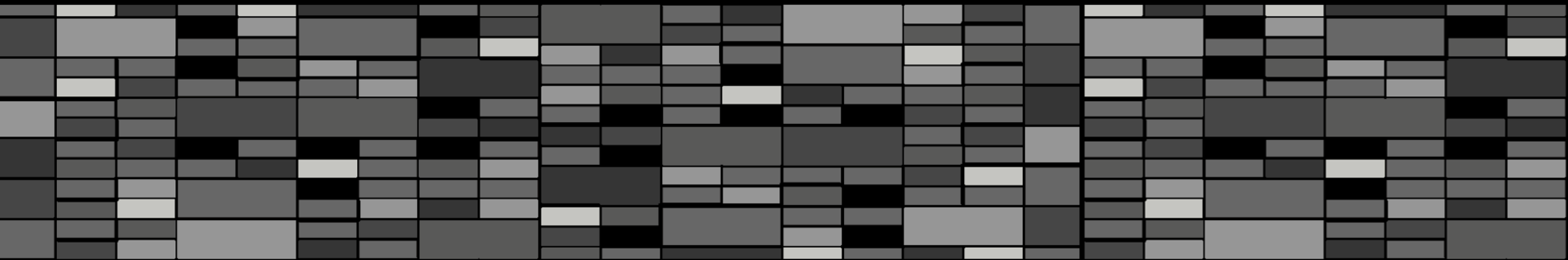


Integration of an Algorithmic BIM Approach in a Traditional Architecture Studio



AD: Algorithmic Design



<http://www.archdaily.com/151303/shanghai-oriental-sports-center-gmp-architekten>

