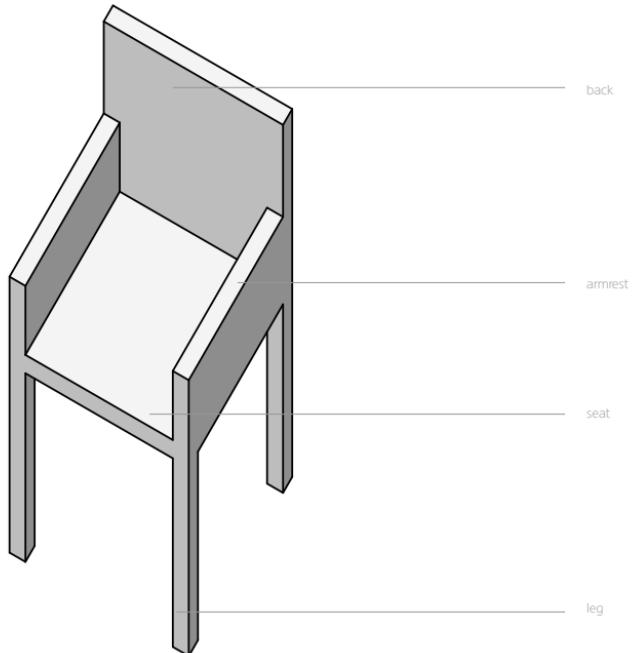


01  
Teng Fengshi

CHAIR

## **CHAIR - Introduction**

The very first thing we did was a chair pattern, through which we had a quick understanding of the ArchCAD software and GDL. It can change in its height and thickness of its most parts. I was fully satisfied with the very first work I typed out and attracted by the quick adjustment of the pattern and the possibility behind it. The later works proved it.



The chair pattern has 4 editable parts - legs, back, armrests and seat. The chair takes its size from the objects dimension 1, 2 and zzyzx, all the elements are related.

#### Chair visibility

- Show legs
- Show seat
- Show back
- Show armrest
- Show hotspots
- Reverse combination

#### Chair geometry

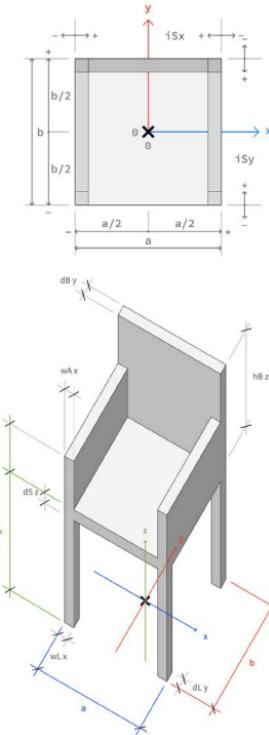
- Leg width
- Leg depth
- Leg inset x
- Leg inset y
- Seat thickness
- Back height
- Back depth
- Armrest height
- Armrest width

#### Attributes

- Pen chair outline
- Material legs
- Material seat
- Material back
- Material armrest
- Pen hotspots

#### 2D View

- Abc v: projection type
- Abc v: model type
- A v: view angle

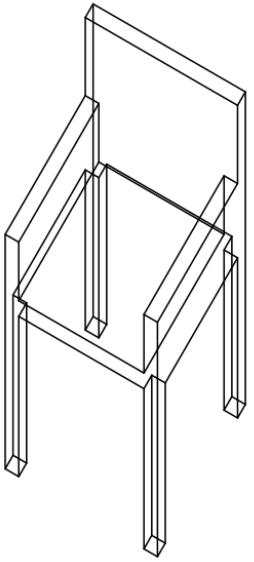


The parameters are created into 4 groups, each of which controls different aspects of the pattern. We add some parameters which allow for more differentiation, and they enable us to generate many other forms of chairs, other furniture, and even a wide range of unrelated forms.

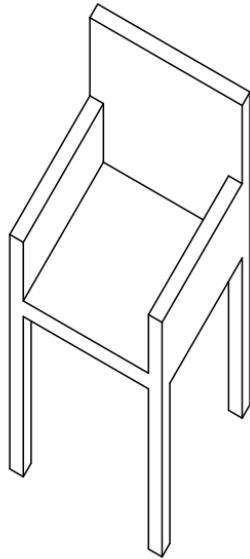
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|---|-----------------------------------|---|
| <input checked="" type="checkbox"/> boolean | <input type="checkbox"/> Abc text | <input type="checkbox"/> material           |
| <input type="checkbox"/> length             | <input type="checkbox"/> angle    | <input type="checkbox"/> surface            |
| <input type="checkbox"/> pen                | <input type="checkbox"/> Integer  | <input checked="" type="checkbox"/> percent |

parameters

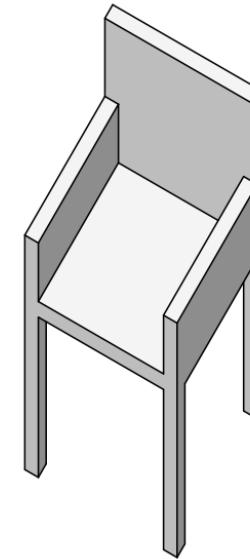
0 chair



1 wireframe



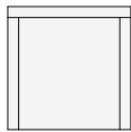
2 hidden line



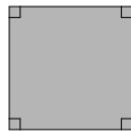
3 shaded

model type

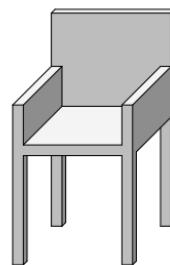
# projection type



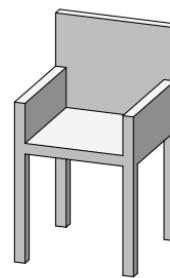
1 top view



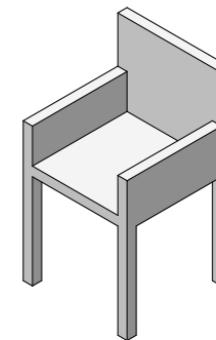
2 bottom view



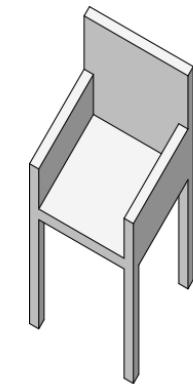
3 frontal axo t



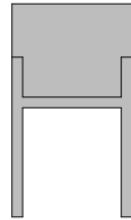
4 dimetric axo t



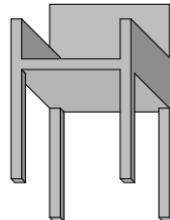
5 isometric axo t



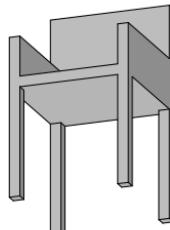
6 monometric axo t



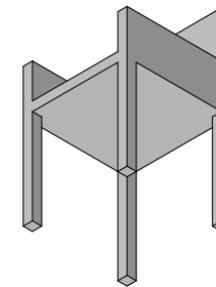
7 side view



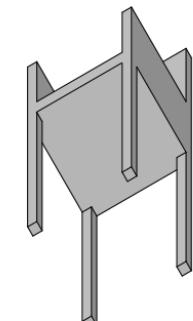
8 frontal axo b



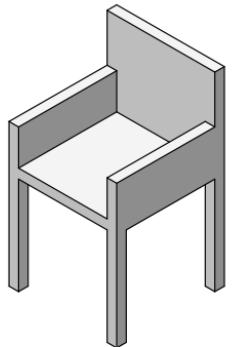
9 dimetric axo b



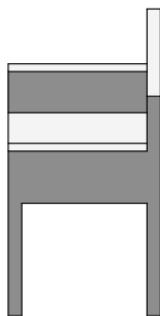
10 isometric axo b



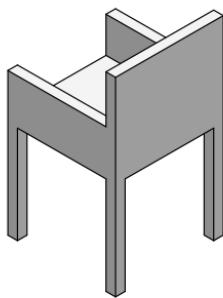
11 monometric axo b



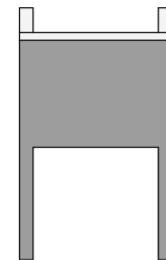
0°



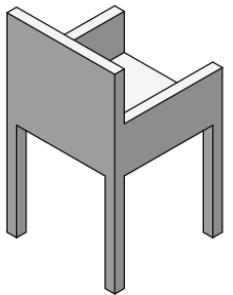
45°



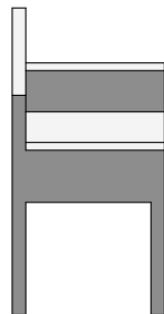
90°



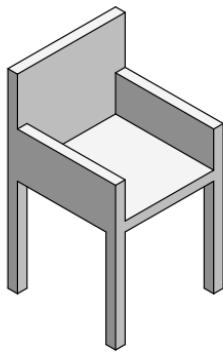
135°



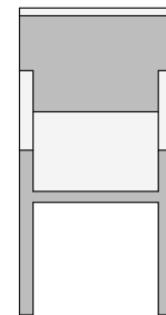
180°



225°



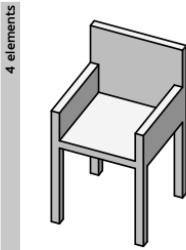
270°



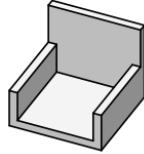
315°

view angle

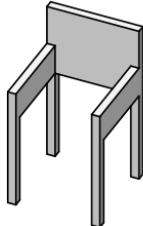
# visibility



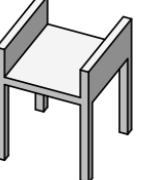
back | seat  
arms | legs



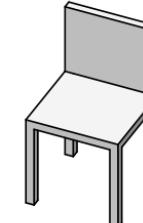
back | seat  
arms | legs



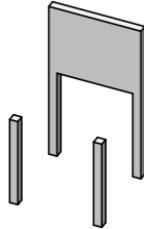
back | seat  
arms | legs



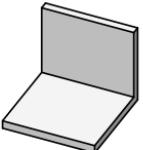
back | seat  
arms | legs



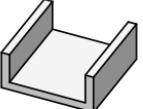
back | seat  
arms | legs



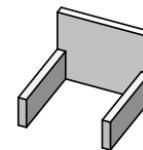
back | seat  
arms | legs



back | seat  
arms | legs



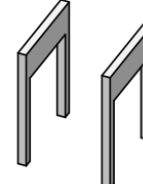
back | seat  
arms | legs



back | seat  
arms | legs



back | seat  
arms | legs



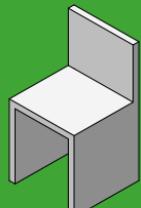
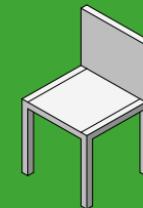
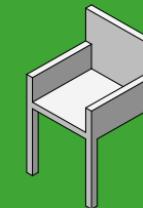
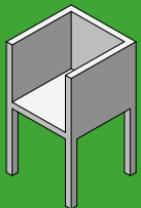
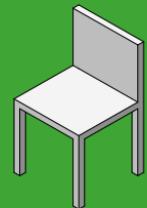
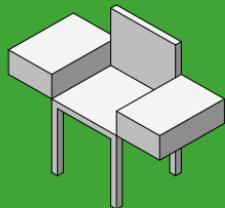
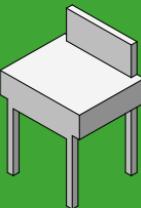
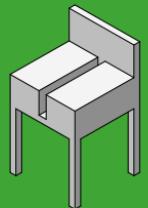
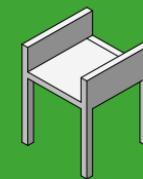
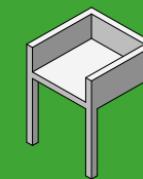
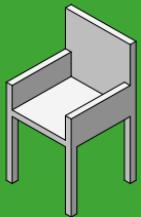
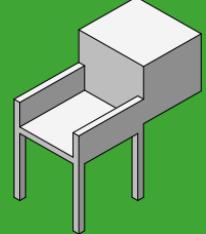
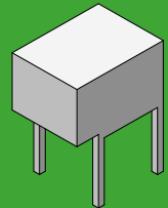
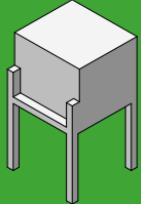
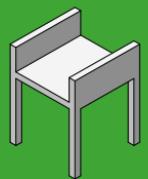
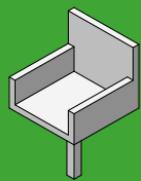
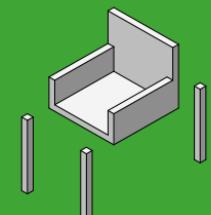
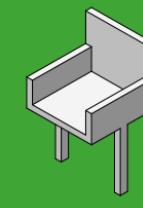
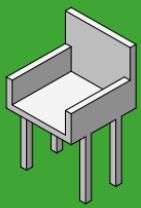
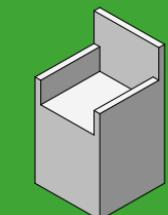
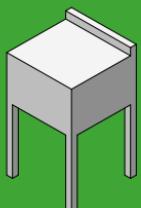
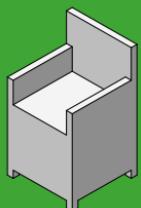
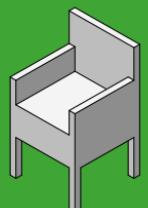
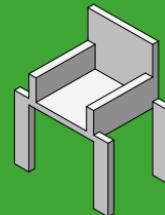
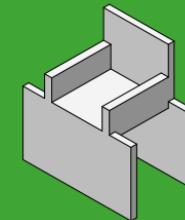
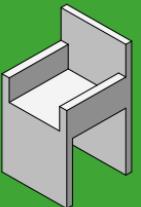
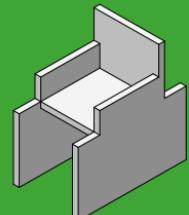
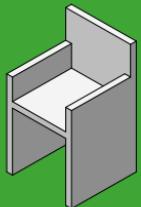
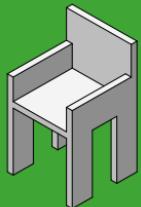
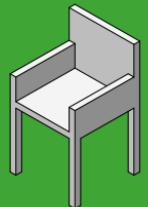
back | seat  
arms | legs

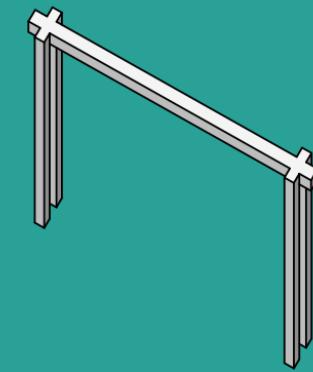
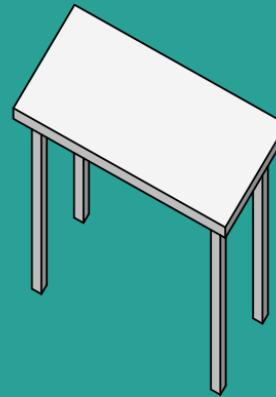
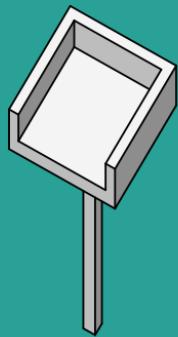
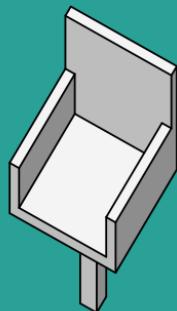
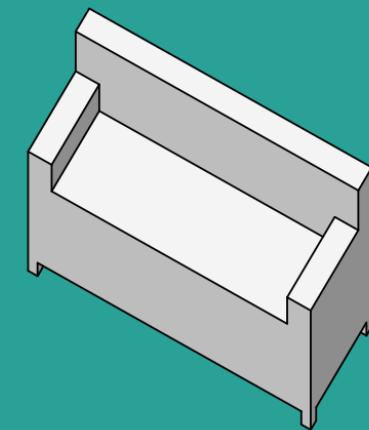
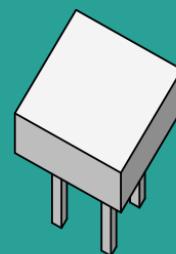
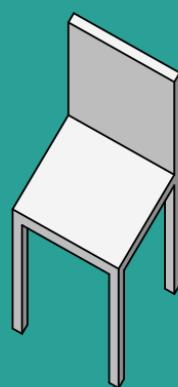
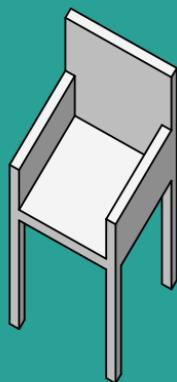
3 elements

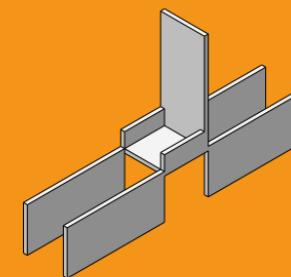
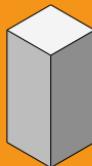
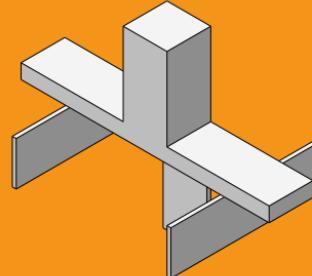
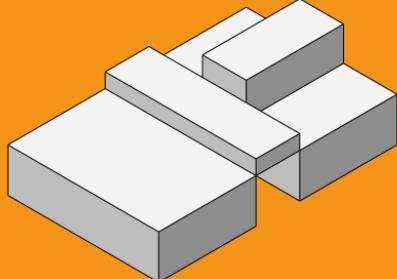
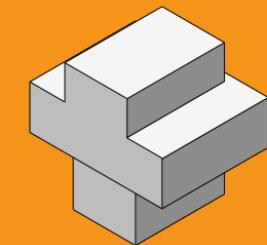
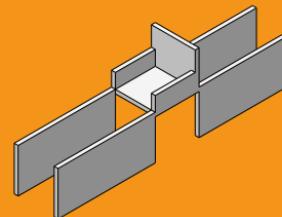
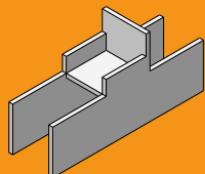
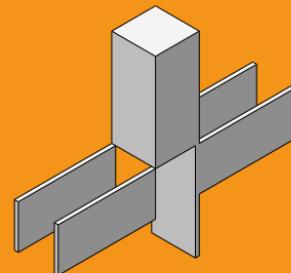
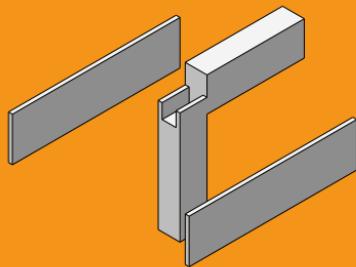
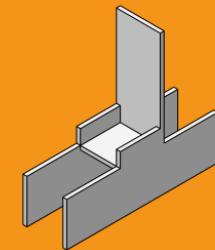
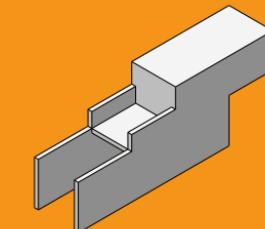
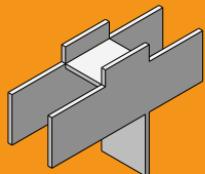
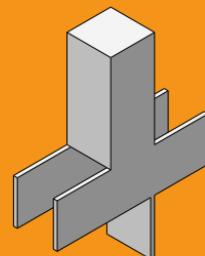
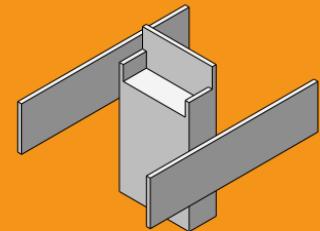
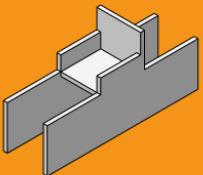
2 elements

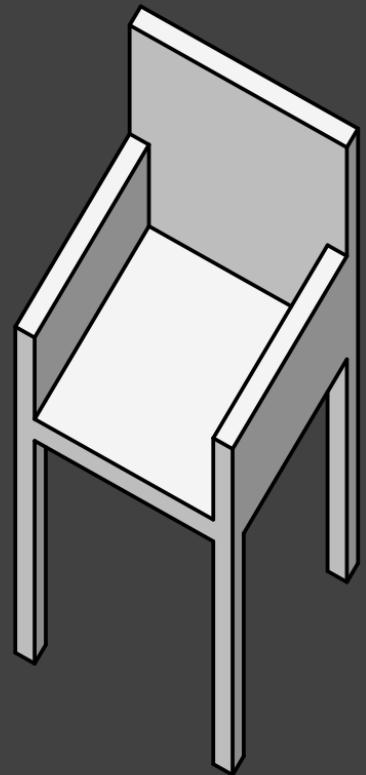
4 elements

1 element



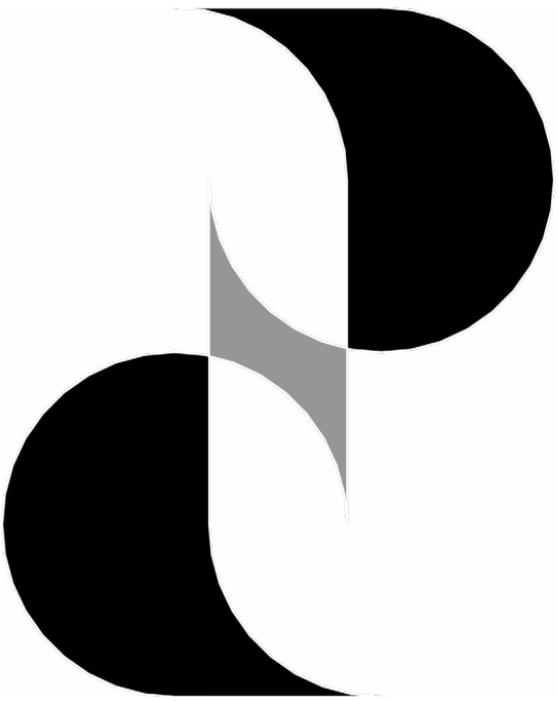








Zhejiang University · CCEA · Department of Architecture  
Year 4 design studio Spring & Summer 2023



02

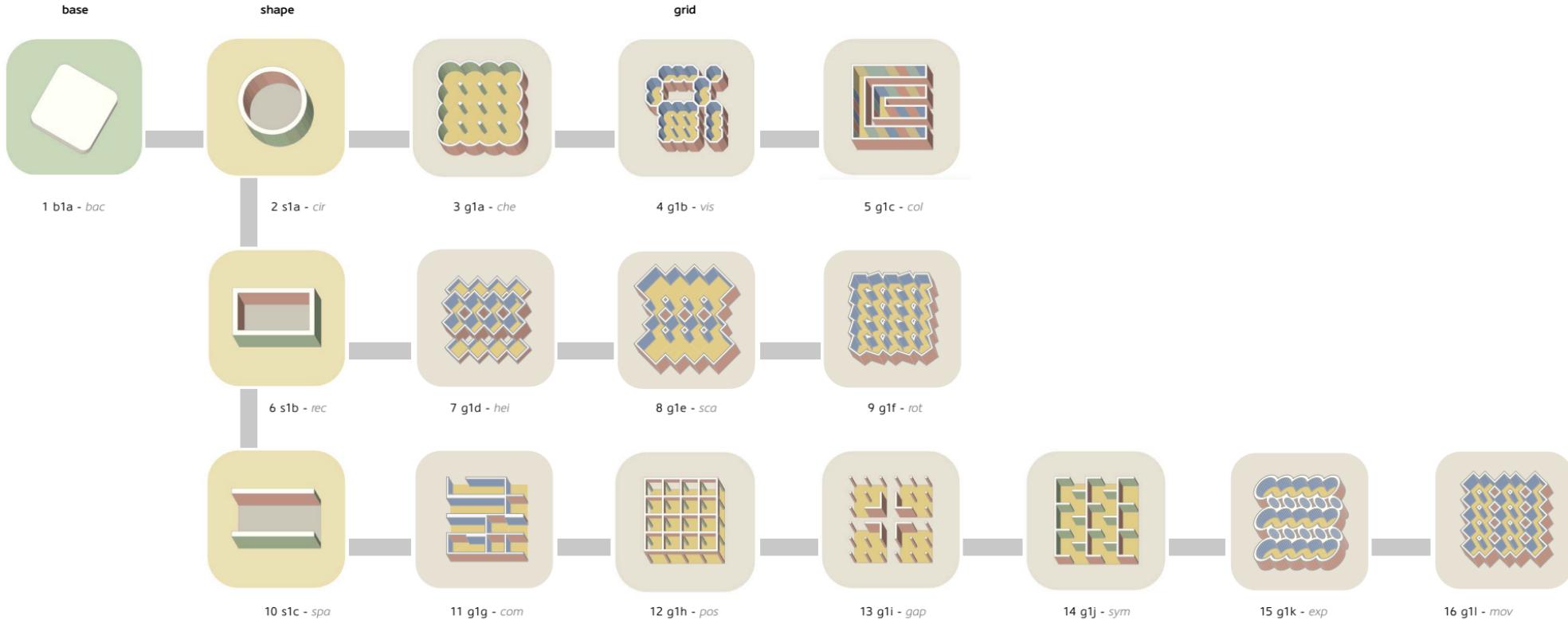
Teng Fengshi

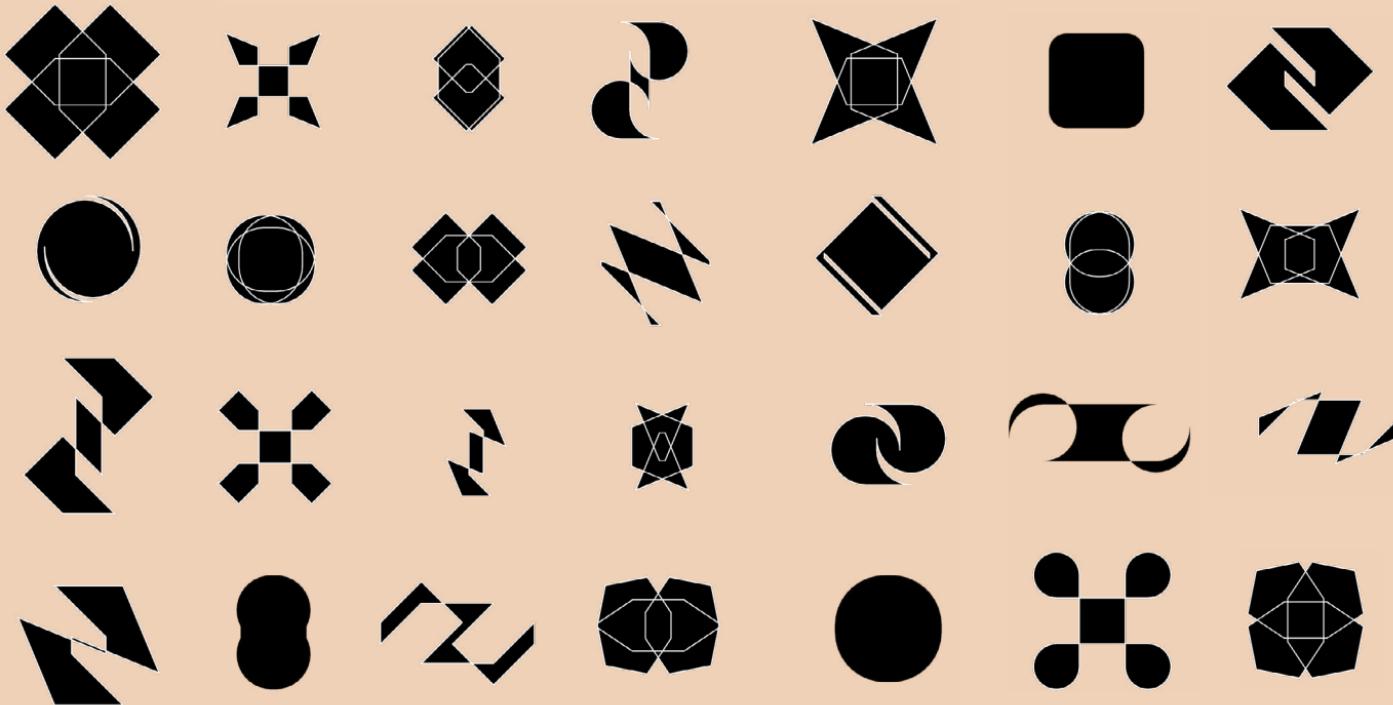
STEPS

## STEP - Introduction

In order to achieve the richness of the functions and the changed of the pattern as we thought of, we divided the whole process of the pattern construction into several steps, during each of which we created a new pattern (base, shape or grid) or generated one of the variations of the parameters listed as follows: visibility, height, color, scale, shape, rotation, gap, position, symmetry, movement and expand.

# overview





1 base

The first element we make is a base which can also serve as a background. We make it as a prism in the form of a rectangle, a rounded rectangle, or an ellipse in plan. It has a height and can be shifted in the z-direction. We centre the base around the origin and add hotspots for placement and selection on the plan. We define it in a way that we can control the graphic appearance and visibility of its outline, surface, and hotspots. We will use a copy of the chair object as a starting point so we can use part of its scripts.ments are related accordingly.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the base.

<input checked="" type="checkbox"/> boolean	<input type="checkbox"/> text	<input type="checkbox"/> material
<input type="checkbox"/> length	<input type="checkbox"/> angle	<input type="checkbox"/> surface
<input type="checkbox"/> pen	<input type="checkbox"/> integer	<input type="checkbox"/> percent

#### Base visibility

- b: show outline
- b: show surface
- b: show hotspots
- b: show only contour edges
- Abc b: no surface is

#### Base geometry

- b: height base slab
- b: lower base slab
- Abc b: shape type
- b: fillet radius
- b: shape rotation angle
- b: elli nodes rotation angle
- b: elli or fillet resolution

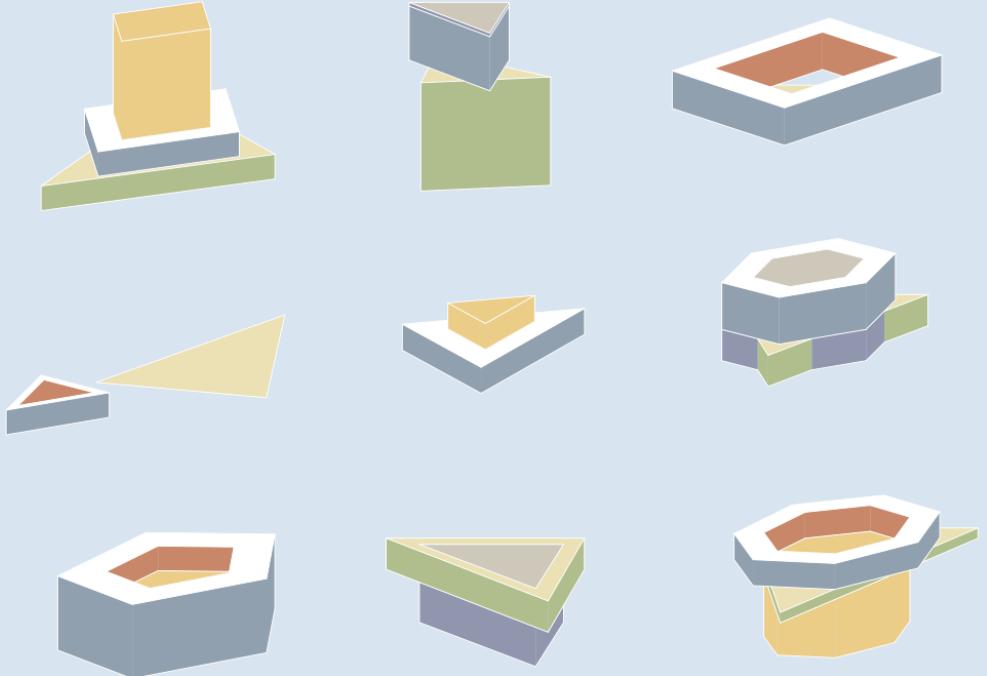


1 b1a - bac

#### Base attributes

- b: pen outline
- b: material surface top
- b: material surface side
- b: use pens for base top
- b: pen base top foreground
- b: pen base top background
- b: pen foreground percentage
- b: use rgb colours
- b: values surface rgb top
- b: values surface rgb sides
- b: pen section outline
- b: material section surface
- b: pen hotspots 104

parameters



The first iteration of the shape is a cylinder – a circle in plan – with a floor and a roof added and the background inserted. We also define a void which turns the circle into a ring. We differentiate the surfaces into top, outside, inside, and bottom for the cylinder. The size of the circle is determined by the reference rectangle and the background by expansions in the four directions. The circle is sized relative to the reference rectangle according to five principles and becomes an ellipse when scaled and the x- and y-dimensions are different. We also scale, move, and expand the circle.

2 circle

#### Shape visibility

- s: show shape outline
- s: show shape surface
- s: show floor outline
- s: show floor surface
- s: show roof outline
- s: show roof surface
- s: show reference frame
- s: show reference hotspots
- s: show corner hotspots
- s: show only contour edges
- Abc s: • no surface is •
- Abc s: • cut model to •

#### Shape geometry

- Abc s: • mass type •
- Abc s: • circle sizing type •
- s: circle resolution
- s: wall thickness
- s: adjust ellipse wall thickness

#### Shape modification

- s: height side
- s: height floor
- s: height roof
- s: scale shape
- s: rotation shape
- s: rotation elli nodes
- Abc s: • shape move values are •
- s: move shape horizontal
- s: move shape vertical
- Abc s: • shape expand values are •
- s: expand shape left
- s: expand shape down
- s: expand shape right
- s: expand shape up

We group the parameters according to kind, that is the role they play for the description, generation, and display of the circle.

#### Shape attributes

- s: use rgb colours for shape
- s: use pens for top and bottom ®
- s: pen shape outline
- s: material shape top
- s: pen shape top foreground
- s: pen shape top background
- s: pen foreground percentage
- s: rgb val shape top
- s: material shape exterior
- s: rgb val shape exterior
- s: material shape interior
- s: rgb val shape interior
- s: material shape bottom
- s: pen shape bottom foreground
- s: pen shape bottom background
- s: pen foreground percentage
- s: rgb val shape bottom
- s: mix rgb colours for top
- s: top colour mix value
- s: use rgb colours for floor
- s: pen floor outline
- s: material floor top
- s: rgb value floor top
- s: material floor sides
- s: rgb value floor sides
- s: use rgb colours for roof
- s: pen roof outline
- s: material roof top
- s: rgb value floor top
- s: material roof sides
- s: roof side = shape exterior
- s: pen reference frame



2 s1a - cir

- s: pen reference hotspots
- Abc s: • for section pen & sur use
- s: pen section outline
- s: material section surface

#### Base geometry

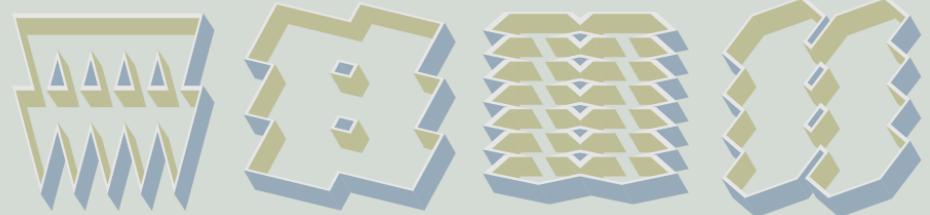
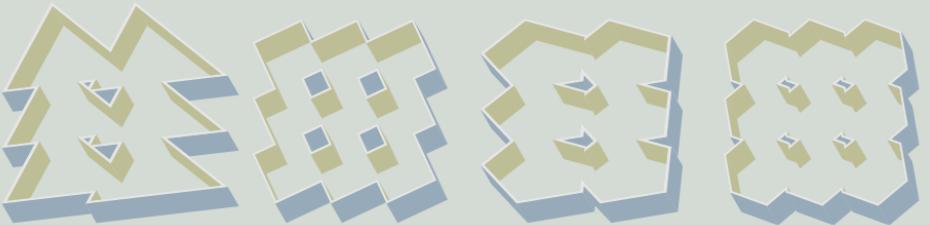
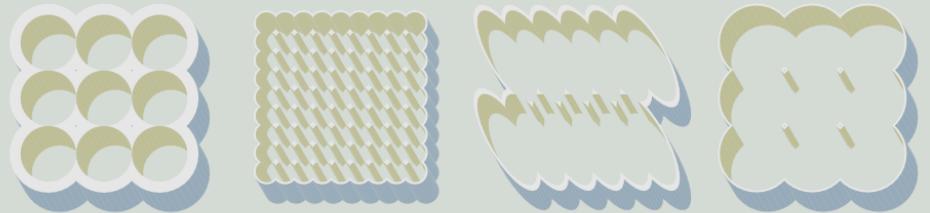
- b: extend left
- b: extend down
- b: extend right
- b: extend up

#### 2d view

- v: rotate monometric axonometry
- v: add plan to view
- v: shift plan view horizontal
- v: shift plan view vertical

- boolean
- length
- angle
- surface
- pen
- integer
- percent

parameters



3 checkered

The first iteration of the grid consists of rectangles based on regularly spaced division lines sized according to minimal intervals or column and row numbers. The circle can be inserted into the rectangle. The reference frame, the regular grid, and the horizontal and vertical division lines can also be constructed, and a background is added. We add another option to the mass type to subtract the accumulated voids from the accumulated solids to create space.

#### Shape general

- Abc s: • mass type •
- Abc s: • circle sizing type •
- s: circle resolution
- s: wall thickness
- s: adjust ellipse wall thickness

#### Shape height

- s: height side
- s: height floor
- s: height roof

#### Shape scale

- ✎ s: scale shape

#### Shape rotation

- ▲ s: rotation shape
- ▲ s: rotation elli nodes

#### Shape movement

- Abc s: • shape move values are •
- s: move shape horizontal
- s: move shape vertical

#### Shape expansion

- Abc s: • shape expand values are •
- s: expand shape left
- s: expand shape down
- s: expand shape right
- s: expand shape up

#### Grid 1 visibility

- 1: show reference frame
- 1: show regular grid
- 1: show div lines horizontal
- 1: show div lines vertical
- 1: show rectangle outlines
- 1: show rectangle surfaces
- 1: show reference hotspots
- Abc 1: • cut model to •

#### Grid 1 geometry

- Abc 1: • subdivision method •
- 1: minimal interval columns
- 1: minimal interval rows
- 1: number of columns
- 1: number of rows

#### Grid 1 attributes

- U 1: pen reference frame
- U 1: pen regular grid lines
- U 1: pen div lines horizontal
- U 1: pen div lines vertical
- U 1: pen reference hotspots
- 1: use rgb colours for rectangle
- U 1: pen rectangle outlines
- 1: material rectangle surfaces
- 1: rgb value grid rectangles
- 1: mod rgb colours for rect's
- ✎ 1: percent value rectangle
- 1: rgb value grid modulation

parameters

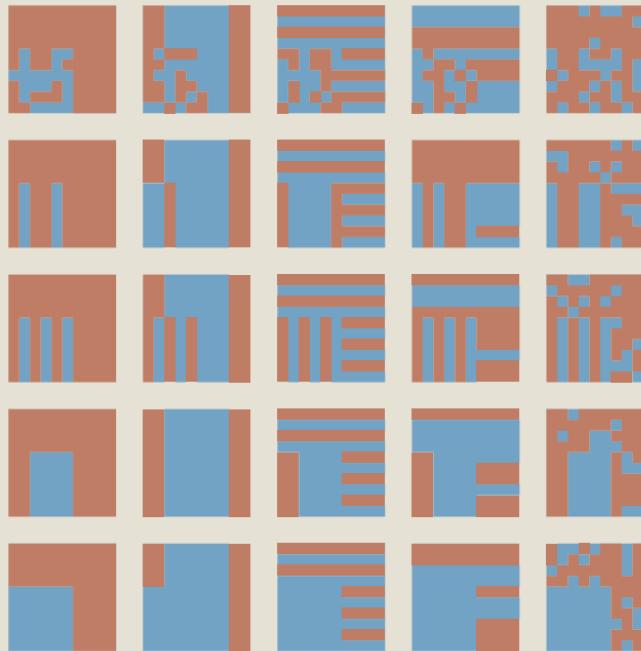
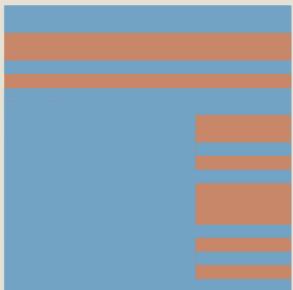
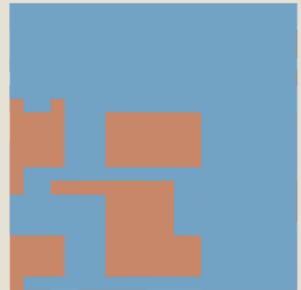
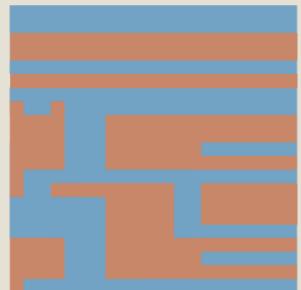
3 g1a - che



#### Used in scripts

- 1: list hor line coordinates
- 1: list ver line coordinates
- 1: list rectangle coordinates
- 1: list insertion point coordinates





## 4 visibility

In this version of the grid, we add options to show or hide shapes. We use what I call distribution patterns to decide which shape is shown or hidden. I prepared five such patterns, divide, alternate, random, percent, and stepped – which only can be used for numerical parameter values. These patterns are defined in separate library parts. The type of patterns is basic and not complete. We use these pattern to distribute two parameter values for the shape over the grid, and use the same types also for making variations and combinations to the two values.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the visibility.

- boolean
- text
- material
- length
- angle
- pen
- integer
- percent

### Shape visibility

- Abc S: • shape visibility type •
- Abc s: 1 • divide options •
- s: divide number of col/row
- Abc s: 2 • alternate options •
- Abc s: 3 • random options •
- s: 4 percent of value 1
- Abc S: • shape visibility type 1 •
- Abc S: • shape visibility type 2 •
- Abc s: • shape visibility combi 1 •
- Abc s: 1 • divide options •
- s: divide number of col/row
- Abc s: 2 • alternate options •
- Abc s: 3 • random options •
- s: 4 percent of value 1
- Abc S: • shape visibility combi2 •
- Abc s: 1 • divide options •
- s: divide number of col/row
- Abc s: 2 • alternate options •
- Abc s: 3 • random options •
- s: 4 percent of value 1

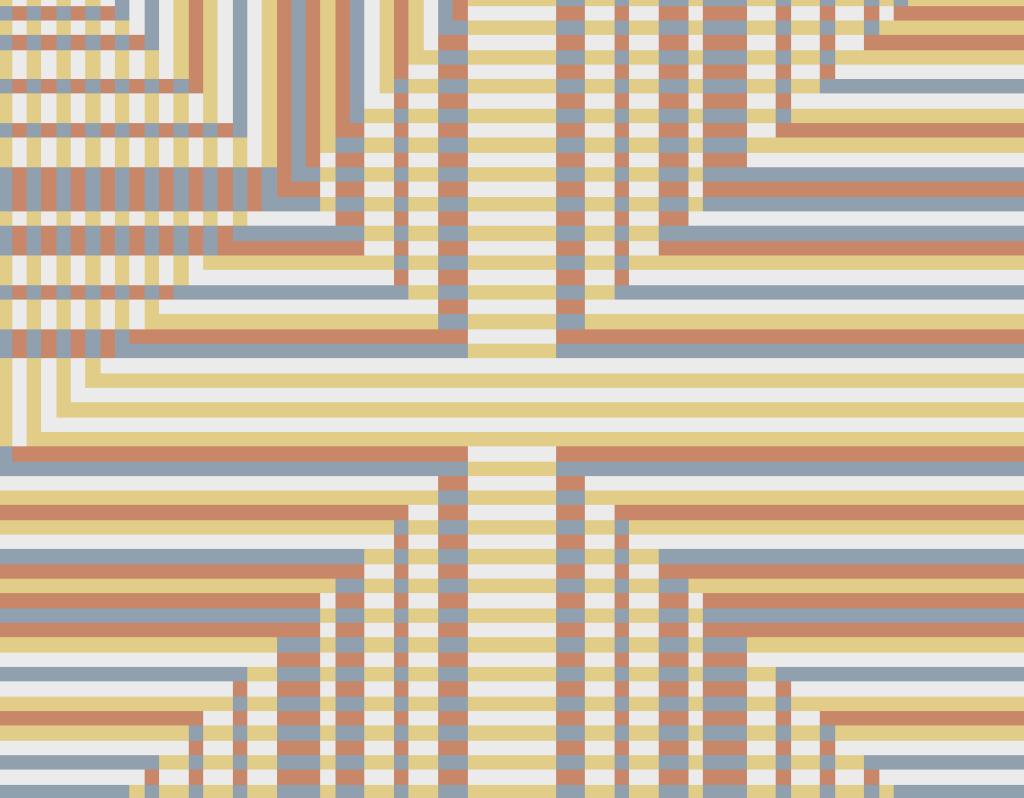
### Used in scripts

- 1: list string options
- 1: list number options
- 1: list divide options
- 1: list alternate options
- 1: list random options
- 1: list stepped options
- 1: list variations 0
- 1: list variations 1
- 1: list variations 2
- 1: list returned integer values
- 1: list returned length values
- 1: list numeric values
- Abc 1: list shape visibility



4 g1b - vis

# parameters



5 color

In this version of the grid, we differentiate the pen colour of the shape outline and the materials and rgb colours of the top, exterior, interior, and bottom surfaces of the shape, the top and side surfaces of the floor and the roof, and the surface of the grid rectangle. We replace the single colours with two options and use the same distribution patterns as for the visibility. Instead of using combinations or variations, we mix the colour of the top shape surface and modulate the grid rectangle surface. For the mixing, we use variations. For the shape surface we add an option to use four colours in combination with the bottom colours.

