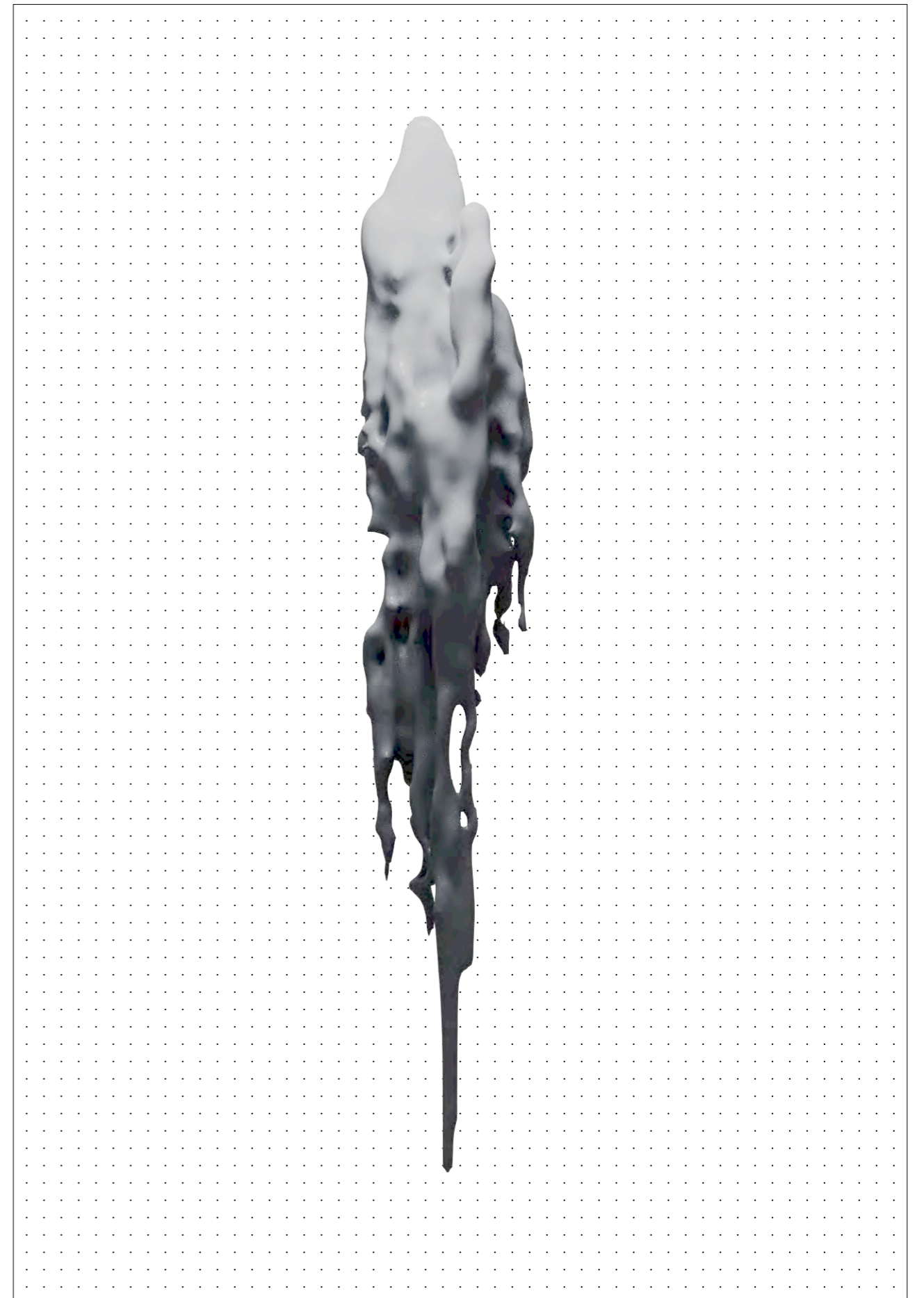
These parameters control how **points** behave in space simulating how the prevalent geological forces affect the grid.