BIM: Building Information Modeling

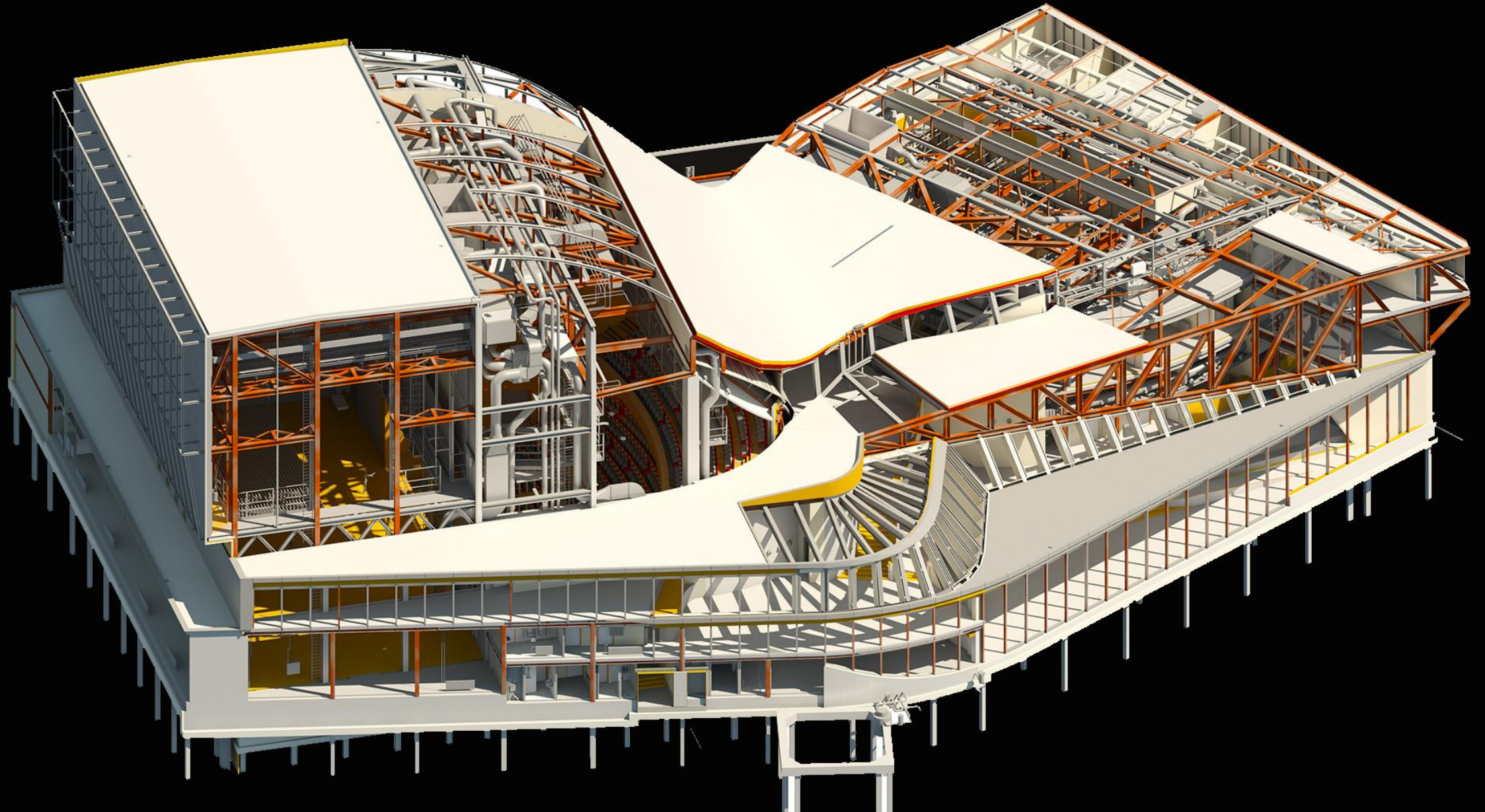


ABB: Algorithmic-Based BIM

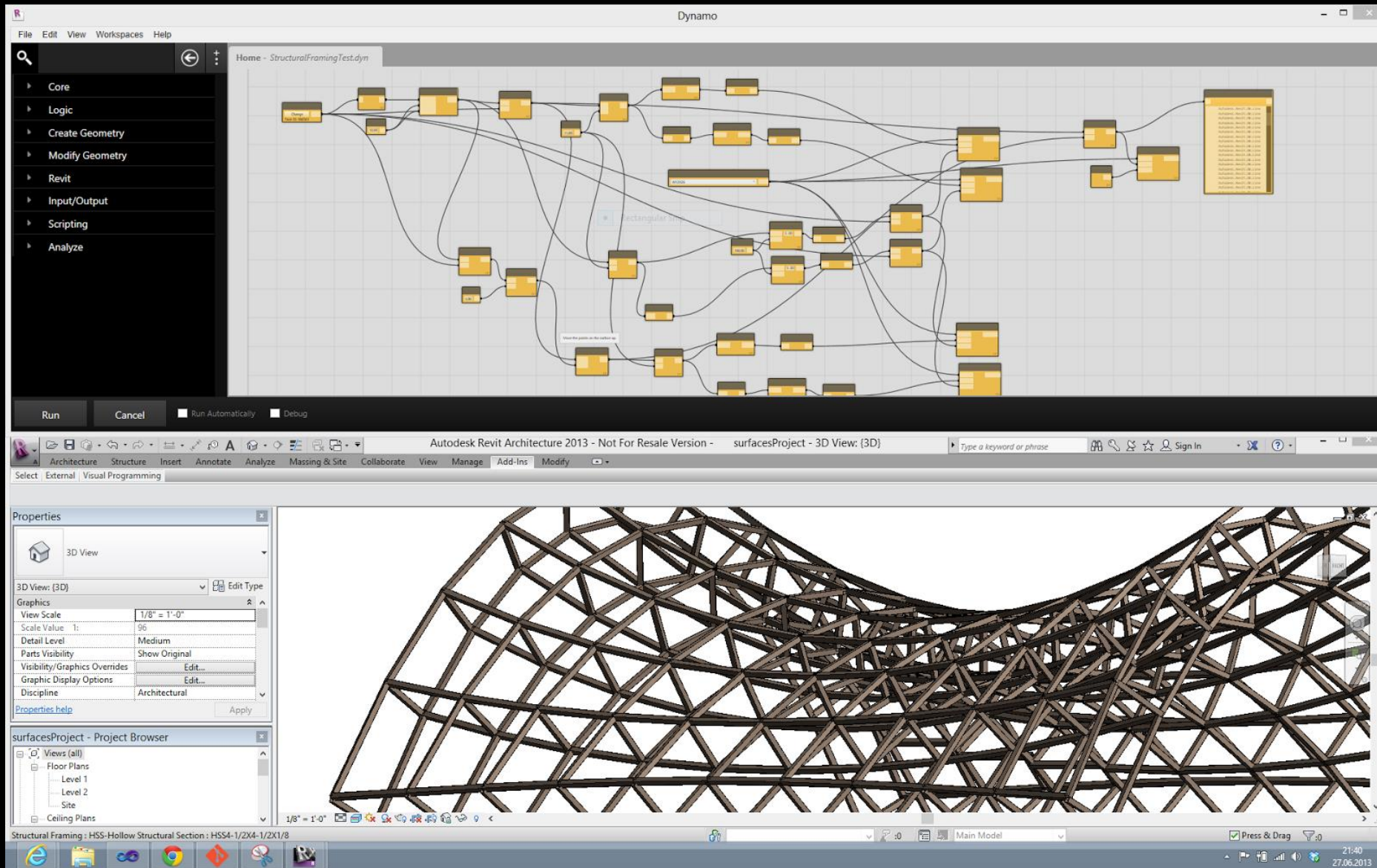


ABB: Algorithmic-Based BIM

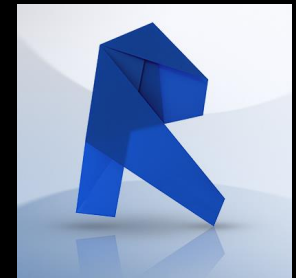
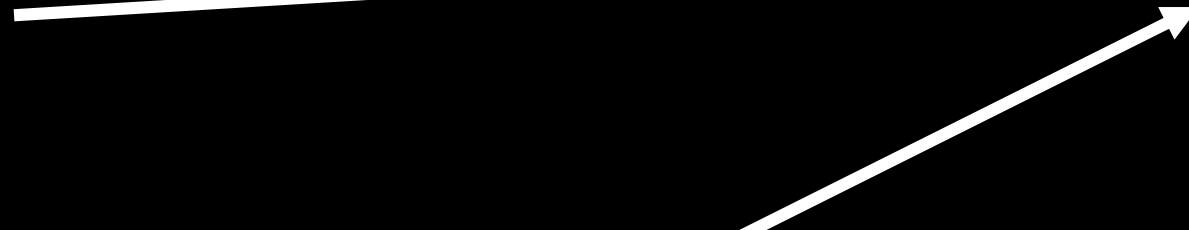
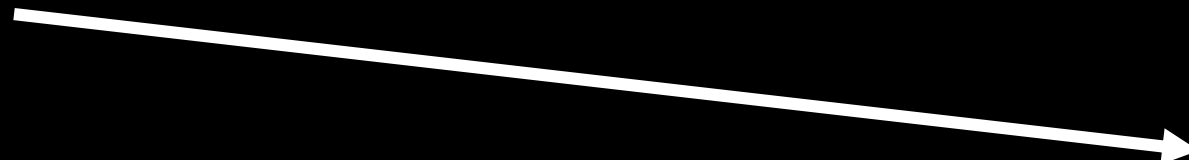
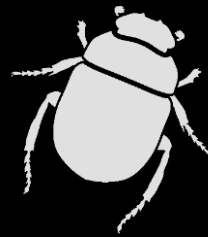
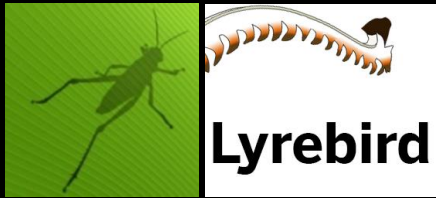
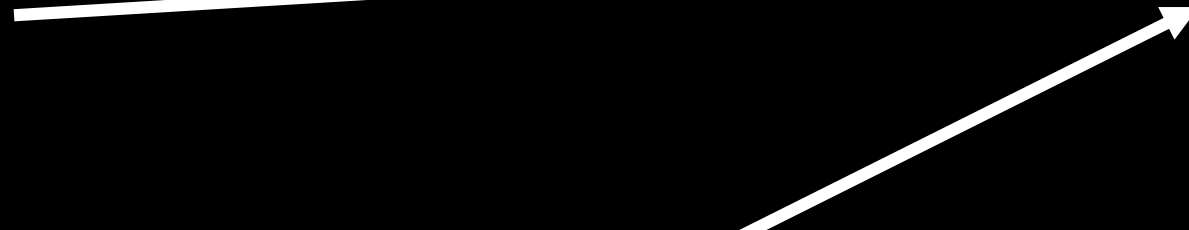
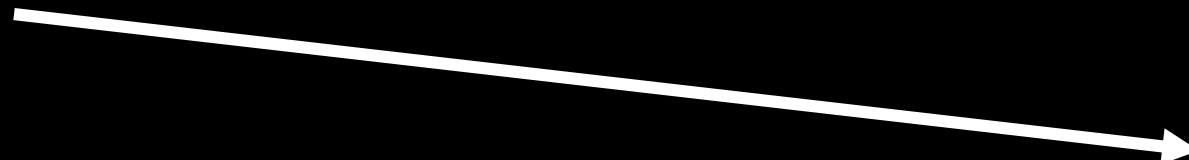
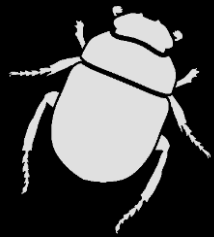
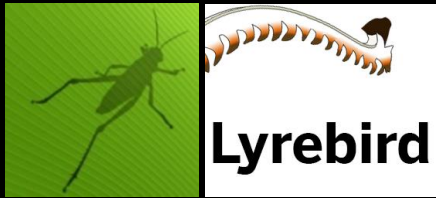