#### Shape attributes

```

Abc s: • pen type shape outline •
Abc s: 1 • divide options
■ s: divide number of col/row
Abc s: 2 • alternate options •
Abc s: 3 • random options •
✗ s: 4 percent of value 1
U s: pen shape outline
U s: pen shape outline 1
U s: pen shape outline 2
☒ s: use pens for top and bottom
☒ s: use rgb colours for shape
Abc s: • colour type shape top •
Abc s: 1 • divide options •
■ s: divide number of col/row
Abc s: 2 • alternate options •
Abc s: 3 • random options •
✗ s: 4 percent of value 1
U s: material shape top
U s: material shape top 1
U s: material shape top 2
U s: pen shape top foreground
U s: pen shape top background
✗ s: pen foreground percentage
U s: pen shape top foreground 1
U s: pen shape top background 1
✗ s: pen foreground percentage 1
U s: pen shape top foreground 2
U s: pen shape top background 2
✗ s: pen foreground percentage 2
■ s: rgb val shape top

```

We group the parameters according to kind, that is the role they play for the description, generation, and display of the color.

<input checked="" type="checkbox"/> boolean	Abc text	<input checked="" type="checkbox"/> material
<input checked="" type="checkbox"/> length	<input checked="" type="checkbox"/> angle	<input checked="" type="checkbox"/> surface
<input checked="" type="checkbox"/> pen	<input checked="" type="checkbox"/> integer	<input checked="" type="checkbox"/> percent



5 g1c - col

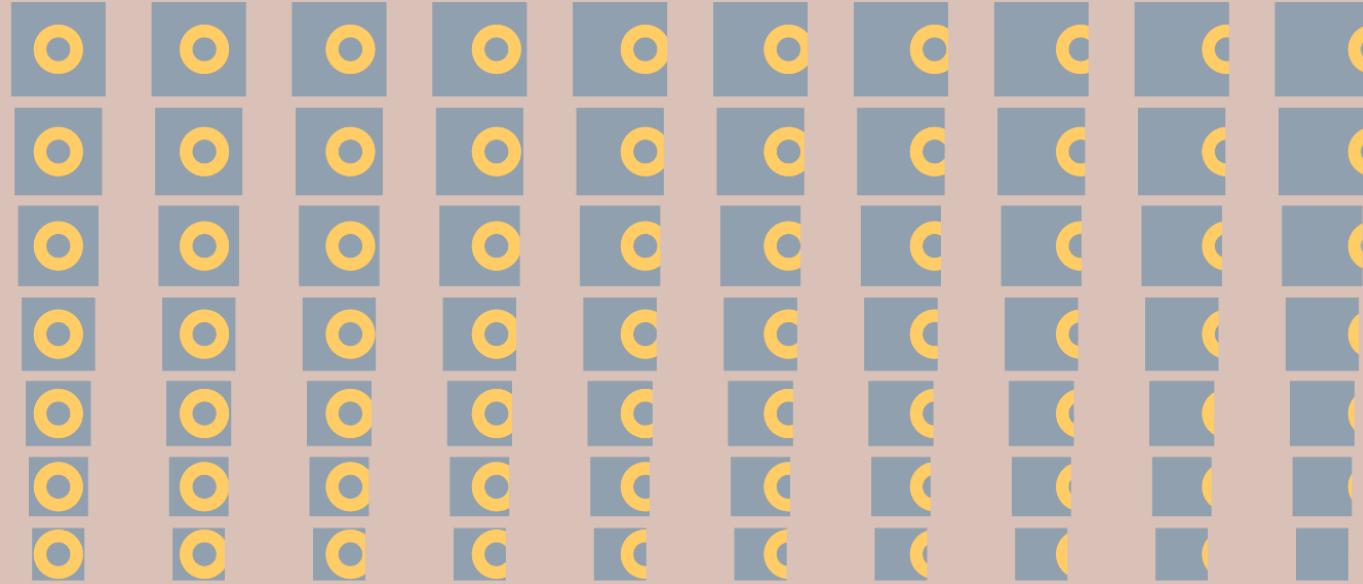
<input checked="" type="checkbox"/> CUSTOM SETTINGS
> SHAPE VISIBILITY
> SHAPE GENERAL
> SHAPE HEIGHT
> SHAPE SCALING
> SHAPE ROTATION
> SHAPE MOVEMENT
> SHAPE EXPANSION
> SHAPE ATTRIBUTES
> ATTRIBUTES FLOOR & ROOF
> ATTRIBUTES EXTRA
> GRID 1 VISIBILITY
> GRID 1 GEOMETRY
> GRID 1 ATTRIBUTES
> BASE VISIBILITY
> BASE GEOMETRY
> BASE ATTRIBUTES
> 2D VIEW

```

U s: pen shape bot background 1
✗ s: pen foreground percentage 1
U s: pen shape bot foreground 2
U s: pen shape bot background 2
✗ s: pen foreground percentage 2
■ s: rgb value shape bottom

```

parameters



6 rectangle

To the second version of the shape object, we add three more options for the shape type: rectangle, bar, and line. The rectangle shape with no modification will be a rectangle with the size and location of the reference frame in plan and a cuboid in the model. The bar width is not affected by scaling or expansions to the left or right. The bar and line only scale and expand up and down.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the rectangle.

- boolean
- text
- material
- length
- angle
- surface
- pen
- integer
- percent

parameters



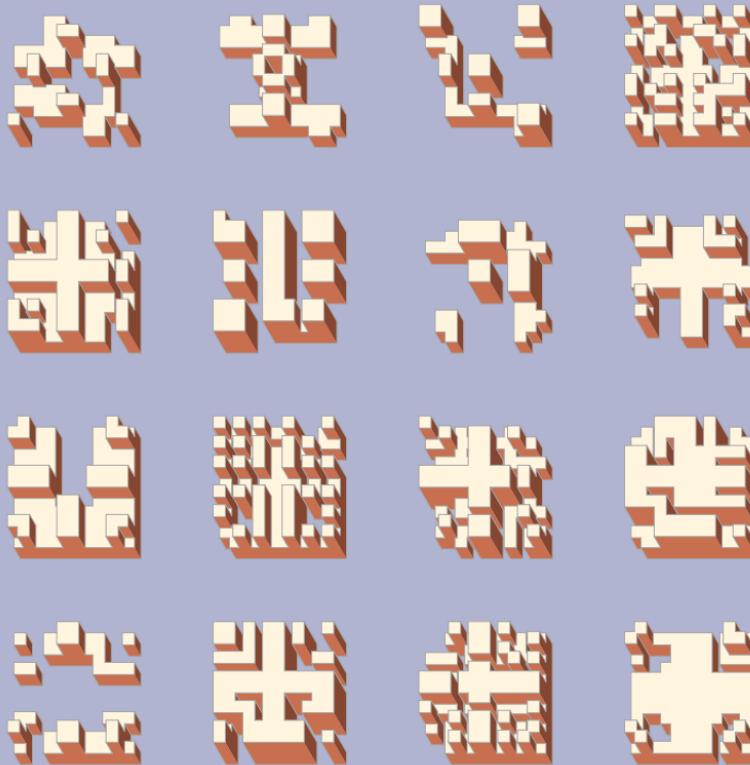
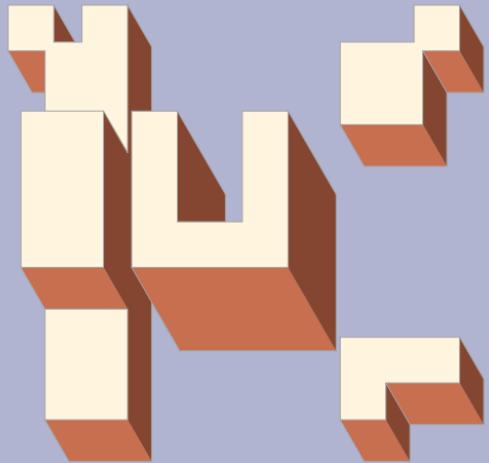
6 s1b - rec

**Shape geometry**

Abc \$: ● shape type •  
■■■■■: bar width

shape type	3 wall	3 solid	3 solid	n/a	n/a
shape type	3 wall	3 solid	3 solid	n/a	n/a
4 3 2 1 a b	abt alt	3 circle 0.01	2 rectangle 0.5 x 1000 rect expand Length percentage	3 bar	4 line 0.1 set1 1 x 0.01 background extension
configuration	shape move	rect expand	length	mass	floor
components	reference frame	mass	floor	roof	background

# 7 height



In this version of the grid, we control the distribution of two shape height values with separate variations over the grid. In addition to the two distribution patterns we used before we use a new one for stepping the values, by also calling the respective function. We split up the parameter list for the shape modification into five sections as illustrated above.

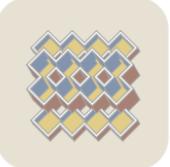
We group the parameters according to kind, that is the role they play for the description, generation, and display of the height.



## Shape height

- Abc 1: • shape height type •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- ☒ 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- ☒ 1: height side
- ☒ 1: height value 1
- ☒ 1: height value 2
- Abc 1: • height variation type 1 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- ☒ 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- ☒ 1: height variation 1 min
- ☒ 1: height variation 1 max
- Abc 1: • height variation type 2 •
- Abc 1: • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- ☒ 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- ☒ 1: height variation 2 min
- ☒ 1: height variation 2 max
- ☒ s: height floor
- ☒ s: height roof

7 g1d - hei



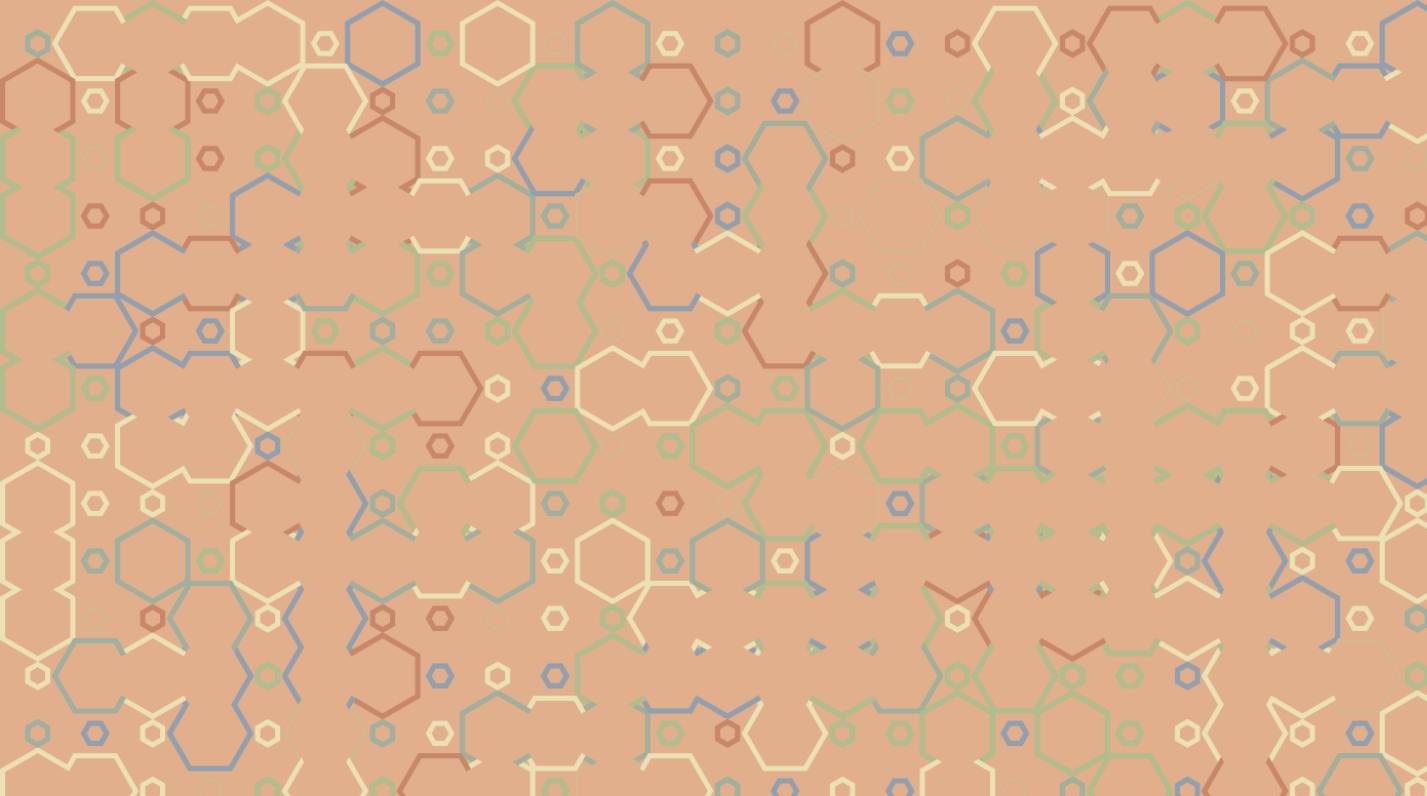
## Shape general

- Abc s: • shape type •
- ☒ s: bar width

## Used in script

- ☒ 1: list shape side heights

parameters



8 scale

We use the same three predefined functions for the distribution patterns of two scale values over the grid.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the scale.

boolean  
 length  
 pen  
 text  
 angle  
 integer  
 surface  
 percent

#### Shape scale

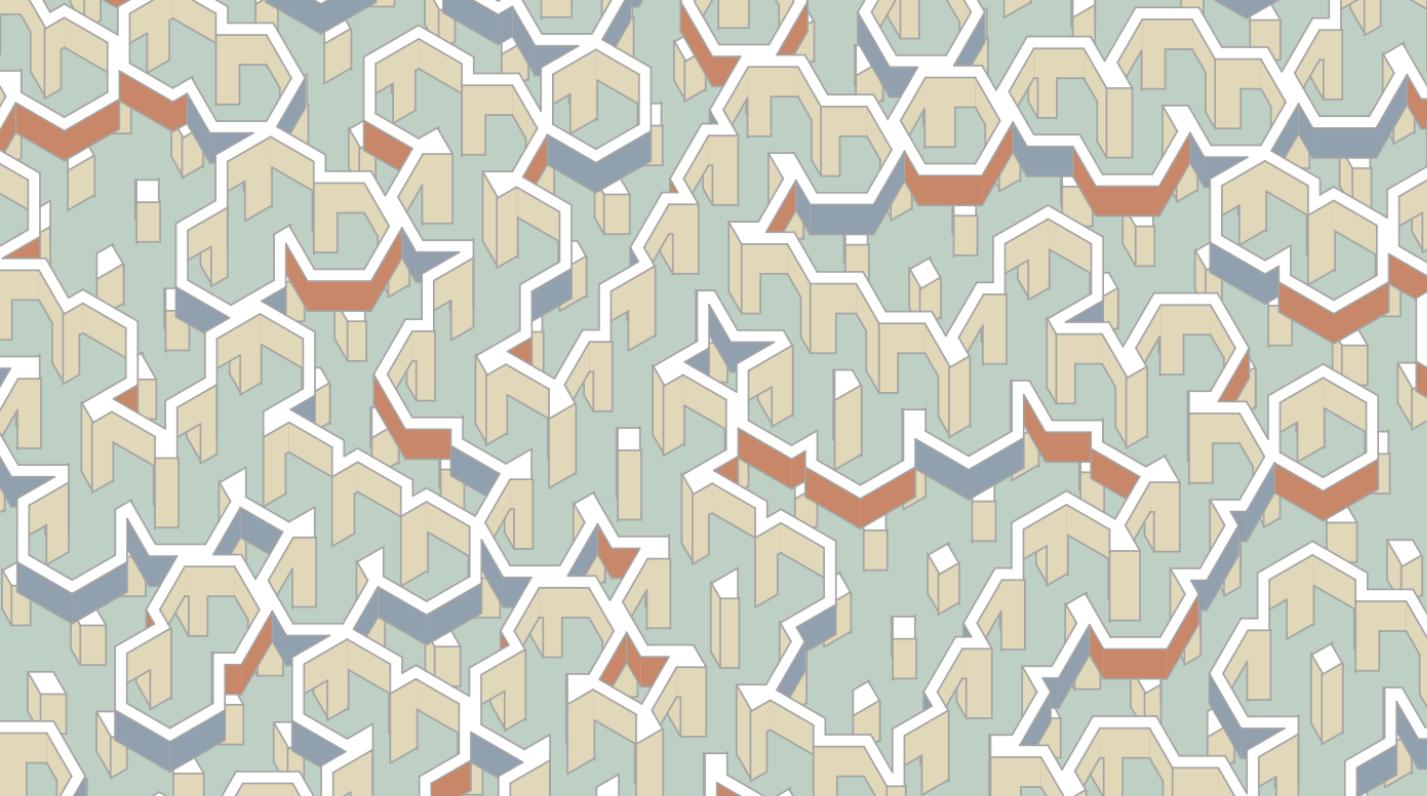
- Abc 1: • shape scaling type •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- ☒ 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- ☒ 1: shape scale value
- ☒ 1: scale value 1
- ☒ 1: scale value 2
- Abc 1: • scaling variation type 1 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- ☒ 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- ☒ 1: scale variation 1 min
- ☒ 1: scale variation 1 max
- Abc 1: • scale variation type 2 •
- Abc 1: • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- ☒ 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- ☒ 1: scale variation 2 min
- ☒ 1: scale variation 2 max



8 g1e - sca

Used in script  
☒ 1: list shape scale

parameters



9 rotation

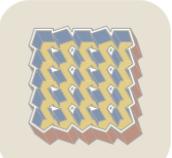
We use the same three predefined functions for the distribution patterns of two scale values over the grid.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the rotation.

boolean  
 length  
 pen  
 text  
 angle  
 integer  
 material  
 percent

#### Shape rotation

- Abc 1: • shape scaling type •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- 1: shape rotation angle
- 1: rotation value 1
- 1: rotation value 2
- Abc 1: • scaling variation type 1 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- 1: rotation variation 1 min
- 1: rotation variation 1 max
- Abc 1: • scale variation type 2 •
- Abc 1: divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: random step intervals
- 1: 4 percent of value 1
- Abc 1: 5 • stepped options •
- 1: rotation variation 2 min
- 1: rotation variation 2 max
- 1: rotation angle elli nodes

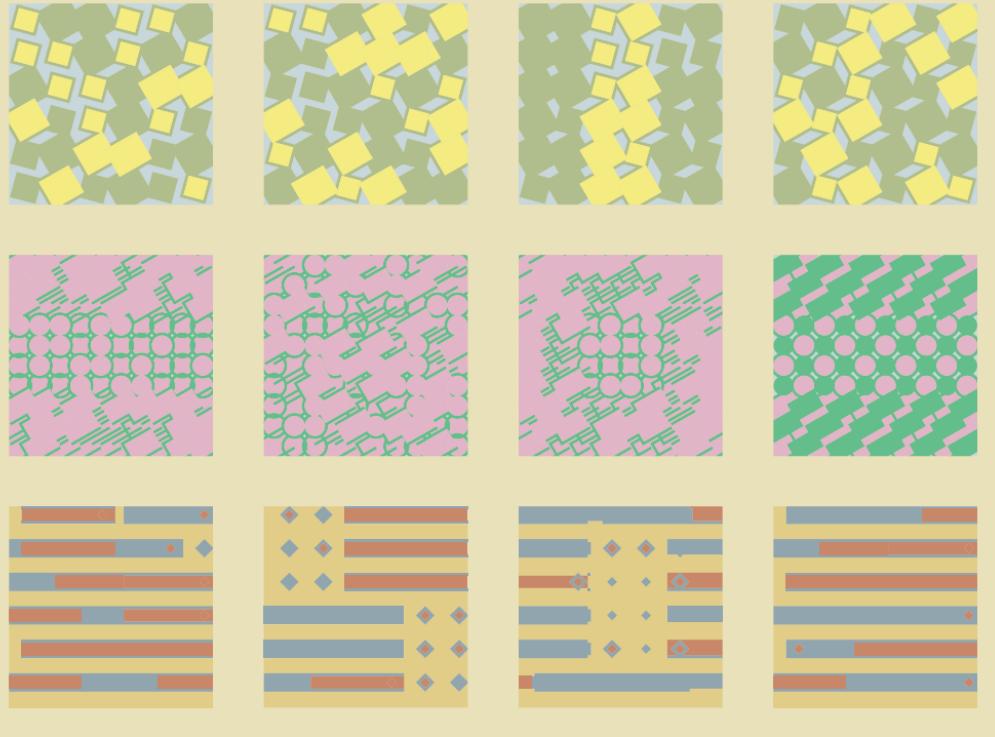


9 g1f - rot

#### Used in script

- 1: list shape rotation anglescale

parameters



## 10 space

For the third version of the shape object, we differentiate the mass type wall into seven space types: ring, bracket, angle, parallel, single, corner, and open. We use additional parameters for the four sides of the rectangle and set their value to zero to keep the wall, and to the wall thickness to remove the wall for an opening.

**Shape geometry**  
Abc 1: ● shape type ●  
**Shape modification**  
☒ s: expand circle

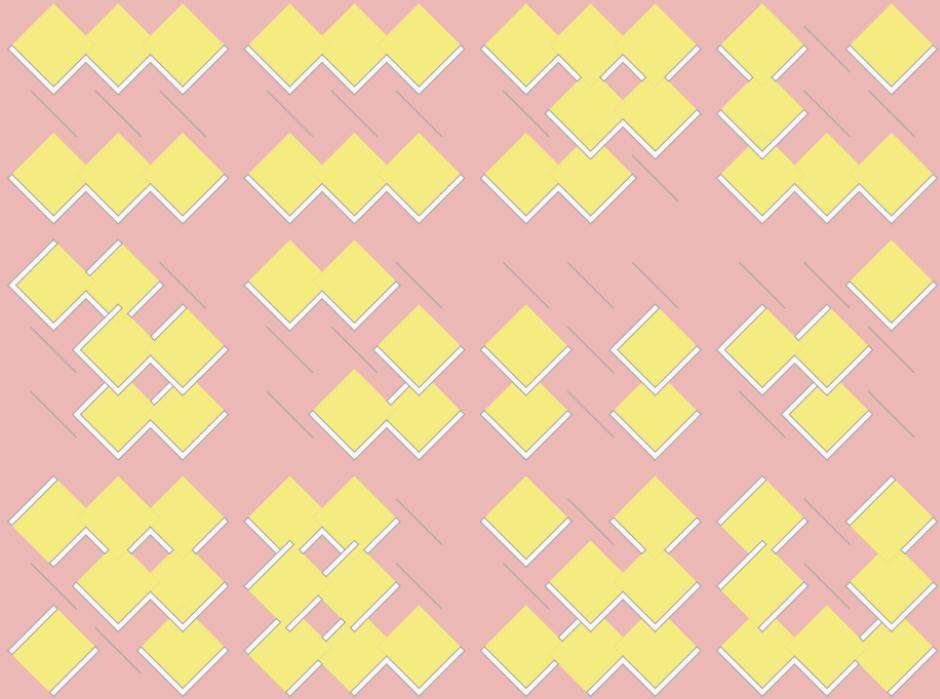


We group the parameters according to kind, that is the role they play for the description, generation, and display of the space.

☒ boolean  
☒ length  
☒ angle  
☒ pen  
☒ integer  
☒ surface  
☒ percent



## parameters



# 11 combine

For this version of the grid, we add a possibility to use a combination of two shape types, two mass types, and two space in the same grid. For the distribution pattern, we use again the two choice and the random number functions.

## Shape general

- Abc 1: • shape type •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1
- Abc s: • shape type •
- Abc 1: • shape type 1 •
- Abc 1: • shape type 2 •
- Abc 1: • shape combination 1 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1
- Abc s: • circle sizing type •
- 1: circle resolution
- 1: circle resolution 1
- 1: circle resolution 2

## Shape modification

- s: expand circle

## Used in scripts

- Abc 1: list shape types
- 1: list shape resolution

We group the parameters according to kind, that is the role they play for the description, generation, and display of the combination.

## Shape general

- Abc 1: • mass type •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1
- Abc s: • mass type •
- Abc 1: • mass type 1 •
- Abc 1: • mass type 2 •
- Abc 1: • mass combination 1 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1
- Abc s: • circle sizing type •
- 1: circle resolution
- 1: circle resolution 1
- 1: circle resolution 2

## Used in scripts

- Abc 1: list mass types



11 g1g - com

## Shape general

- Abc 1: • space type •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options • v
- 1: 4 percent of type 1
- Abc s: • space type •
- Abc 1: • space type 1 •
- Abc 1: • space type 2 •
- Abc 1: • space combination 1 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1
- Abc 1: • space combination 2 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1
- Abc 1: • space combination 2 •
- Abc 1: 1 • divide options •
- 1: divide number of col/row
- Abc 1: 2 • alternate options •
- Abc 1: 3 • random options •
- 1: 4 percent of type 1

## Used in scripts

- Abc 1: list space types



boolean



text



material



length



angle



pen

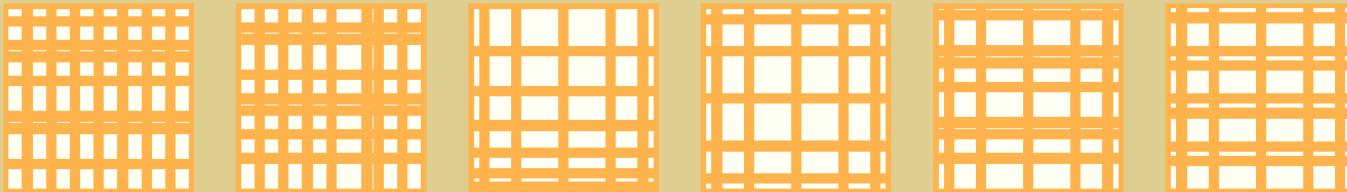
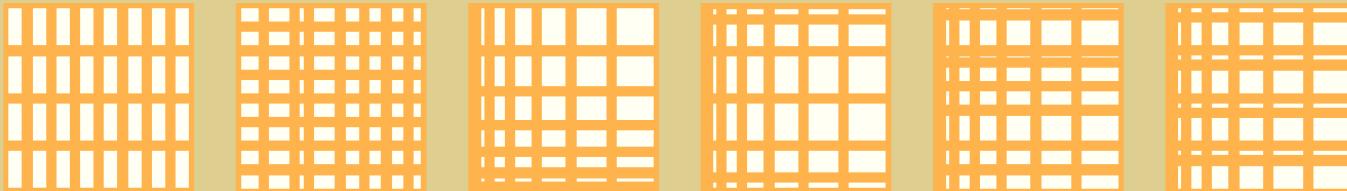
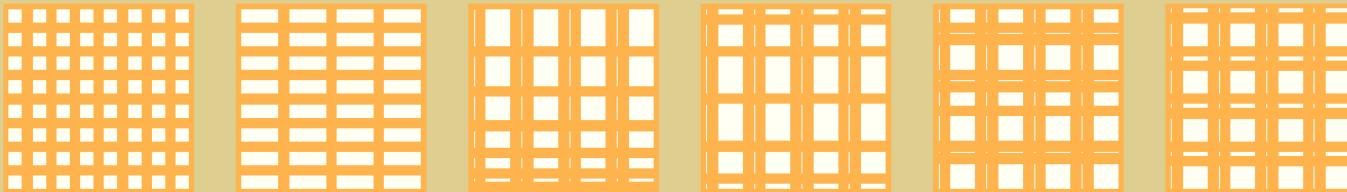


integer



percent

parameters



12 g1h - pos

#### Grid 1 geometry

- Abc 1: • horizontal line position type •  
☒ 1: horizontal line position 1  
☒ 1: horizontal line position 2  
☒ 1: horizontal line variation min  
☒ 1: horizontal line variation max
- Abc 1: • vertical line position type •  
☒ 1: vertical line position 1  
☒ 1: vertical line position 2  
☒ 1: vertical line variation min  
☒ 1: vertical line variation max

#### Used in scripts

- ☒ 1: list division line shift values x
- ☒ 1: list division line shift values y

12 position

In this version of the grid, we add a possibility to control the position of the division lines. I provide another function for eight distribution patterns which can be applied to the horizontal and vertical division lines. For both directions there are two parameters with fixed values for grid interval changes and two values for line position variations. We also have to modify the division line coordinates.

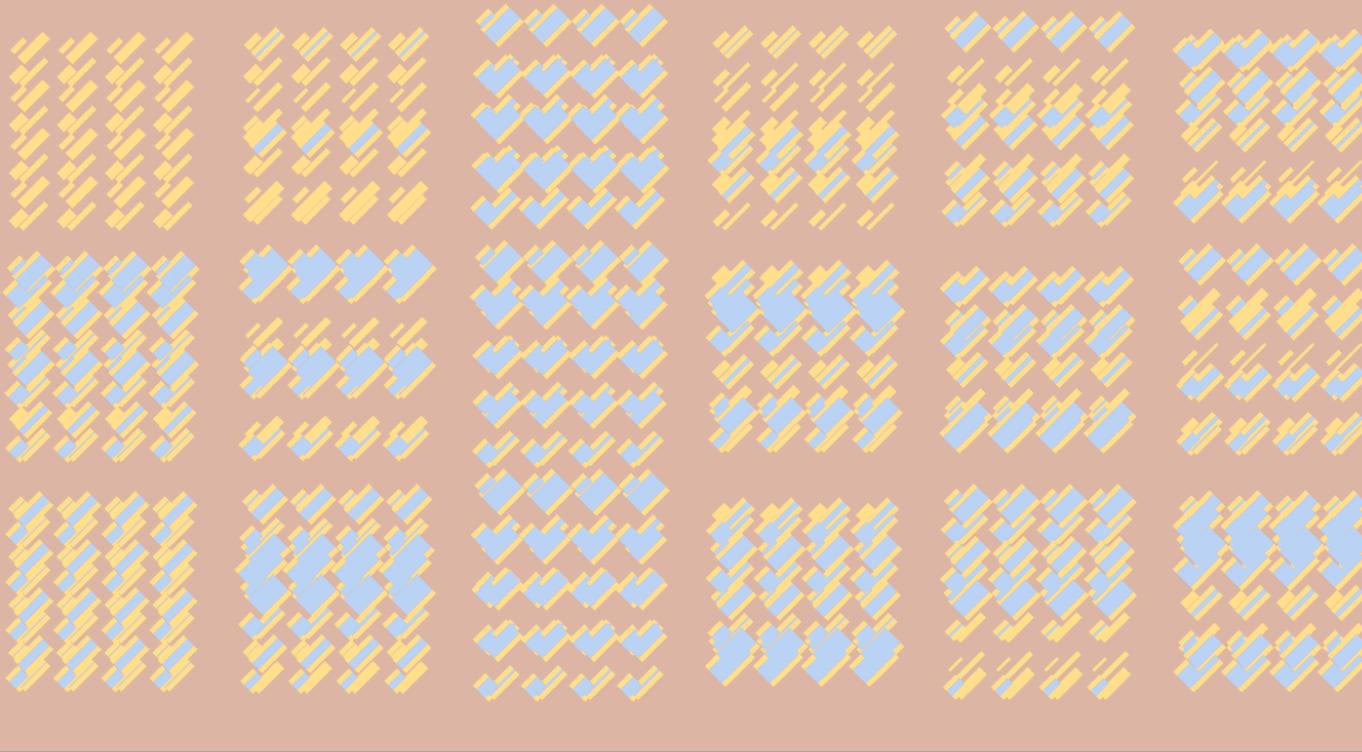
We group the parameters according to kind, that is the role they play for the description, generation, and display of the position.

boolean  
 length  
 angle  
 pen  
 text  
 integer  
 material  
 percent

parameters



13 g1i - gap



#### Grid 1 geometry

- Abc 1: • horizontal gap type •  
      1: horizontal gap width 1  
      1: horizontal gap width 2  
      1: horizontal gap variation min  
      1: horizontal gap variation max
- 1: no gap first & last horizontal line
- Abc 1: • vertical gap type •  
      1: vertical gap width 1  
      1: vertical gap width 2  
      1: vertical gap variation min  
      1: vertical gap variation max
- 1: no gap first & last vertical line

#### Used in scripts

- 1: list hor gap width
- 1: list ver gap width

In this version of the grid, we add a possibility to make and control gaps between the grid rectangles. I provide another function for eight distribution patterns which can be applied to the horizontal and vertical gaps. For both directions there are two parameters with fixed values for grid interval changes and two values for line position variations and an option to omit first and last gaps. We also have to modify the rectangle coordinates.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the gap.

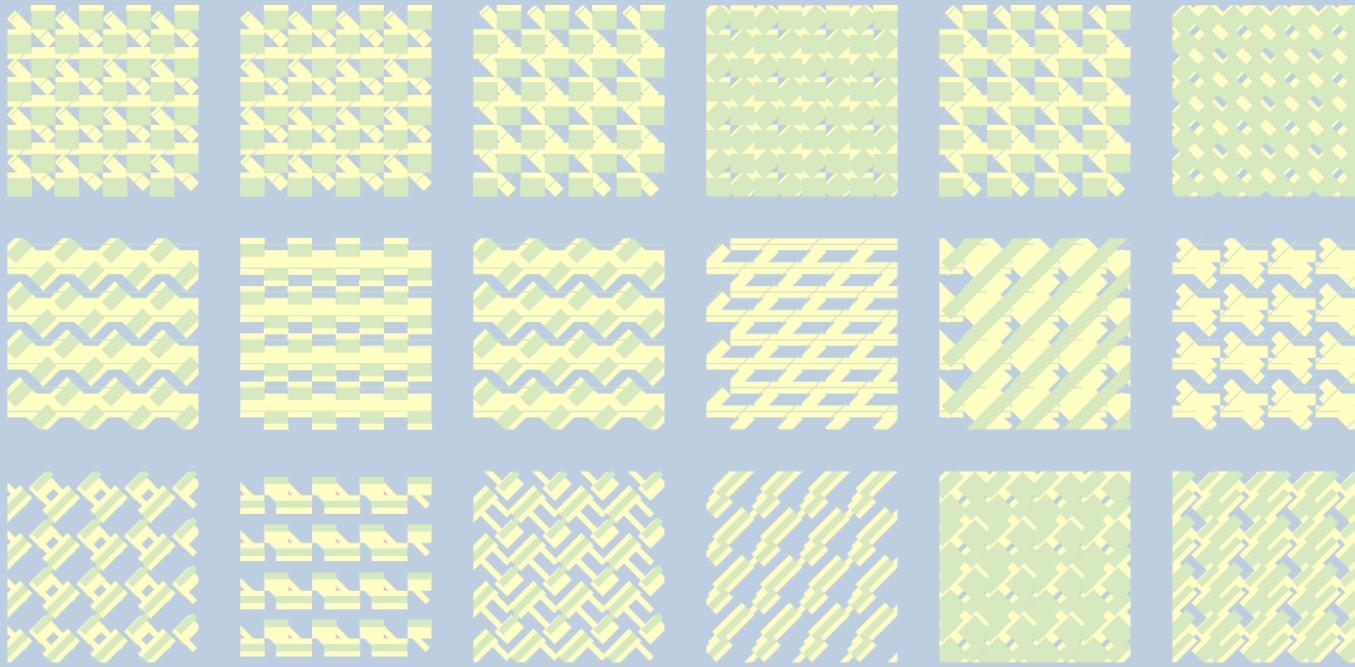
<input checked="" type="checkbox"/>	boolean	Abc	text	<input checked="" type="checkbox"/>	material
<input checked="" type="checkbox"/>	length	angle	<input checked="" type="checkbox"/>	surface	
<input checked="" type="checkbox"/>	pen	integer	<input checked="" type="checkbox"/>		percent

13 gap

parameters



14 g1j - sym



**Grid 1 geometry**  
Abc 1: • Symmetry type •  
**Used in scripts**  
☒ 1: list returned symmetry values  
☒ 1: list scales – mul  
☒ 1: list rotations – rot  
☒ 1: list a & b values

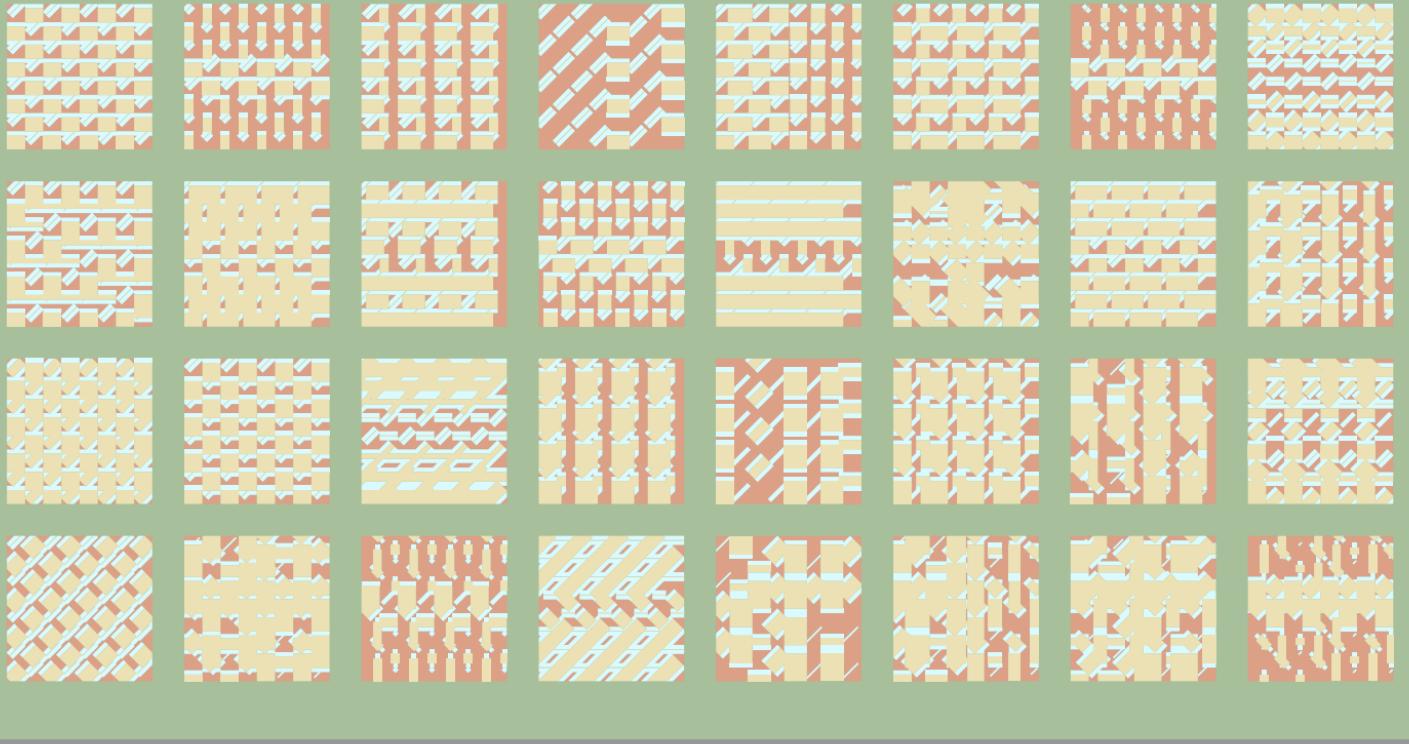
14 symmetry

For this version of the grid, we add a possibility to create patterns with different symmetries. We distinguish thirteen types with different combinations of the symmetry operations reflection, glide-reflection, halfturn, and four fold rotation. Plus translation and three random distributions.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the symmetry.

boolean    Abc text     material  
 length     angle     surface  
 pen     integer     percent

parameters



15 expand

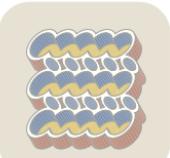
In this version of the grid, we control the distribution of the expansion of the rectangles in all four direction, the bar, and the lines. We use the same distribution patterns as before, by calling the respective functions.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the expansion.

boolean  
 length  
 angle  
 integer  
 material  
 pen  
 percent

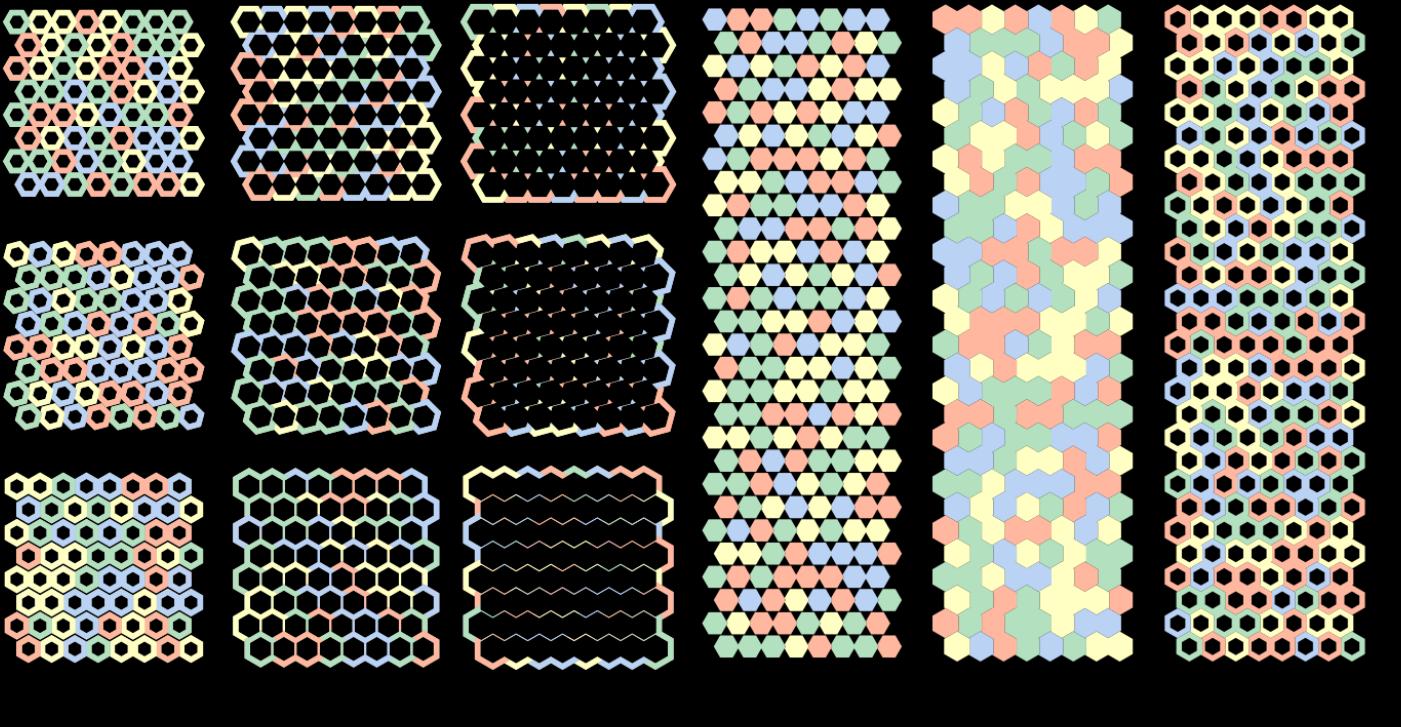
#### Shape expansion ( left, as example )

- Abc S: • shape expand values are •
  - s: expand circle
  - Abc 1: • shape expand left type •
  - Abc 1: 1 • divide options •
  - 1: divide number of col/row
  - Abc 1: 2 • alternate options •
  - Abc 1: 3 • random options •
  - 1: random step intervals
  - 1: 4 percent of value 1
  - Abc 1: 5 • stepped options •
  - S: expand shape left
  - 1: expand left value 1
  - 1: expand left value 2
  - Abc 1: • shape expand left variation 1 •
  - Abc 1: 1 • divide options •
  - 1: divide number of col/row
  - Abc 1: 2 • alternate options •
  - Abc 1: 3 • random options •
  - 1: random step intervals
  - 1: 4 percent of value 1
  - Abc 1: 5 • stepped options •
  - 1: expand left variation 2 min
  - 1: expand left variation 2 max
  - ..... ( same with the other directions)
- Used in scripts**
- 1: list rectangle expansion left
  - 1: list rectangle expansion down
  - 1: list rectangle expansion right
  - 1: list rectangle expansion up



15 g1k - exp

parameters



16 move

In this version of the grid, we control the distribution of the movement of all shape types. We use the same distribution patterns as before, by calling the respective functions.