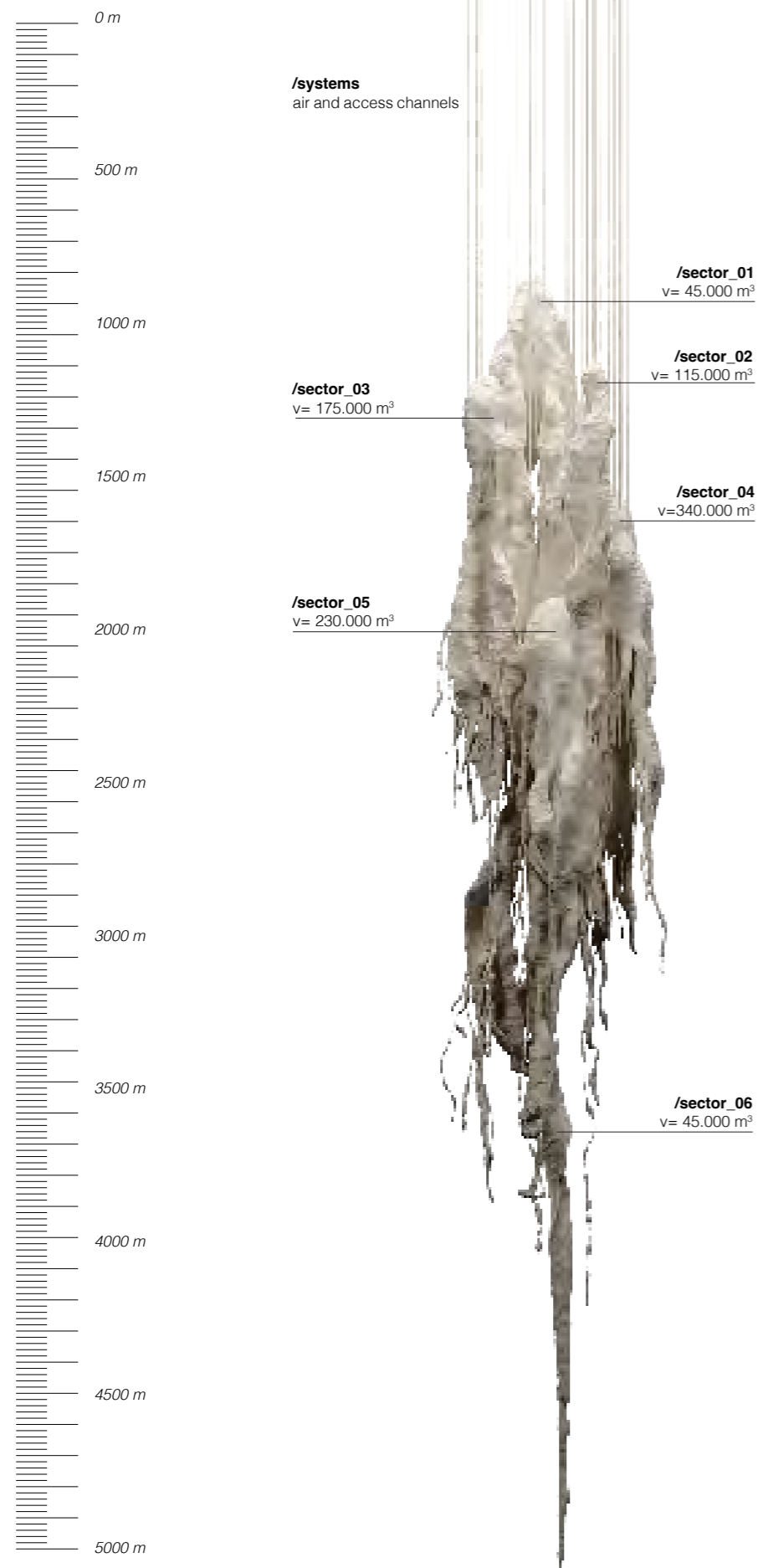


4
Point trails simulate the data informed relationship and circulation patterns between spaces within the system.



5
Each point is assigned a **volume** that defines the spatial boundaries and density.





1/20000

6

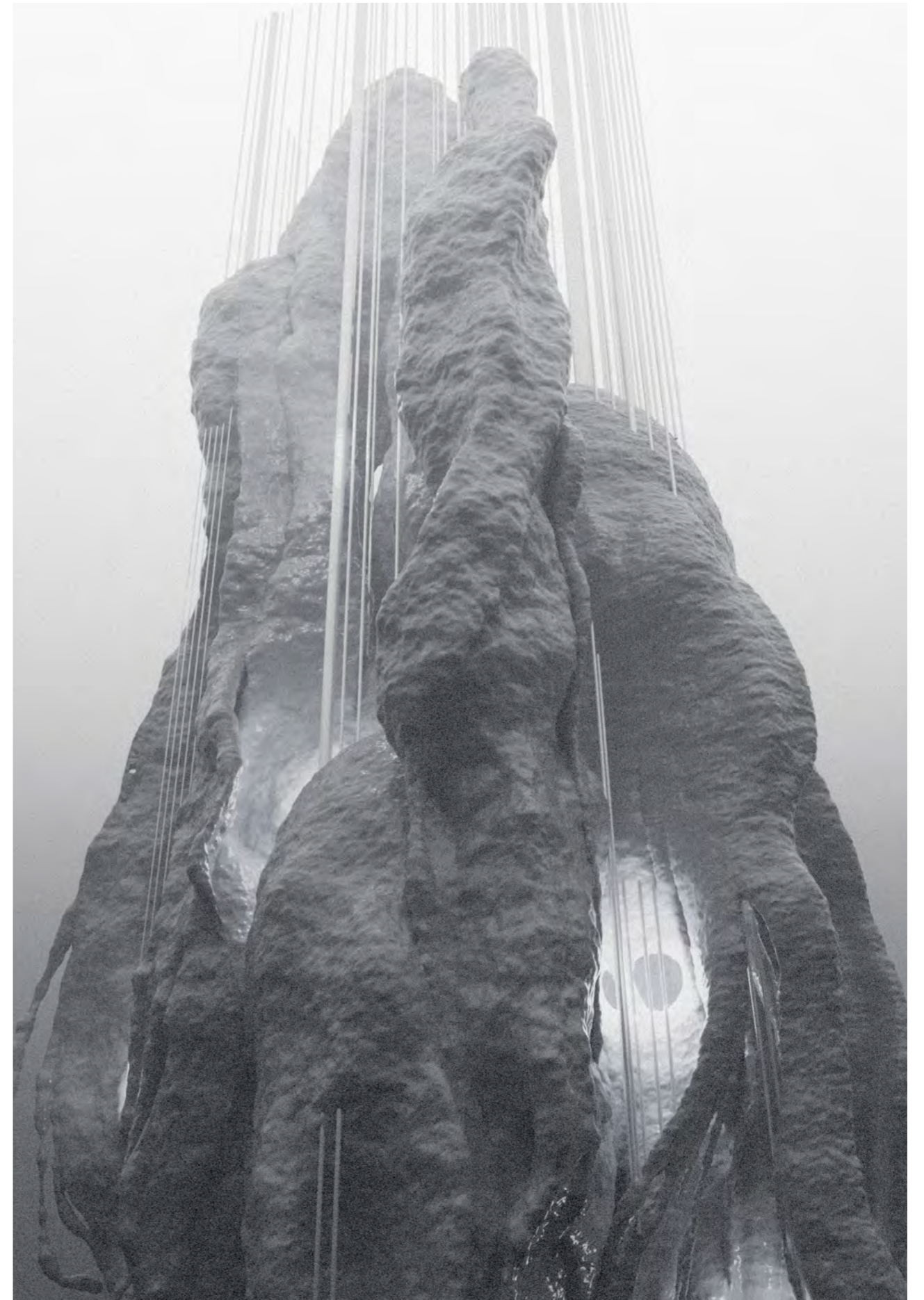
The system is excavated according to the computed simulation. The space is divided into seven sectors, each designated by functions.

01	defense and administration
02	agriculture
03	residence
04	community
05	labour
06	production

generative iterations



As primitive as these carved spaces may seem, they are instead so complex. They are sensible and adaptive. Spontaneous yet so calculated. **Vernacular.**