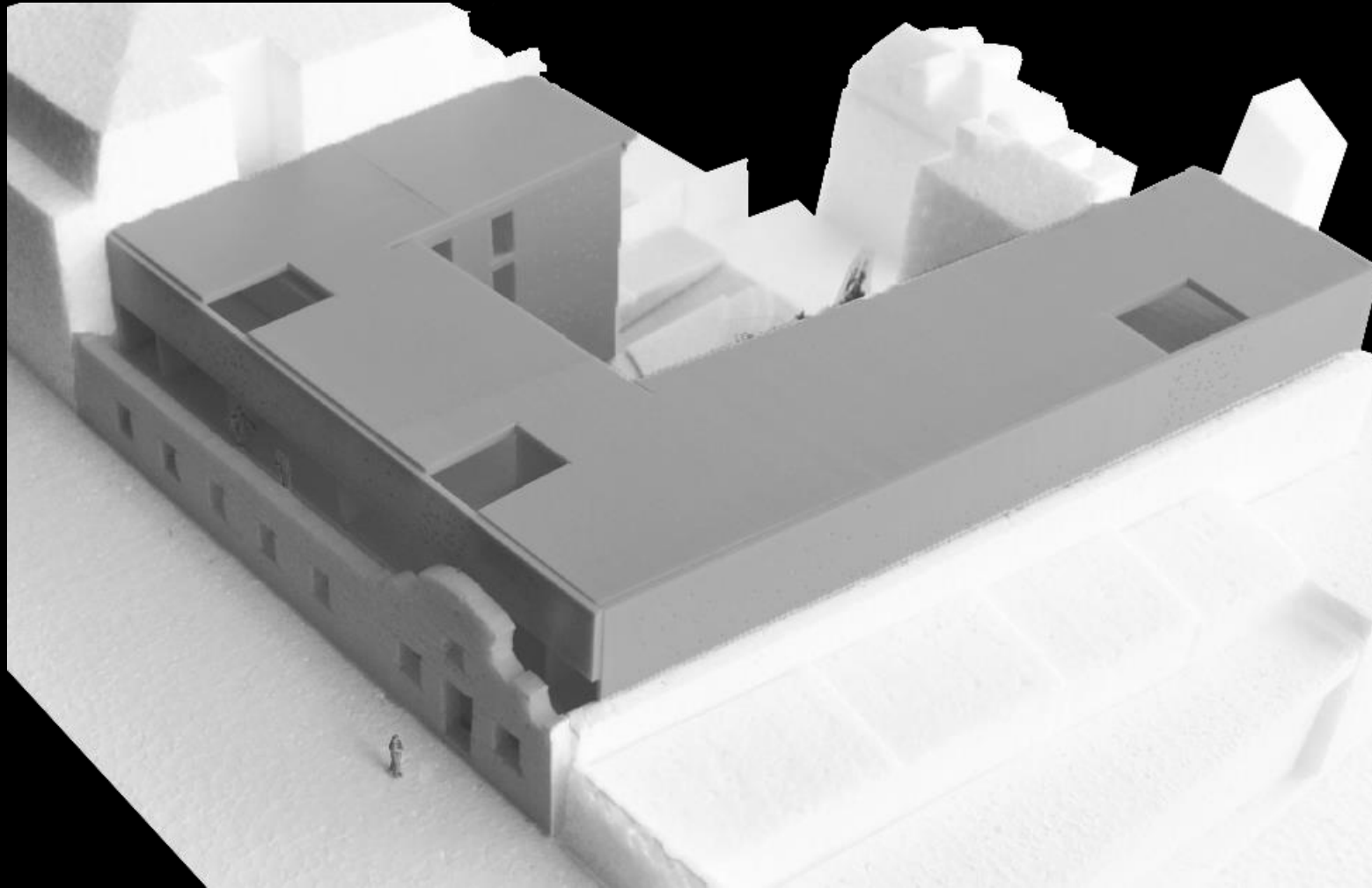
ABB: Algorithmic-Based BIM



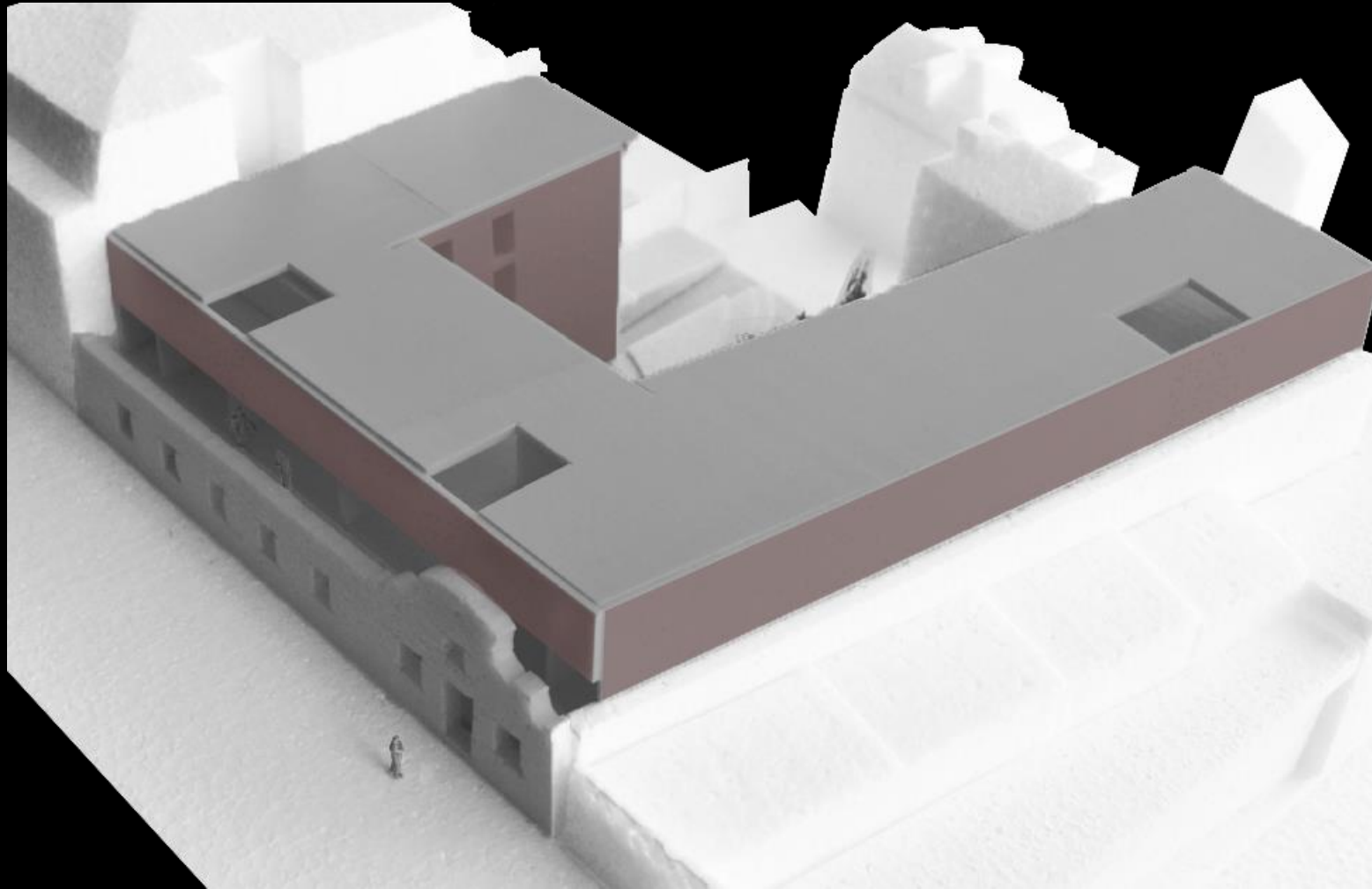


+ FORA

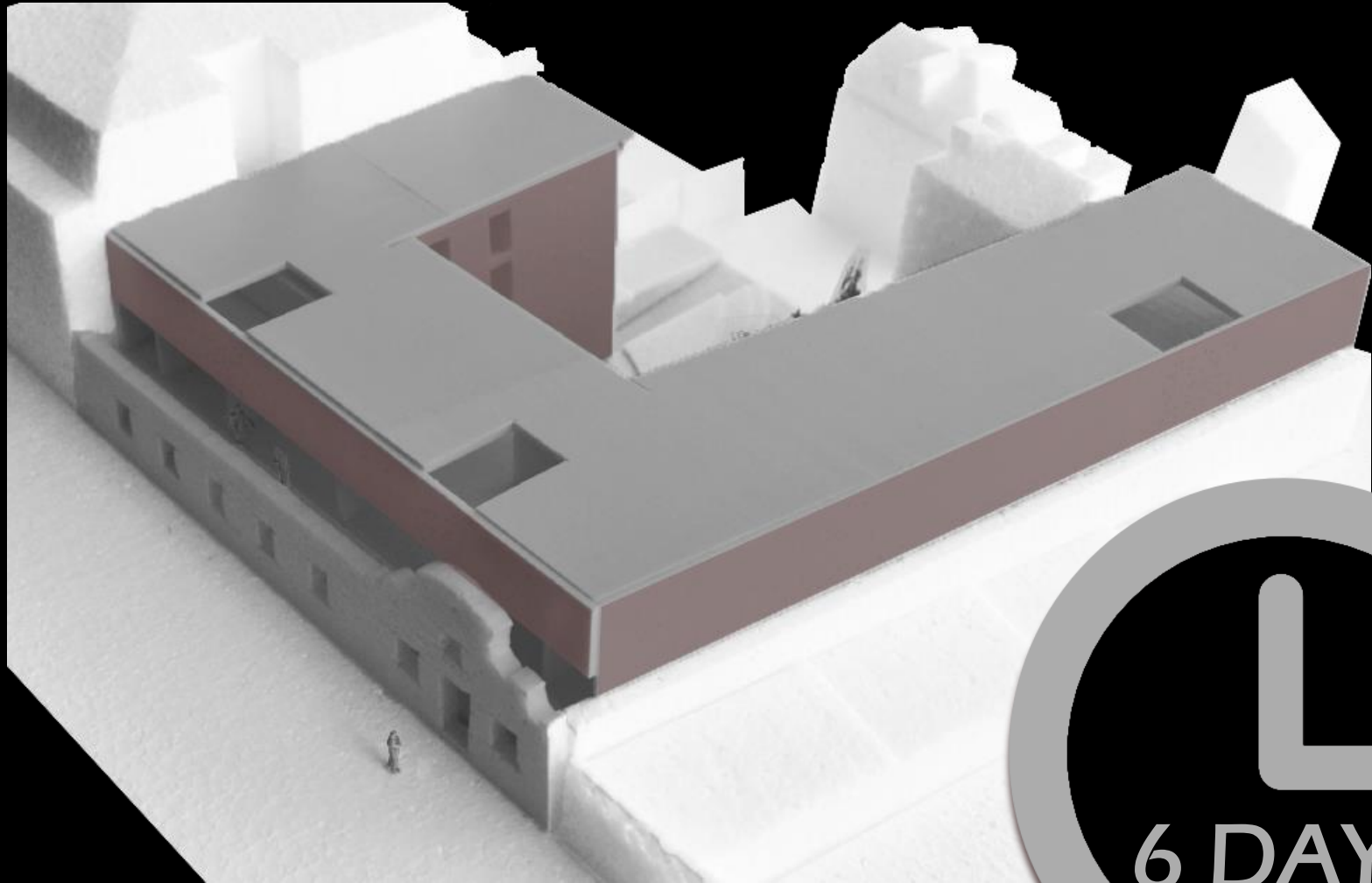
Parametric Facades



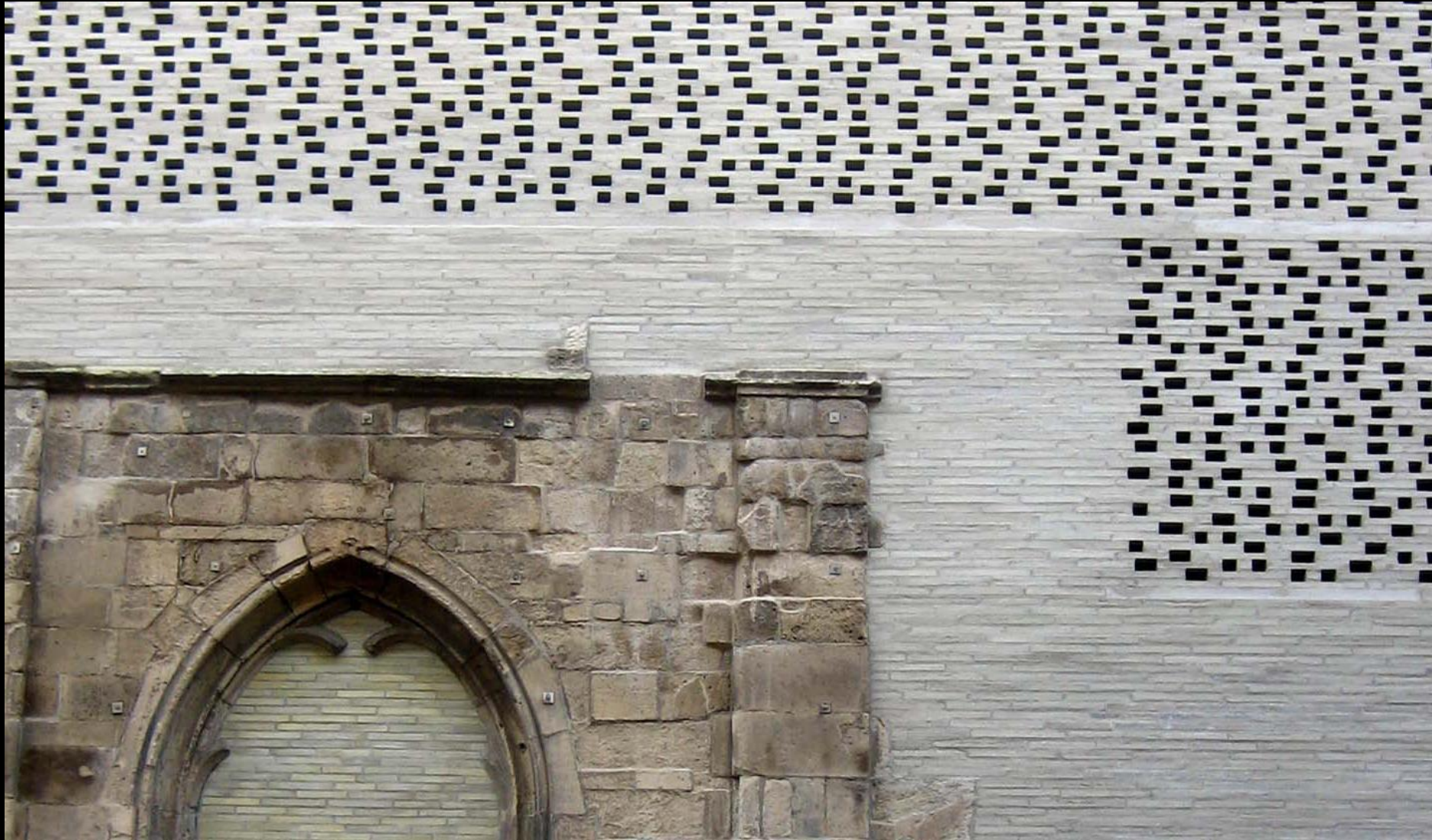
Parametric Facades



Parametric Facades

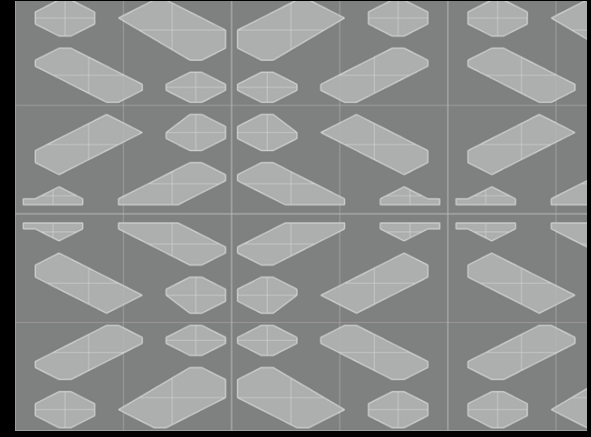