We group the parameters according to kind, that is the role they play for the description, generation, and display of the movement.

boolean  
 length  
 angle  
 text  
 integer  
 material  
 pen  
 percent

#### Shape movement

Abc S: • shape move values are •  
 Abc 1: • shape move horizontal type •

Abc 1: 1 • divide options •  
 Abc 1: 2 • alternate options •

Abc 1: 3 • random options •  
 Abc 1: 4 random step intervals

Abc 1: 5 • stepped options •  
 Abc S: move shape horizontal

Abc 1: 1 move horizontal value 1  
 Abc 1: 2 move horizontal value 2

Abc 1: • shape move horizontal variation 1 •  
 Abc 1: 1 • divide options •

Abc 1: 2 • alternate options •  
 Abc 1: 3 • random options •

Abc 1: 4 random step intervals  
 Abc 1: 5 • stepped options •

Abc 1: 1 move horizontal variation 1 min  
 Abc 1: 2 move horizontal variation 1 max

Abc 1: • shape move horizontal variation 2 •  
 Abc 1: 1 • divide options •  
 Abc 1: 2 • alternate options •

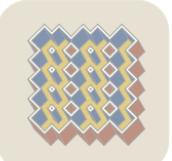
Abc 1: 3 • random options •  
 Abc 1: 4 percent of value 1  
 Abc 1: 5 • stepped options •

Abc 1: 1 move horizontal variation 2 min  
 Abc 1: 2 move horizontal variation 2 max

..... (same with the vertical)

#### Used in scripts

Abc 1: list shape movement horizontal  
 Abc 1: list shape movement vertical

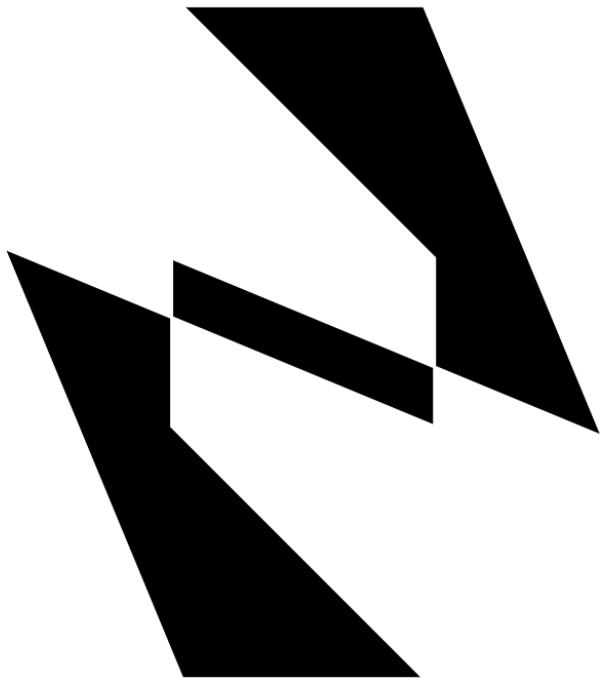


16 g11 - mov

parameters



Zhejiang University · CCEA · Department of Architecture  
Year 4 design studio Spring & Summer 2023



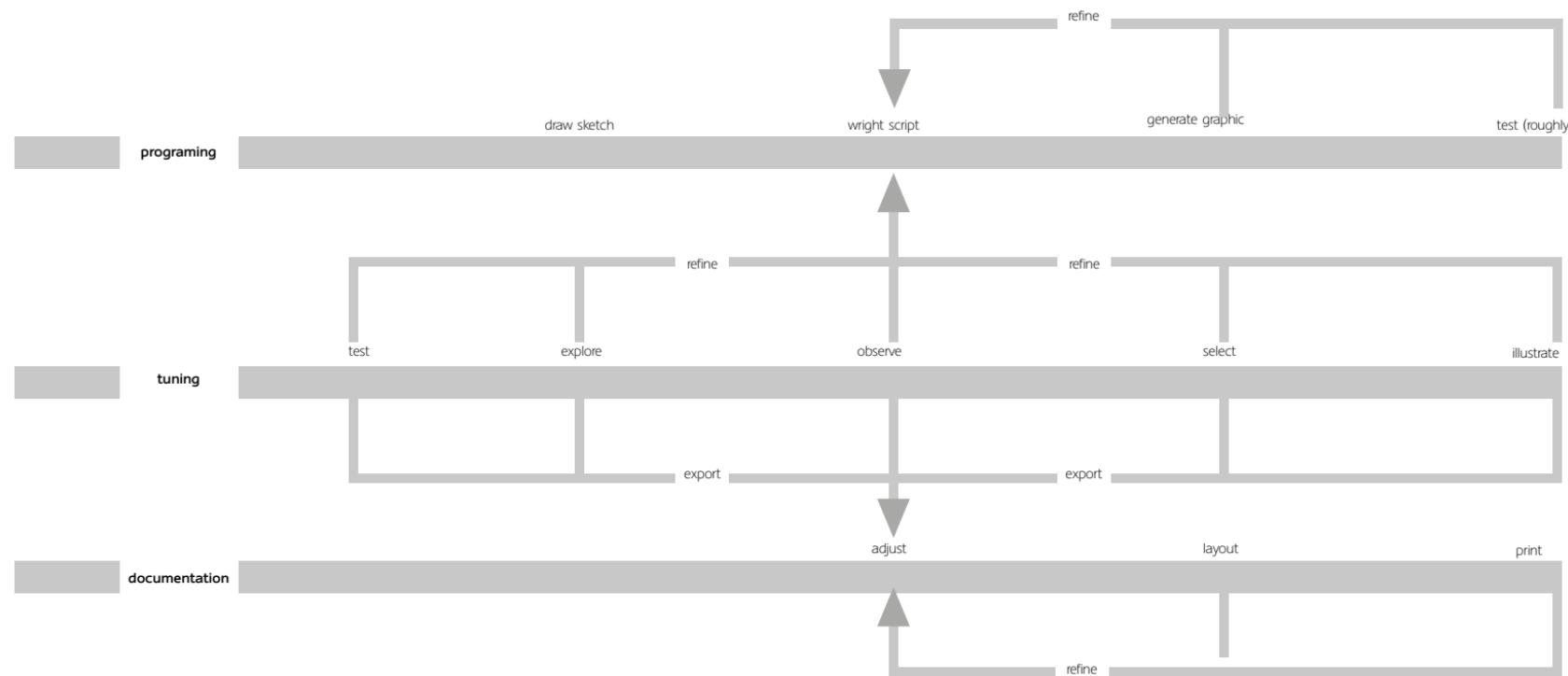
03  
Teng Fengshi

PROCESS

## PROCESS - Introduction

In the tutorials we worked together on the object and write the scripts, after which we quickly tested the object and the students should conduct further tests as homework. The main part of the homework is to explore differentiation and variation of the object, by changing parameter values, to find interesting and beautiful patterns and spaces. We eventually documented it. Throughout the whole process, constant feedback will be needed for refinement.

# overview

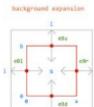


## sketch & diagram



2 s1a - cir

The first iteration of the shape is a cylinder – a circle in plan – with a floor and a roof added and the background inserted. We also define a void which turns the circle into a ring. We differentiate the surfaces into top, outside, inside, and bottom for the cylinder. The size of the circle is determined by the reference rectangle and the background by expansions in the four directions. The circle is sized relative to the reference rectangle according to five principles and becomes an ellipse when scaled and the x- and y-dimensions are different. We also scale, move, and expand the circle.



process steps

## parameter list

Display	Variable	Type	Name	Value
<b>Shape visibility</b>				
•	showS_o	checkbox	s: show shape outline	On
•	showS_s	checkbox	s: show shape surface	On
•	showF_o	checkbox	s: show floor outline	Off
•	showF_s	checkbox	s: show floor surface	On
•	showR_o	checkbox	s: show roof outline	Off
•	showR_s	checkbox	s: show roof surface	Off
•	showRef	checkbox	s: show reference frame	On
•	showShs	checkbox	s: show reference hotspots	Off
•	showSchs	checkbox	s: show corner hotspots	Off
•	showDcon	checkbox	s: show only contour edges	On
•	noneSurf	checkbox	s: no surface is	> 1 white
•	B cutSm	checkbox	s: cut model to	> 0 none
<b>Shape geometry</b>				
•	B massTyp	checkbox	s: mass type is	> 3 wall
•	sizTyp	checkbox	s: circle sizing type	> Horizontal
•	resScr	checkbox	s: circle resolution	36
•	thisWal	checkbox	s: wall thickness	0.3000
•	adjSel	checkbox	s: adjust ellipse wall thickness	Off
<b>Shape modification</b>				
•	heiSsid	checkbox	s: height side	0.8000
•	heiSflo	checkbox	s: height floor	0.0000
•	heiSroo	checkbox	s: height roof	0.2000
•	scsSha	checkbox	s: scale shape	% 100.00
•	rotSha	checkbox	s: rotation shape	*
•	rotSmid	checkbox	s: rotation ell nodes	*
•	B movVal	checkbox	s: shape move values are	> 1 length
•	movS_h	checkbox	s: move shape horizontal	+/-%
•	movS_v	checkbox	s: move shape vertical	+/-%
•	B expVal	checkbox	s: shape expand values are	> 1 length
•	expS_l	checkbox	s: expand shape left	+/-%
•	expS_d	checkbox	s: expand shape down	+/-%
•	expS_r	checkbox	s: expand shape right	+/-%
•	expS_u	checkbox	s: expand shape up	+/-%

Display	Variable	Type	Name	Value
<b>Shape attributes</b>				
•	B useS_r	checkbox	s: use rgb colours for shape	Off
•	toppen	checkbox	s: use pens for top and bottom	Off
•	penS_o	checkbox	s: pen shape outline	88
•	matS_t	checkbox	s: material shape top	■■■ 23
•	forS_t	checkbox	s: pen shape top foreground	■■■ 114
•	bacS_t	checkbox	s: pen shape top background	■■■ 84
•	persS_t	checkbox	s: pen foreground percentage	% 50.00
•	rgbS_t	checkbox	s: rgb val shape top	:: [1][3]
•	matS_e	checkbox	s: material shape exterior	■■■ 155
•	rgbS_e	checkbox	s: rgb val shape exterior	:: [1][3]
•	matS_i	checkbox	s: material shape interior	■■■ 46
•	rgbS_i	checkbox	s: rgb val shape interior	:: [1][3]
•	matS_b	checkbox	s: material shape bottom	■■■ 162
•	forS_b	checkbox	s: pen shape bottom foreground	■■■ 250
•	bacS_b	checkbox	s: pen shape bottom background	■■■ 87
•	persS_b	checkbox	s: pen foreground percentage	% 50.00
•	rgbS_b	checkbox	s: rgb val shape bottom	:: [1][3]
•	B mixTop	checkbox	s: mix rgb colours for top	Off
•	perStop	checkbox	s: top colour	mix value % 50.00
•	B useF_r	checkbox	s: use rgb colours for floor	Off
•	penF_o	checkbox	s: pen floor outline	228
•	matF_t	checkbox	s: material floor top	■■■ 126
•	rgbF_t	checkbox	s: rgb value floor top	:: [1][3]
•	matF_s	checkbox	s: material floor sides	■■■ 126
•	rgbF_s	checkbox	s: rgb value floor sides	:: [1][3]
•	B useE_r	checkbox	s: use rgb colours for roof	Off
•	penE_o	checkbox	s: pen roof outline	228
•	matE_t	checkbox	s: material roof top	■■■ 126
•	rgbE_t	checkbox	s: rgb value roof top	:: [1][3]
•	matE_s	checkbox	s: material roof sides	■■■ 126
•	rgbE_s	checkbox	s: rgb value roof sides	:: [1][3]
•	extS_t	checkbox	s: roof side = shape exterior	Off
•	penRef	checkbox	s: pen reference frame	104
•	penShot	checkbox	s: pen reference hotspots	104
•	B attSec	checkbox	s: for section pen & sur use	> 2 shape no outline
•	penSec	checkbox	s: pen section outline	96
•	matSec	checkbox	s: material section surface	■ 34
<b>Base geometry</b>				
•	extB_l	checkbox	b: extend left	++ 1.4000
•	extB_d	checkbox	b: extend down	++ 0.9000
•	extB_r	checkbox	b: extend right	++ 1.0000
•	extB_u	checkbox	b: extend up	++ 1.5000
<b>2d view</b>				
•	rotInon	checkbox	v: rotate planometric axonometry	Off
•	addPla	checkbox	v: add plan to view	Off
•	shifHor	checkbox	v: shift plan view horizontal	++ 0.0000
•	shifVer	checkbox	v: shift plan view vertical	++ -6.4000

## script

```

parameter-script
master-script

```

```

script
parameter-script
master-script

```

```

script
parameter-script
master-script

```

```

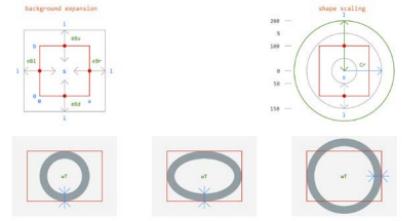
script
3d-script
2d-script

```

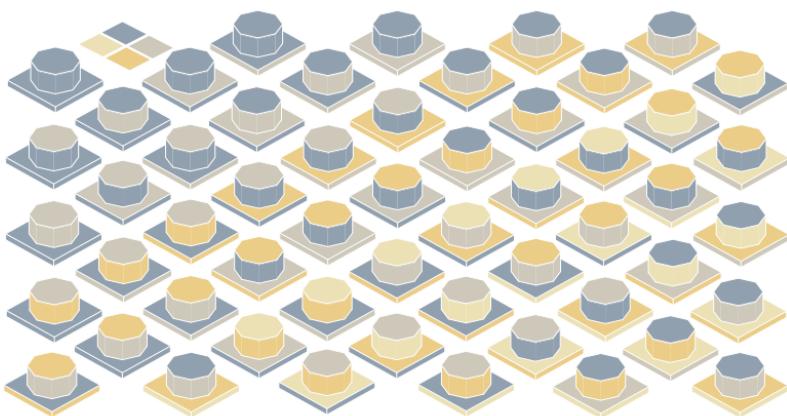
```

script
3d-script
2d-script

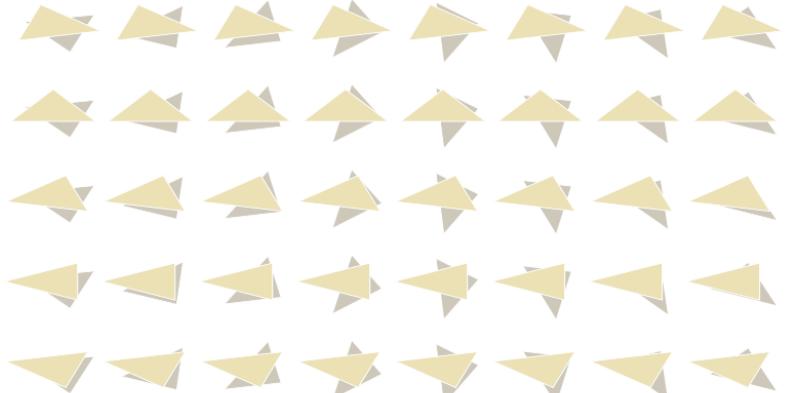
```



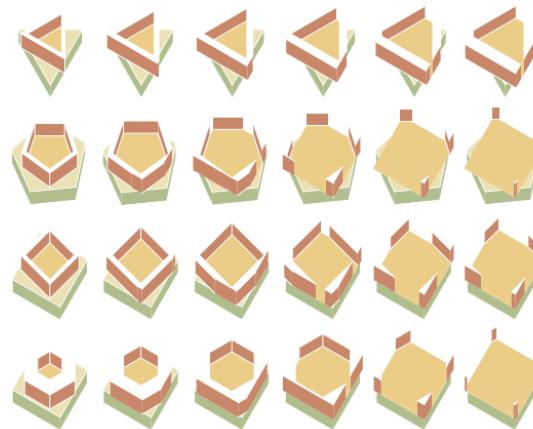
test



exploration



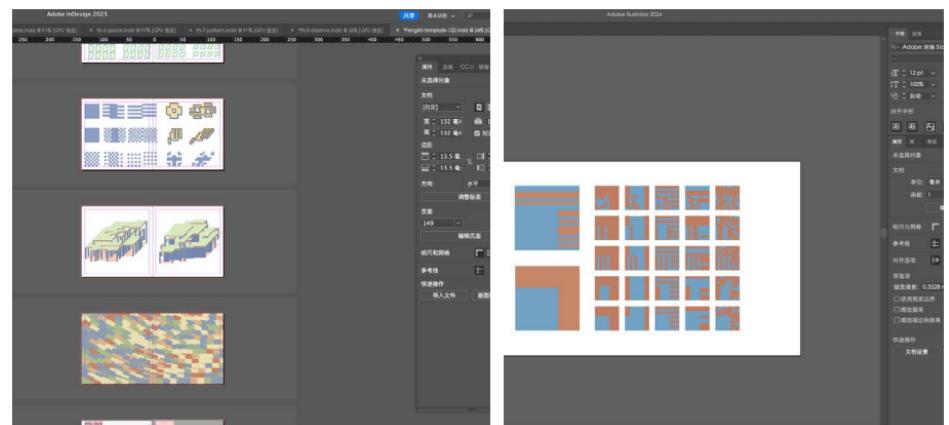
observation



study



documentation



	Boolean	Values			Types			
		pairs	single	list	general	options	functions	
Base	b: show outline b: show surface b: show hotspots b: show only contour edges		b: height base slab b: resolution ellipse b: lower base slab b: base pen/material b: radius fillet b: section pen/material b: rotation angle shape b: pen hotspots b: rotation angle elli nodes v: view angle	b: values surface rgb	b: no surface is b: shape type b: use rgb colours v: projection type v: model type			
Shape	s: show shape outline/surface s: show only contour edges s: show corner hotspots s: show floor outline/surface s: adjust ellipse wall thickness v: rotate monometric axonometry s: show roof outline/surface s: show pens for top and bottom s: use rgb colours for shape/floor/foc v: add plan to view s: show reference frame/hotspots s: roof side same as shape exterior s: mix rgb colors for shape top s: expand circle		s: circle resolution s: wall thickness s: shape/floor/roof height s: shape scale s: shape/ellipse nodes rotation s: shape/floor/roof pen/material s: section pen/material s: reference pen/material s: pen hotspots s: shape move h/v s: rectangle expand l/d/r/u v: shift plan view l/v	s: values shape/floor/roof surface rgb	s: no surface is s: shape type s: cut model to s: shape move values are s: mass type s: rectangle expand values are s: circle sizing type s: space type			
Grid	1: show reference frame/hotspots 1: use gb colours for rectangle 1: show regular grid s: use rgo colours for shape 1: show div lines horizontal/vertical 1: show cutting outline 1: show rectangle outlines/surfaces	s: pen shape outline 1/2 s: material shape top/ext/int/bot 1/2 s: material floor/roof top/sid 1/2 s: height value 1/2 s: height variation 1/2 min/max s: scale value 1/2 s: scale variation 1/2 min/max s: rotation value 1/2 s: rotation variation 1/2 min/max	1: h/v line position 1/2 1: h/v line variation min/max 1: h/v gap width 1/2 1: h/v gap variation min/max s: rectangle expand l/d/r/u value 1/2 s: rectangle expand l/d/r/u var 1/2 min/max s: shape move h/v value 1/2 s: shape move h/v var 1/2 min/max	1: minimal interval columns/rows 1: pen reference frame/hotspots 1: pen div lines h/v s: percentage of pen/mat values 1 s: percentage of height values 1 s: percentage of scale values 1 s: percentage of rotation values 1 s: percentage of sha/mas/spa types 1 s: percentage of expand values 1 s: percentage of move values 1 1: ellipse quarter resolution outline/cutout 1: cut out shift x/y	1: number of columns/rows 1: pen regular grid lines 1: rectangle pen/material s: pen floor/roof outline s: height variation intervals 1/2 s: scale variation intervals 1/2 s: rotation variation intervals 1/2 s: circle resolution 1/2 s: expand l/d/r/u var intervals 1/2 s: move h/v var intervals 1/2 1: cutout length x/y 1: pen cut outline	1: values rectangle surface rgb 1: cut model to 1: sub division method s: use four colours for 1: symmetry type s: shape type 1/2 s: mass type 1/2 s: rectangle expand type l/d/r/u s: shape scale type s: shape move type h/v	s: pen type shape outline s: shape rotation type s: colour type shape top/ext/int/bot s: sha/mas/spa combination type s: shape height type s: mass type 1/2 s: rectangle expand type l/d/r/u s: shape scale type s: shape move type h/v	s: two choice options s: stepping options s: variation type 1: h/v line position type 1: h/v line gap type

## parameter types

## parameter-script

```
! parameter-script
! zju2af 02 shape 1a cir
! 2023.12.06 vb
! sia

! 2d view <
! -
! > added plan <
! -
! > shape <
! -
! > cut shape model <
! -
values "cutMod",
"0 none",
"1 to frame",
"2 to base"
"attSsec",
"1 shape with lines",
"2 shape no outline",
"3 section with lines",
"4 section no outline"
! -
! > no surface types <
! -
values "noneSur",
"1 white",
"2 transparent",
"3 wireframe"
```

## master-script

```
! master-script
! zju2af 02 shape 1a cir
! 2023.12.06 vb
! sia

! > shape size and centre <
! -
! > expansion and movement <
if expVal = "2 percent" then
    expS_l = expS_l*a/100
    expS_d = expS_d*b/100
    expS_r = expS_r*a/100
    expS_u = expS_u*b/100
endif

if movVal = "2 percent" then
    movS_h = movS_h*a/100
    movS_v = movS_v*b/100
endif

! > width x and depth y <
lenX = abs((a + expS_l + expS_r)*scaSha/100)
lenY = abs((b + expS_d + expS_u)*scaSha/100)

if thiSwal < 0 then
    thiSwal = abs(thiSwal)
    lenX = lenX * 2*thiSwal
    lenY = lenY * 2*thiSwal
endif

! > insertion point <
insX = (expS_r - expS_l)/2 + movS_h
insY = (expS_u - expS_d)/2 + movS_v

! > circle radius and scale <
! -
! > default scale and radius <
scaX = 1
scaY = 1
radCir = abs(lenX/2)

! > radius and scale <
if sizStyp = "1 horizontal" then
    radCir = abs(lenY/2)
endif

if sizStyp = "2 vertical" then
endif
```

## 3d-script

```
! 3d-script
! zju2af 02 shape 1a cir
! 2023.12.06 vb
! sia

! > insert base <
! -
add (extB_r - extB_l)/2, (extB_u - extB_d)/2, 0
call "zju24c-01-bia-bac.gsm"
parameters all,
    a = a + extB_l + extB_r,
    b = b + extB_d + extB_u
del 1

! > construct reference frame <
! -
if showRef = 1 then
    model wire
        pen penRef
        add a/2, -b/2, 0
        block a, b, heiSsid
        del 1
    model solid
endif

! > construct shape <
! -
! > set attributes <
pen          penSs_o
resol        resScr
sect_attrs(2) penSec
building_material matSec

define material "matHid" 7, 1, 1, 1      ! > white
define material "matTra" 11, 1, 1, 1      ! > transparent
                                         0, 0, 0, 1, 0, 0, 0
if noneSur = "1 white"      then noSurMat = "matHid"
if noneSur = "2 transparent" then noSurMat = "matTra"
if noneSur = "3 wireframe"   then noSurMat = "matSec"

! > group definitions <
group "solShape"           ! > solid
    ! > status code <
    showOut = showSs_o
    gosub 71                      ! > status code
END
```

## 2d-script

```
! 2d-script
! zju2af 02 shape 1a cir
! 2023.12.06 vb
! sia

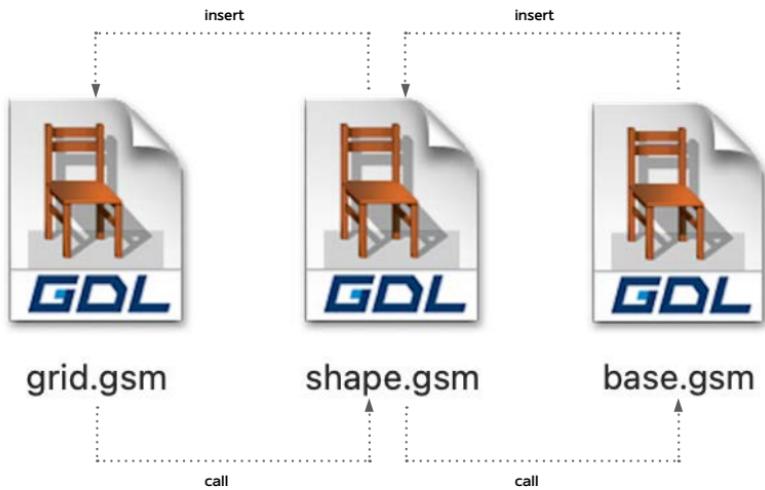
! > projection settings <
! -
! > project model on plan <
! -
! > view <
if proCode = 8 & rotVmon = 1 then rot2 vieVang - 240
    project2 proCode, vieVang, modCode
    if proCode = 8 & rotVmon = 1 then del 1
! > plan <
if addVpla = 1 then
    add2 shiVhor, shiVer
    rot2 vieVang - 270
    project2 3, vieVang, modCode
    del 2
endif

! > place hotspots <
! -
if proCode = 8 & rotVmon = 0 then rot2 240 - vieVang
! > view <
if showRhs = 1 then gosub 1
if showBhot = 1 then gosub 2
if showSchs = 1 then gosub 3

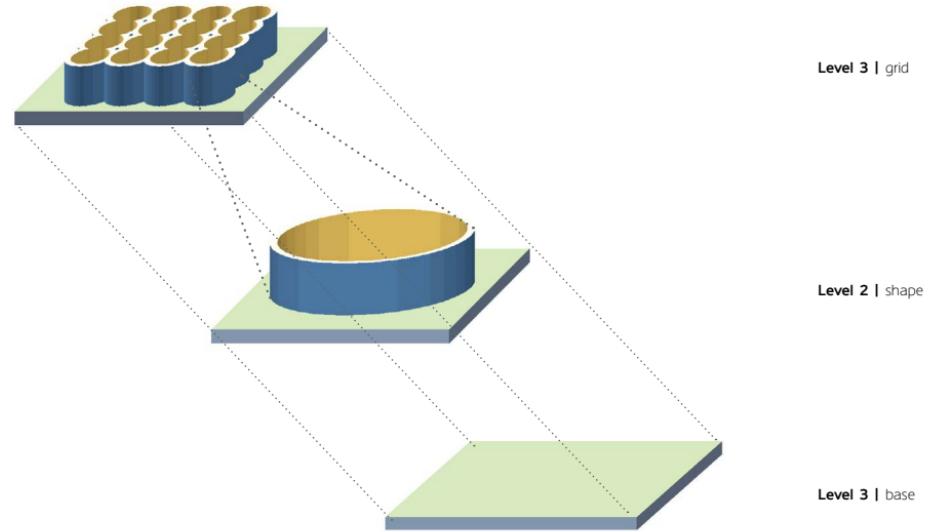
! > plan <
if addVpla = 1 then
    add2 shiVhor, shiVer
        if showRhs = 1 then gosub 1
        if showBhot = 1 then gosub 2
        if showSchs = 1 then gosub 3
    del 1
endif
if proCode = 8 & rotVmon = 0 then del 1

! > END <
```

script structures



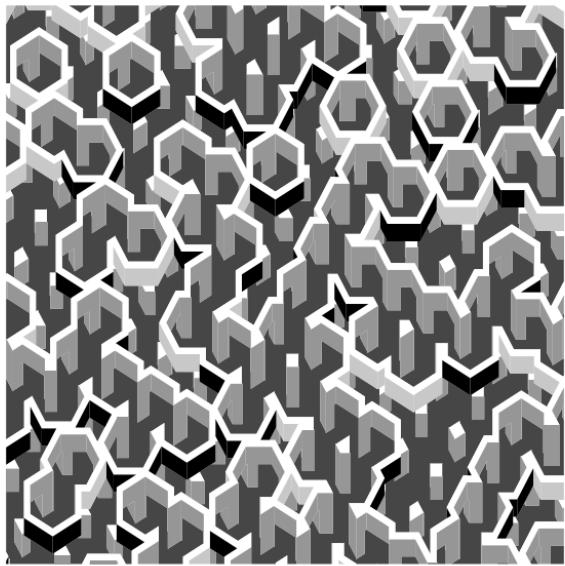
levels



Form and its structure are organized into levels and stages in our tutorials, focusing on grid, shape, and base. Each level has multiple stages refining the hierarchy. Each level has its own file. The higher level calls the lower by sending parameter values and matching elements. For example, a base includes reference rectangle and base model stages, while shape includes reference rectangle, shape location, shape model, and inserted base stages. The grid includes reference rectangle, division lines, rectangles, and inserted base and shape stages. Each stage builds upon the previous. Levels are linked by matching reference rectangles.



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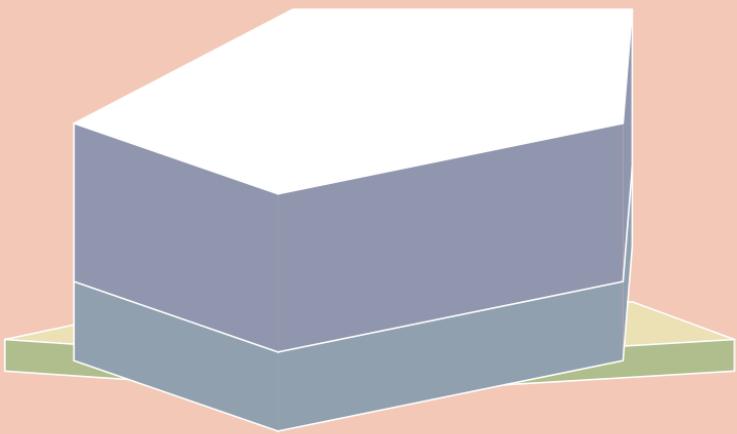
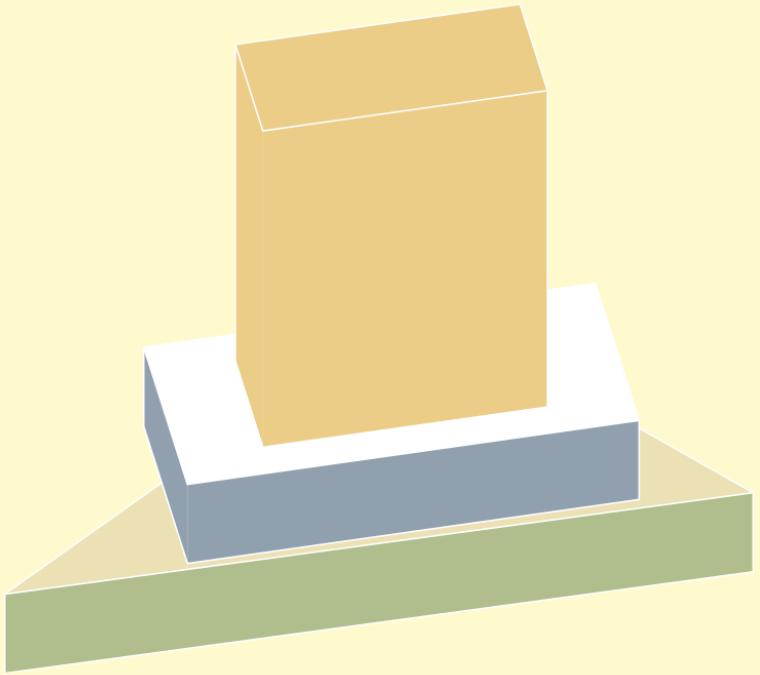
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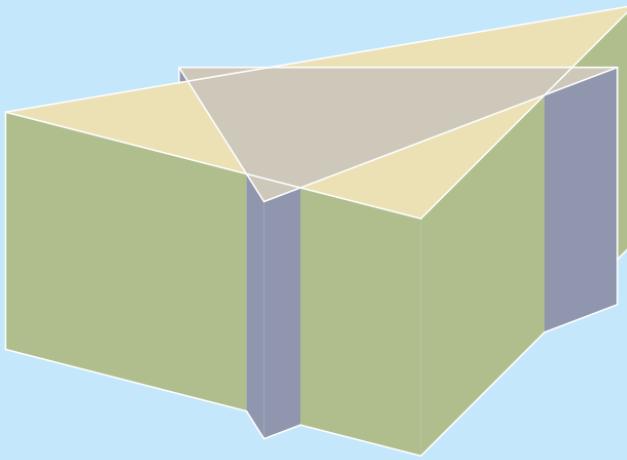
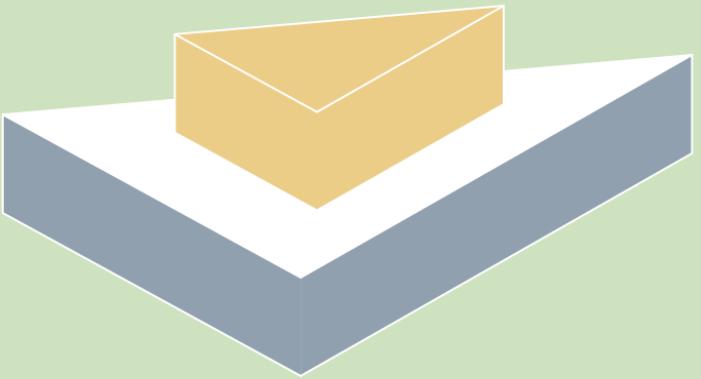
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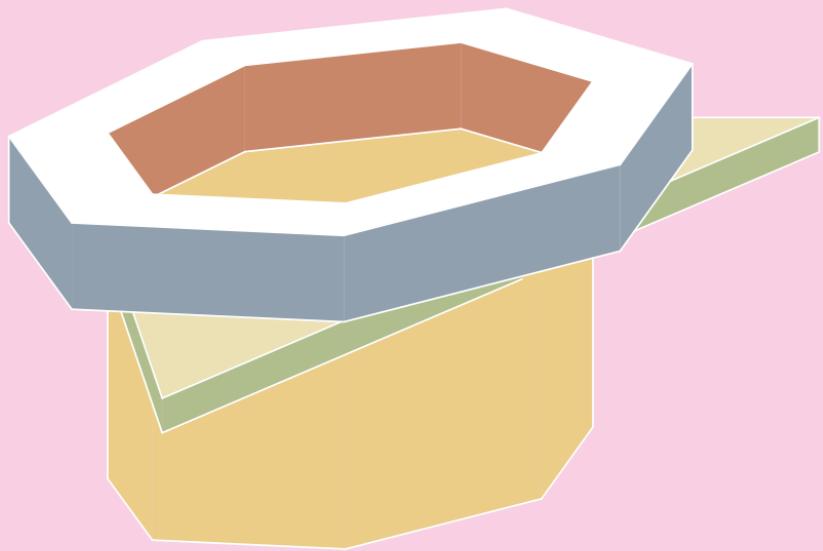
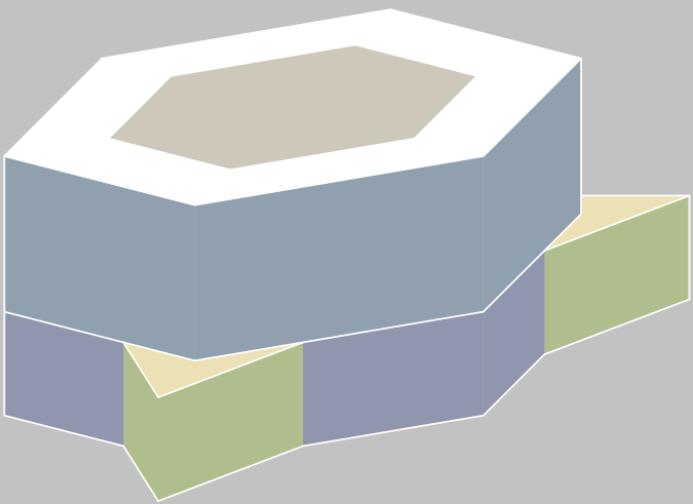
SPACE

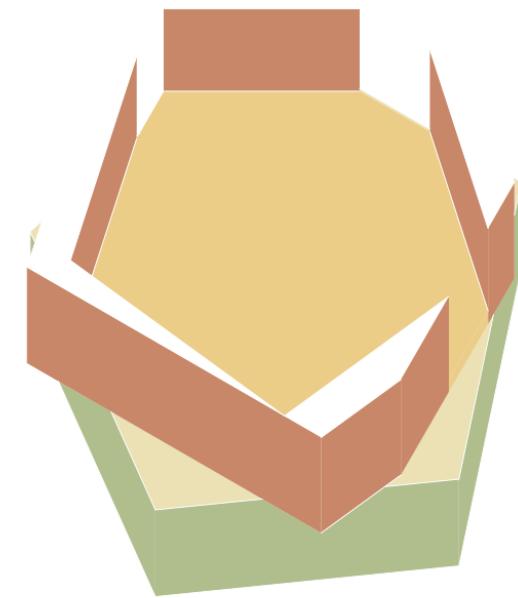
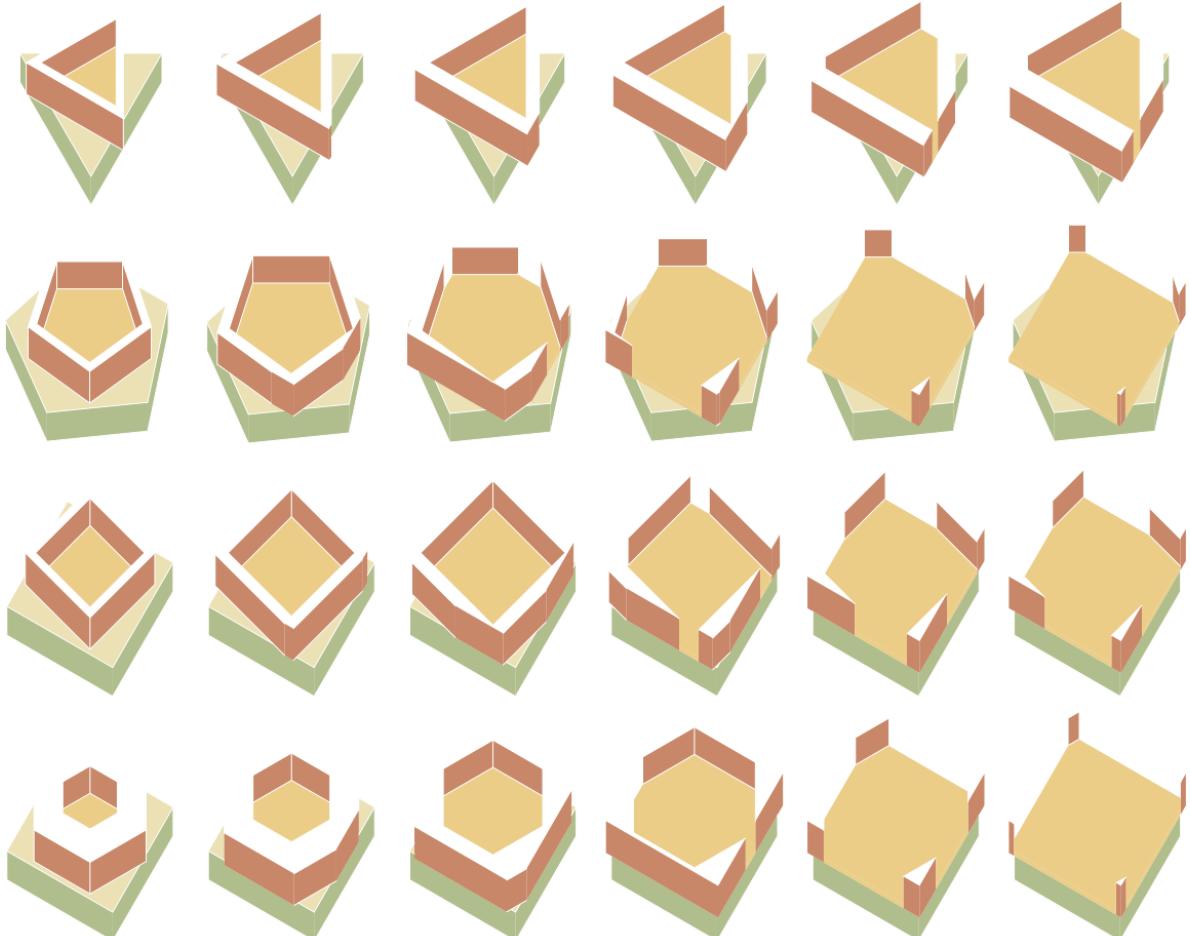
## SPACE - Introduction

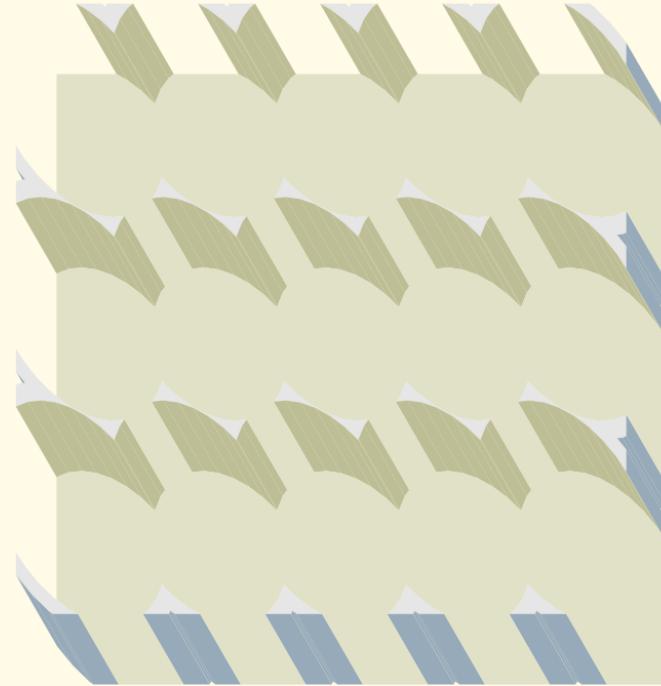
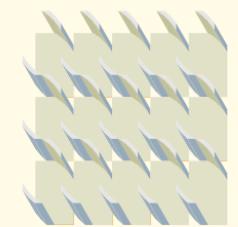
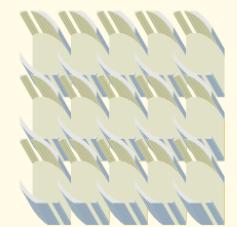
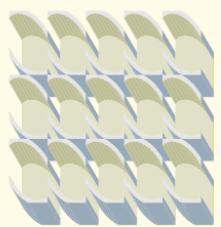
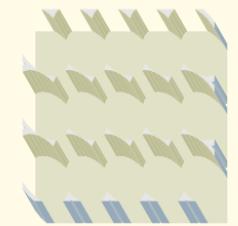
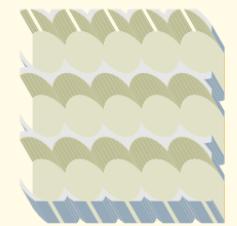
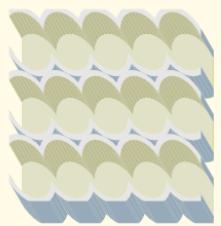
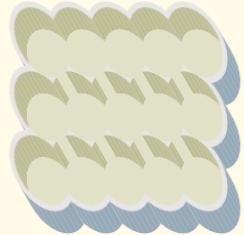
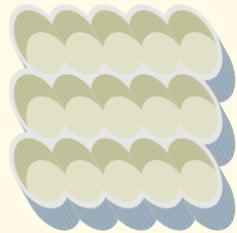
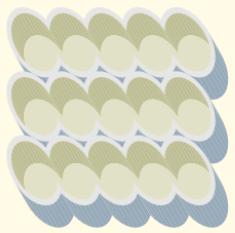
After finishing the test and exploration, the most interesting and charming part of the course is to see a collection of the outcome, among which the most interesting and beyond my widest dream is the spaces I created. This collection covers a wide range of forms, layers and complexity.