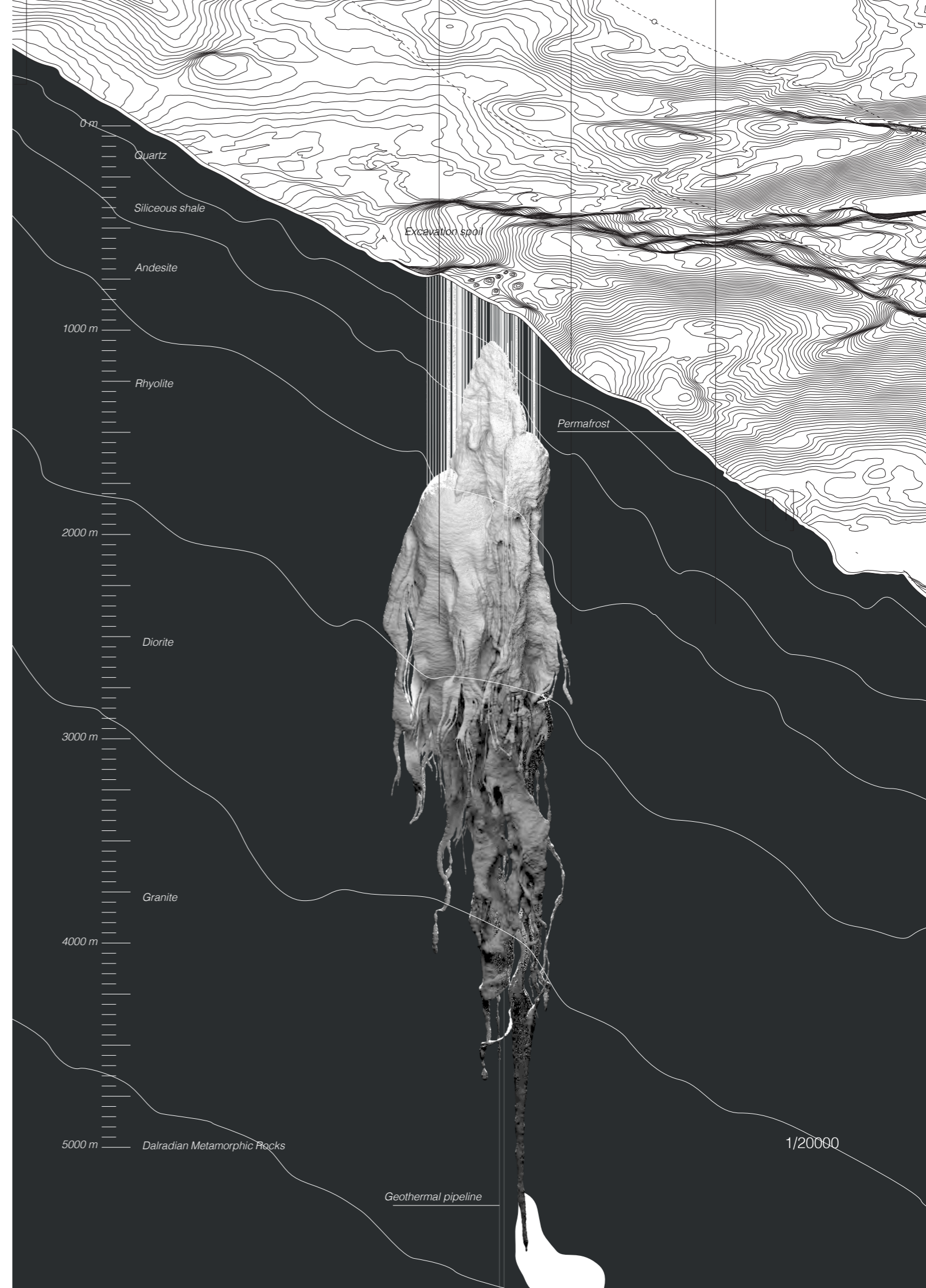


So we return to the **soil**.

PART III
THE SPACE



The structure is carved into layers of predominantly volcanic rock connected by vertical tunnels that reach depths of up to 5 km. The excavated soil from the tunnels was transported to the surface where it forms a protective well around the entrance.





1.



2.