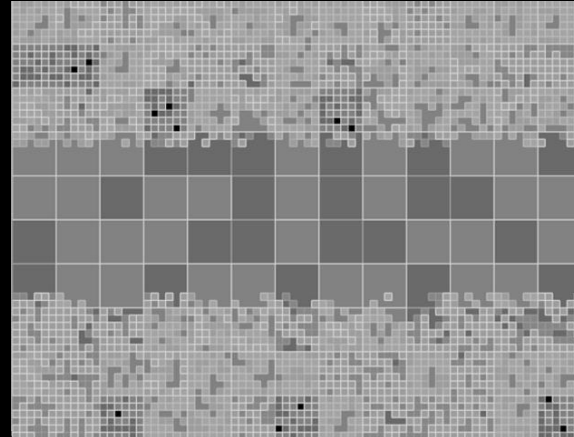
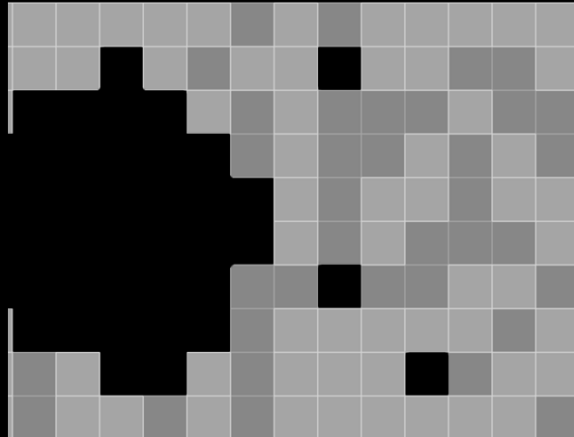
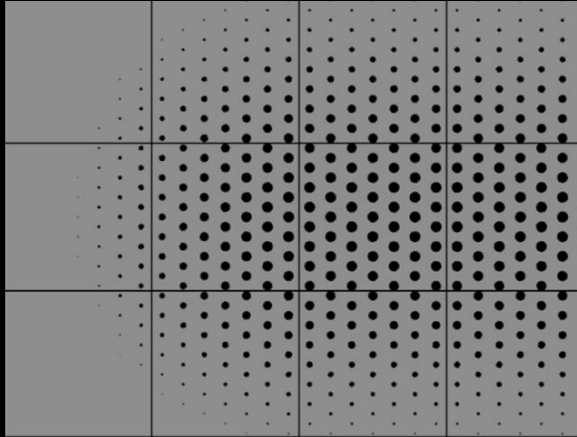


Concept *permeability-opacity*

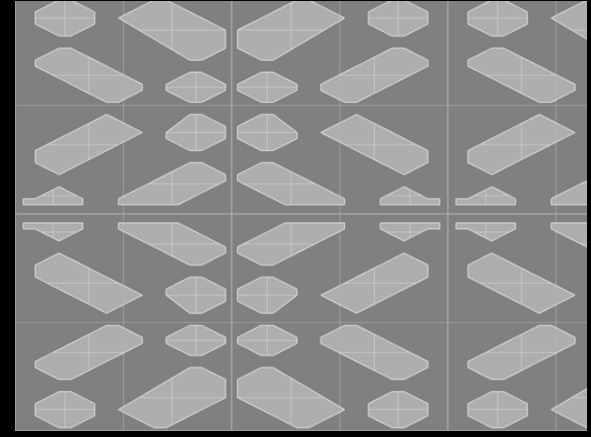
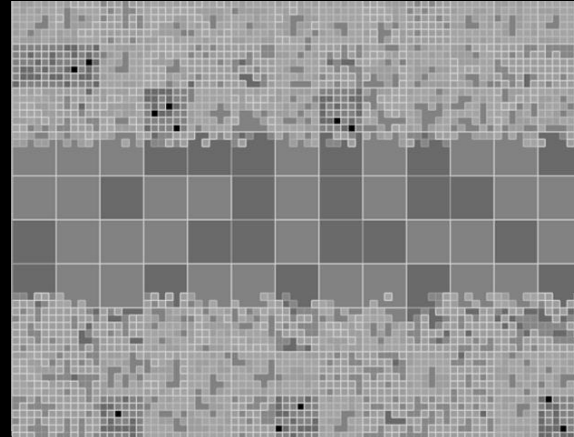
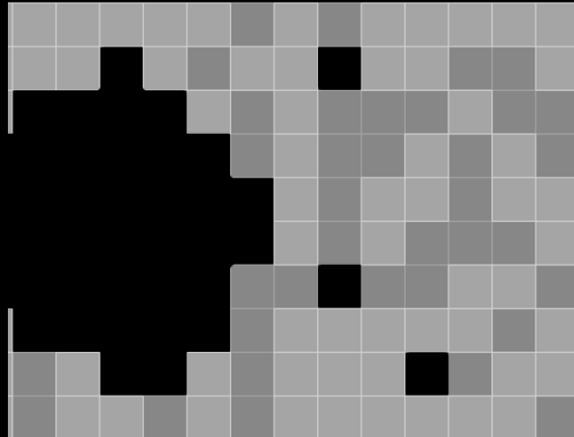
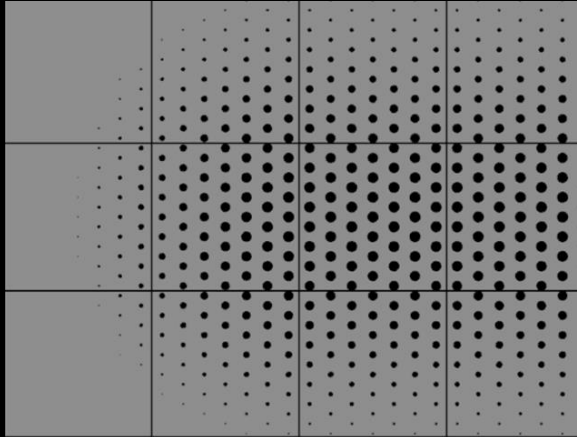