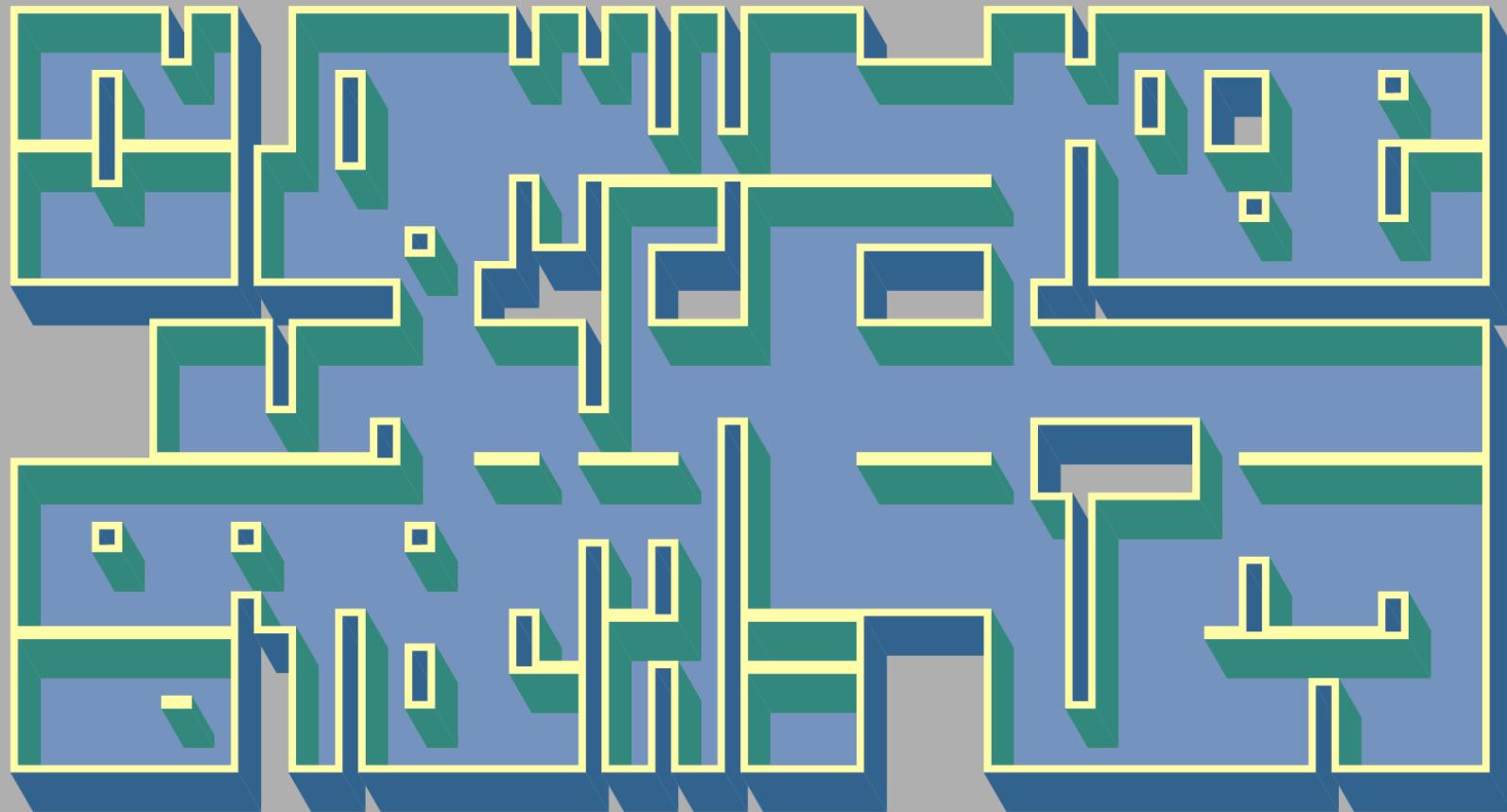


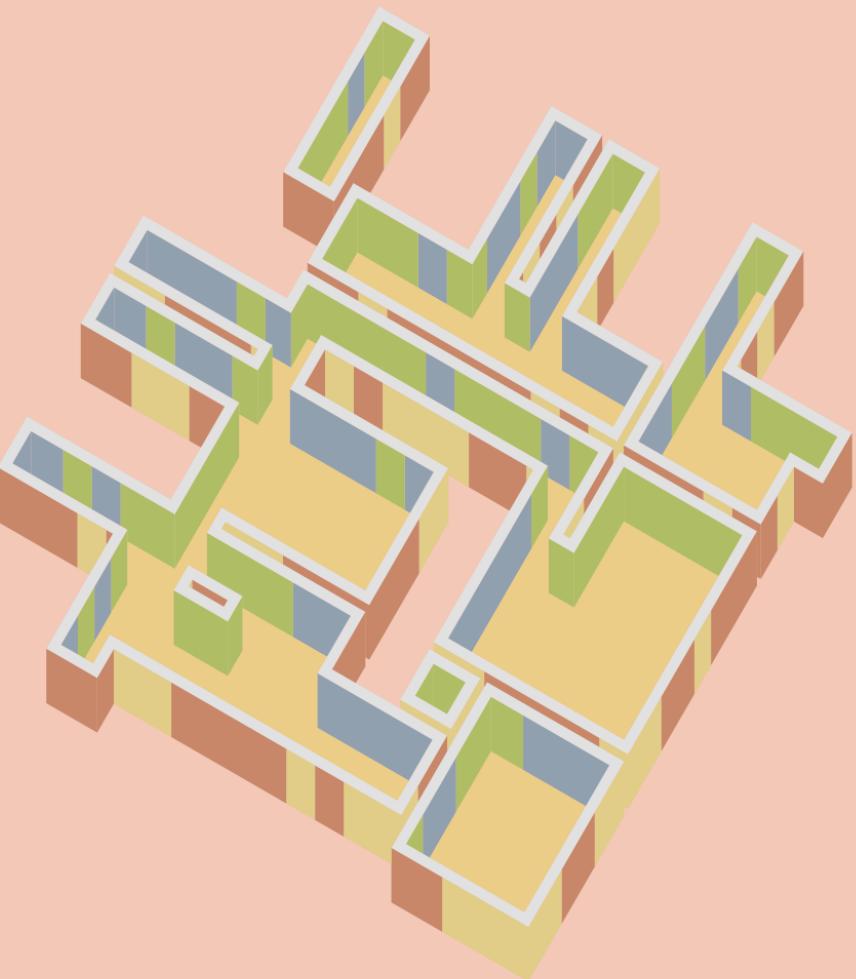
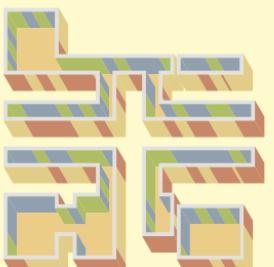
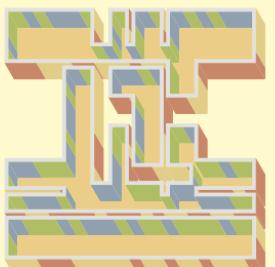
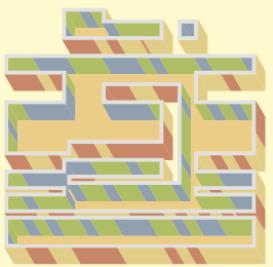
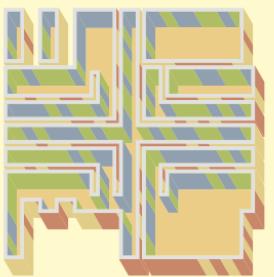
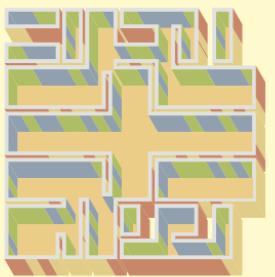
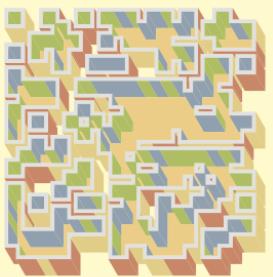
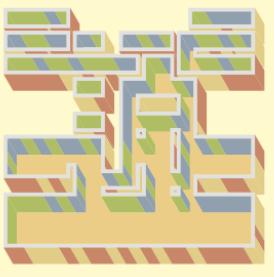
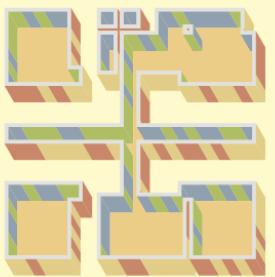
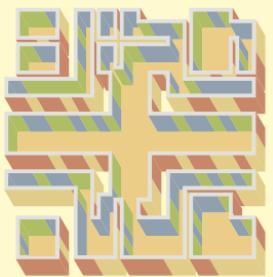


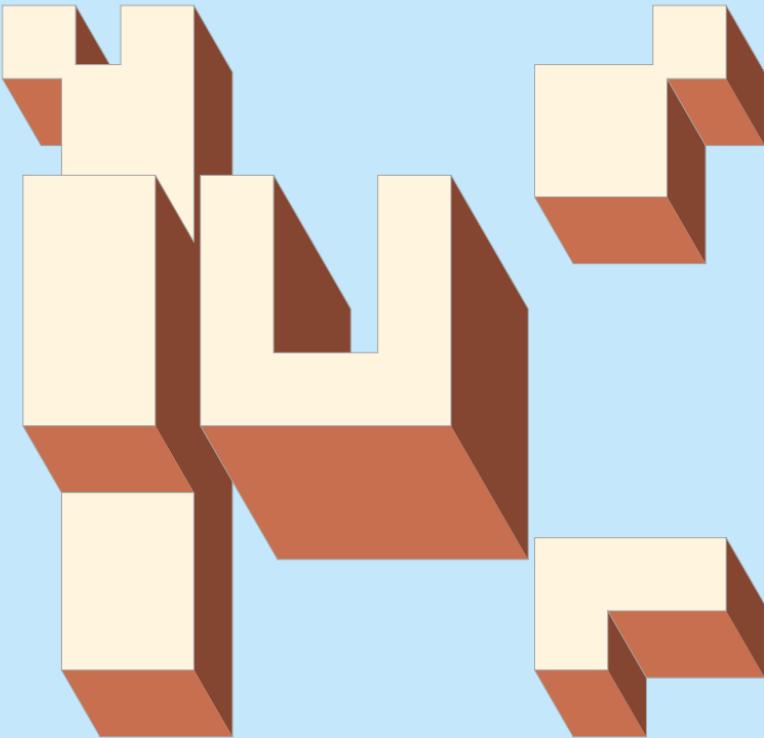
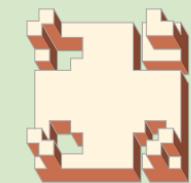
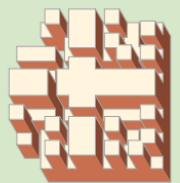
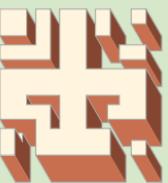
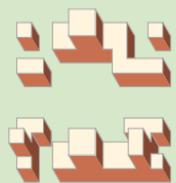
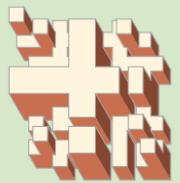
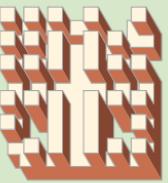
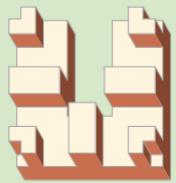
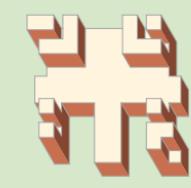
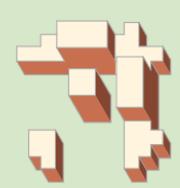
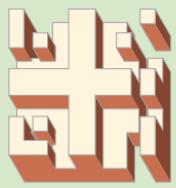
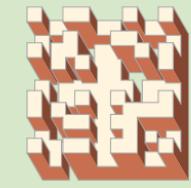
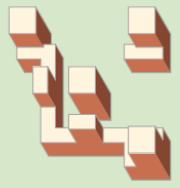
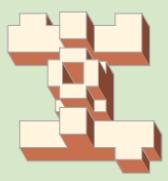
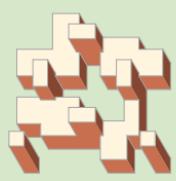


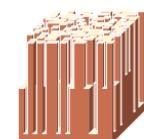
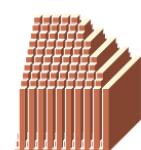
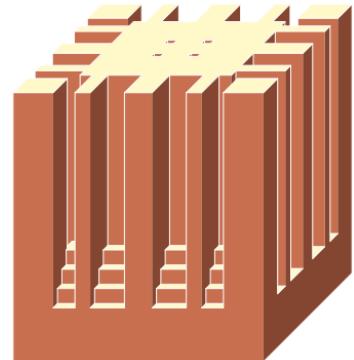
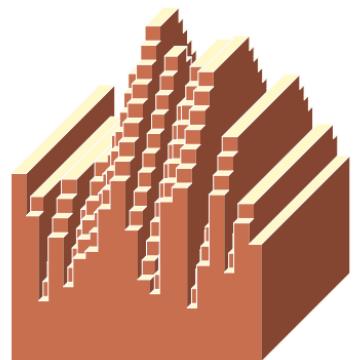
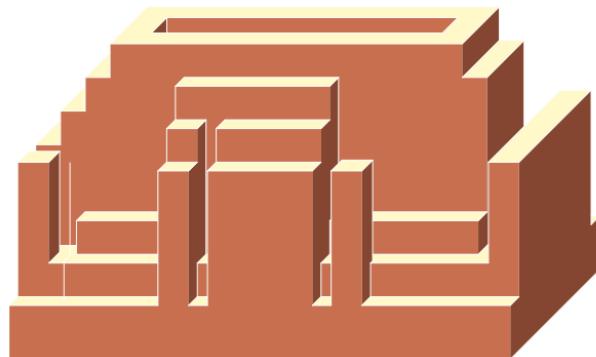


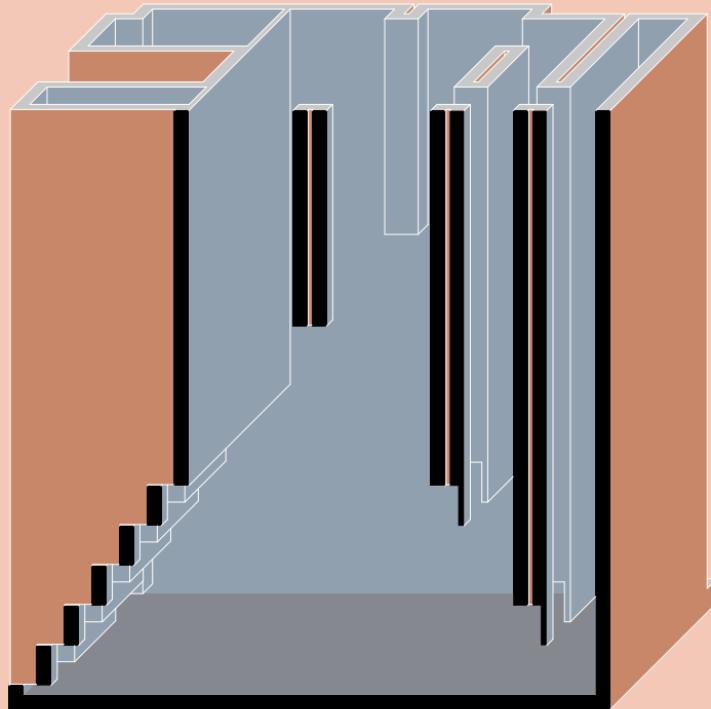
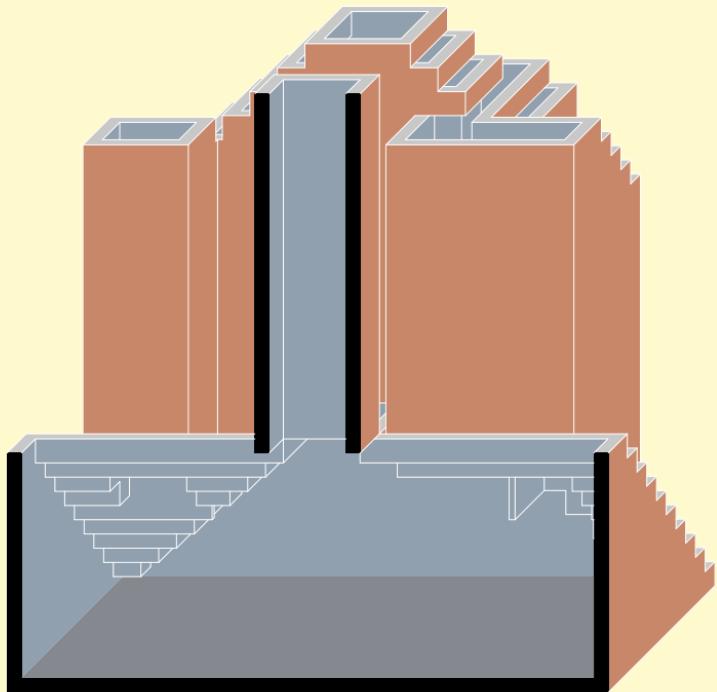


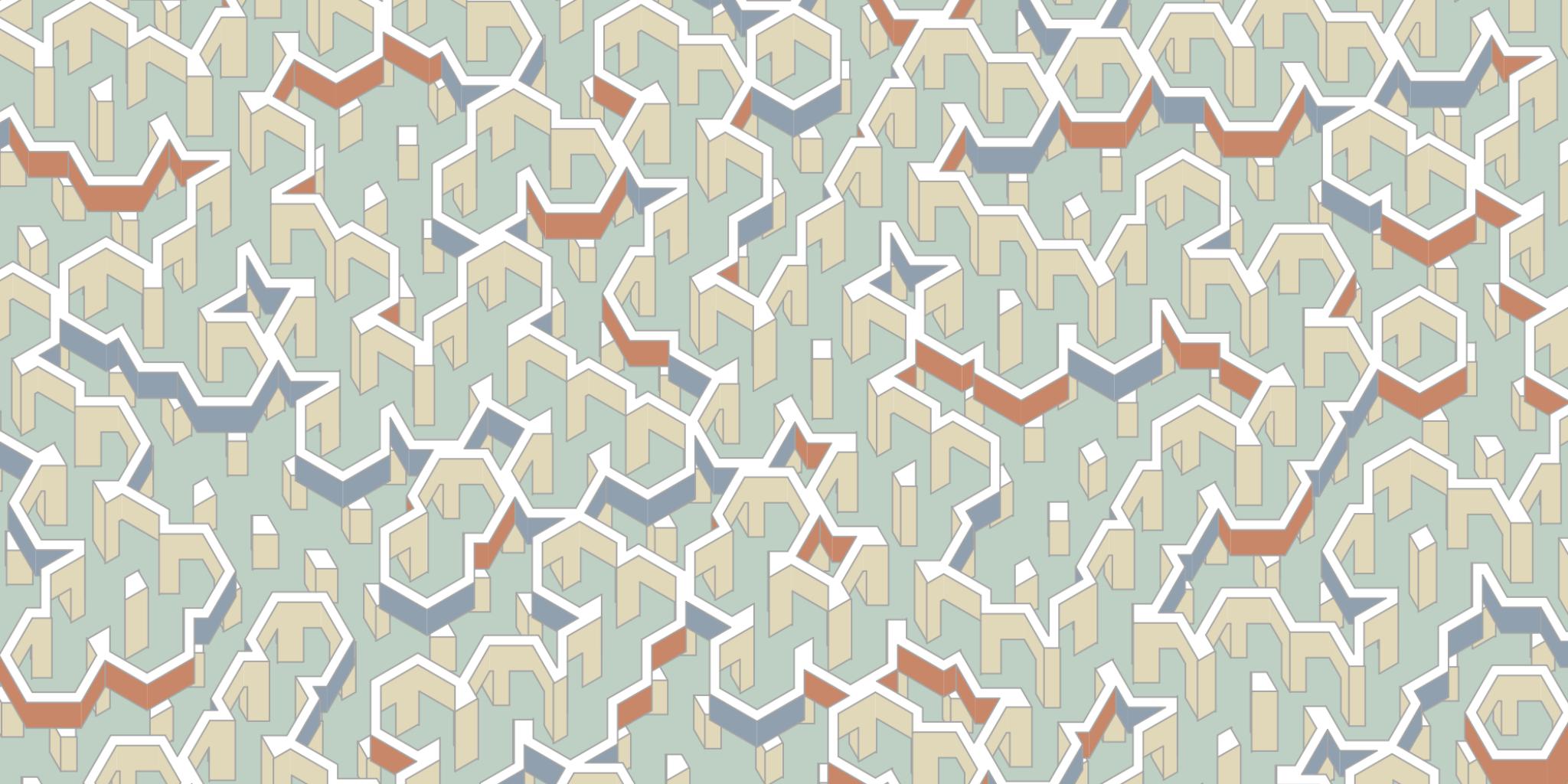




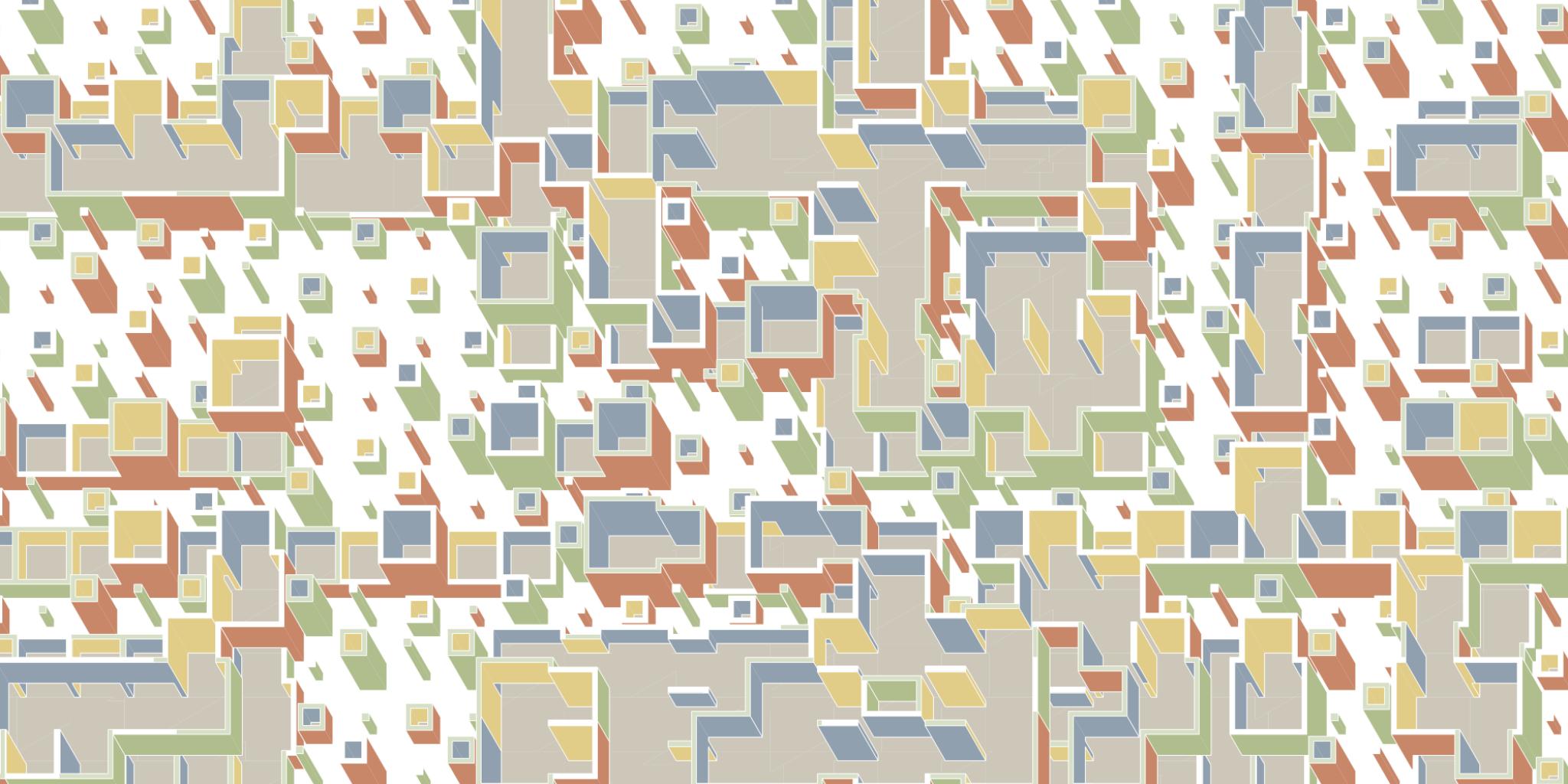


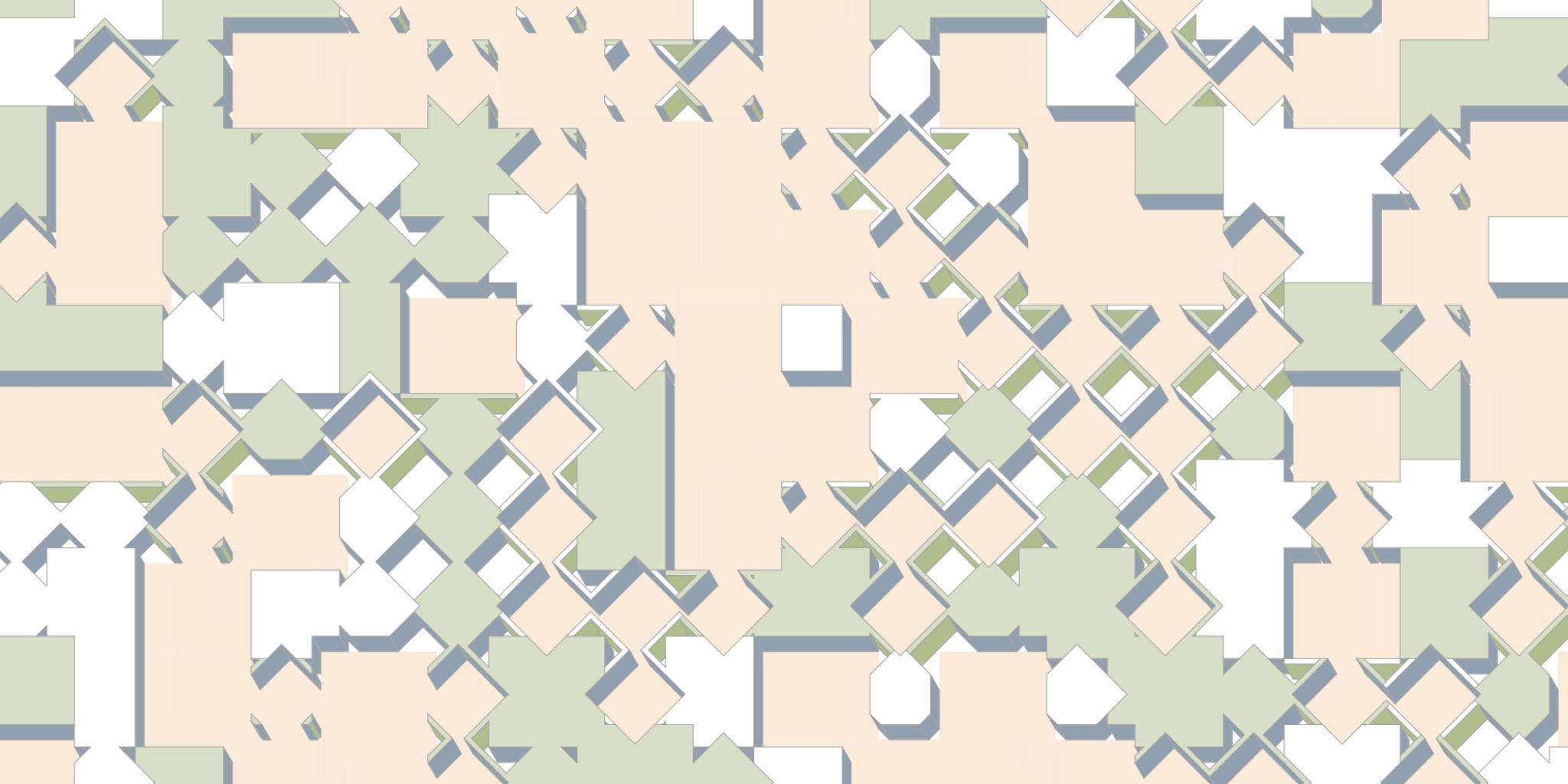


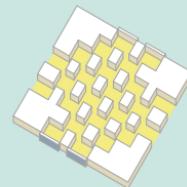
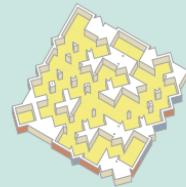
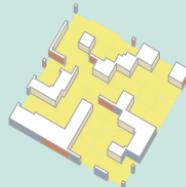
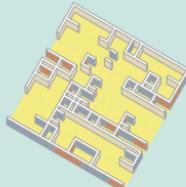
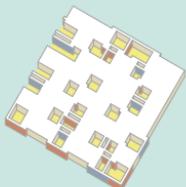
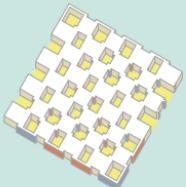
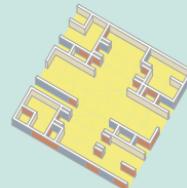
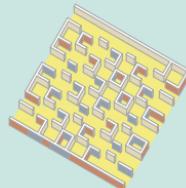
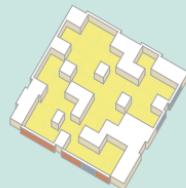
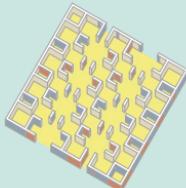
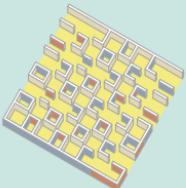
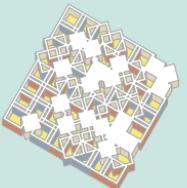
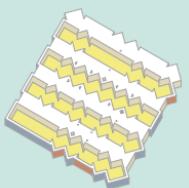
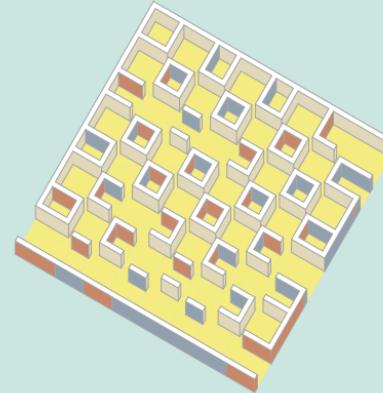
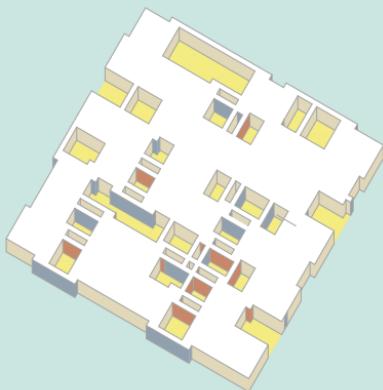
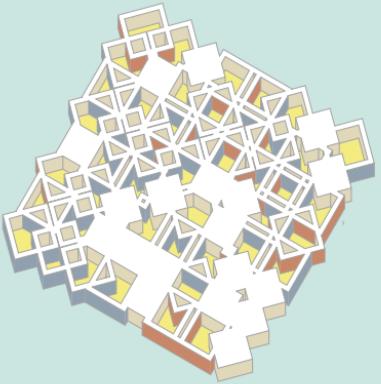


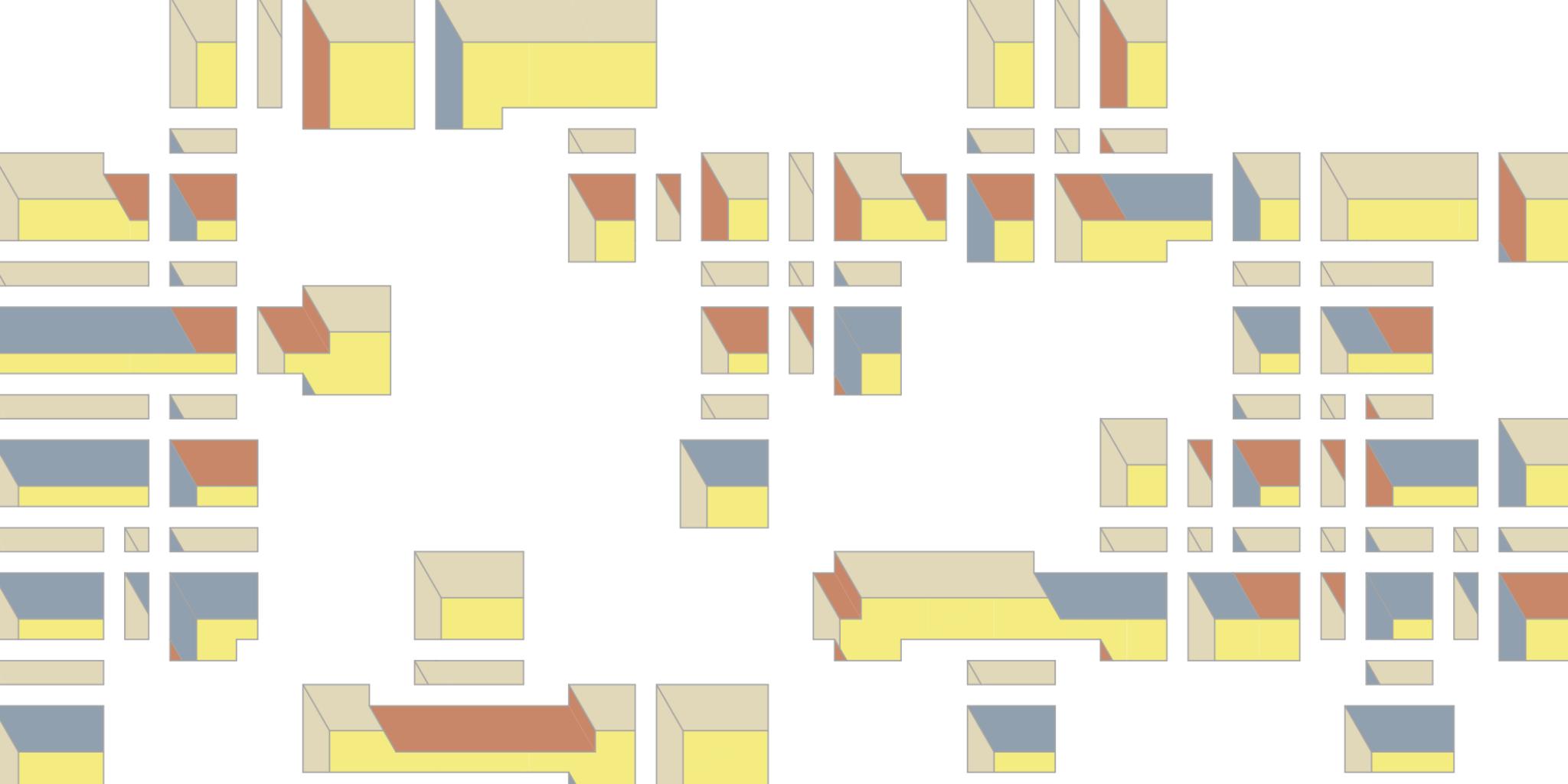


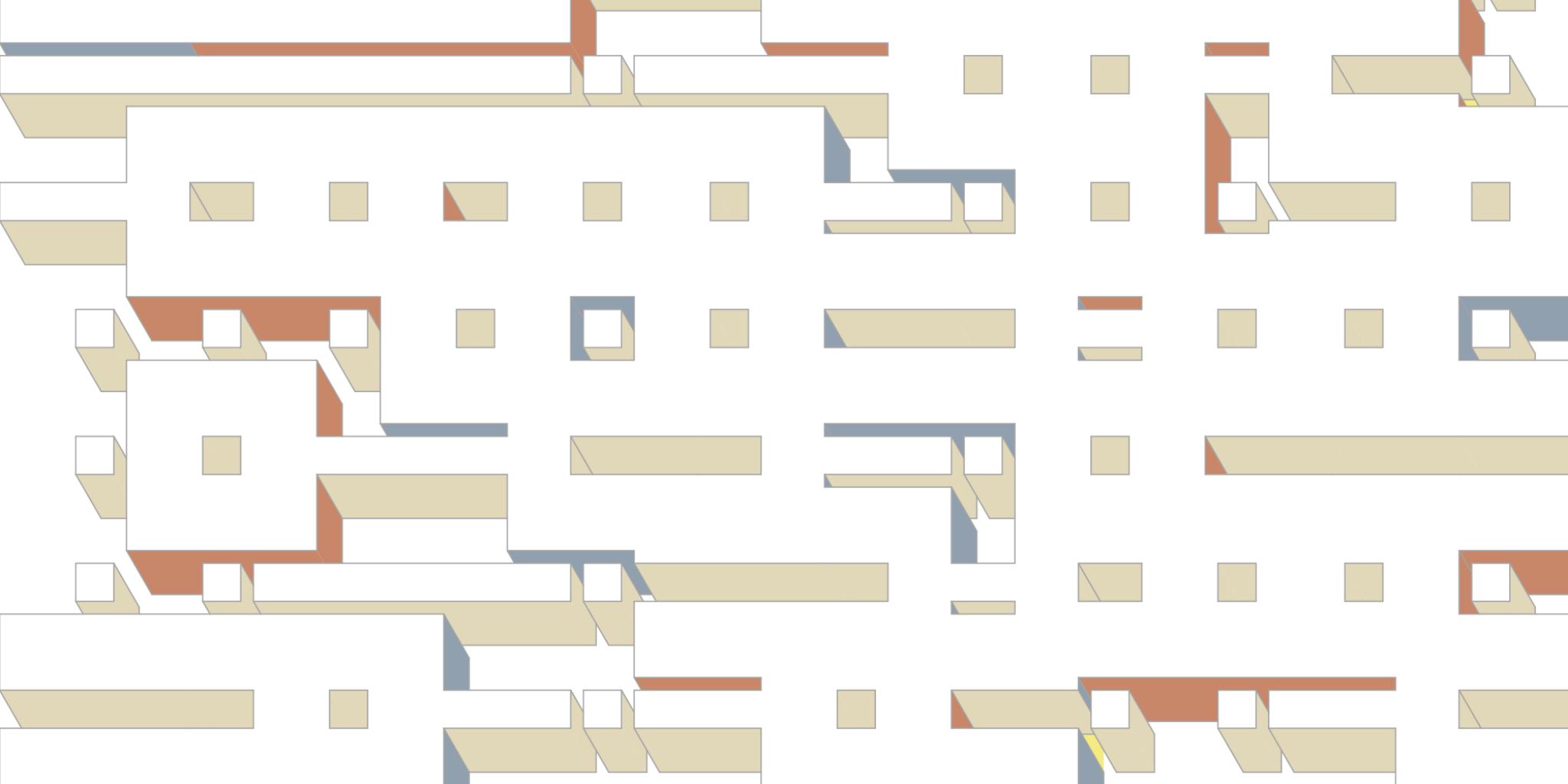


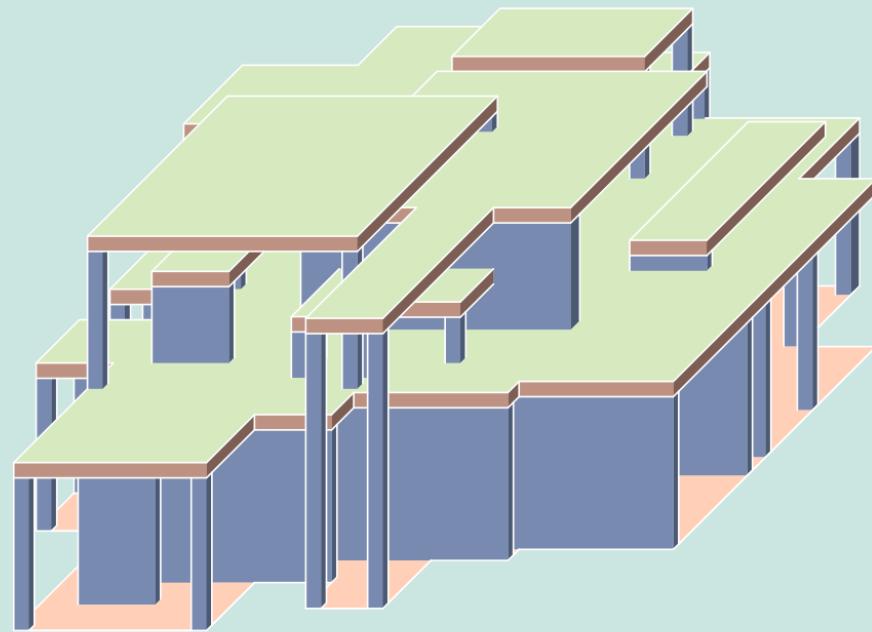
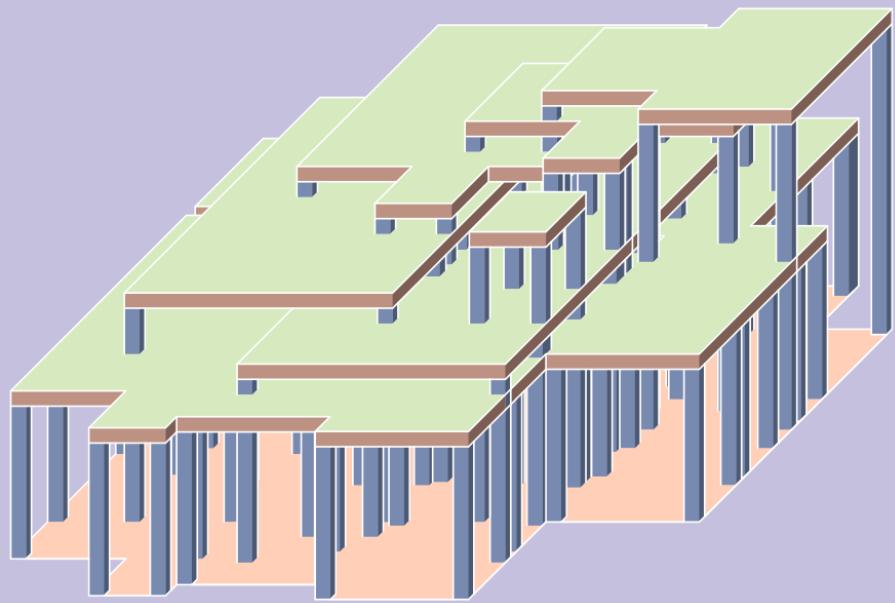