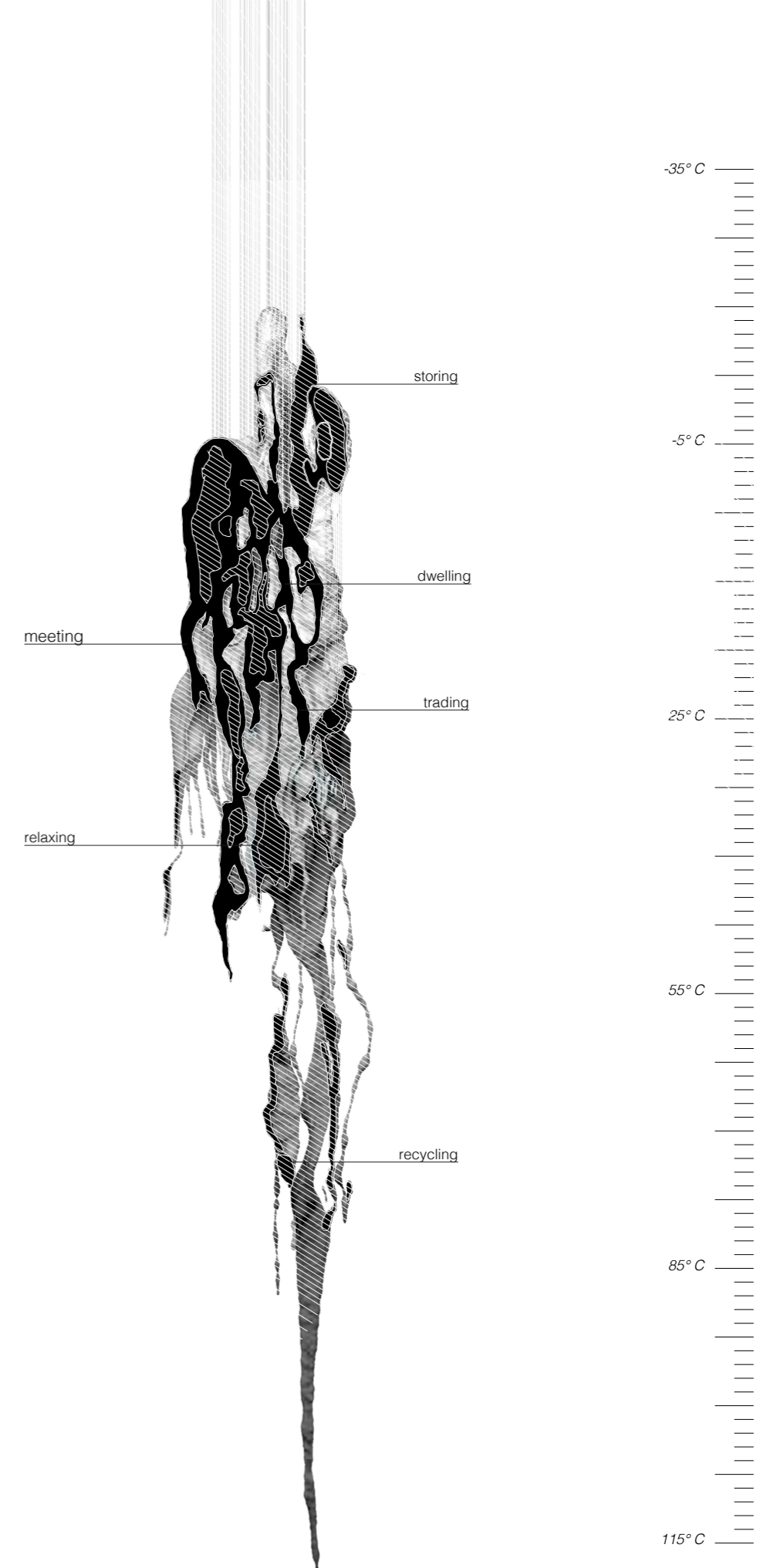
3.



4.

1. *Shale*
2. *Andesite*
3. *Rhyolite*
4. *Granite*

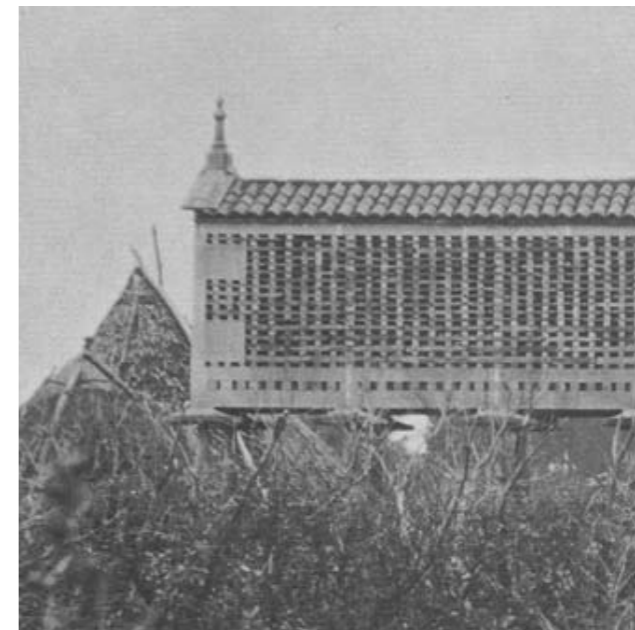
Geothermal energy naturally stabilizes the subterranean environment. Inhabitants used this natural warmth to their advantage, centring their activities around depths with mild climates.