Kolumba Museum | Peter Zumthor

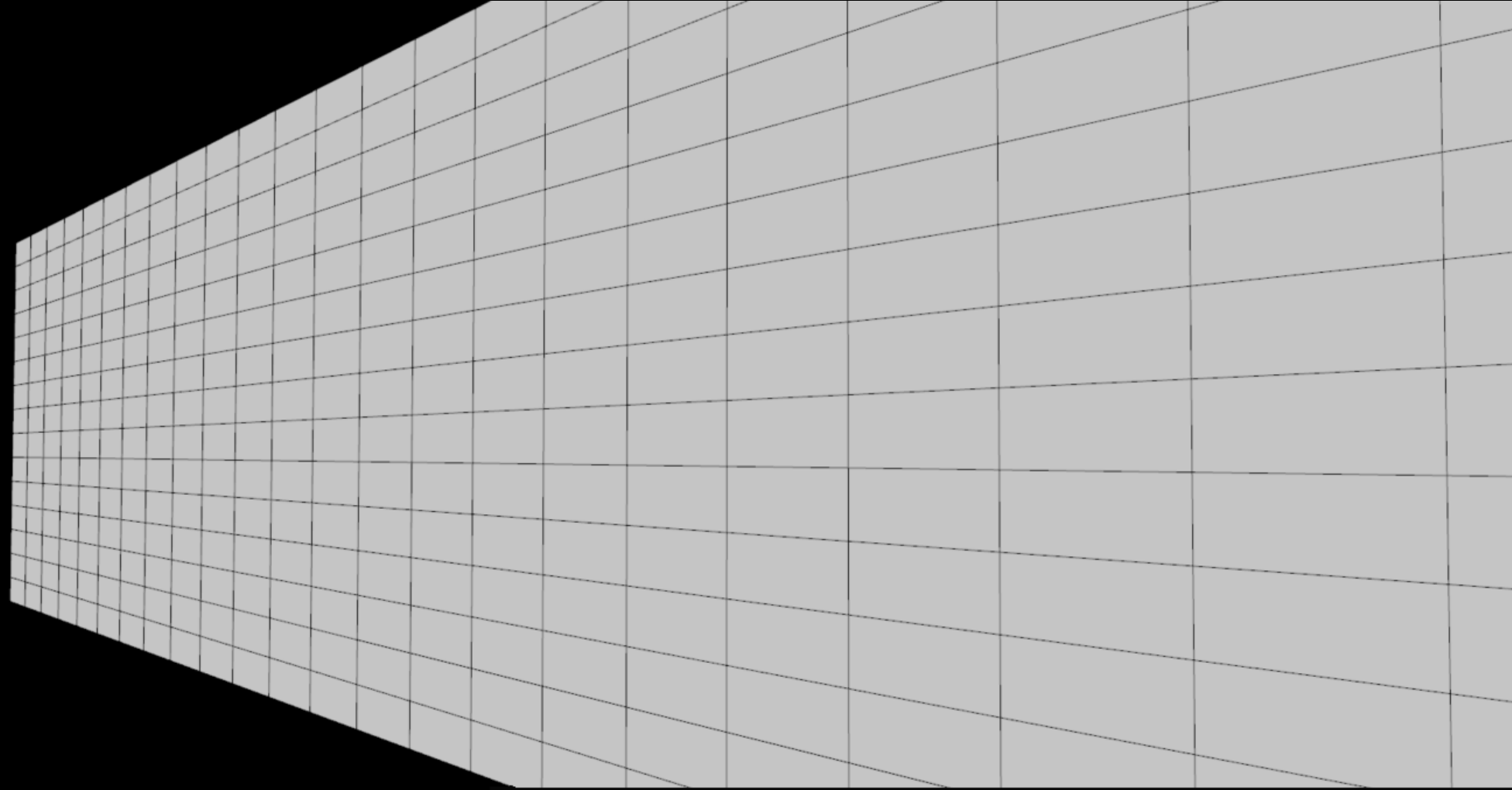
Concept *permeability-opacity*



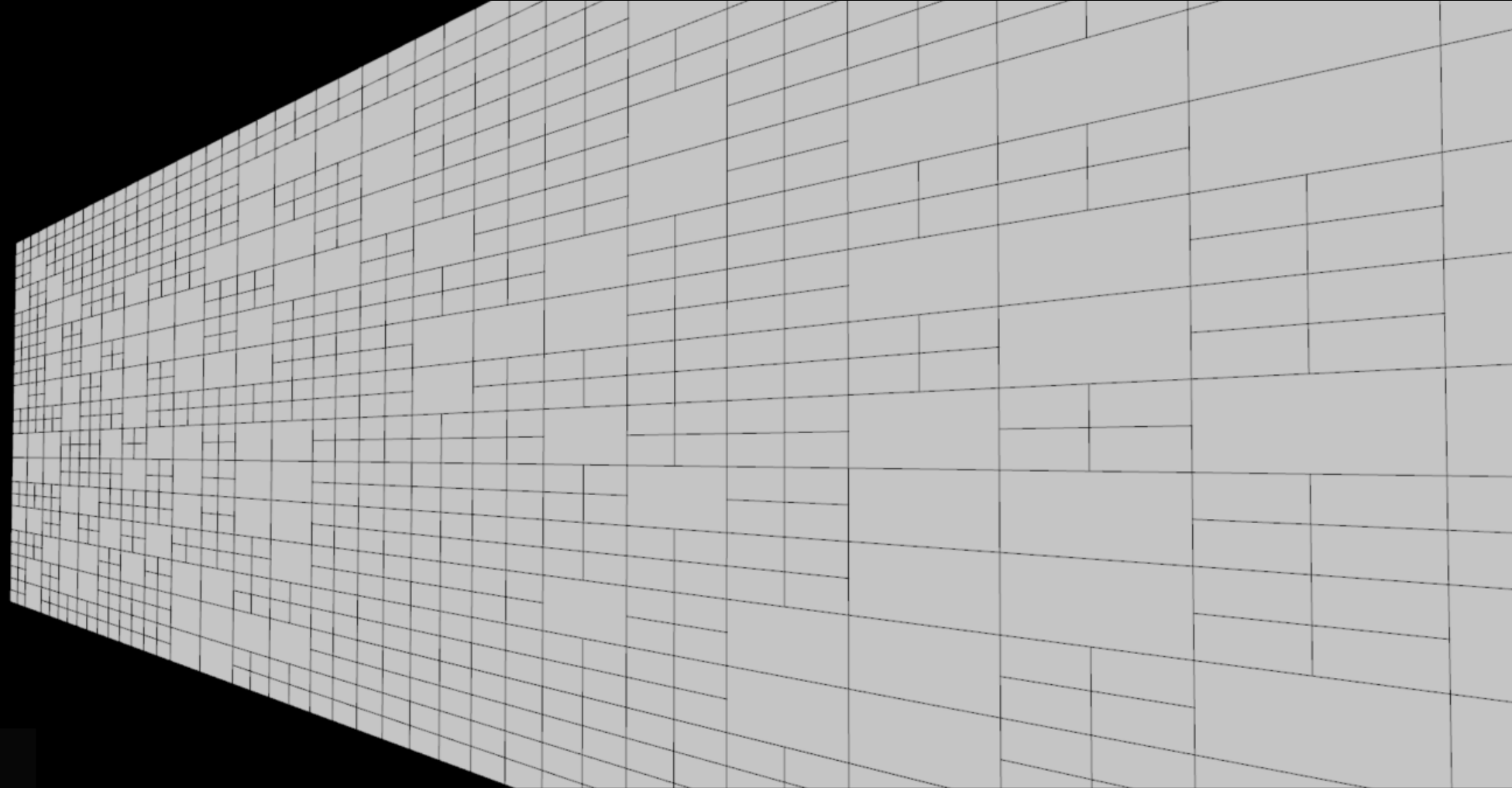
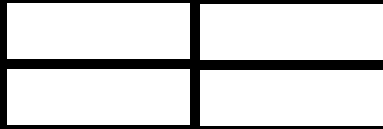
Concept *permeability-opacity*



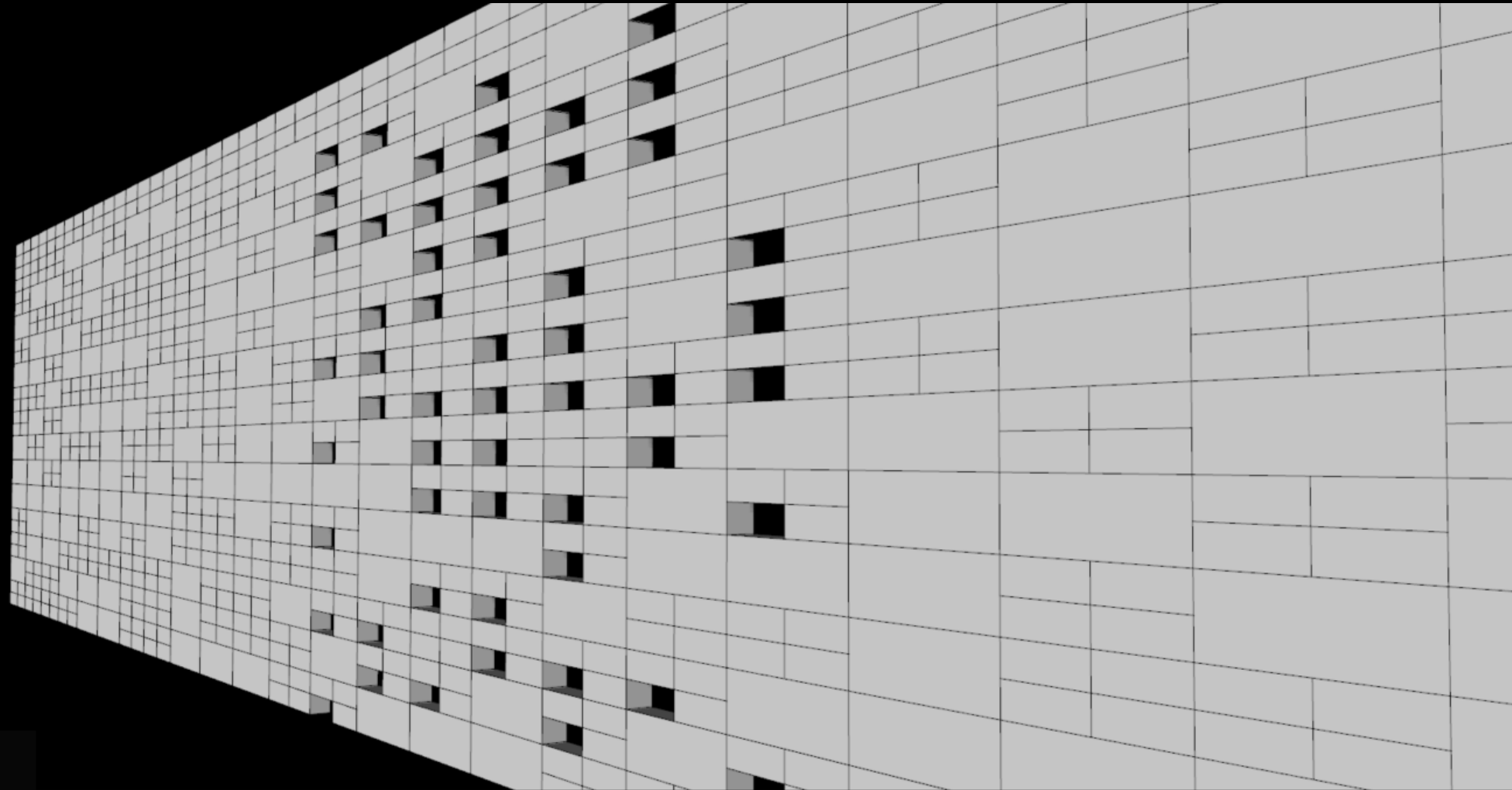
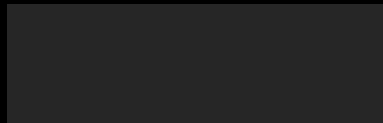
Pattern Development