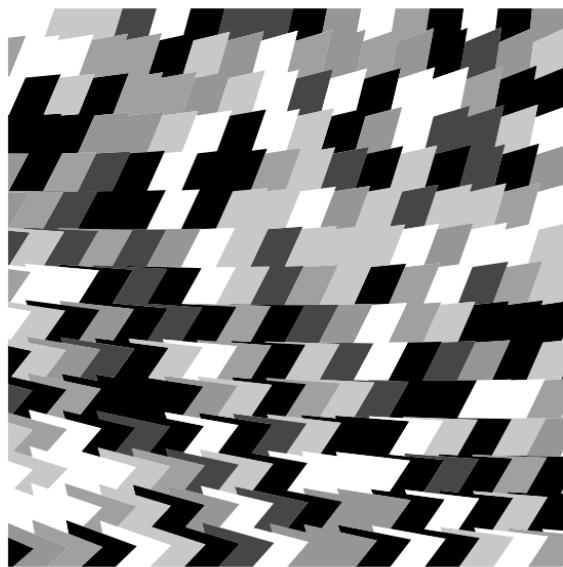








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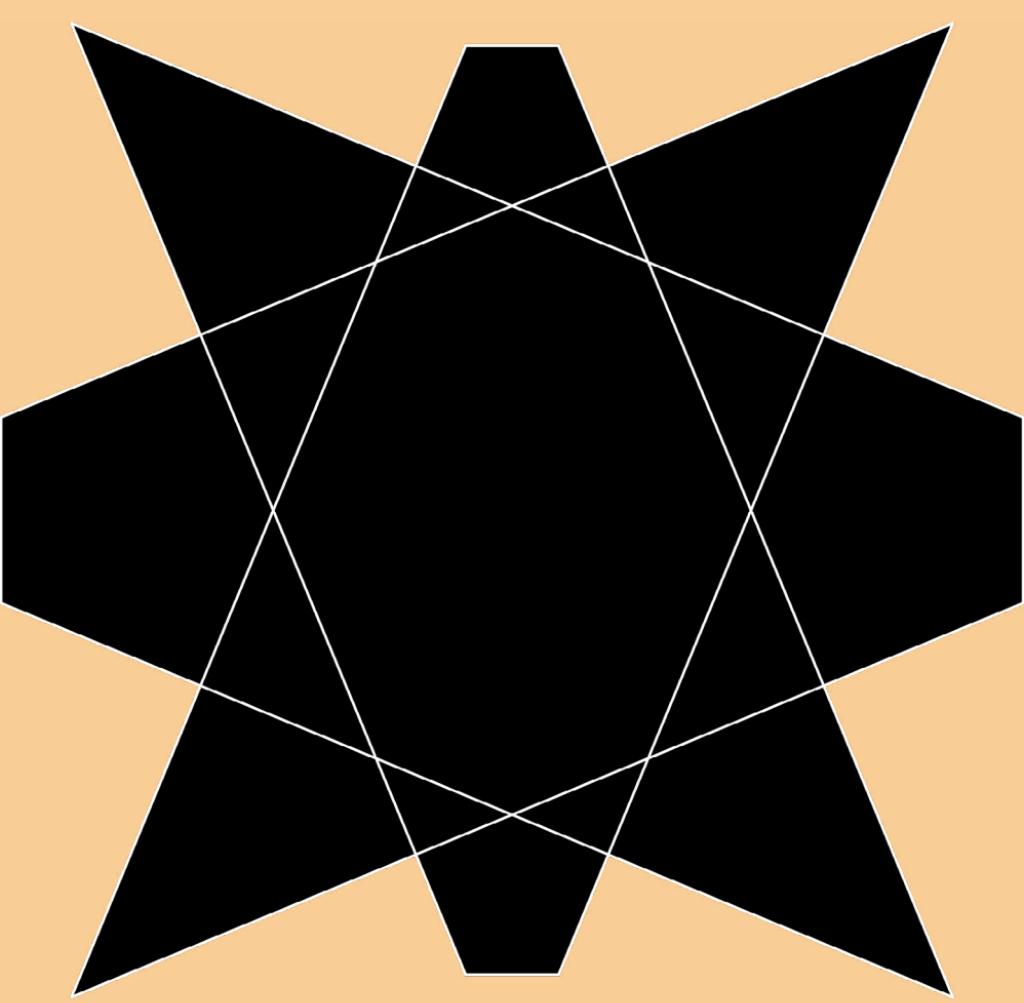
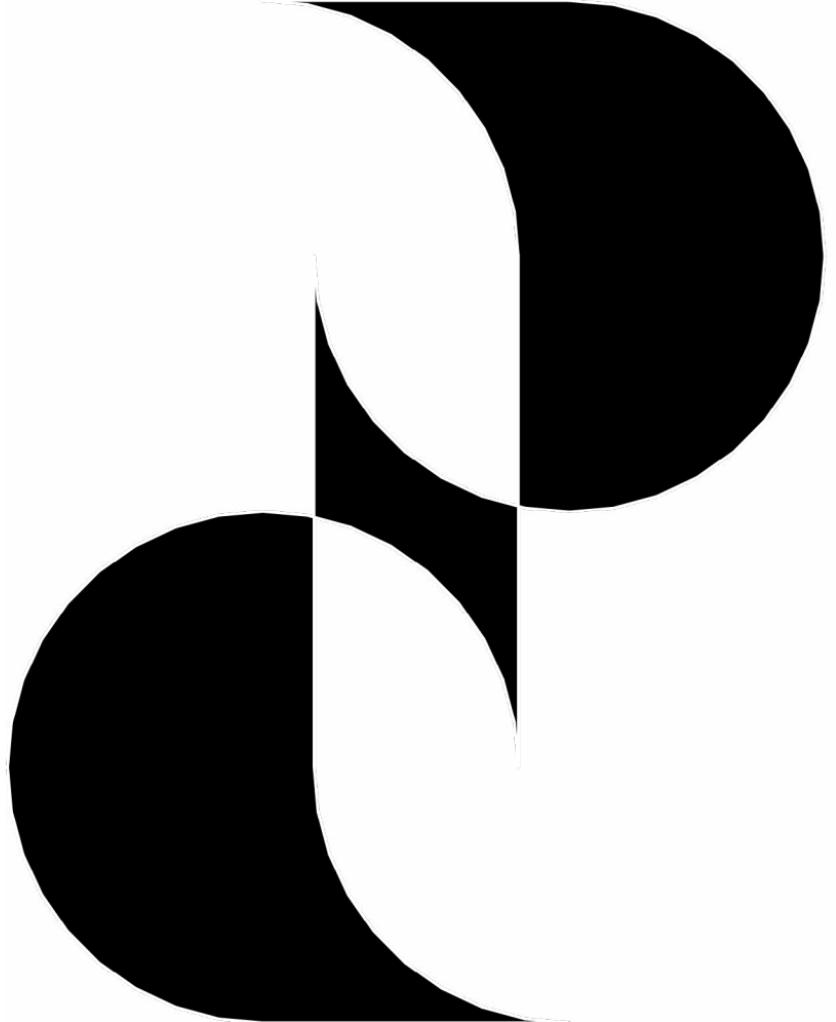
07  
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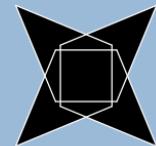
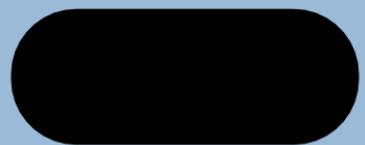
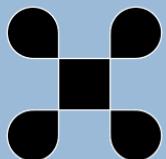
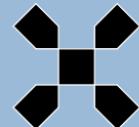
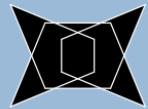
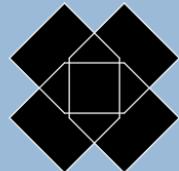
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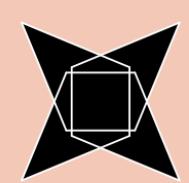
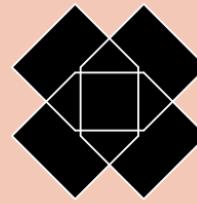
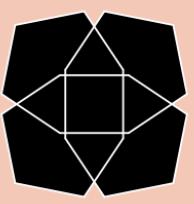
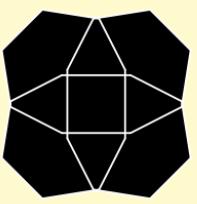
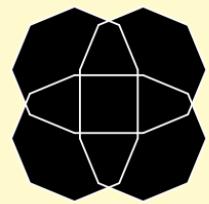
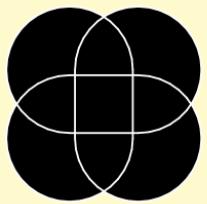
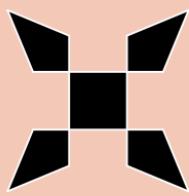
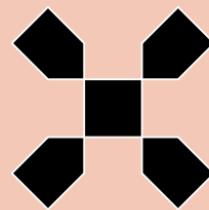
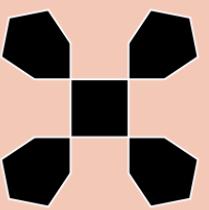
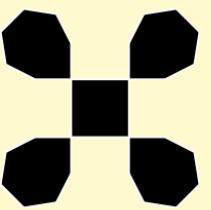
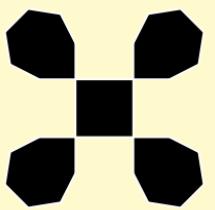
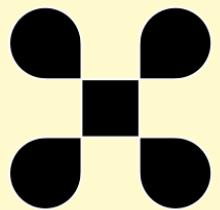
## PATTERN - Introduction

Another result of the test and exploration is the collection of all the beautiful patterns, including a wide range of both single and complex patterns, some of which look like textiles or wall papers. It shows how interesting and amazing work we can do through a single change of parameters.

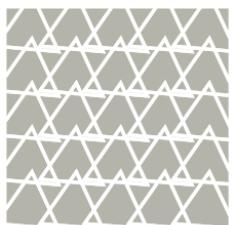
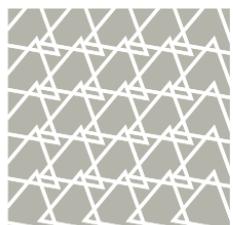
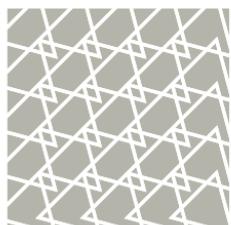
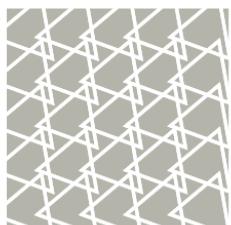
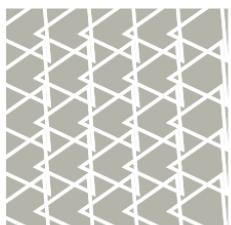
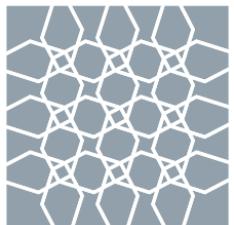
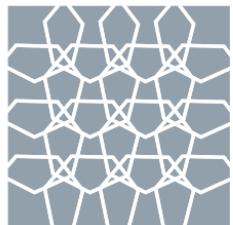
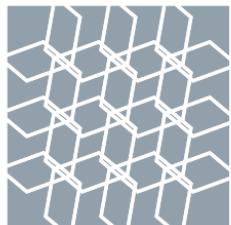
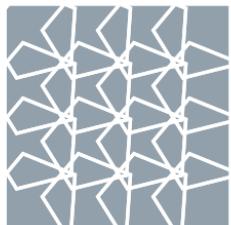
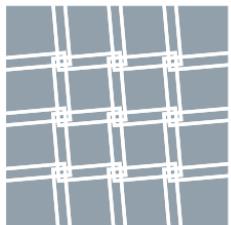
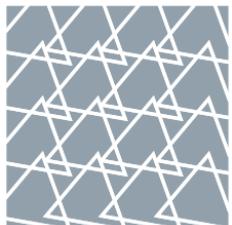
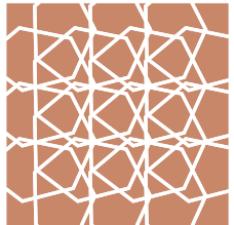
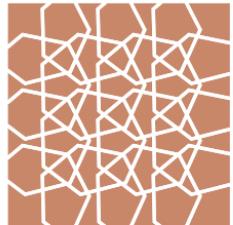
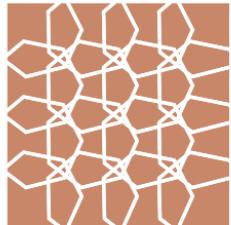
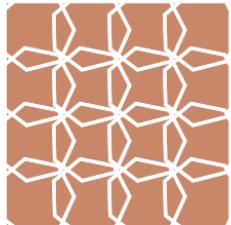
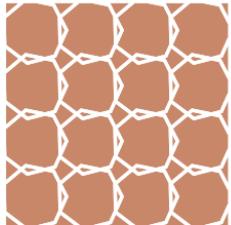


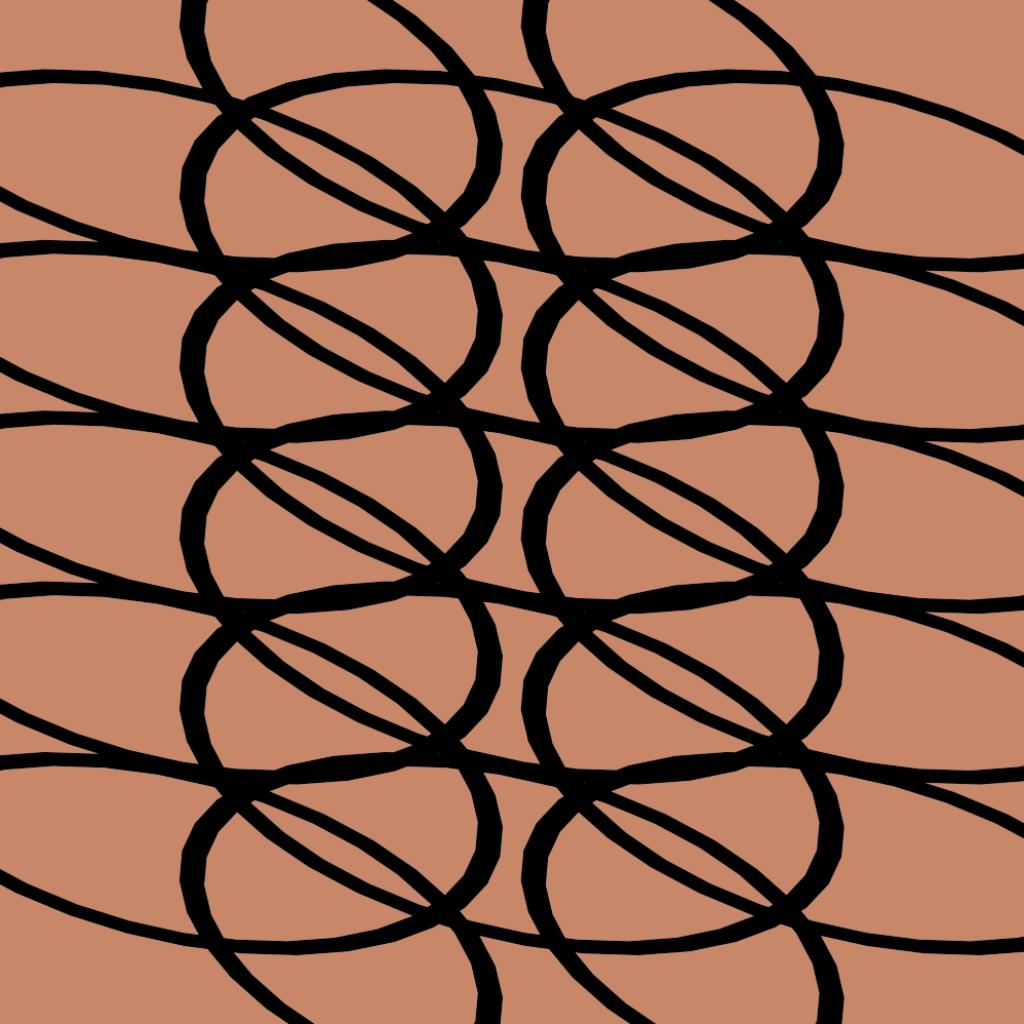


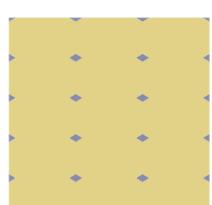
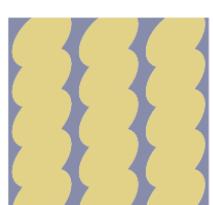
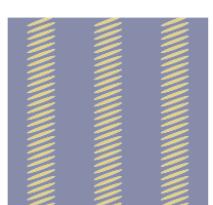
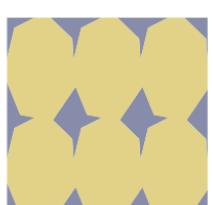
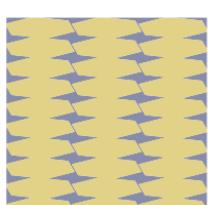
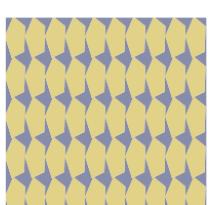
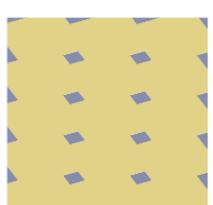
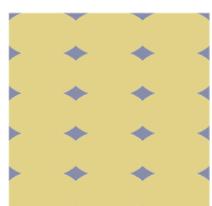
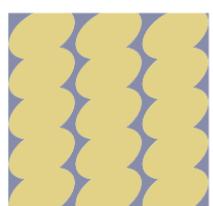
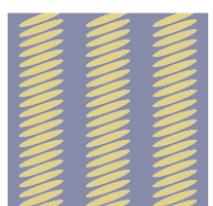
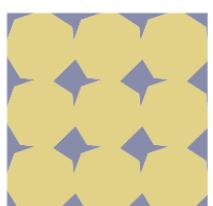
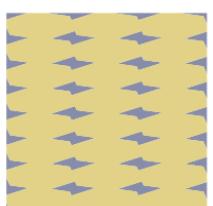
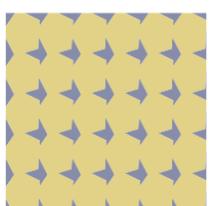
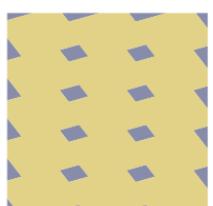
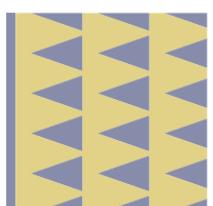
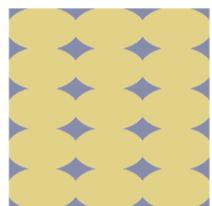
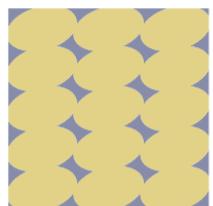
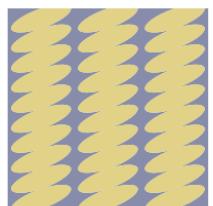
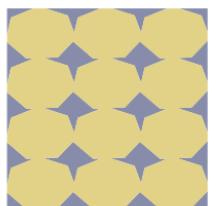
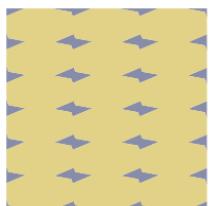
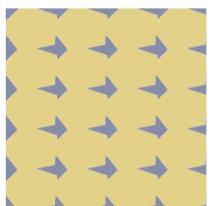
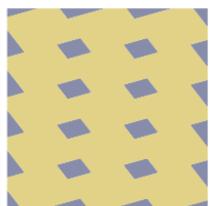
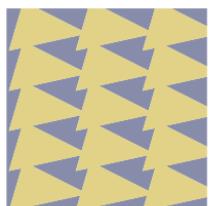
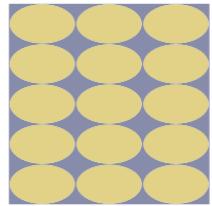
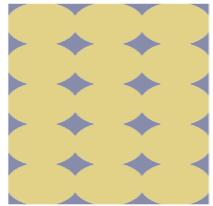
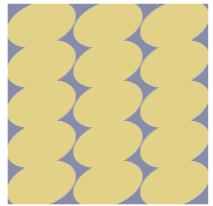
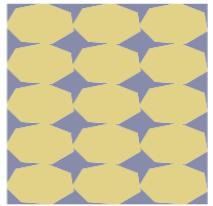
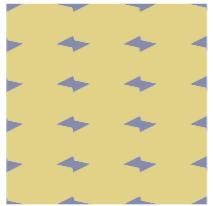
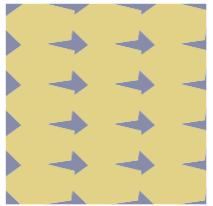
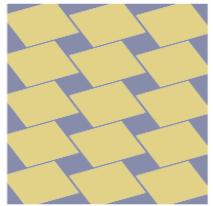


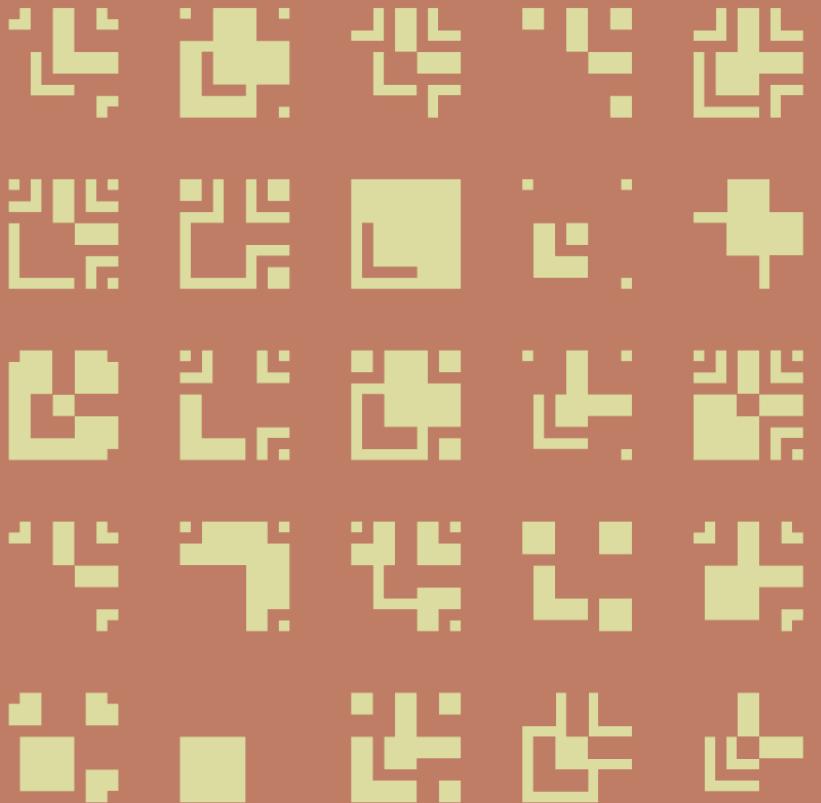
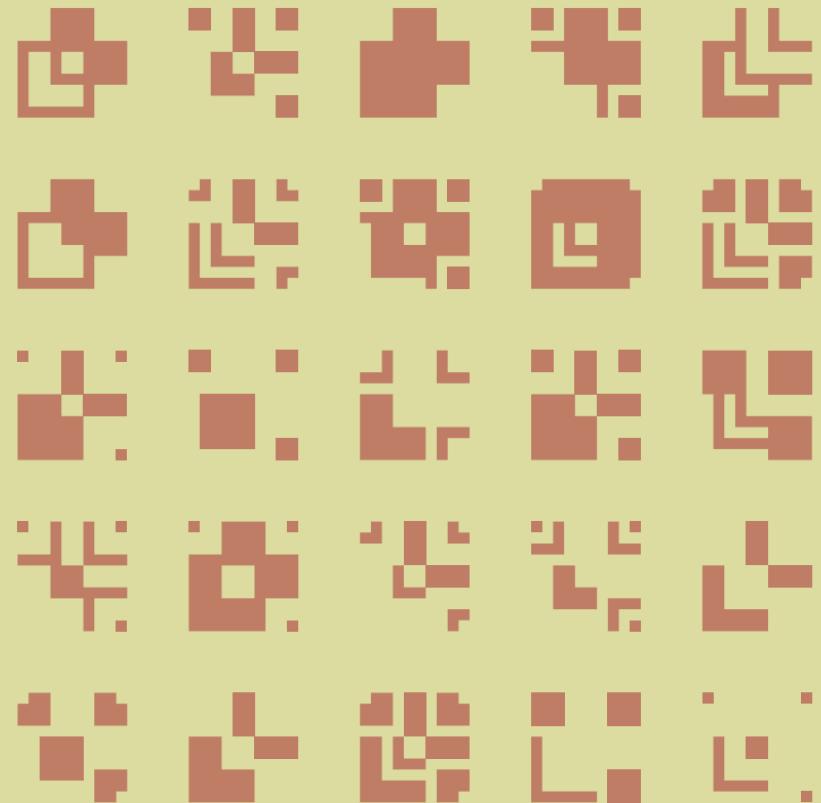


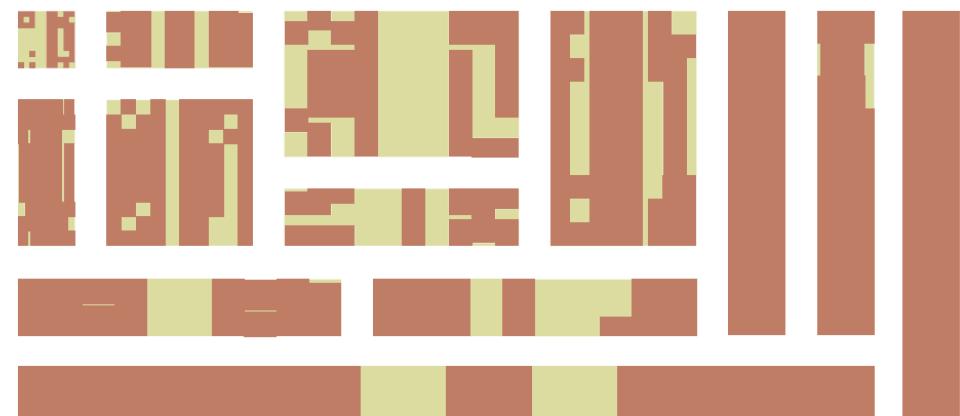
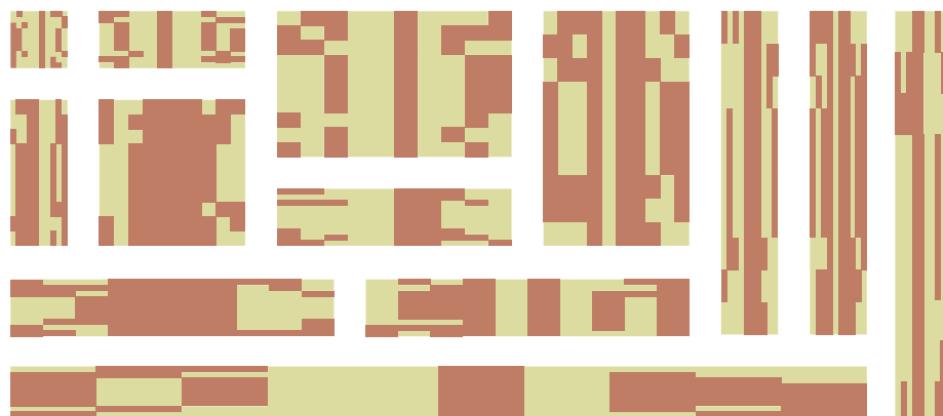
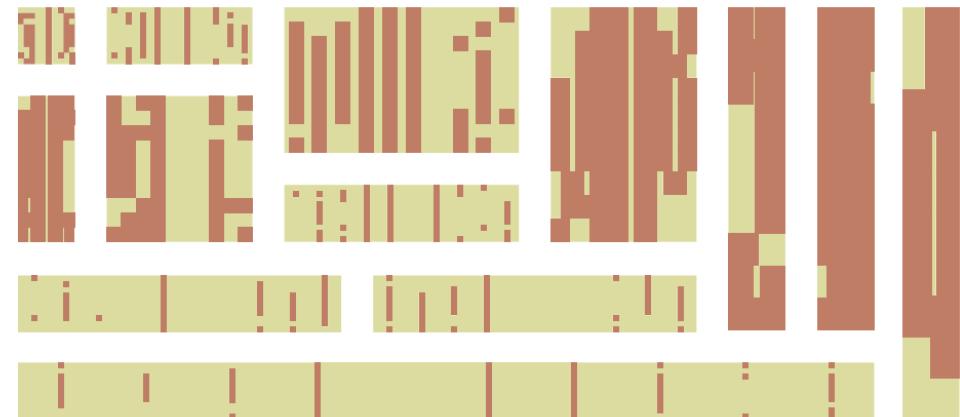
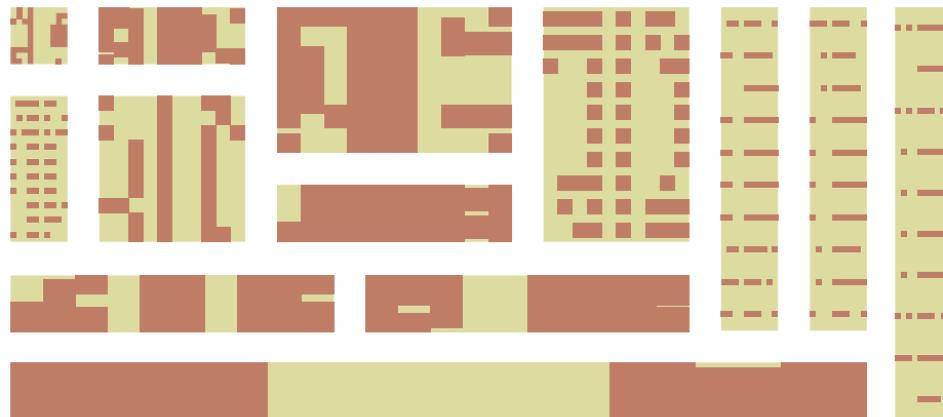


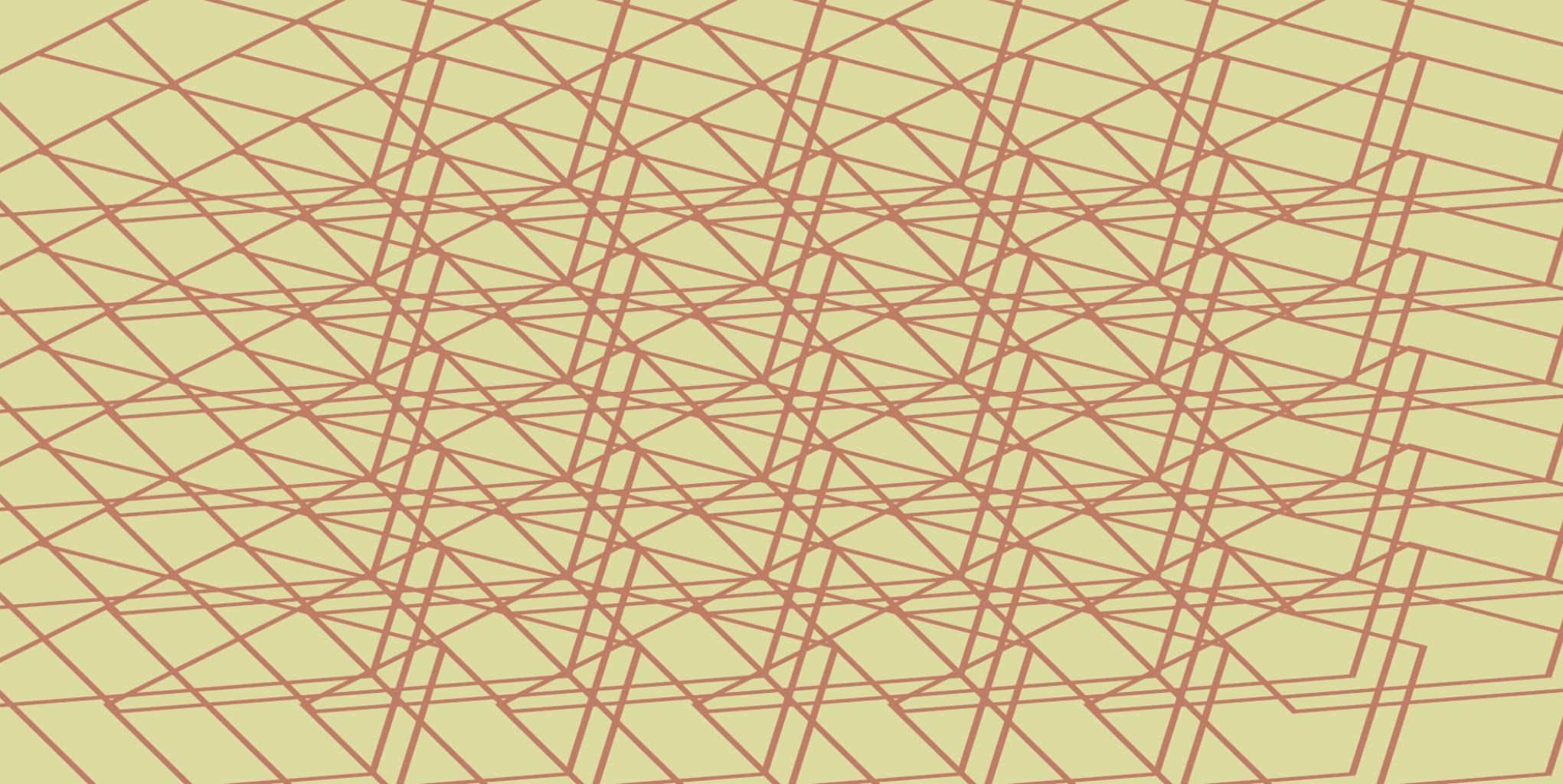


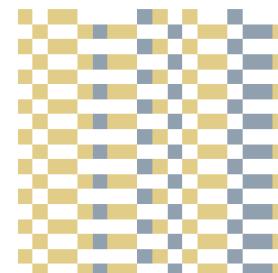
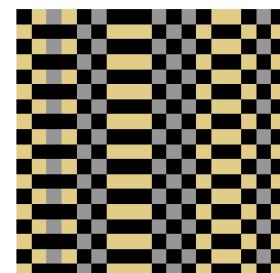
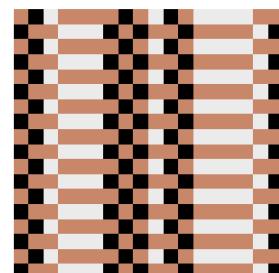
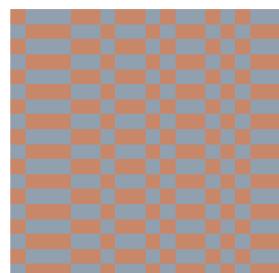
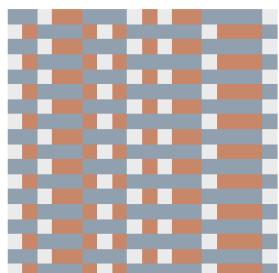
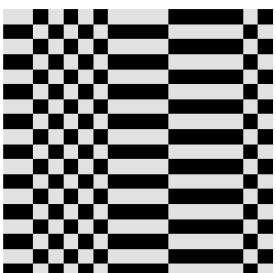
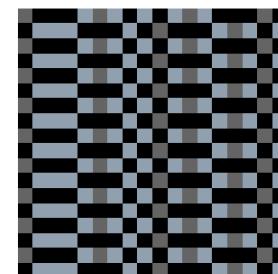
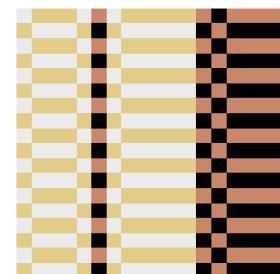
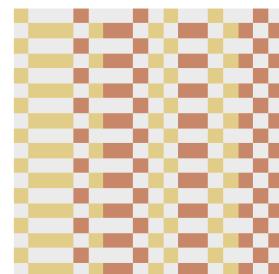
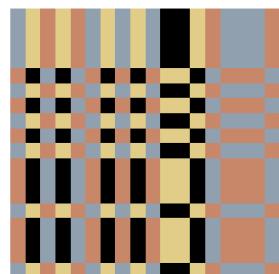
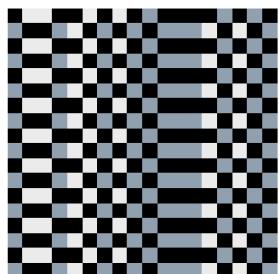
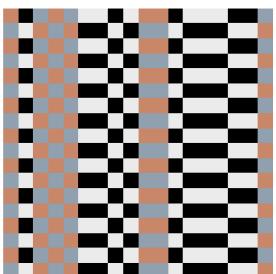
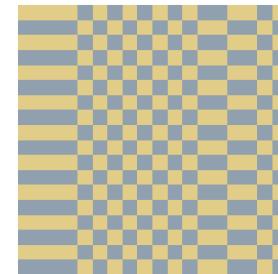
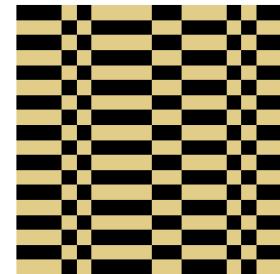
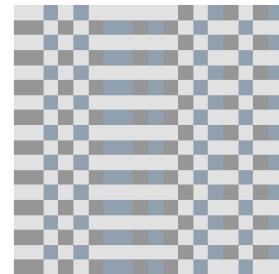
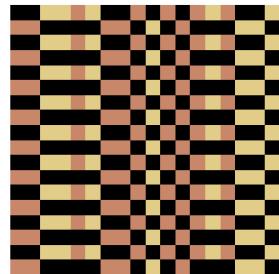
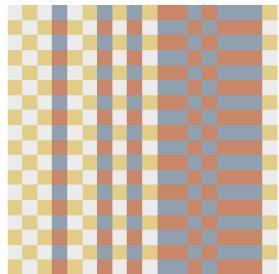
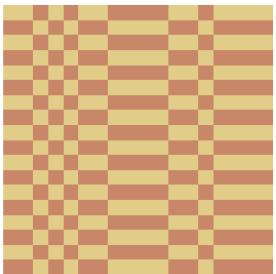


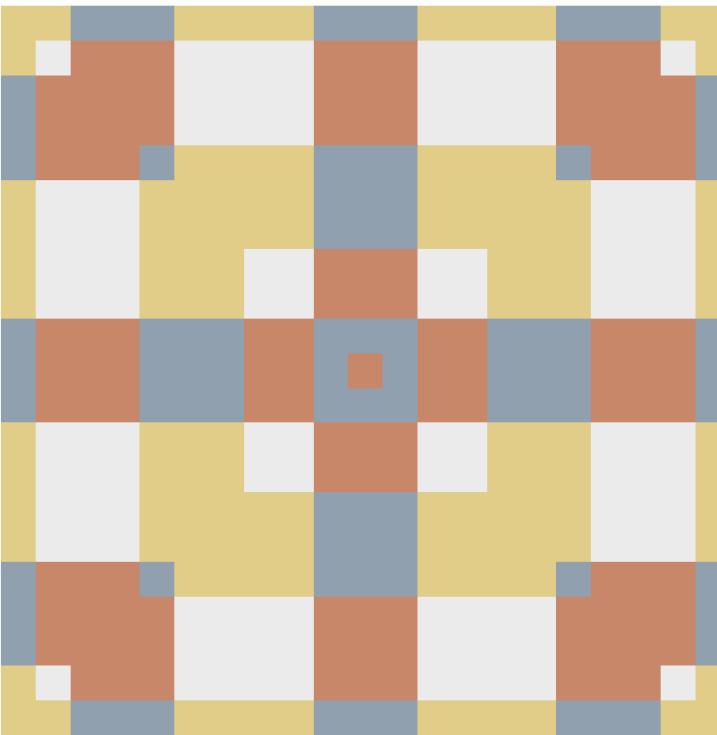
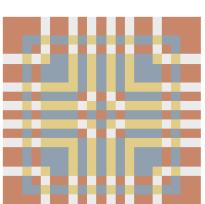
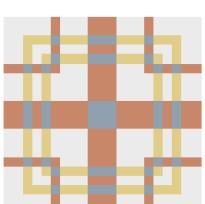
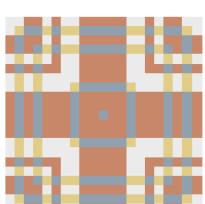
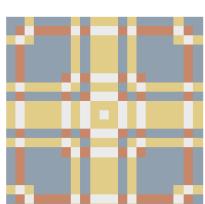
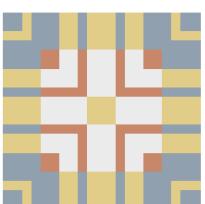
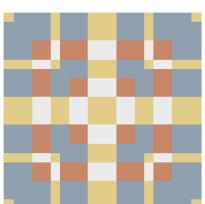
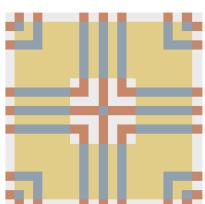
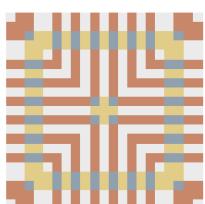
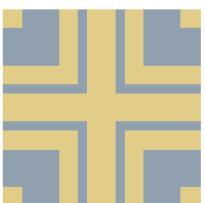
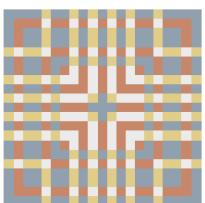
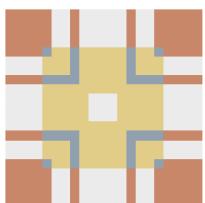
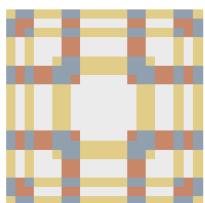
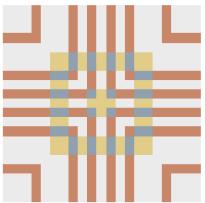
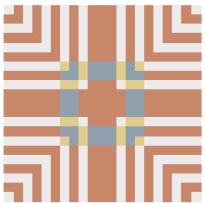
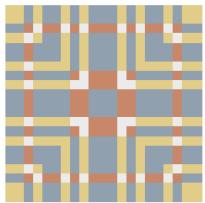
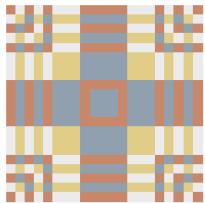