The systems are entirely self-sufficient where almost all resources are produced or harvested internally. Amongst these resources is **grain**.



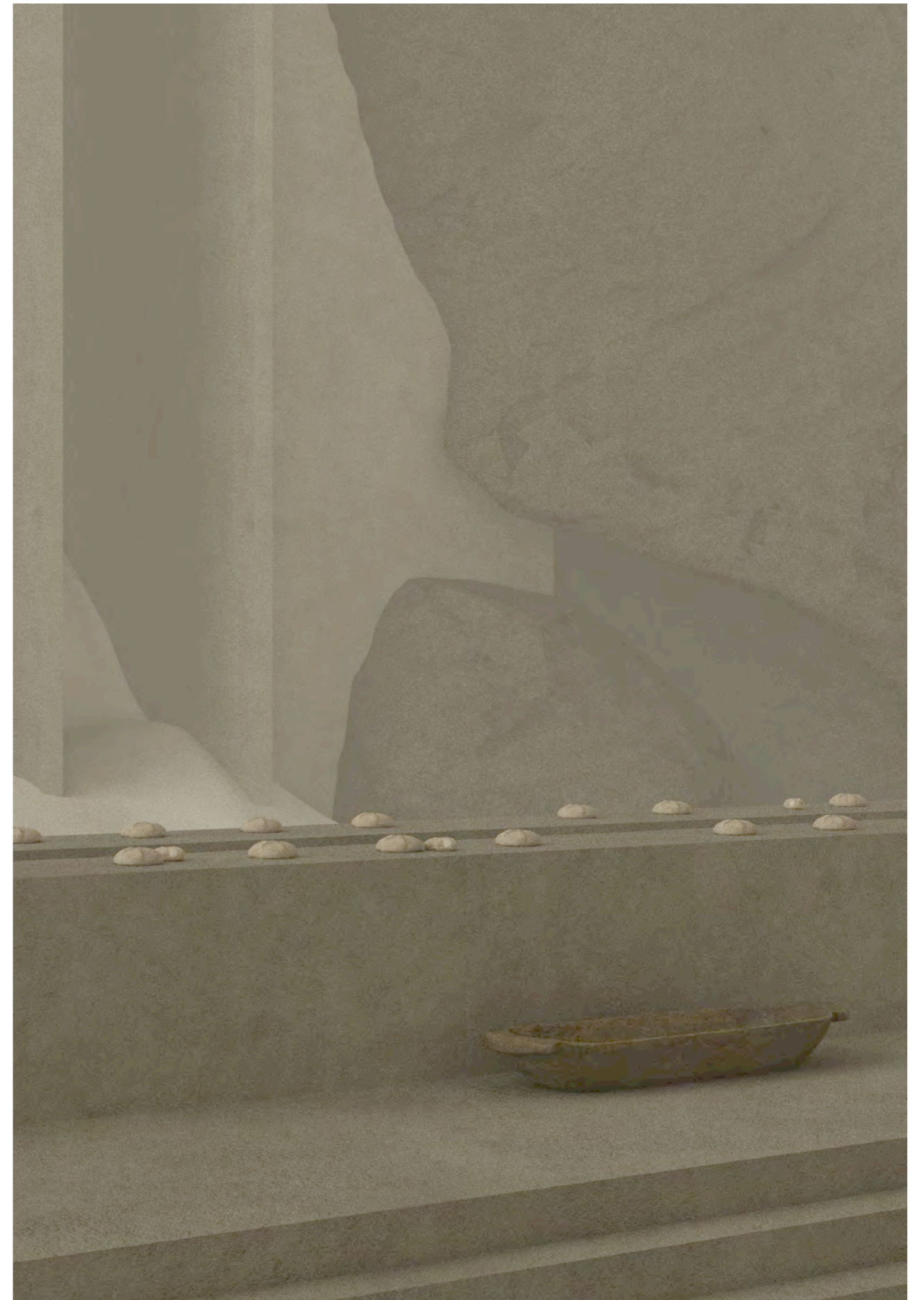
In societies where food is regarded as a divine gift rather than an industrial product, the architecture of granaries is solemn. Storehouses attain a monumental status - quasi sacred.