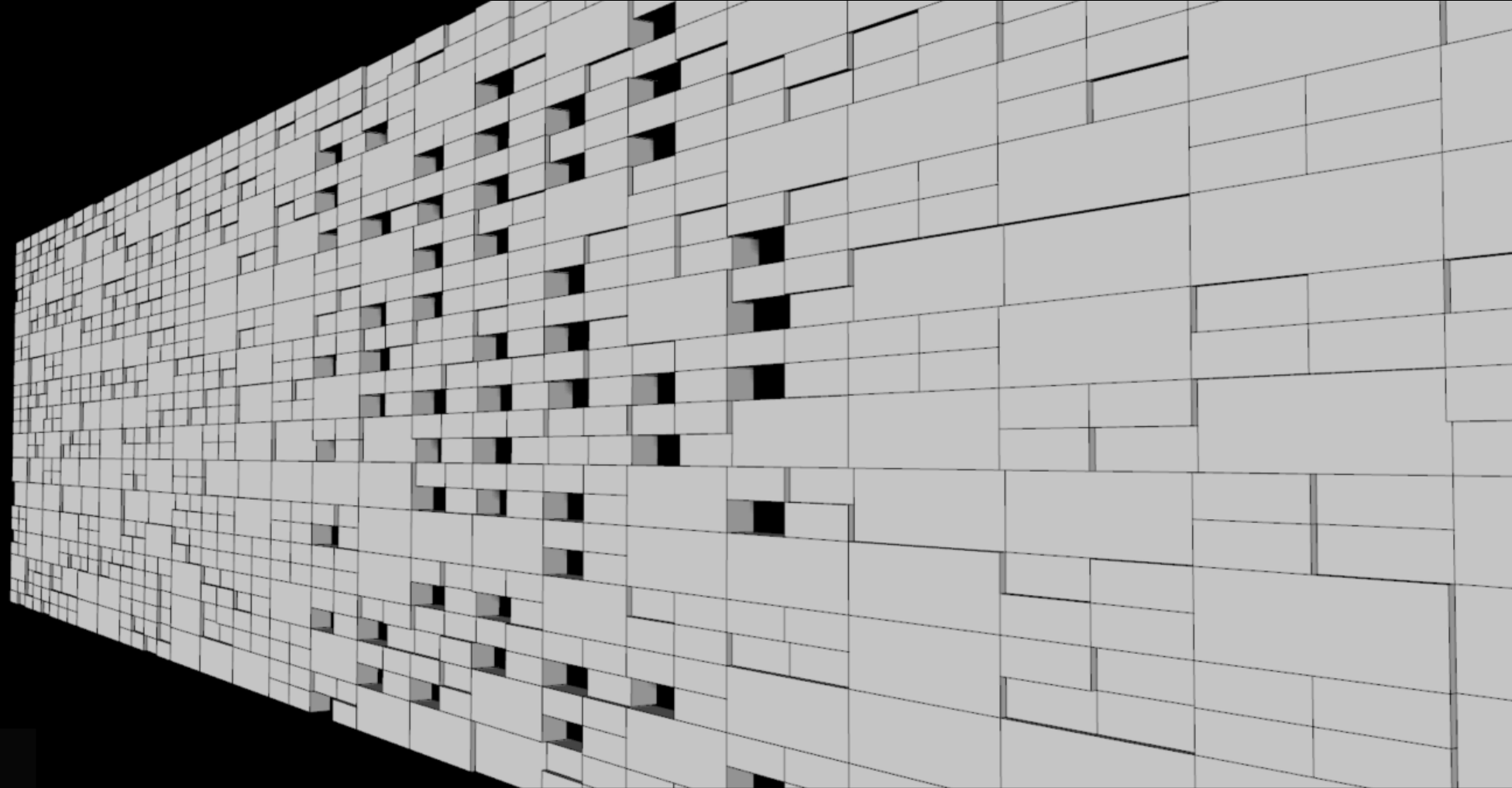
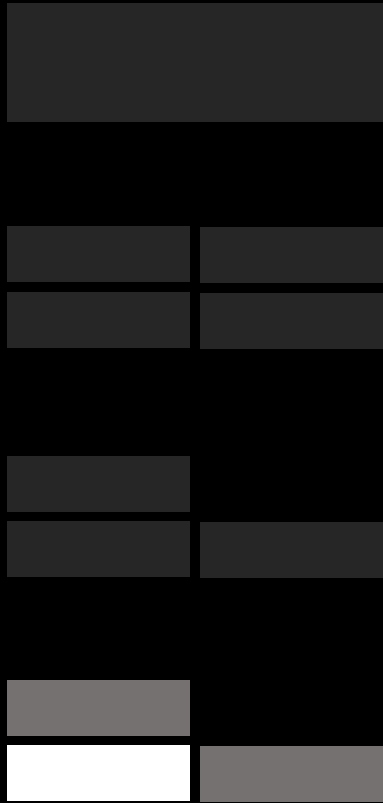
Pattern Development



Pattern Development

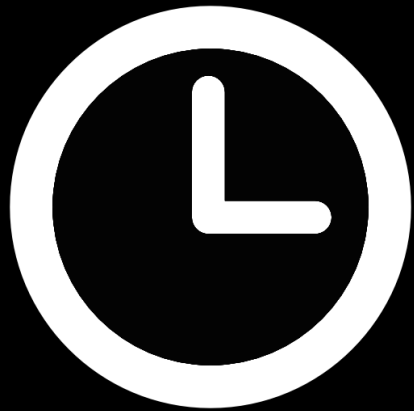


Pattern Development



CAD / BIM portability

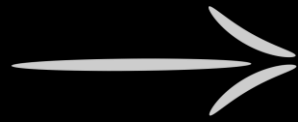
CAD tool



**QUICKLY GENERATE
SEVERAL SOLUTIONS**

BIM tool

CAD / BIM portability



**QUICKLY GENERATE
SEVERAL SOLUTIONS**

CAD tool

BIM tool

Pattern Development

The screenshot displays the Autodesk Revit software interface for a project named "WallInterior_duasFamilias". The main view is a 3D perspective of a brick wall with a red brick pattern and a blue grid overlay. The interface includes a ribbon with various toolsets, a Properties panel on the left, and a Project Browser on the bottom left.

Properties Panel (3D View):

3D View: {3D}	Edit Type
View Scale	1 : 100
Scale Value	1: 100
Detail Level	Medium
Parts Visibility	Show Original
Visibility/Graph...	Edit...
Graphic Display...	Edit...
Discipline	Coordination
Show Hidden Li...	By Discipline

Project Browser - WallInterior_duasFa...:

- Views (all)
 - Floor Plans
 - Level 1
 - Site
 - Ceiling Plans
 - Level 1
 - 3D Views
 - Elevations (Building Elevation)
 - East
 - North
 - South
 - West
 - Legends
 - Schedules/Quantities
 - Sheets (all)
 - Families

Bottom Status Bar:

Click to select, TAB for alternates, CTRL adds, SHIFT unselects. 1 : 100 Main Model

Pattern Development

The screenshot displays the Autodesk Revit software interface. The main window shows a 3D view of a brick wall pattern, rendered in a reddish-brown color. The interface includes a ribbon at the top with various toolsets such as Architecture, Structure, Systems, Insert, Annotate, Analyze, Massing & Site, Collaborate, View, Manage, Add-Ins, and Modify. The Properties panel on the left shows the 3D View settings, including View Scale (1:100), Scale Value (1:100), Detail Level (Medium), Parts Visibility (Show Original), Visibility/Graph... (Edit...), Graphic Display... (Edit...), Discipline (Coordination), and Show Hidden Li... (By Discipline). The Project Browser on the left shows the hierarchy of views, including Floor Plans, Ceiling Plans, 3D Views, and Elevations (Building Elevation). A large red timestamp '00:06:43' is overlaid on the bottom right of the 3D view.

Properties

3D View

3D View: {3D} Edit Type

Graphics

View Scale	1 : 100
Scale Value	1 : 100
Detail Level	Medium
Parts Visibility	Show Original
Visibility/Graph...	Edit...
Graphic Display...	Edit...
Discipline	Coordination
Show Hidden Li...	By Discipline

Properties help Apply

Project Browser - WallInterior_duasFa...

- Views (all)
- Floor Plans
 - Level 1
 - Site
- Ceiling Plans
 - Level 1
- 3D Views
- Elevations (Building Elevation)
 - East
 - North
 - South
 - West
- Legends
- Schedules/Quantities
- Sheets (all)
- Families