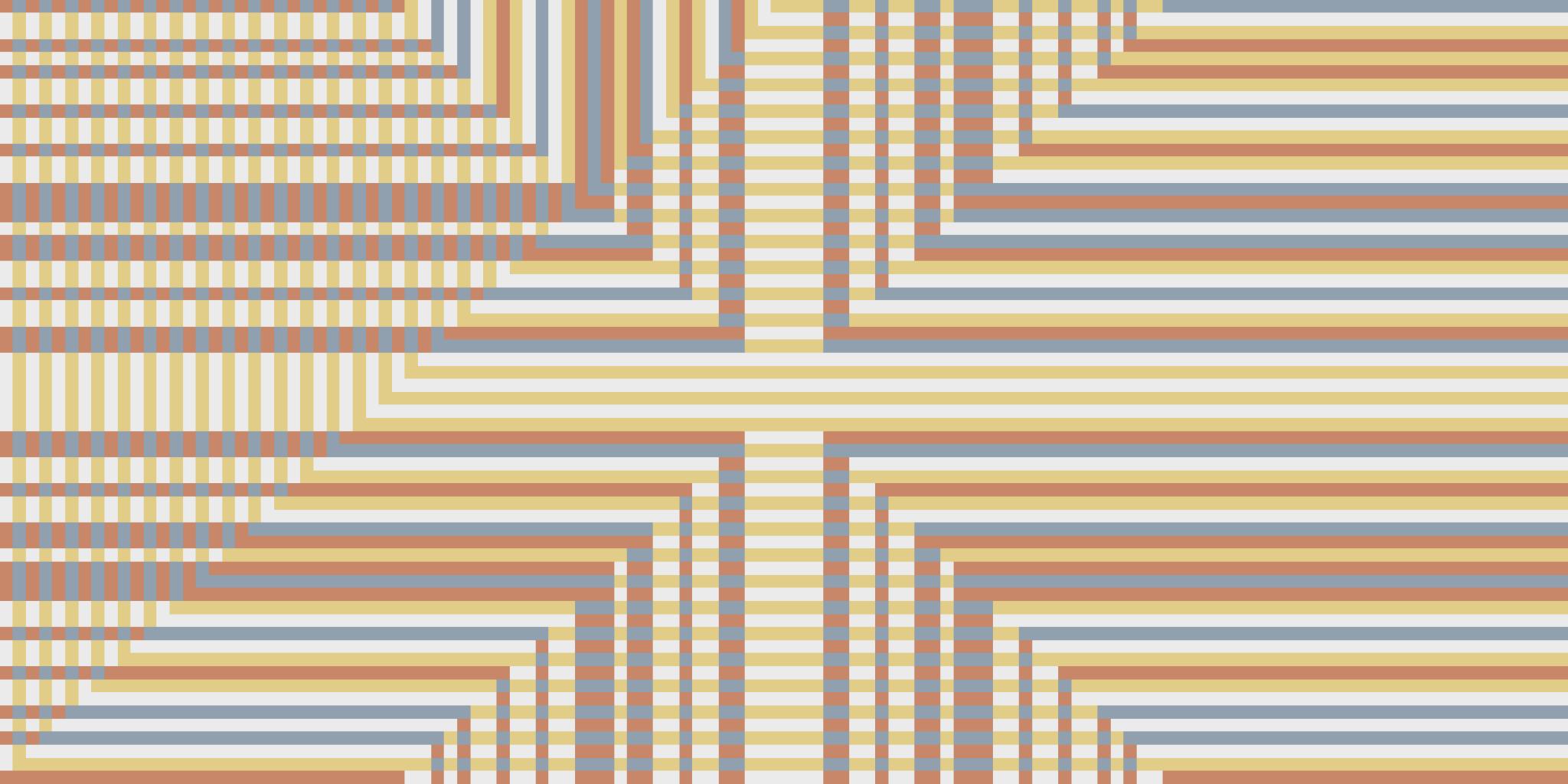


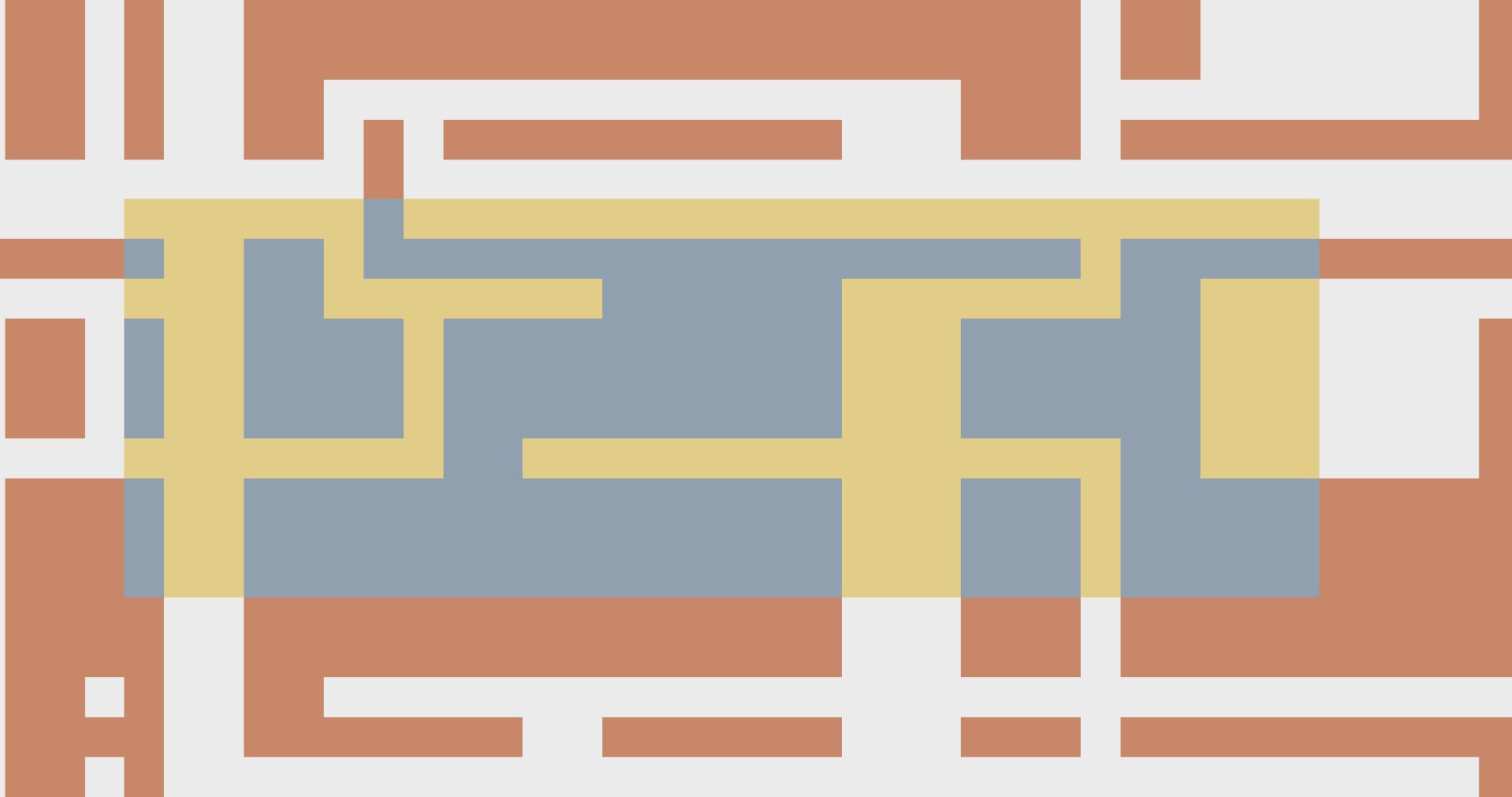


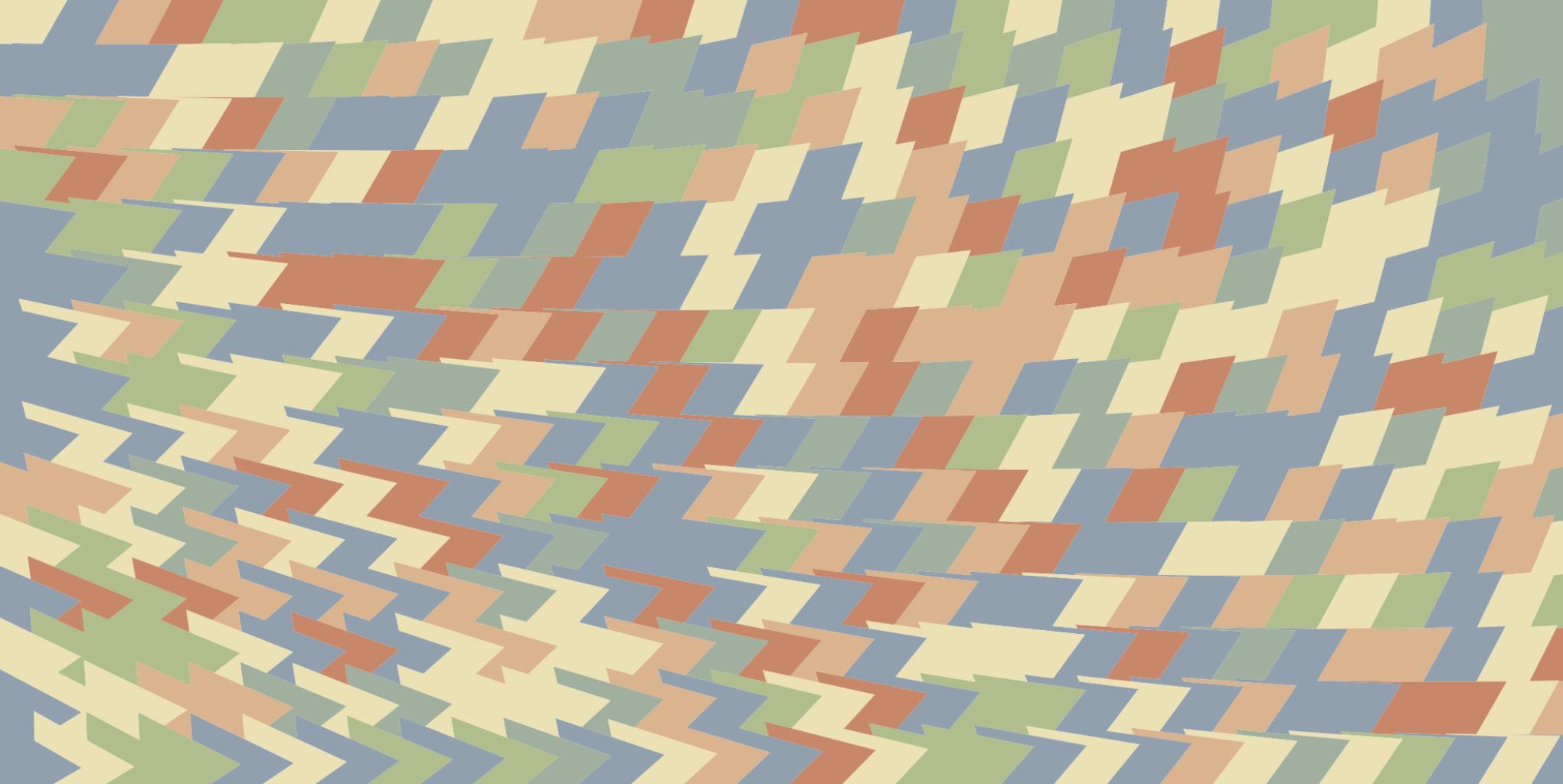


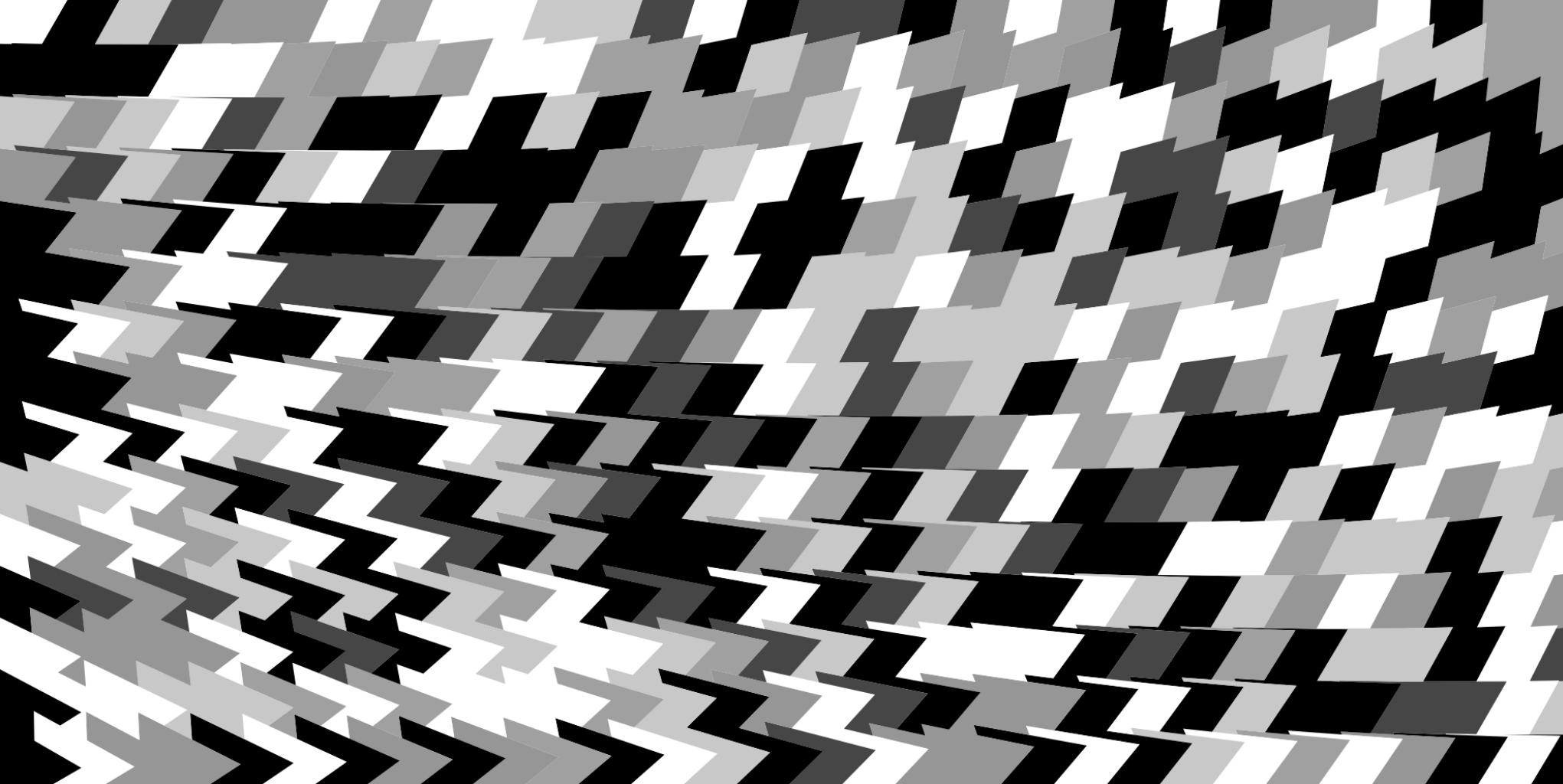


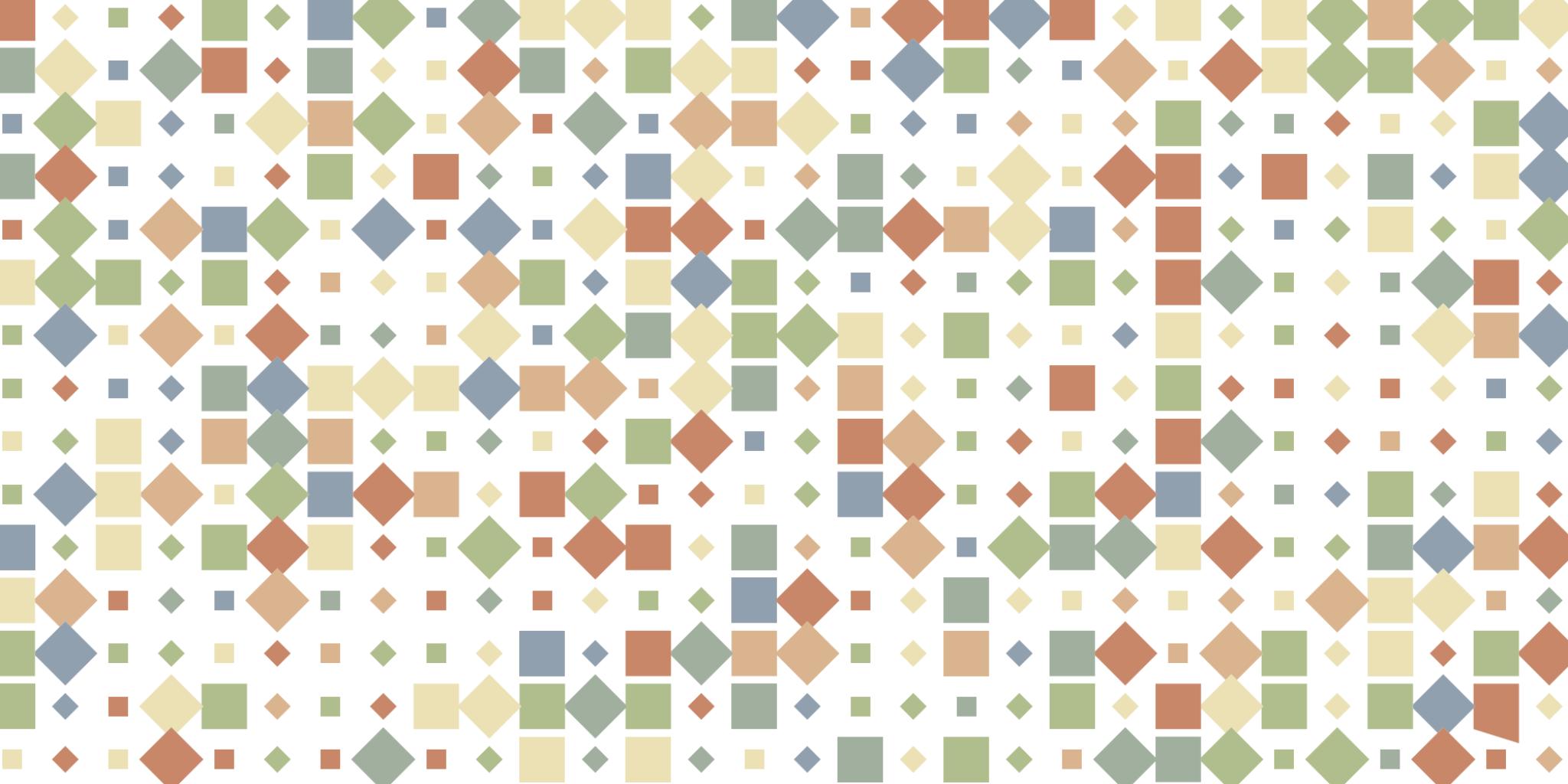


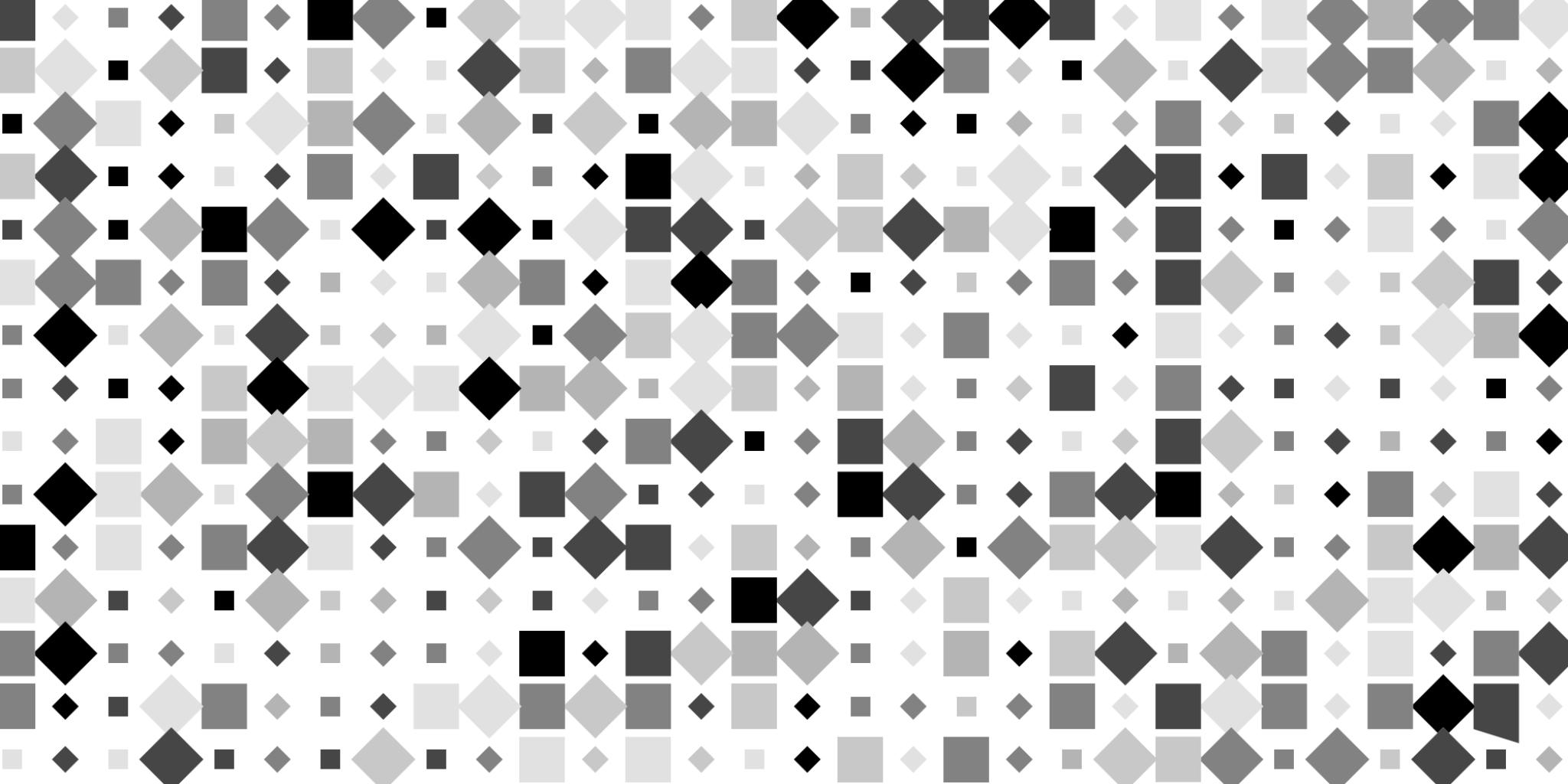


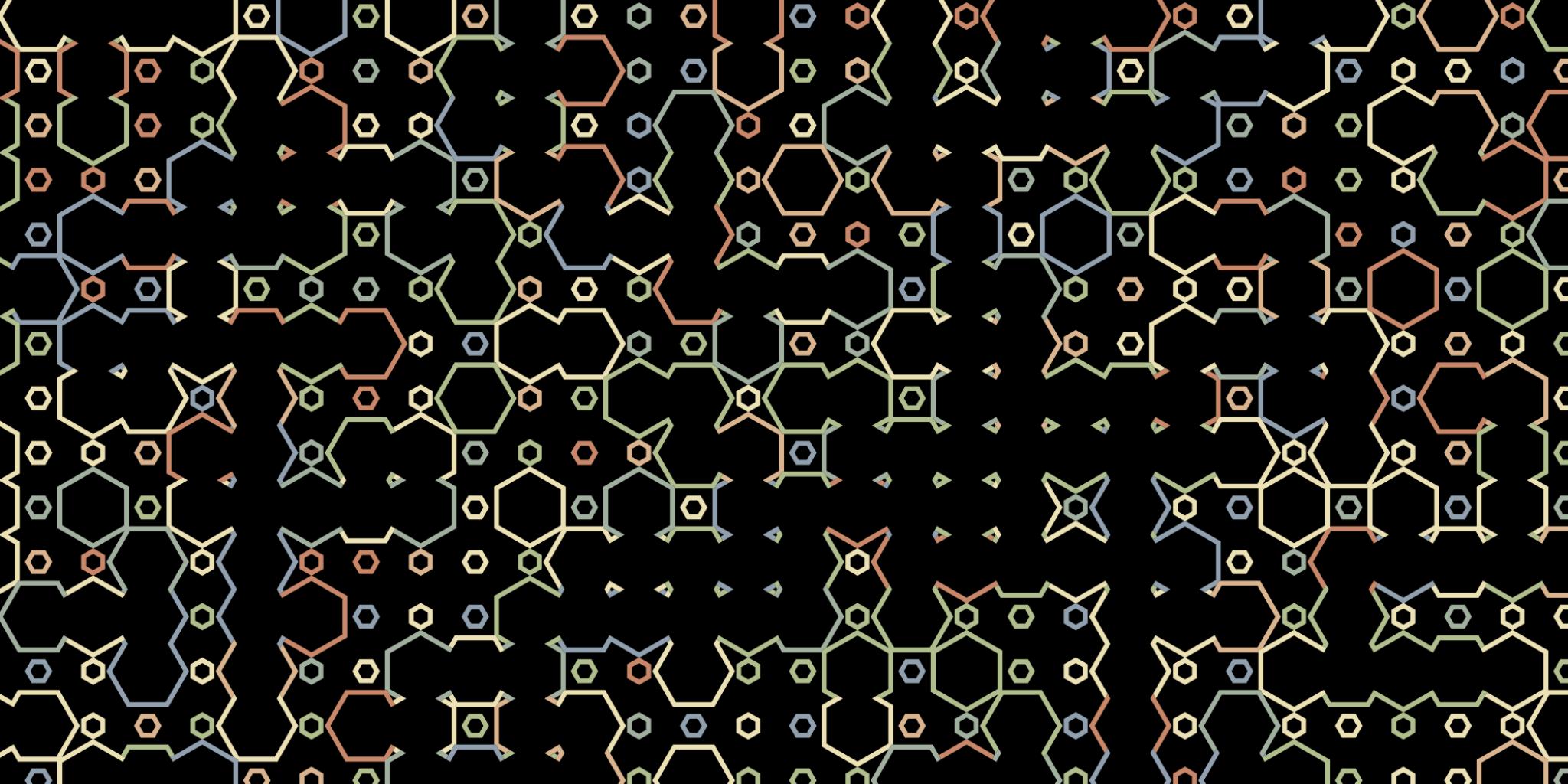


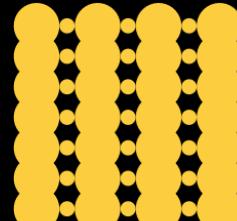
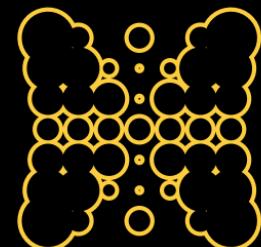
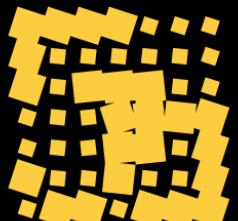
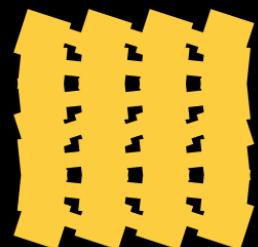
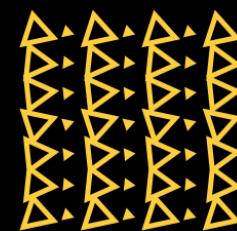
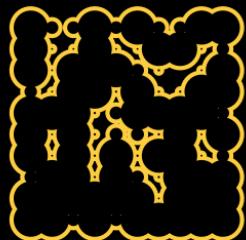
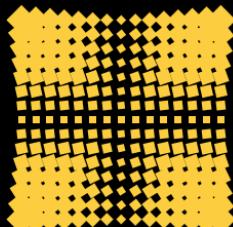
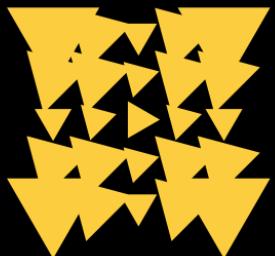
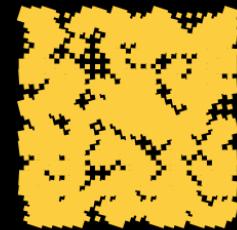
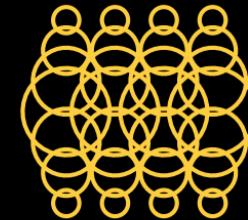
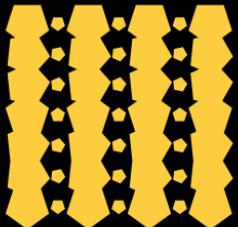
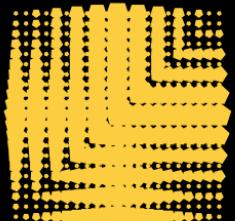
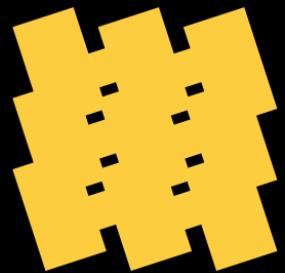




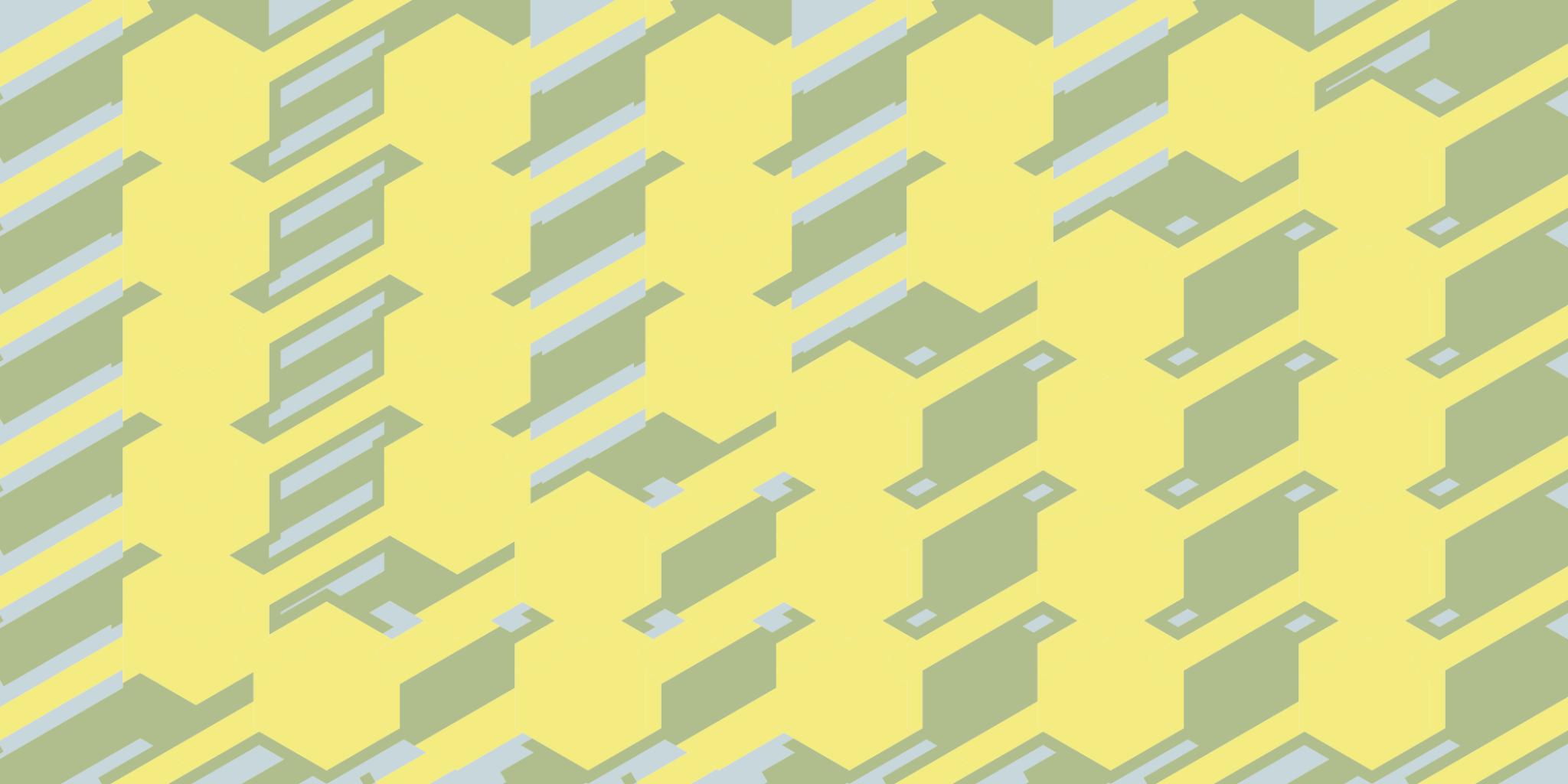






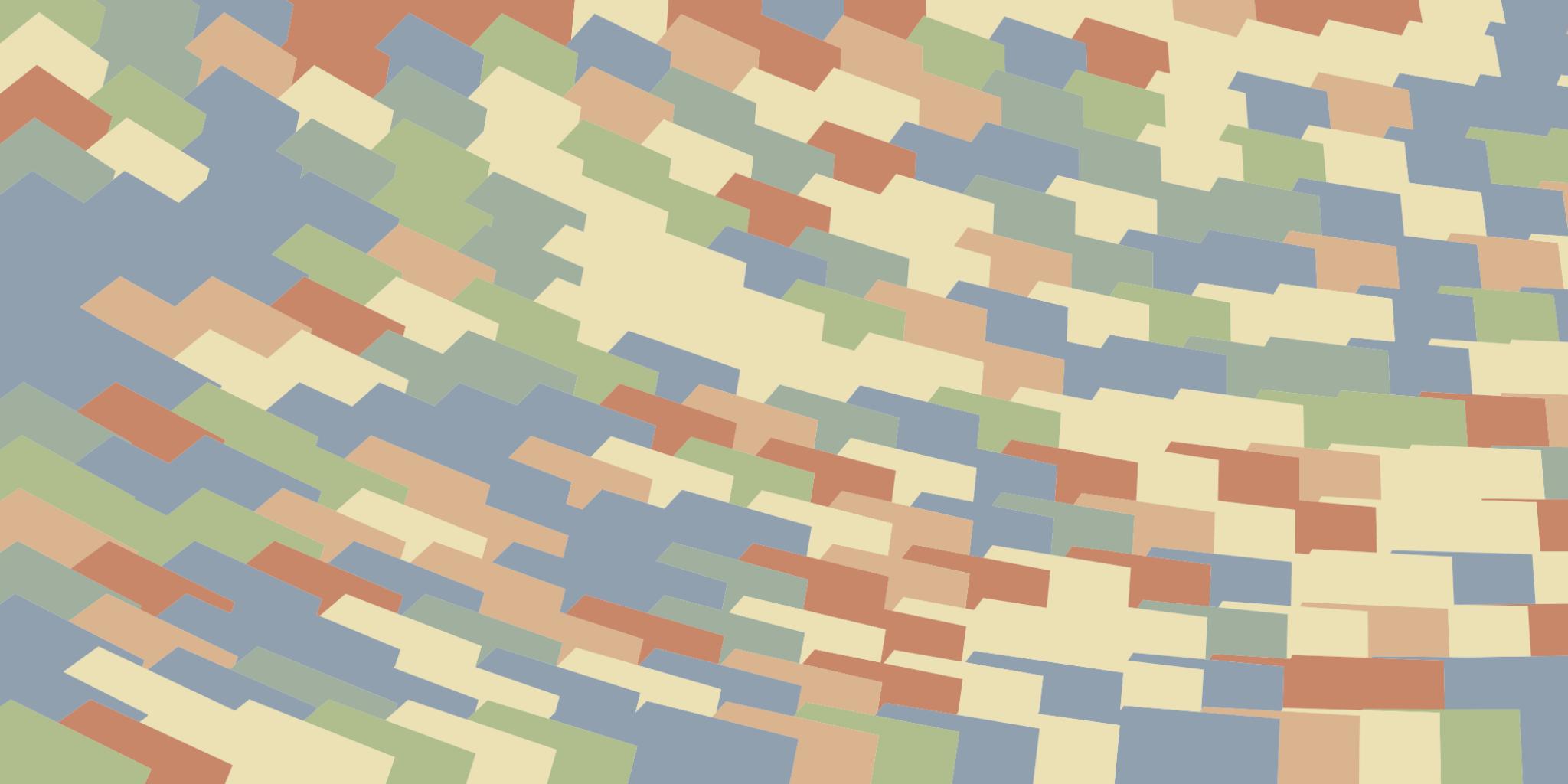


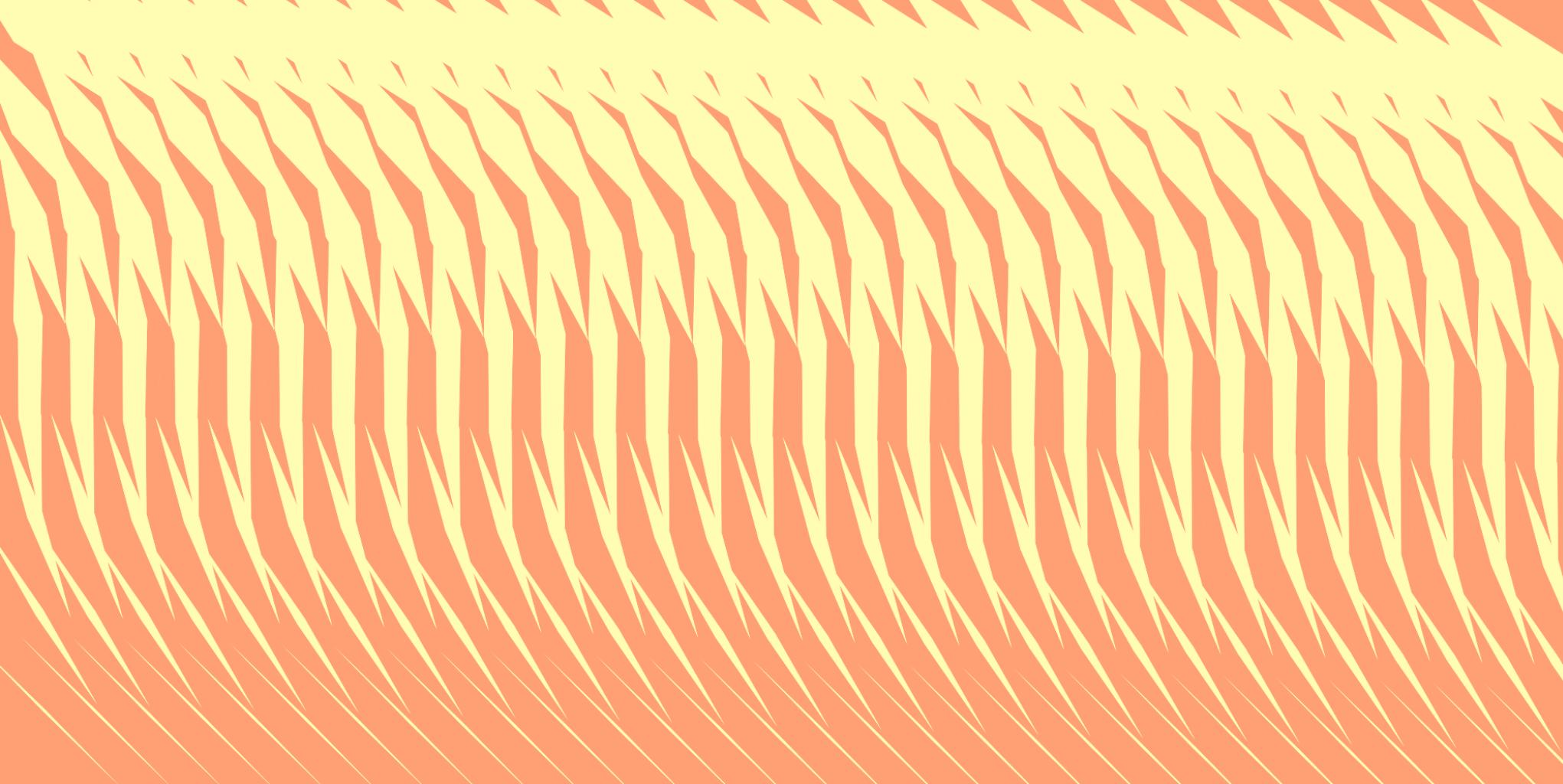


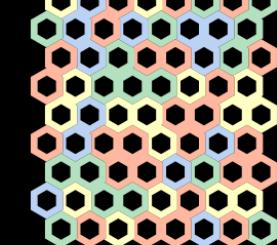
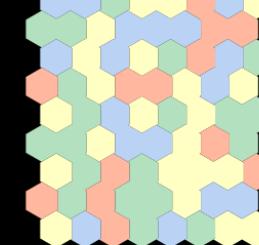
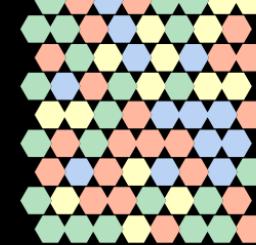
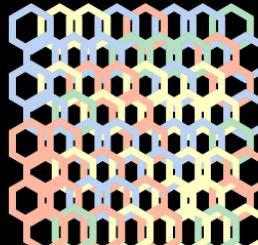
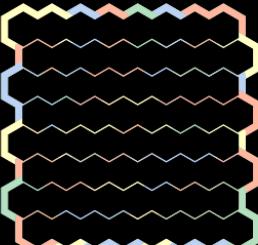
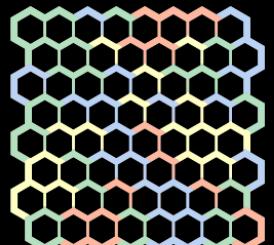
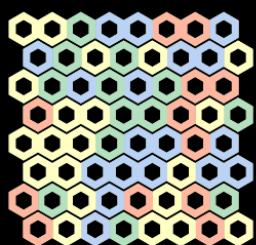
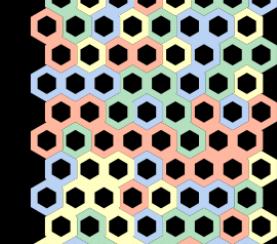
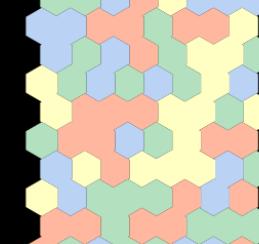
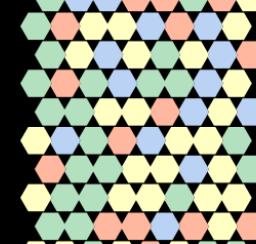
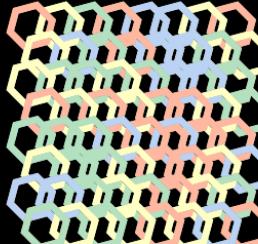
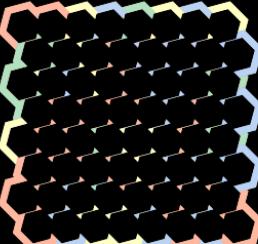
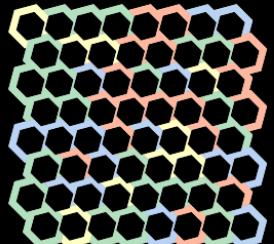
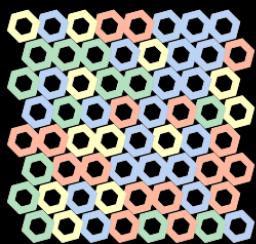
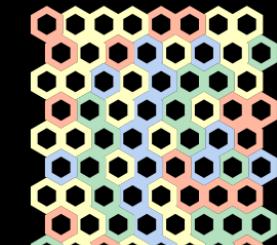
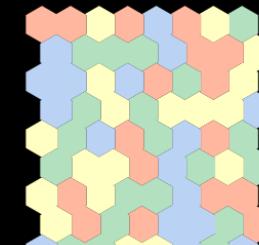
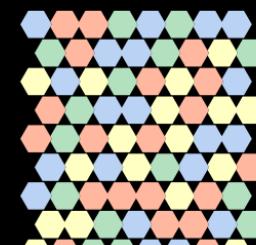
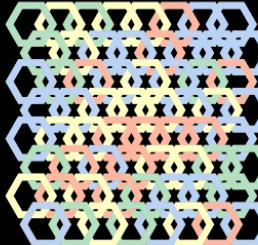
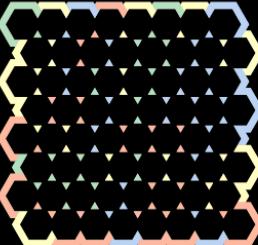
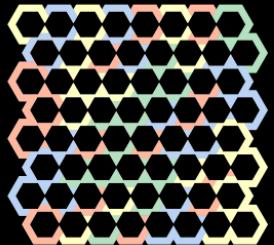
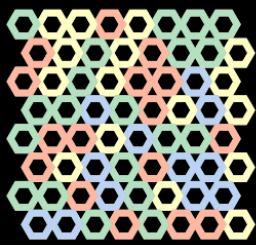