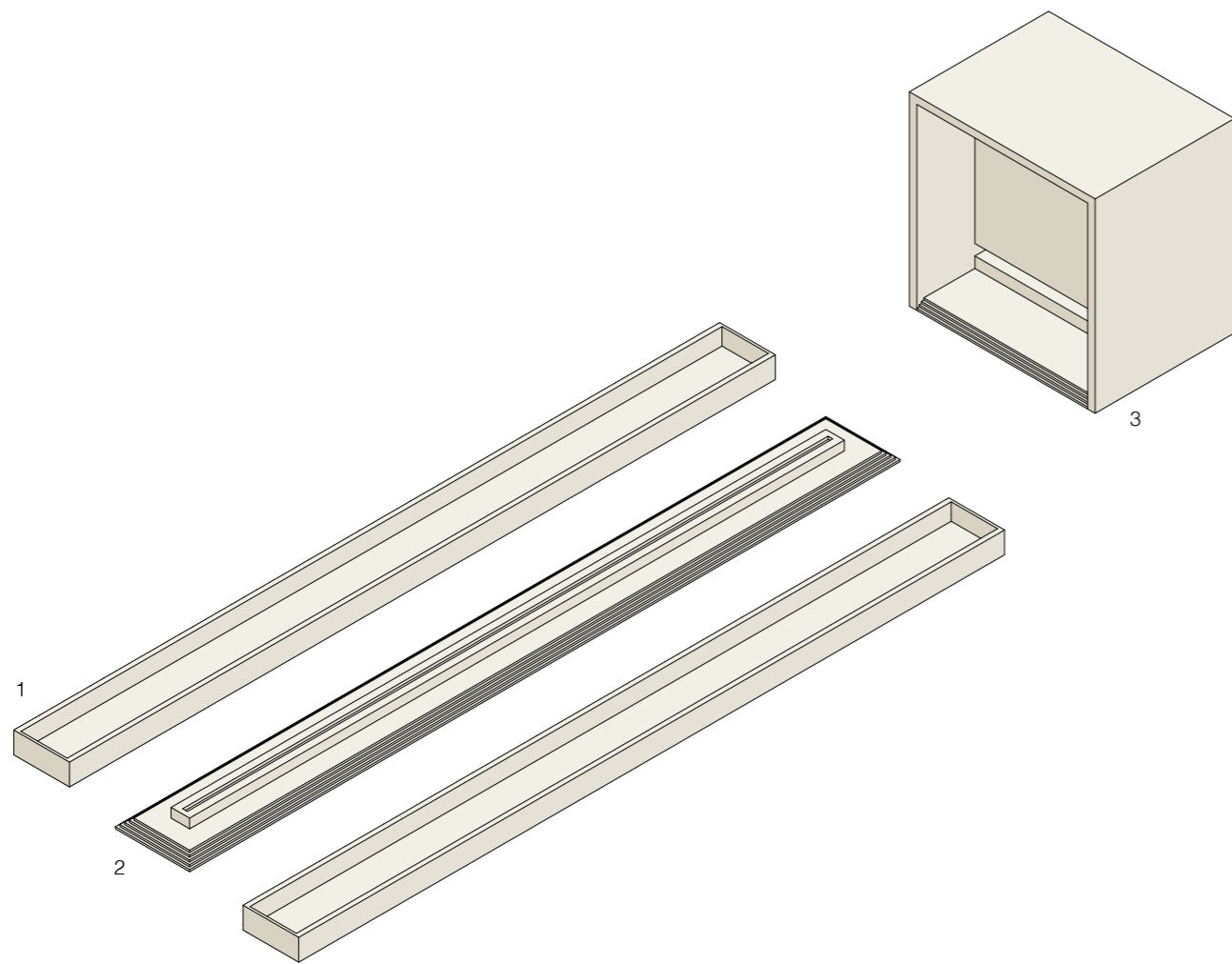


The ritual of baking bread collectively emerges as a spiritual practice to strengthen the community bond.



The flour derives from the hydroponic farms.
The grain is first dried, cleaned and milled before the fresh flour fills the through.





1 store
2 prepare
3 bake



The freshly baked bread is shared and eaten in a ceremony around the long table.



RESEARCH QUESTION

How can algorithms **leverage vernacular architecture** to enable communities to reclaim **agency over habitable spaces** and **decolonize the architectural practice?**