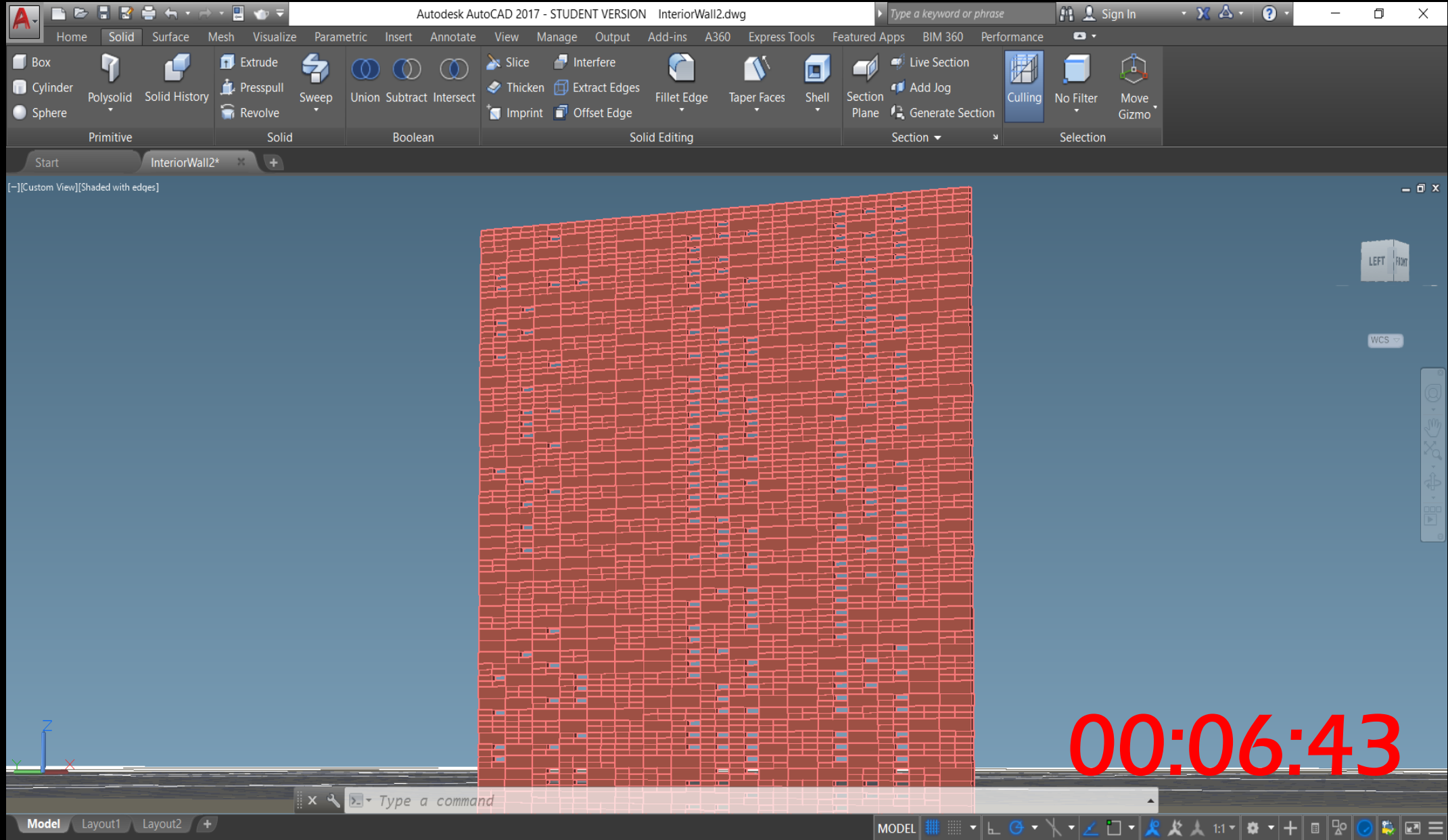
1 : 100

00:06:43

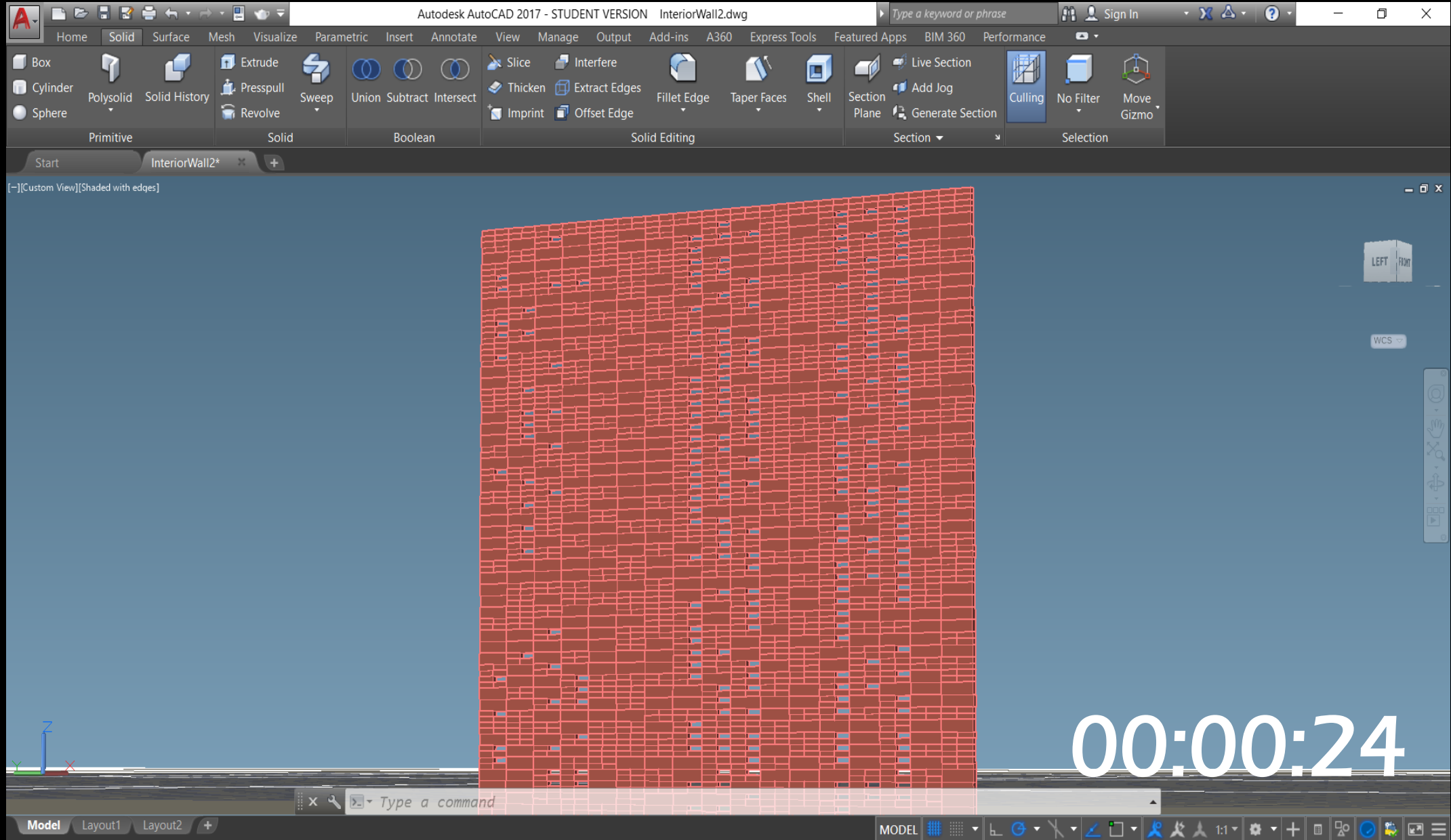
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.