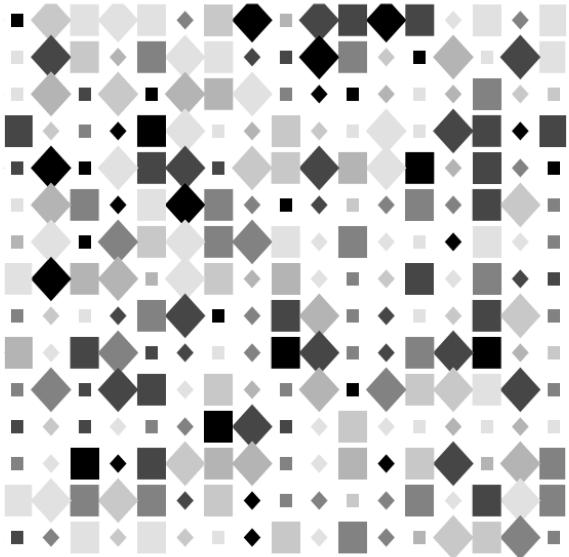








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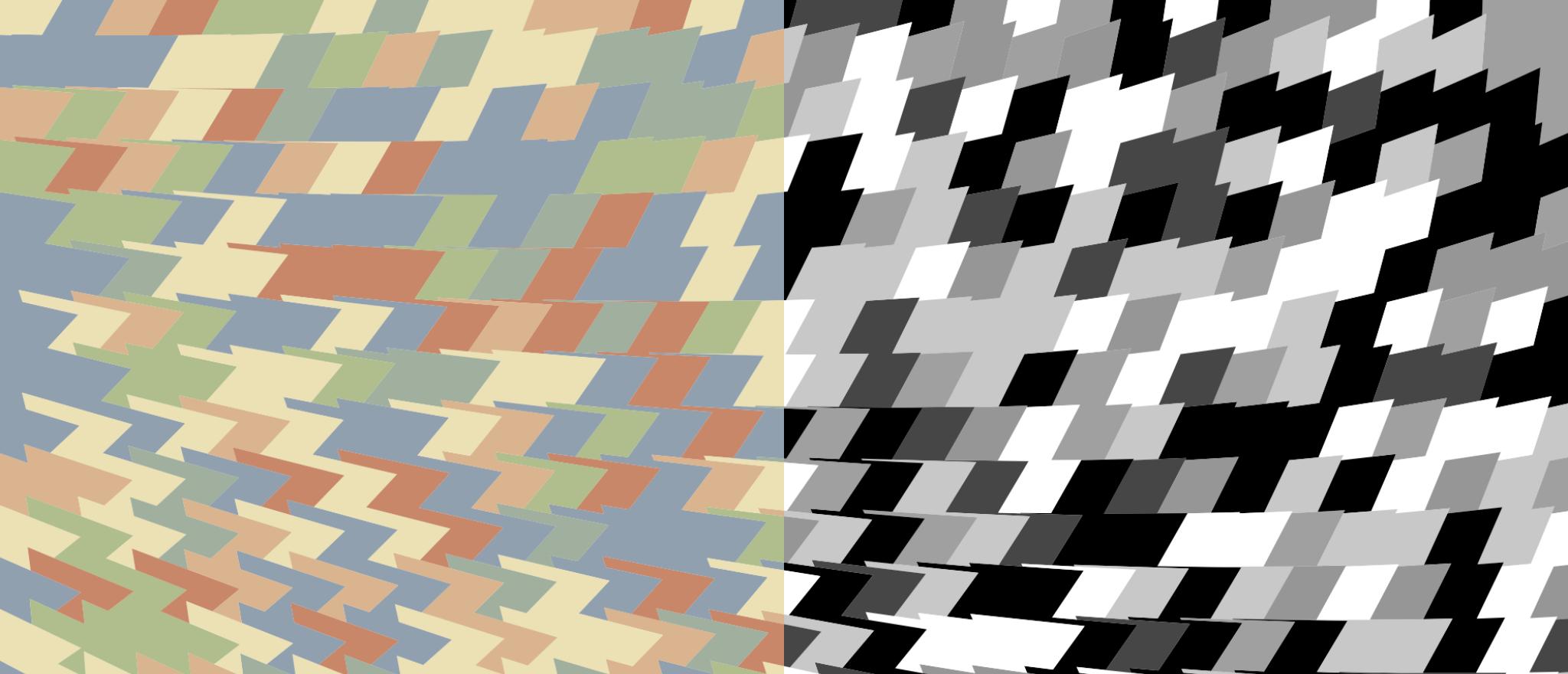


08  
Teng Fengshi

OBSERVE

## OBSERVE - Introduction

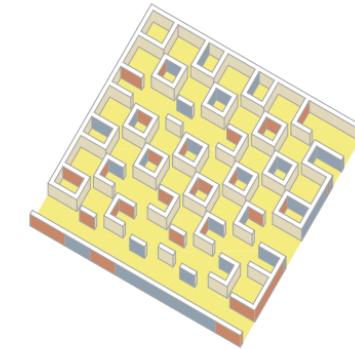
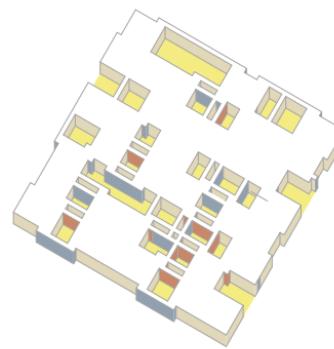
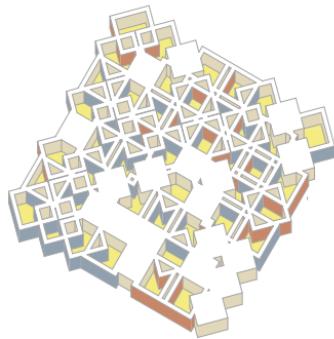
The whole learning process is very tough in the process but very interesting and charming in its outcomes. I learned a lot and developed several methods in exploring different 2D patterns and 3D space with the same script.



study - color

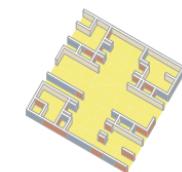
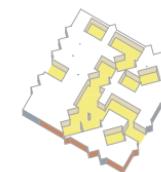
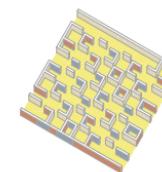
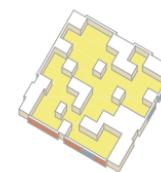
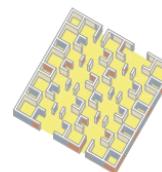
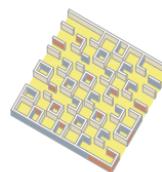
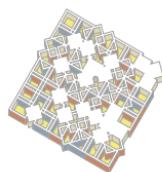
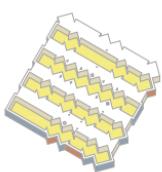
try:

- different functions
- different variation types
- different values



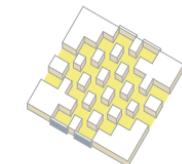
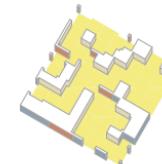
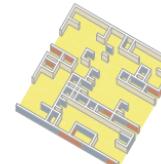
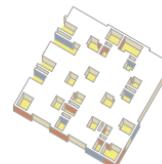
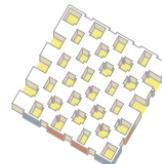
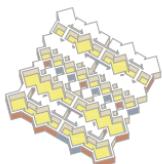
try:

- two or more parameters at the same time
- combination of two types
- different colors



try:

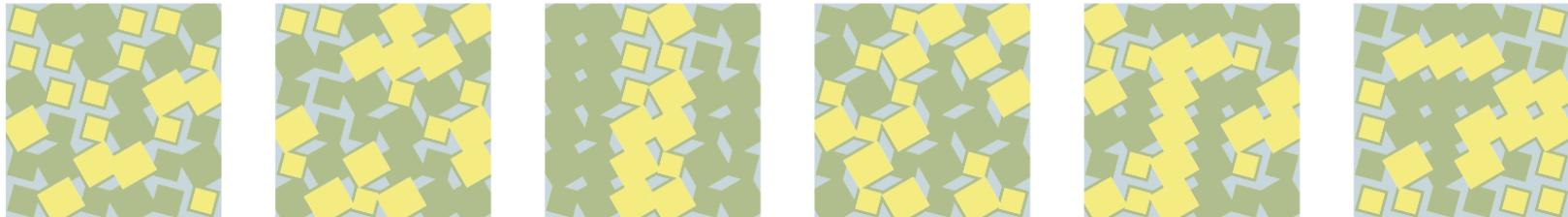
- visibilities of different parts
- visibilities of outlines and surfaces
- different shape | mass | space type



study - space

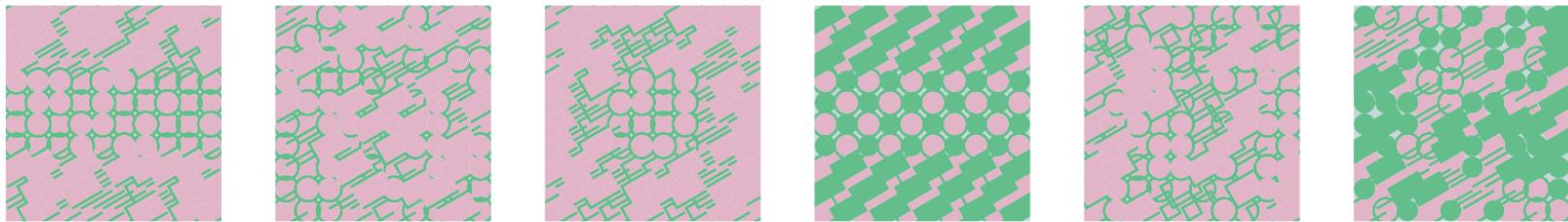
try:

- different functions
- different variation types
- different values



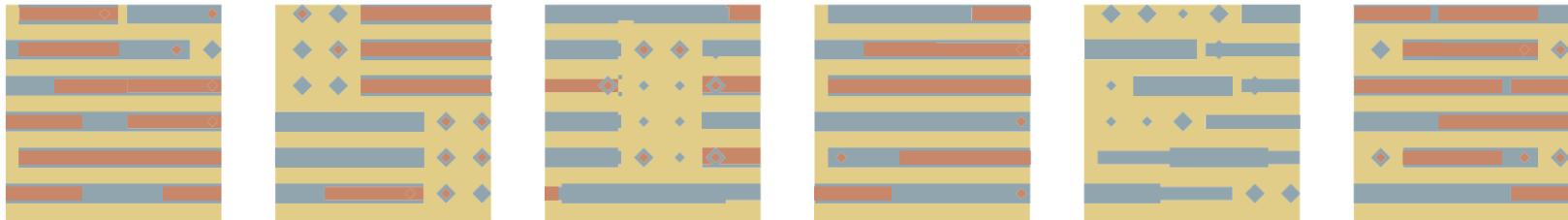
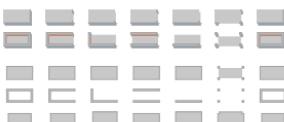
try:

- two or more parameters at the same time
- combination of two types
- different colors

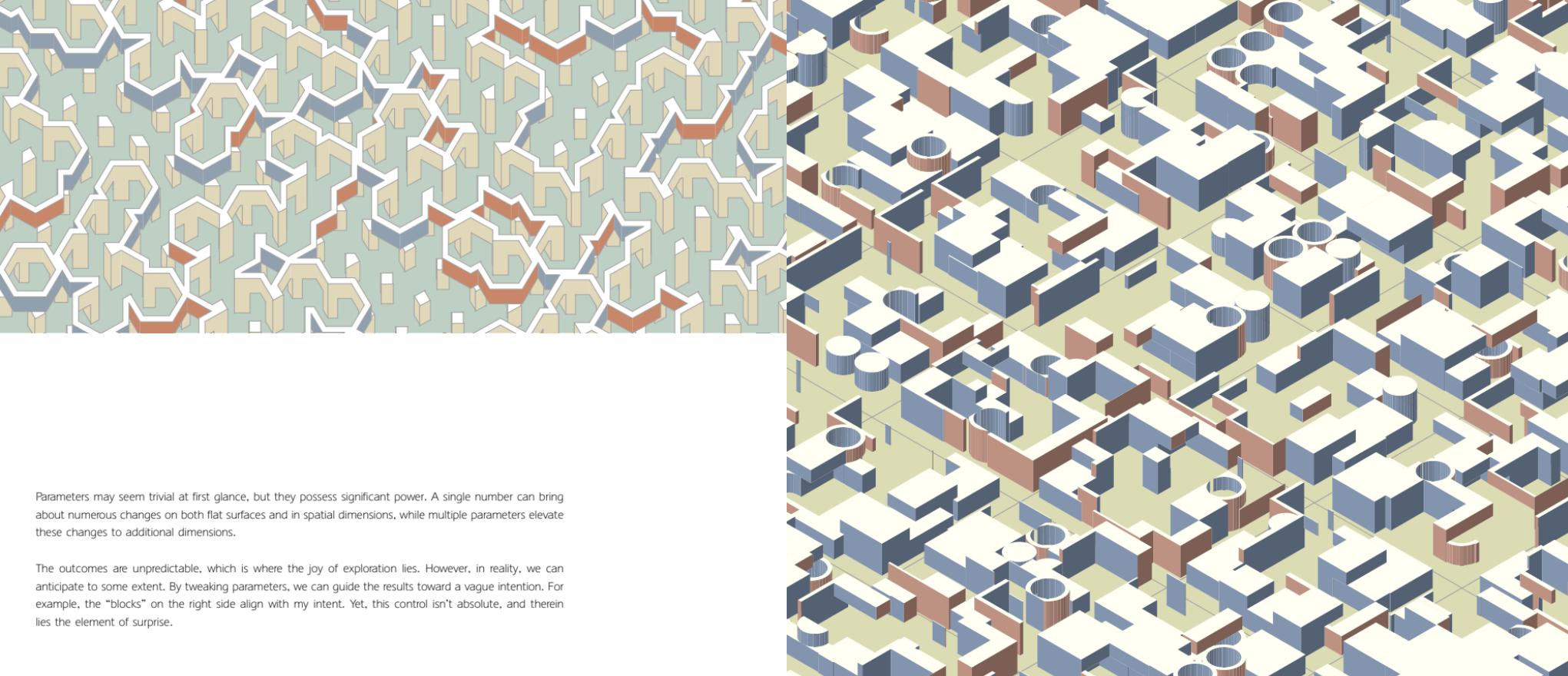


try:

- visibilities of different parts
- visibilities of outlines and surfaces
- different shape | mass | space type



study - pattern



Parameters may seem trivial at first glance, but they possess significant power. A single number can bring about numerous changes on both flat surfaces and in spatial dimensions, while multiple parameters elevate these changes to additional dimensions.

The outcomes are unpredictable, which is where the joy of exploration lies. However, in reality, we can anticipate to some extent. By tweaking parameters, we can guide the results toward a vague intention. For example, the “blocks” on the right side align with my intent. Yet, this control isn’t absolute, and therein lies the element of surprise.

discovery

## reflection

The course itself in the spring semester is meaningful, inspiring us to explore spatial possibilities and stimulate creativity. However, I believe the course could be somewhat condensed. In reality, many scripts are just copied from the teacher, which is a waste of time. Personally, I think we could spend less time on this aspect and simply learn the scripts in an explanatory manner.

In the spring semester, I personally learned a lot, especially realizing how interesting the results can be from just one parameter. I also discovered the joys of parametric design and the convenience of programming in design. More importantly, this course has been revolutionary and inspiring compared to our traditional architectural studies. I patiently completed course tasks and managed my time effectively, despite the challenges of conflicting schedules with my graduation project.





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04 TEST  
Teng Fengshi

## TEST - Introduction

In order to make sure that the scripts work we take tests about the parameter types, values and variations. Some parameters are general while others are specific parameters through calls to functions. The parameter values and variation cause more complex changes, which are illustrated an example in the end.

# overview

## general

mode type  
projection type  
visibility  
colour  
grid



## function

function role  
visibility  
height  
scale  
rotation  
shape  
mass  
space  
move  
expand  
position  
gap  
symmetry



## combination

examples of types and combinations/variations



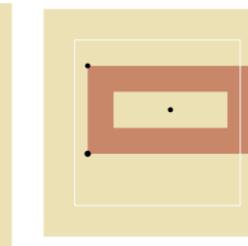
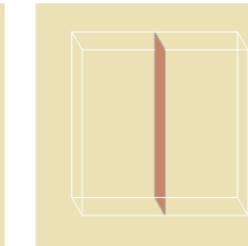
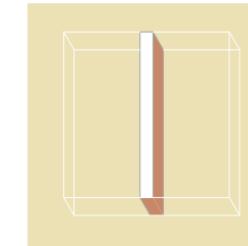
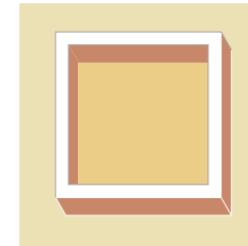
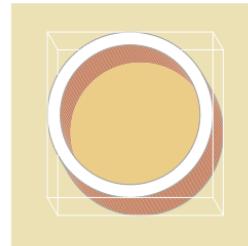
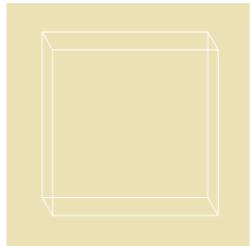
## general

same distribution type different parameters

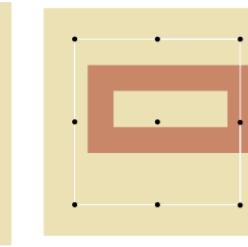
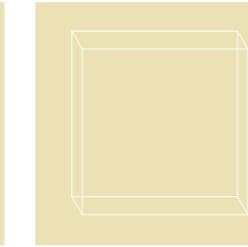
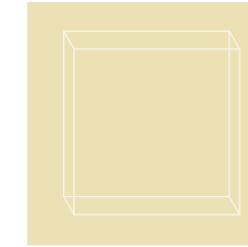
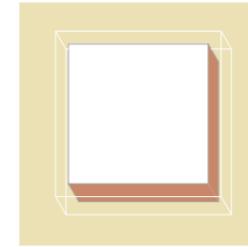
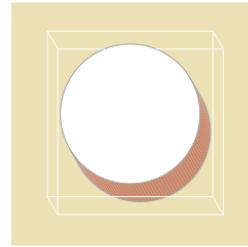
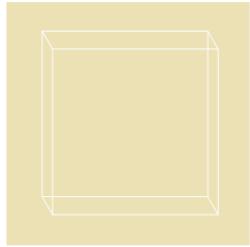




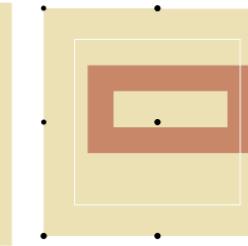
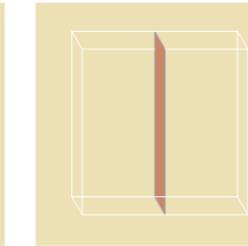
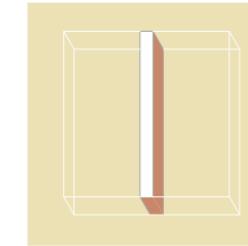
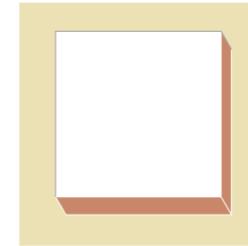
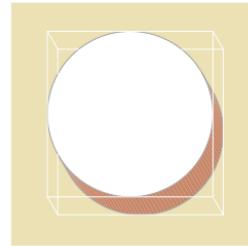
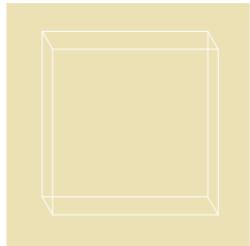
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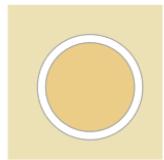
voldi



solid



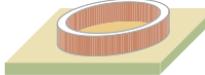
model type



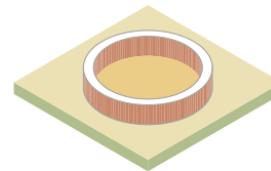
1 top view



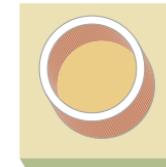
2 side view



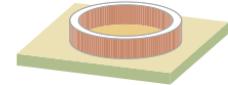
3 frontal axo t



4 isometric axo t



5 monometric axo t



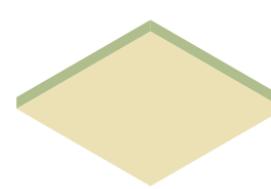
6 dimetric axo t



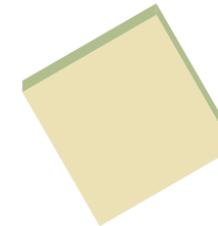
7 bottom view



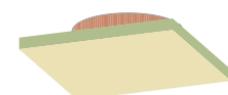
8 frontal axo b



9 isometric axo b



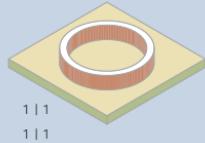
10 monometric axo b



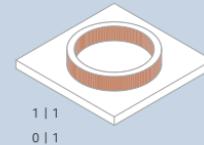
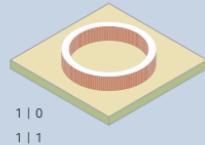
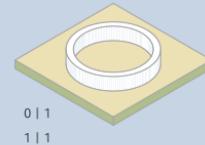
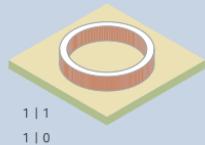
11 dimetric axo b

projection type

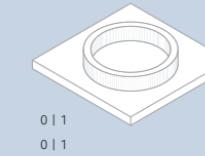
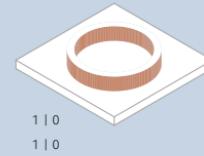
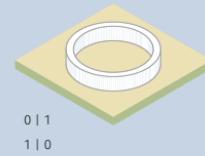
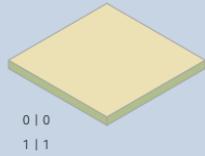
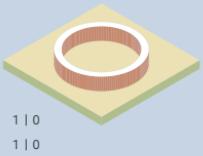
4 on



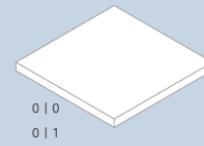
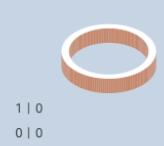
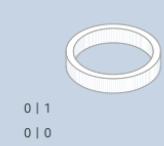
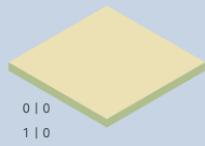
3 on



2 on



1 on

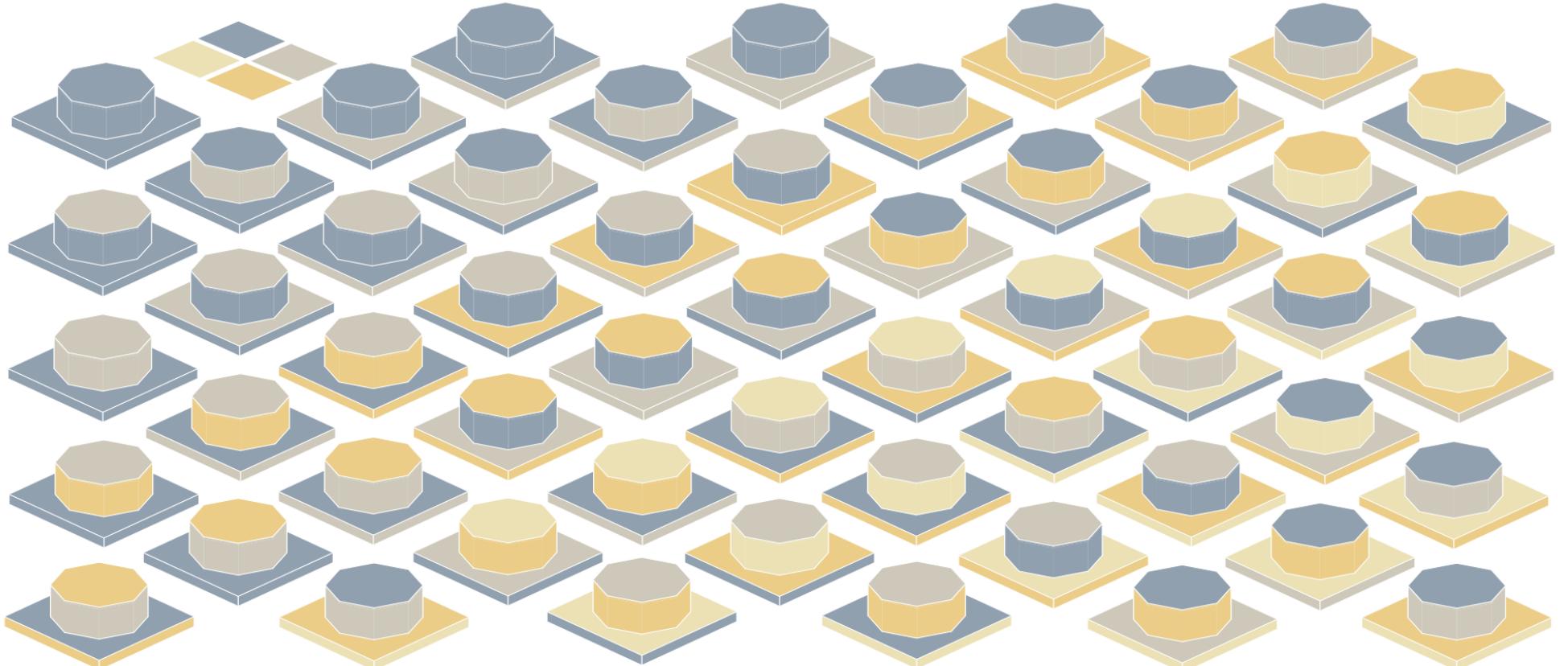


0 on

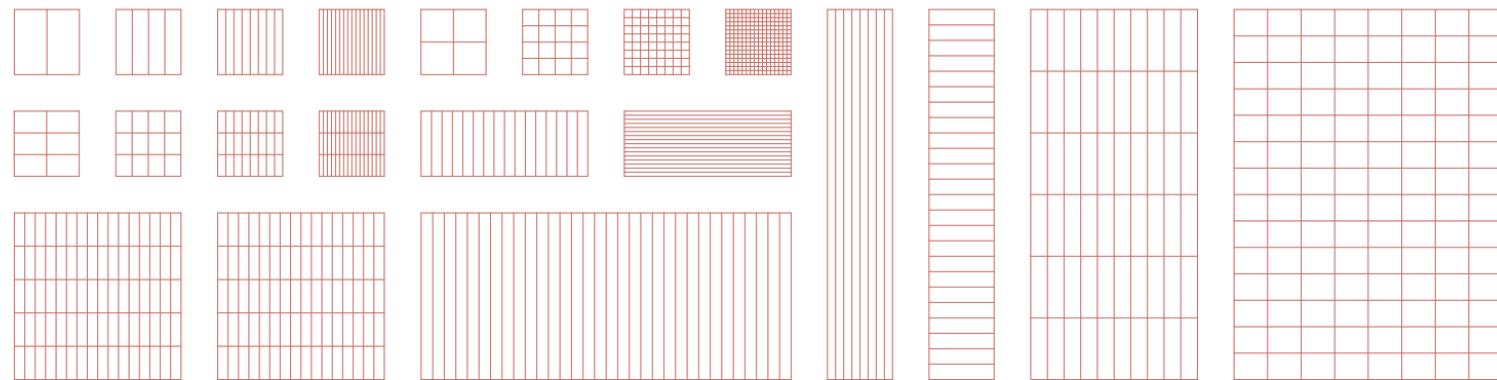
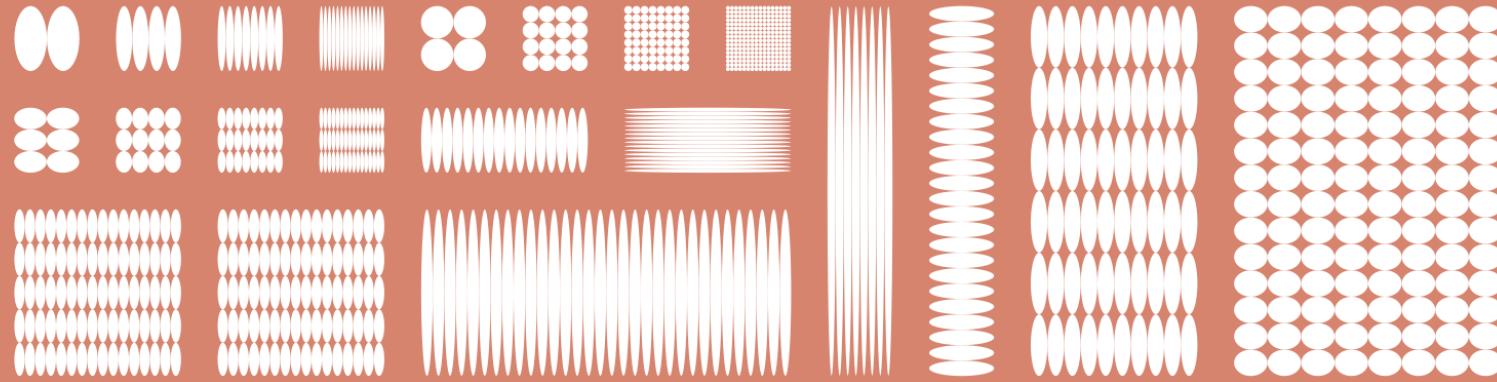


visibility

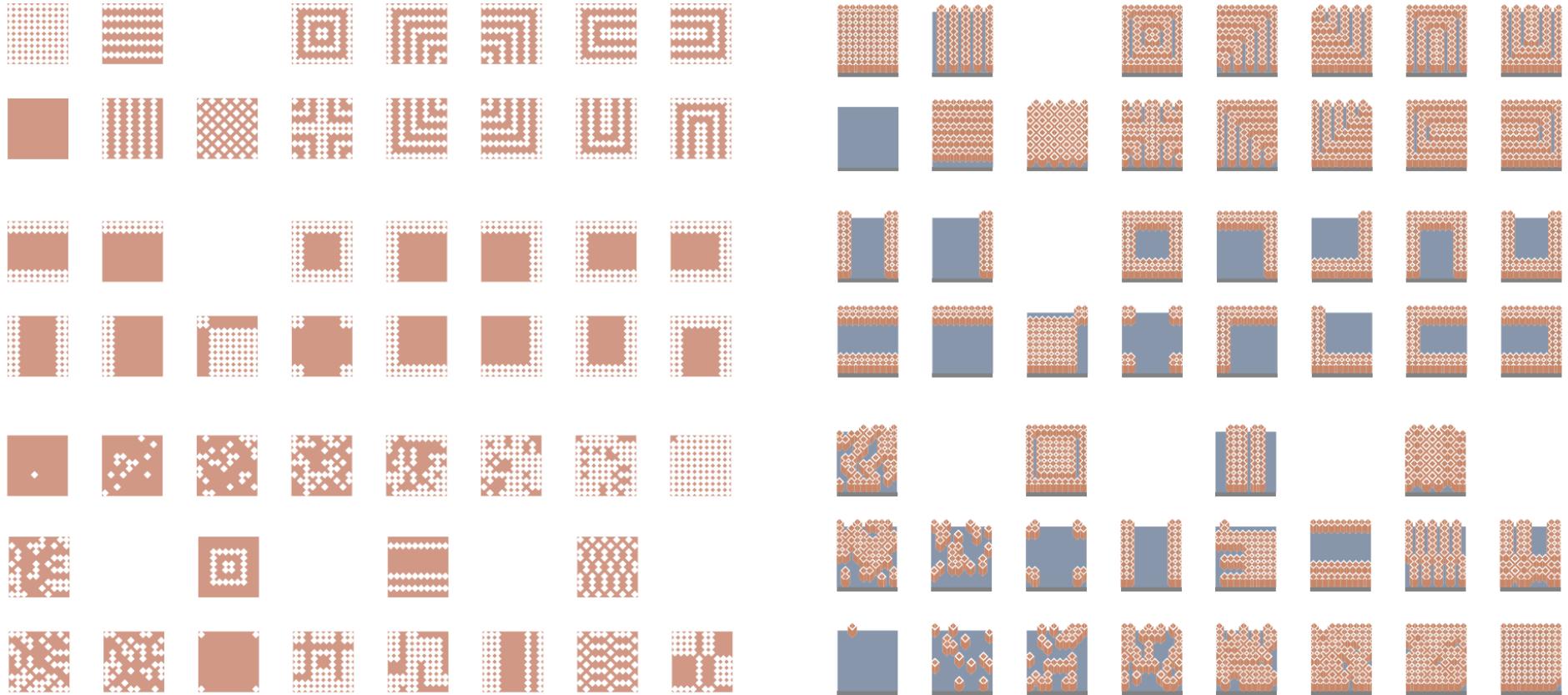
sha sur | sha out  
bas sur | bas out



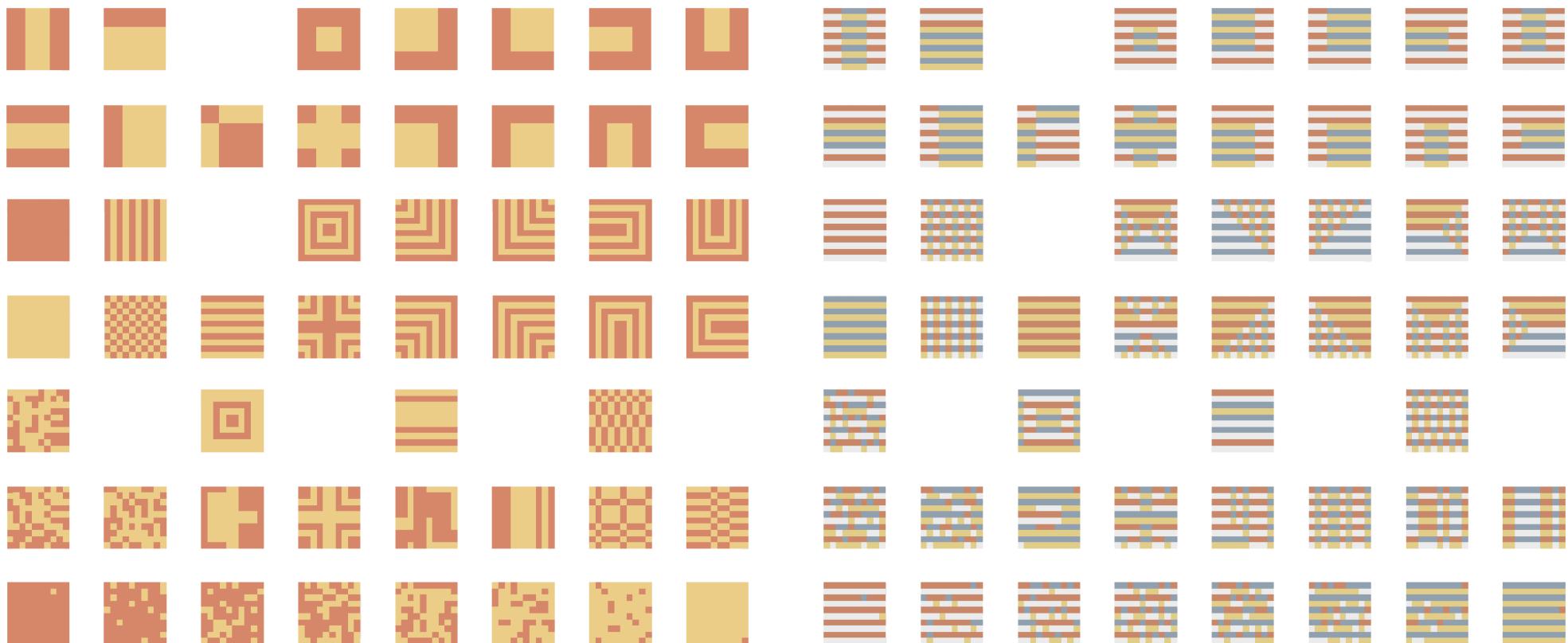
material & colour



grid

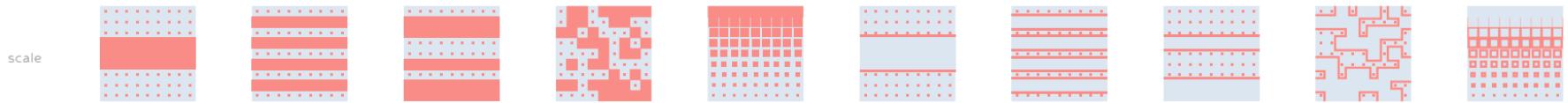


FUNCTION - visibility



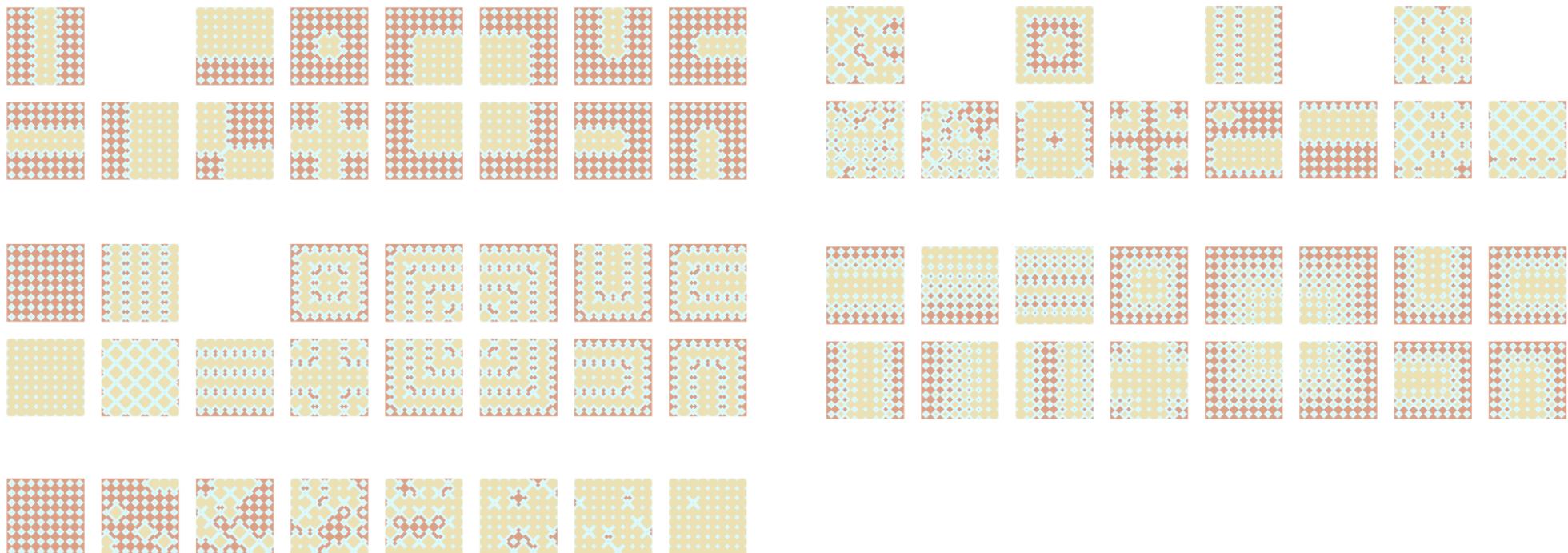
FUNCTION - color

1 divide	2 alternate	3 random	4 persent	5 stepped
1 2 1 1	1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1	1 2 1 1 2 2 2 2 1 1 1 2 2 1 1 1 2 2 2 1 2 2 1 1 1 2 2 2 1 2 2 1 1 1 2 2 2 1 2 2 1 1 1 2 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2	1 1 2 1 2 2 1 2 2 1 1 2 1 2 2 1 2 2	9 9 9 9 9 9 9 9 9 7 7 7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 5 5 5 5 5 5 5 5 5 4 4 4 4 4 4 4 4 4 3 3 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1

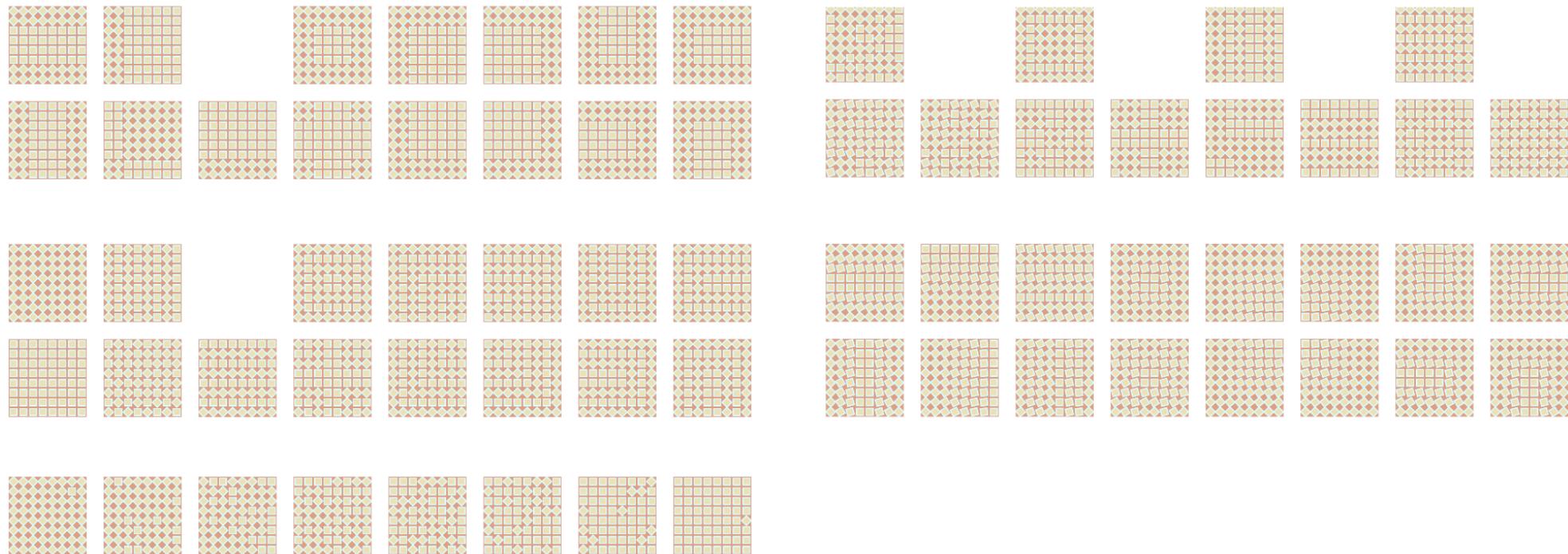


1 divide	2 alternate	3 random	4 persent	5 stepped
1 2 1 1	1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1	1 1 1 2 1 2 1 2 1 2 1 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2 2 1 2 1 1 1 1 2 1 2 1 1 2 1 2 2 2 1 2 2 2 2 2 1 2 1 2 2 2 1 2 2 2 2 1 2 1 2 2 2 1 2 2 2 2 1 2 1 1 1 2 1 1 1 2 2 2 2 1 1 2 2 1 1 1 2 2 2 2 1 1 2 2 1 1 1 2 2 2 2 1	9 9 9 9 9 9 9 9 9 7 7 7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 5 5 5 5 5 5 5 5 5 4 4 4 4 4 4 4 4 4 3 3 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1	

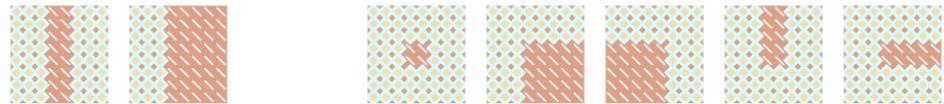
# FUNCTION - height



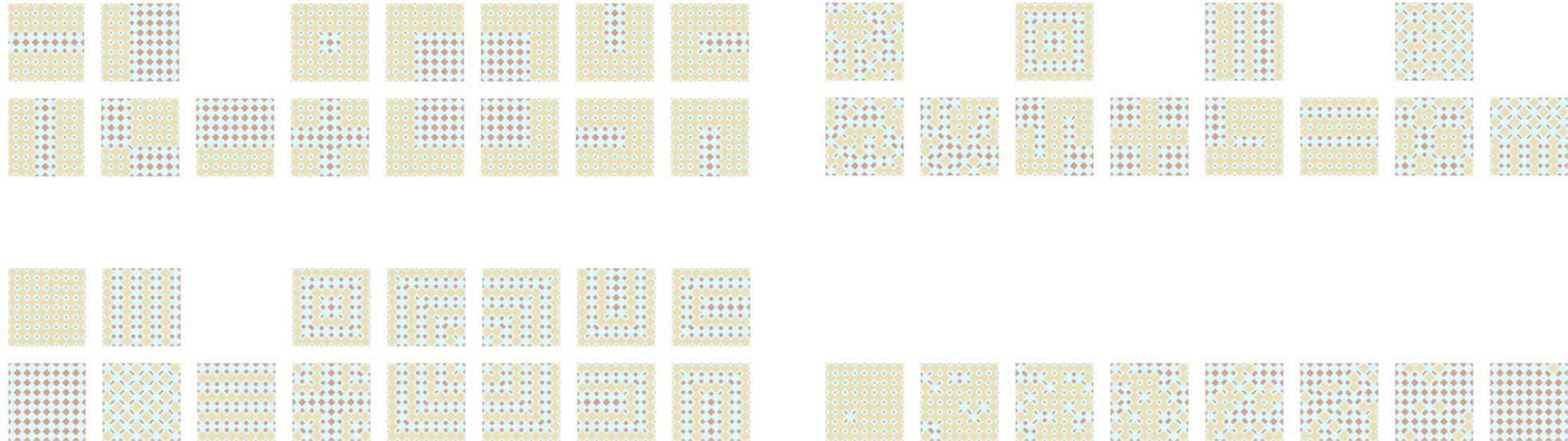
FUNCTION - scale



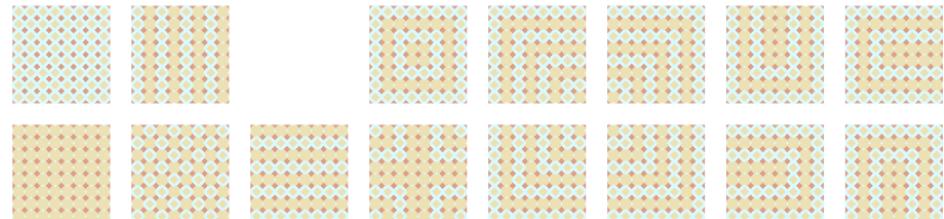
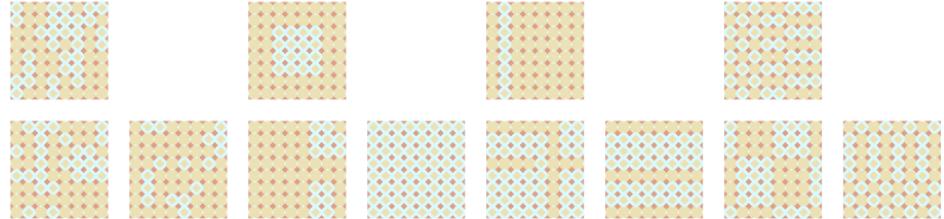
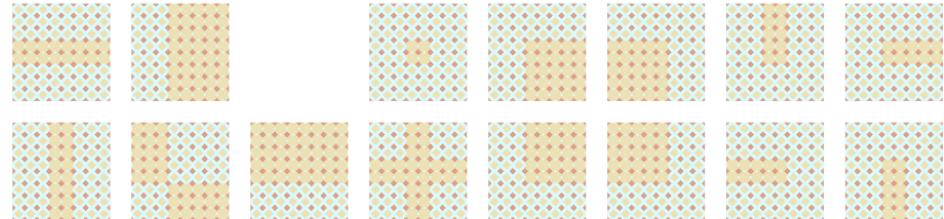
FUNCTION - rotation



FUNCTION - shape



FUNCTION - mass



FUNCTION - space

odd - 8



1 regular



2 alternating 1



3 alternating 2



4 random two



5 random both



6 random range



7 left to right



8 edge to centre



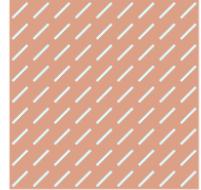
odd - 9



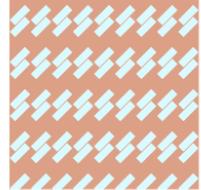
1 regular



2 alternating 1



3 alternating 2



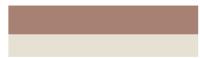
4 random two



5 random both

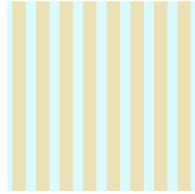


6 random range

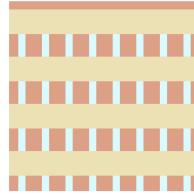


FUNCTION - position

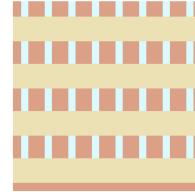
8 - odd



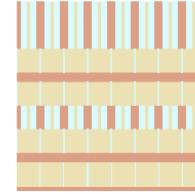
1 regular



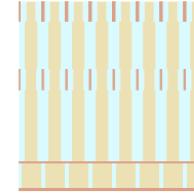
2 alternating 1



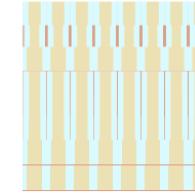
3 alternating 2



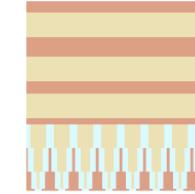
4 random two



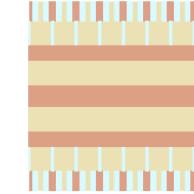
5 random both



6 random range

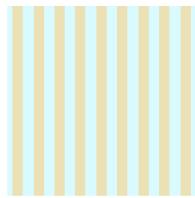


7 left to right

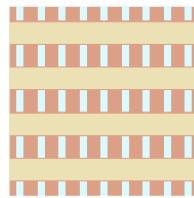


8 edge to centre

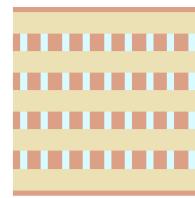
9 - odd



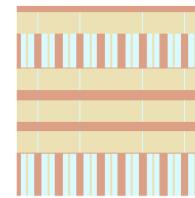
1 regular



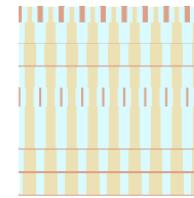
2 alternating 1



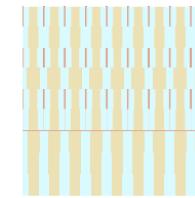
3 alternating 2



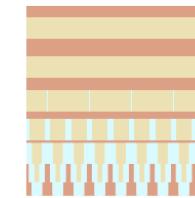
4 random two



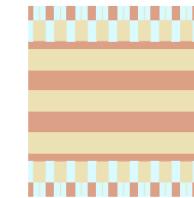
5 random both



6 random range

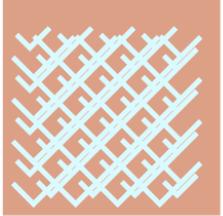


7 left to right



8 edge to centre

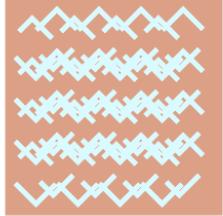
FUNCTION - gap



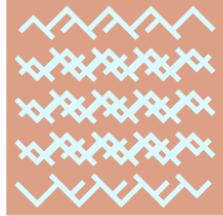
1 translate



2 reflect vertical



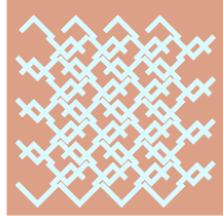
3 reflect horizontal



4 reflect both



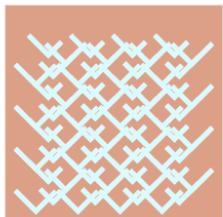
5 ref ver gli ref hor v



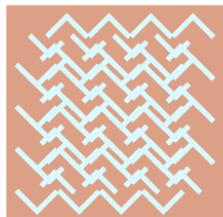
6 ref hor gli ref ver



7 glide reflect hor



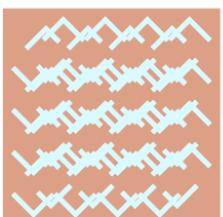
8 glide reflect ver



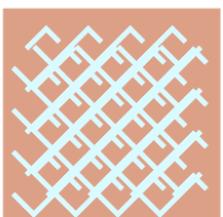
9 glide reflect both



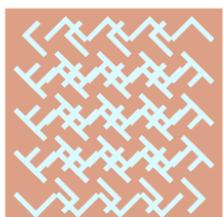
10 rotate vertical



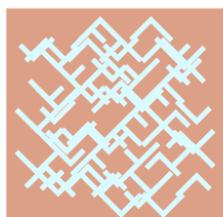
11 rotate horizontal



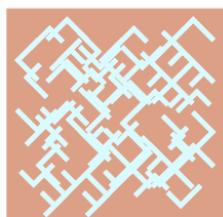
12 rotate both



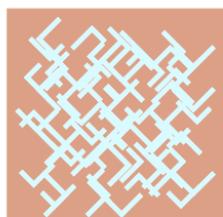
13 rotate four



14 random reflect

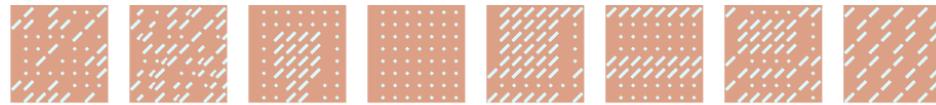
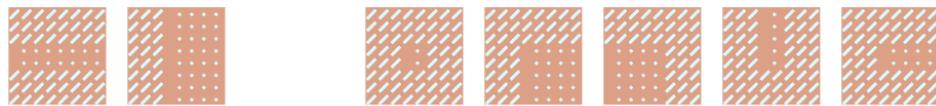


15 random rotate

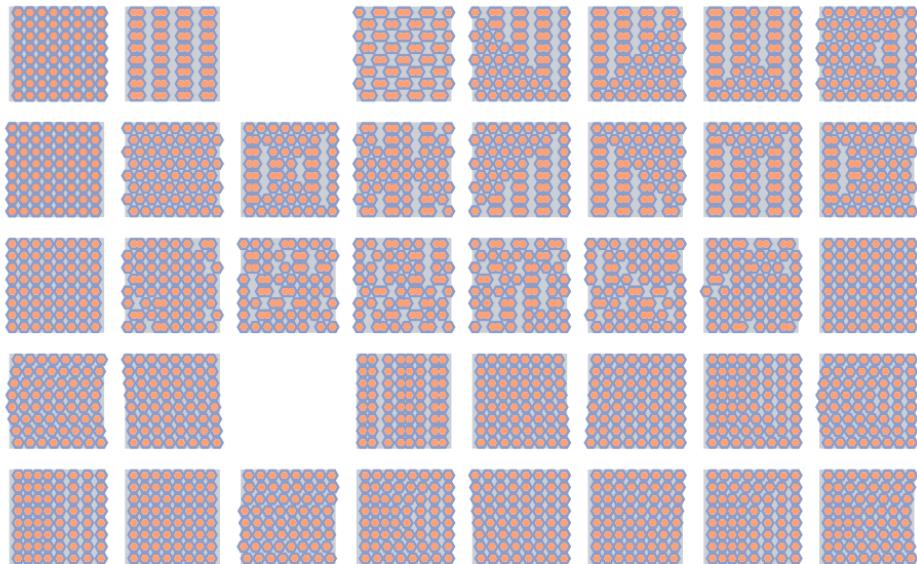
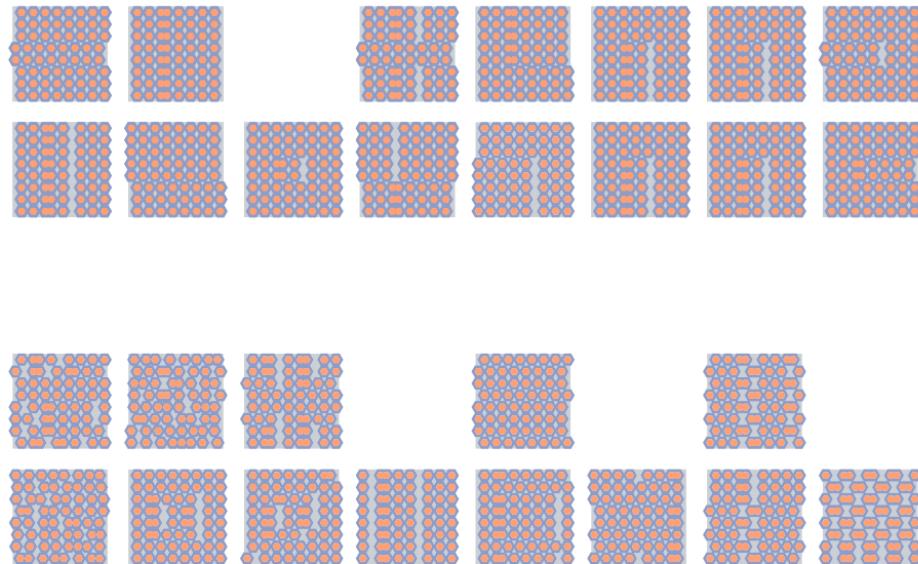


16 random both

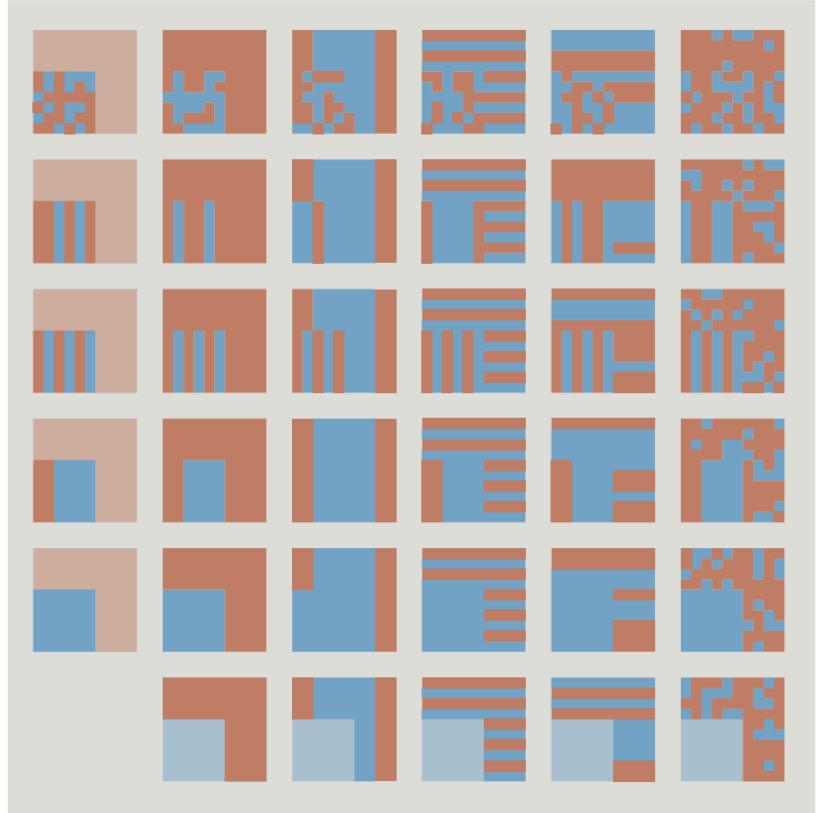
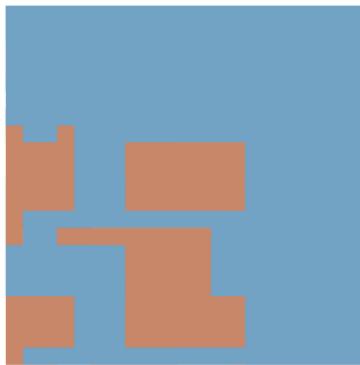
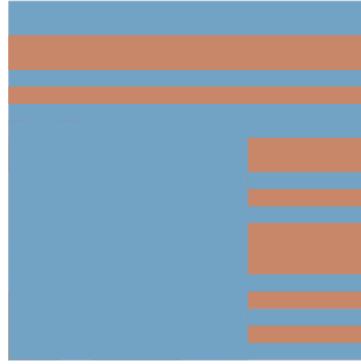
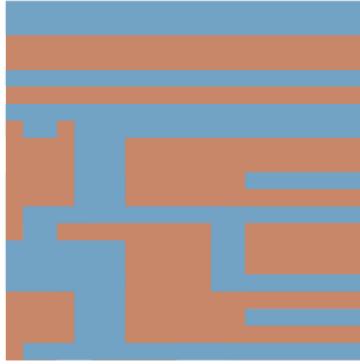
FUNCTION - symmetry



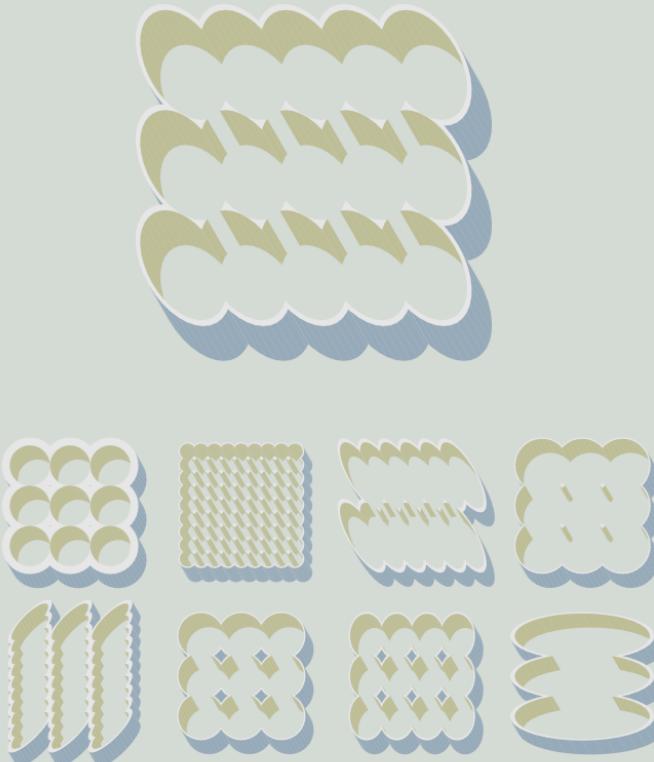
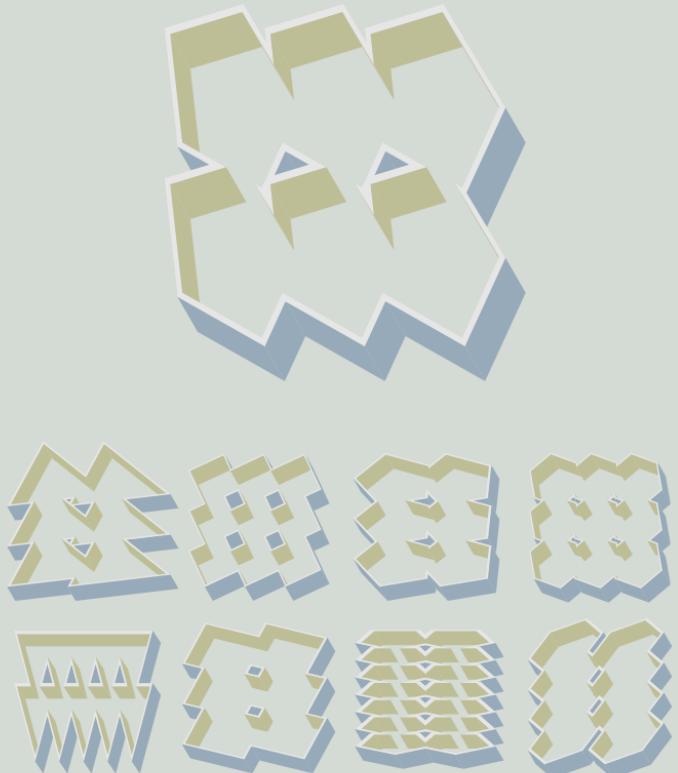
FUNCTION - expand



FUNCTION - move



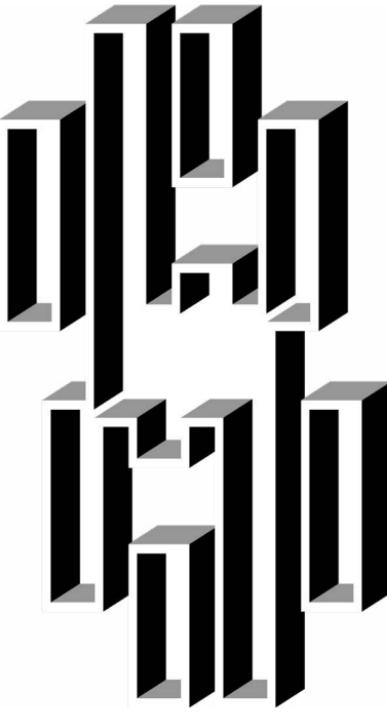
FUNCTION - combination and variations



illustrations



Zhejiang University · CCEA · Department of Architecture  
Year 4 design studio Spring & Summer 2023



05  
Teng Fengshi

EXPLORE

## EXPLORE - Introduction

In exploration we systematically work with parameter type, values, variation and the role of different combinations of parameters to explore the role in more depth. Based on this, in tuning we intuitively observe and study, and are able to use parameters to achieve range of forms and specific forms.

# overview

## purpose

The purpose of the exploration is to find interesting spaces and beautiful illustrations, in order to find the extend we can reach with the pattern and these parameters. We are surprised by how a little number can make a dramatic change to the patterns and spaces. Besides, what we can do during the exploration is to practice generating spaces and illustrations with the script, which help we have a better understanding of the scripts and do more in the future work in summer.

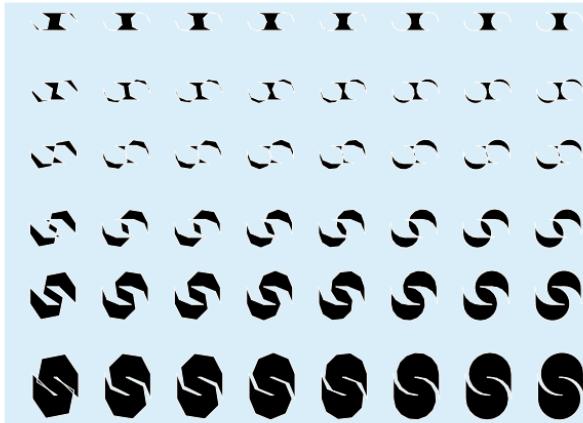
## methods

We use different methods to explore what we can do with it. The most used way is to change one parameter in a set intervals sequently, from one extreme to another. Then try change two together. Sometimes random adjustment of the parameters or even wrong performance can make beautiful and amazing results.

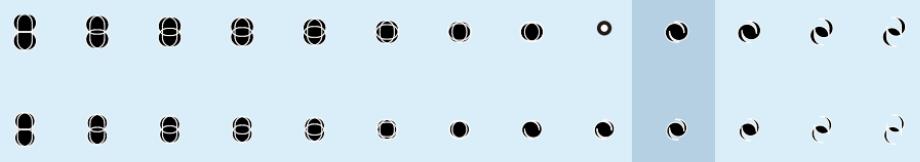
The aspects of the exploration include:

- systematic | intuitive
- transformations
- inflection points
- randomness
- layered forms
- specific forms
- range of forms
- type | variations | values
- ...

resolution change

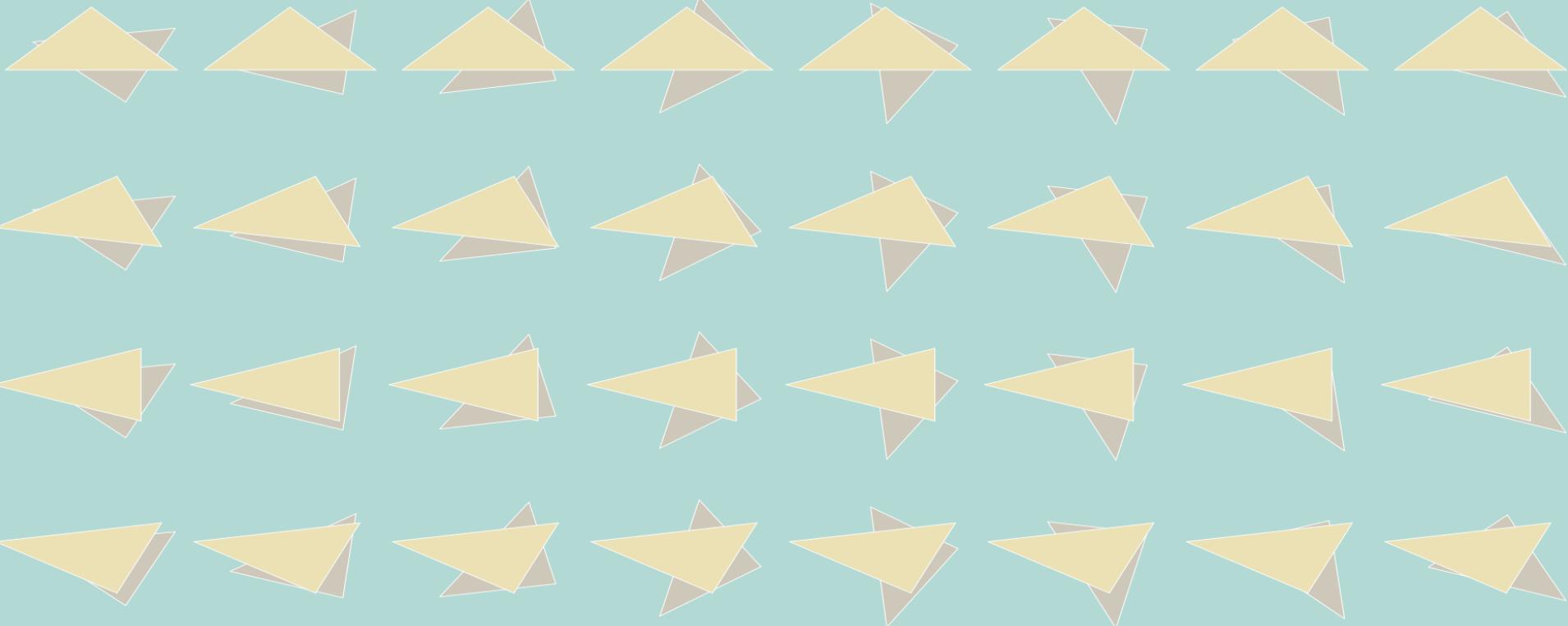


width change



details

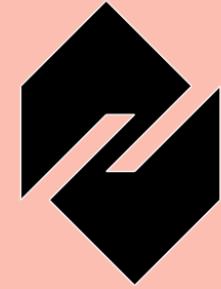
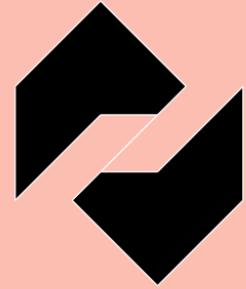
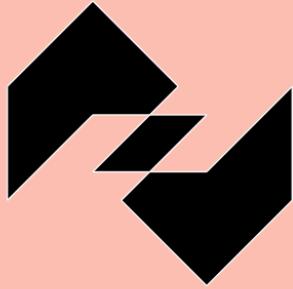
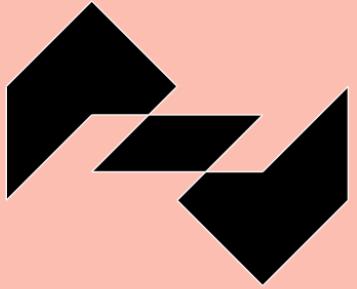
shape rotation change →



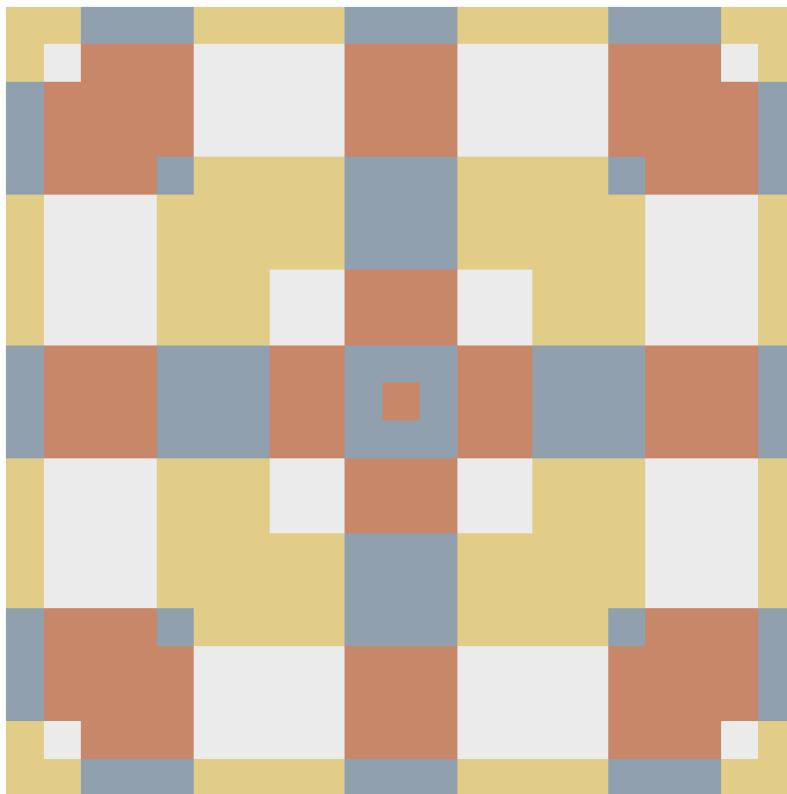
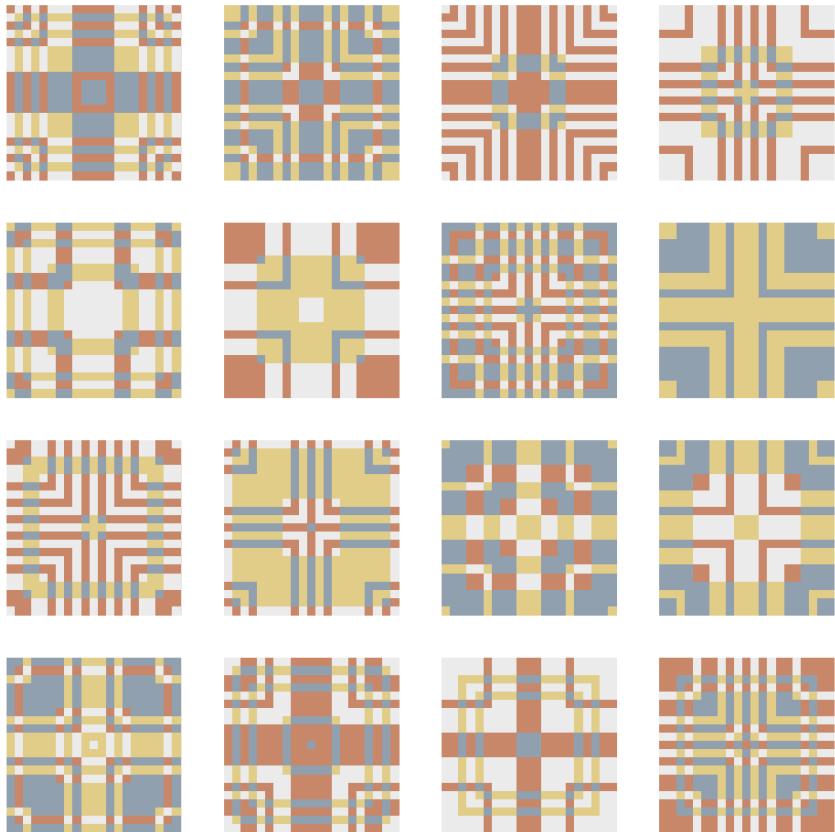
node rotation change ↑

systemetic | intuitive

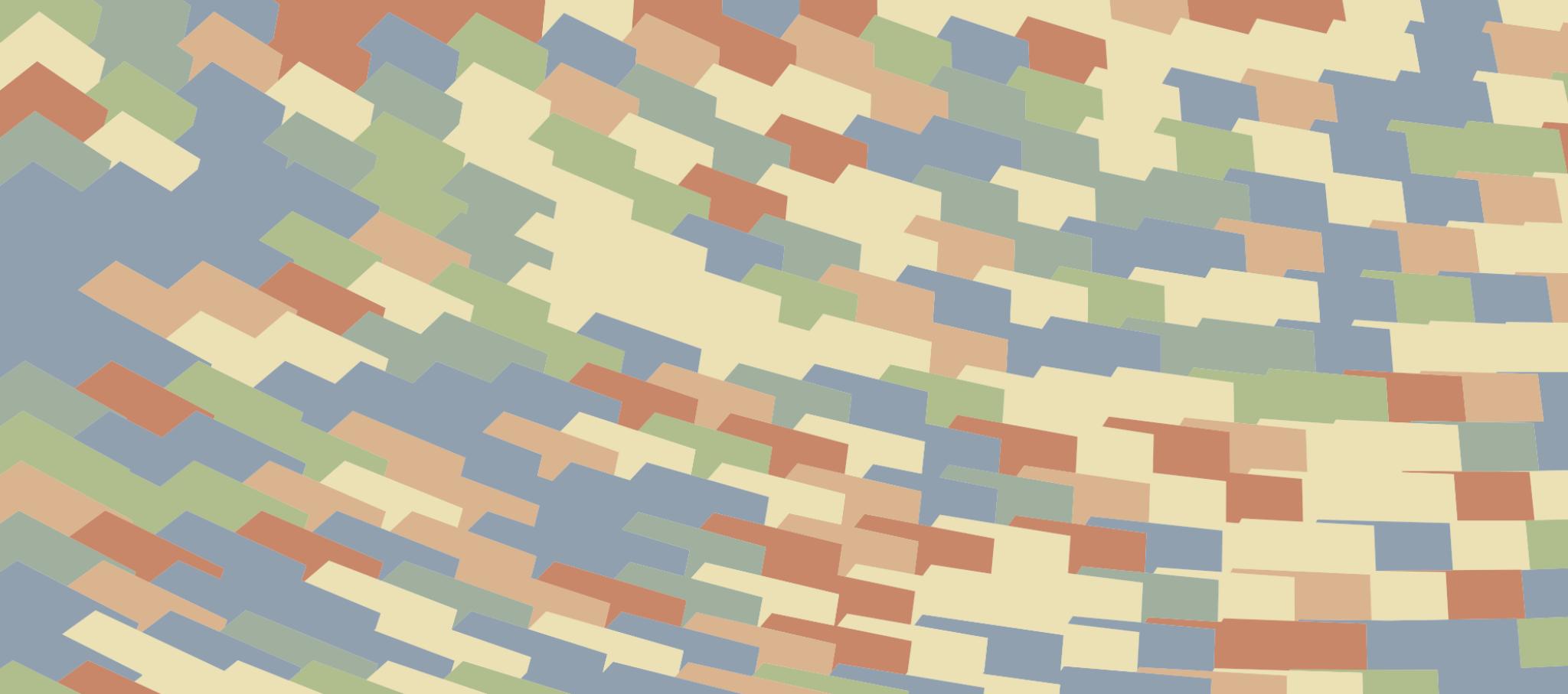




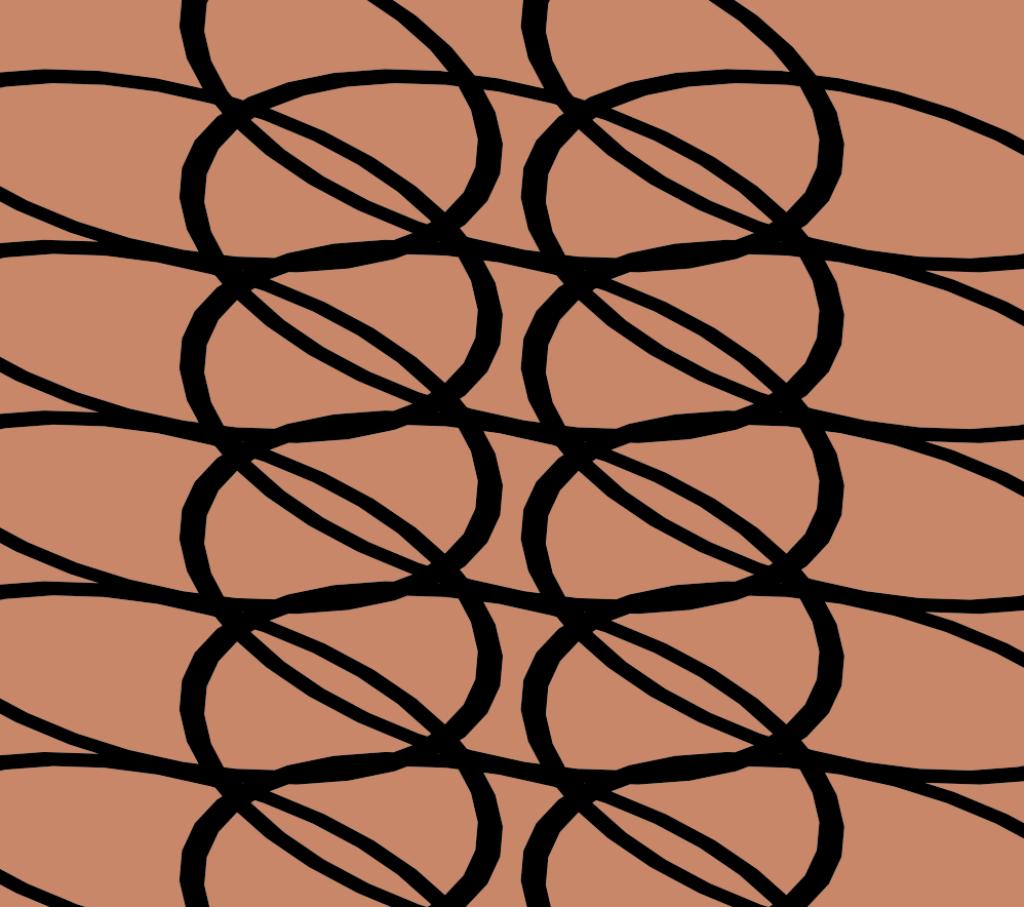
inflection points



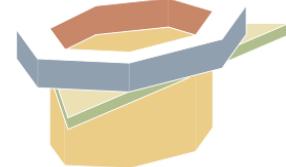
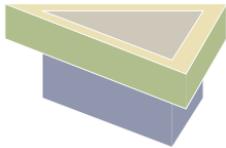
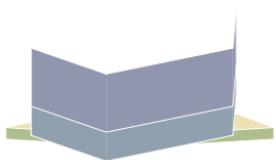
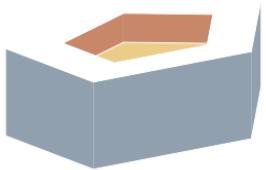
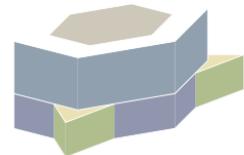
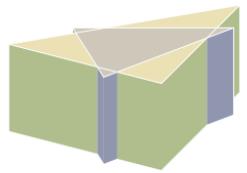
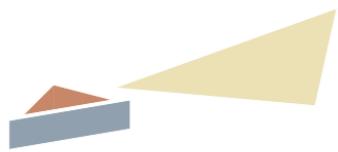
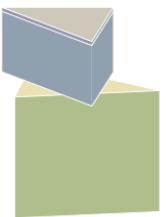
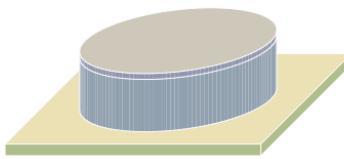
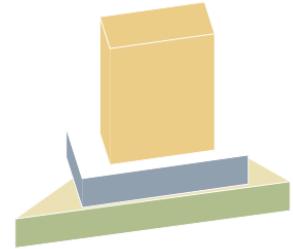
randomness



layered forms

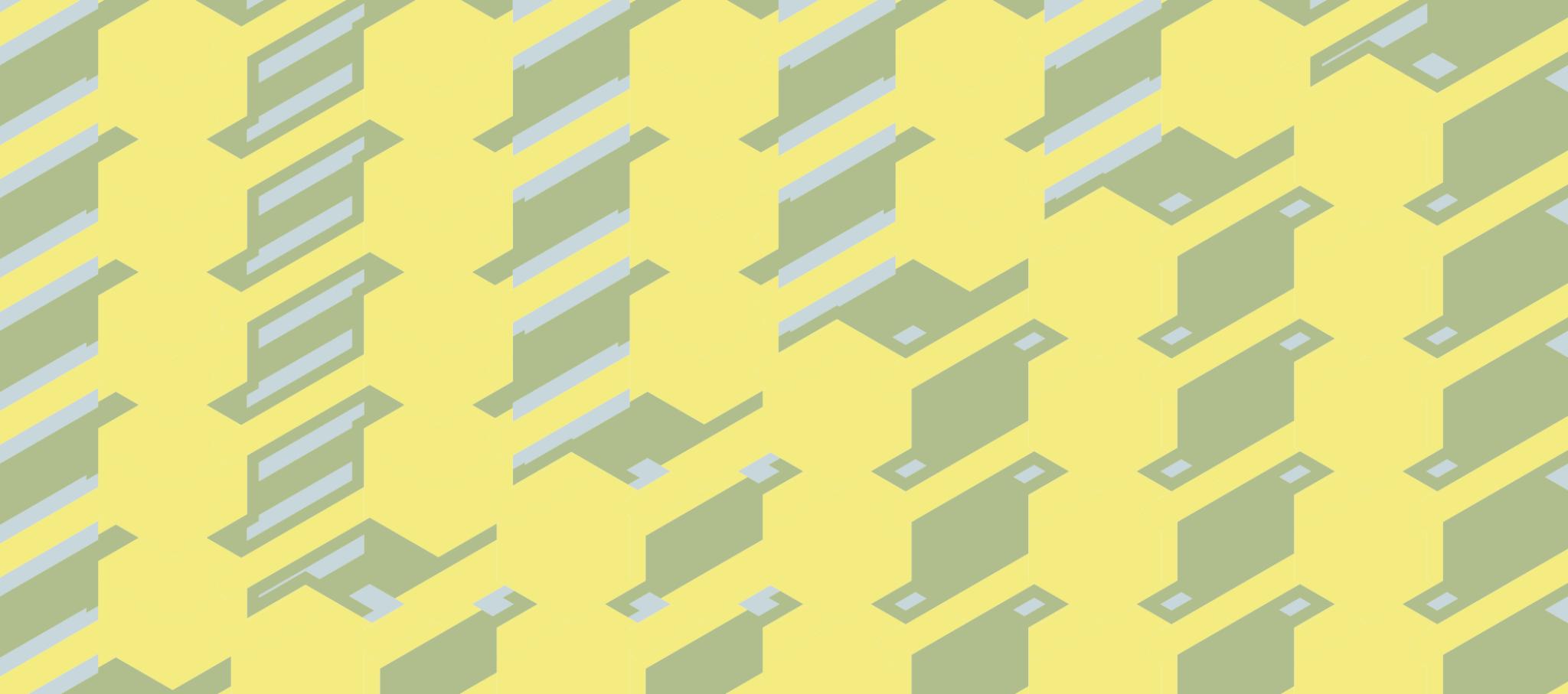


specific forms



range of forms

type | variations | values





Zhejiang University · CCEA · Department of Architecture  
Year 4 design studio Spring & Summer 2023