Main Model

Pattern Development



Pattern Development



CAD / BIM portability



**QUICKLY GENERATE
SEVERAL SOLUTIONS**



CAD tool

BIM tool

CAD / BIM portability

CAD tool



**QUICKLY GENERATE
SEVERAL SOLUTIONS**



BIM tool

CAD / BIM portability



CAD tool

**QUICKLY GENERATE
SEVERAL SOLUTIONS**



BIM tool

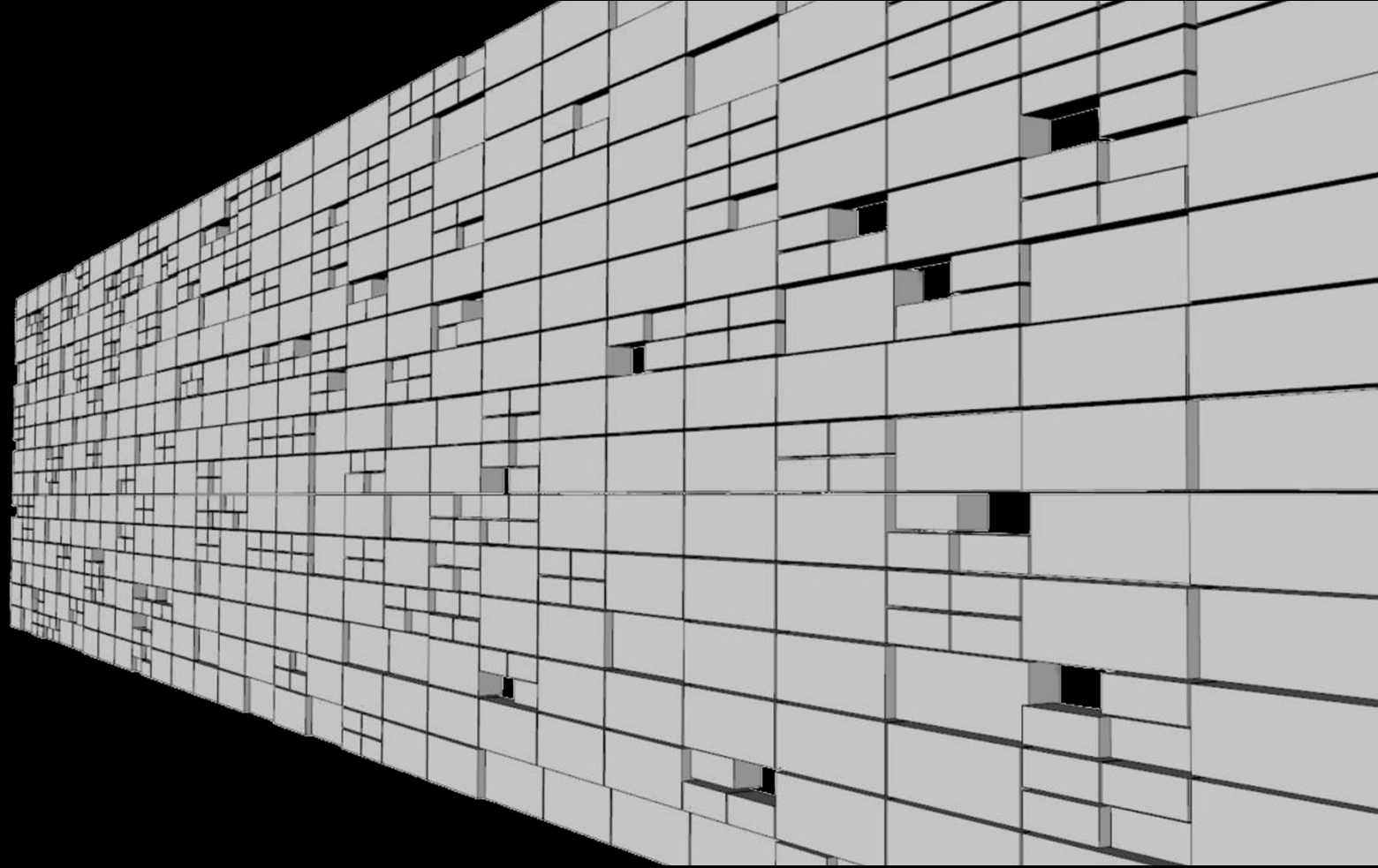
BIM families ✓

Information ✓

Dimensions ✓

Advantages of an algorithmic approach

	%
%	

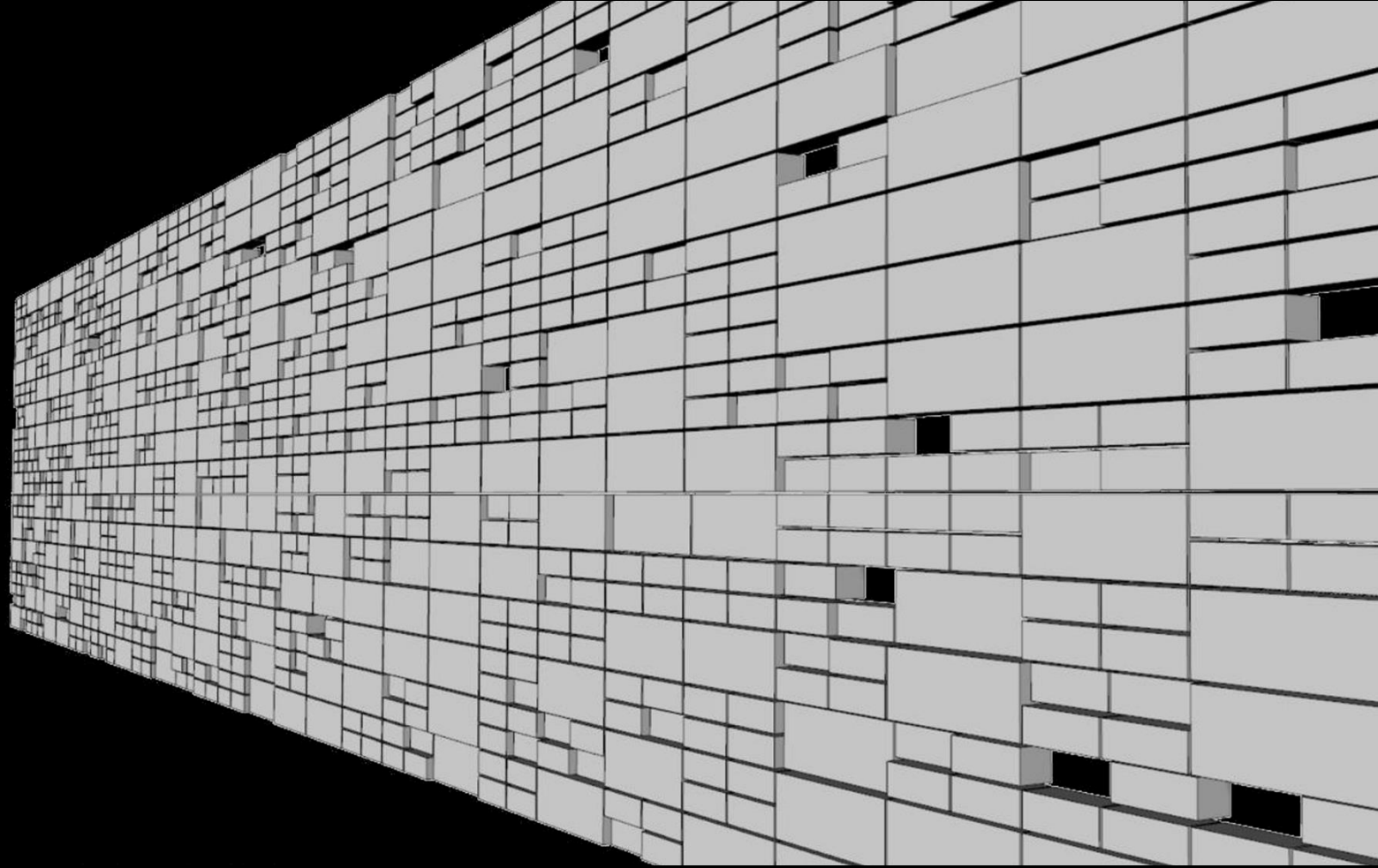


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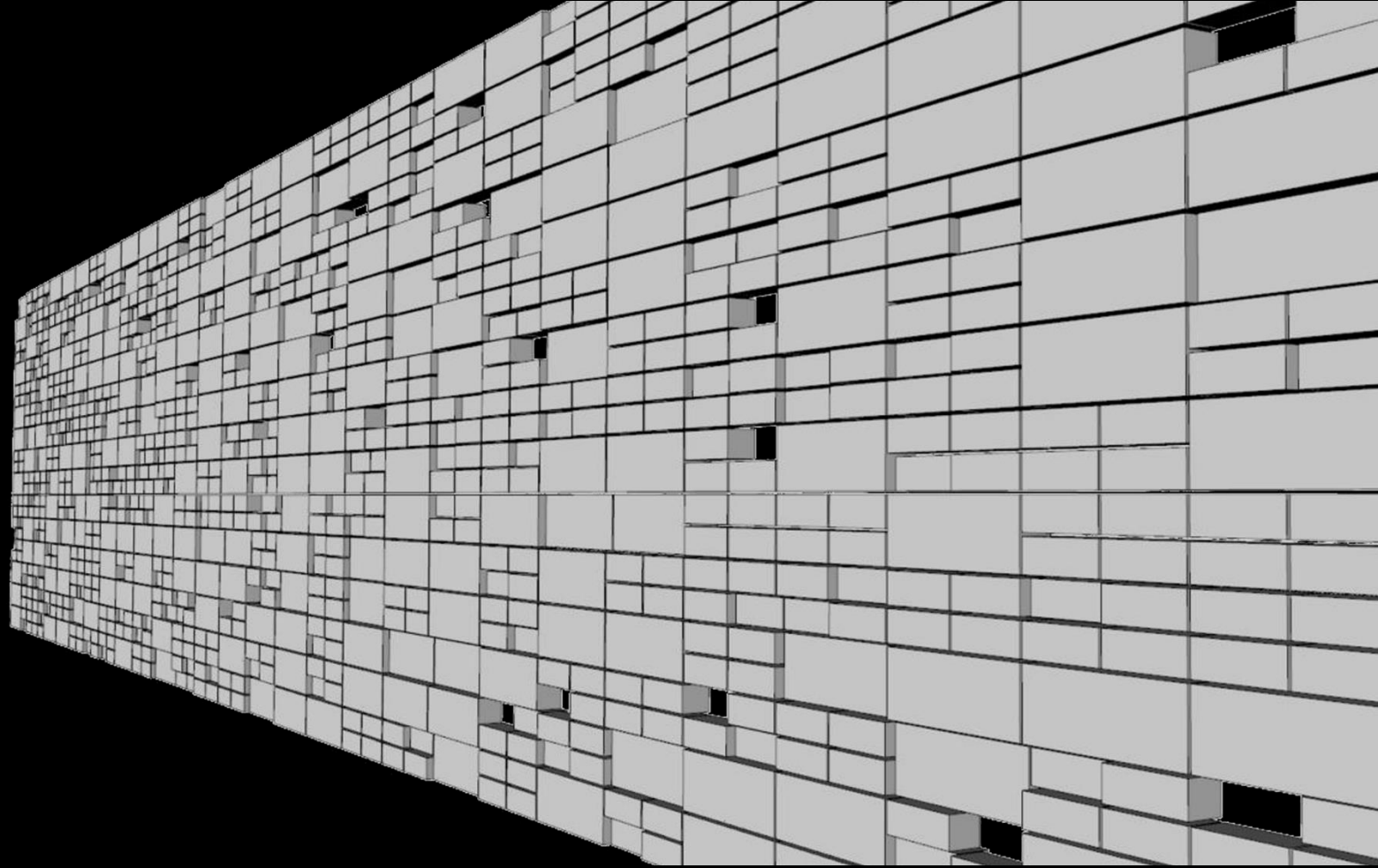
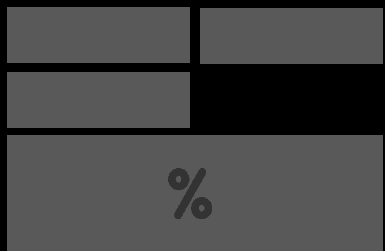
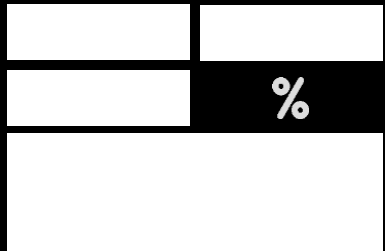
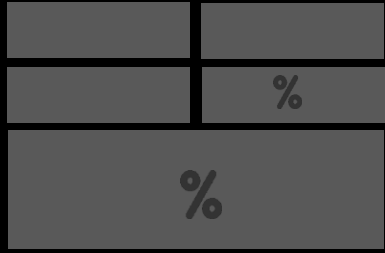
Advantages of an algorithmic approach

	%
%	

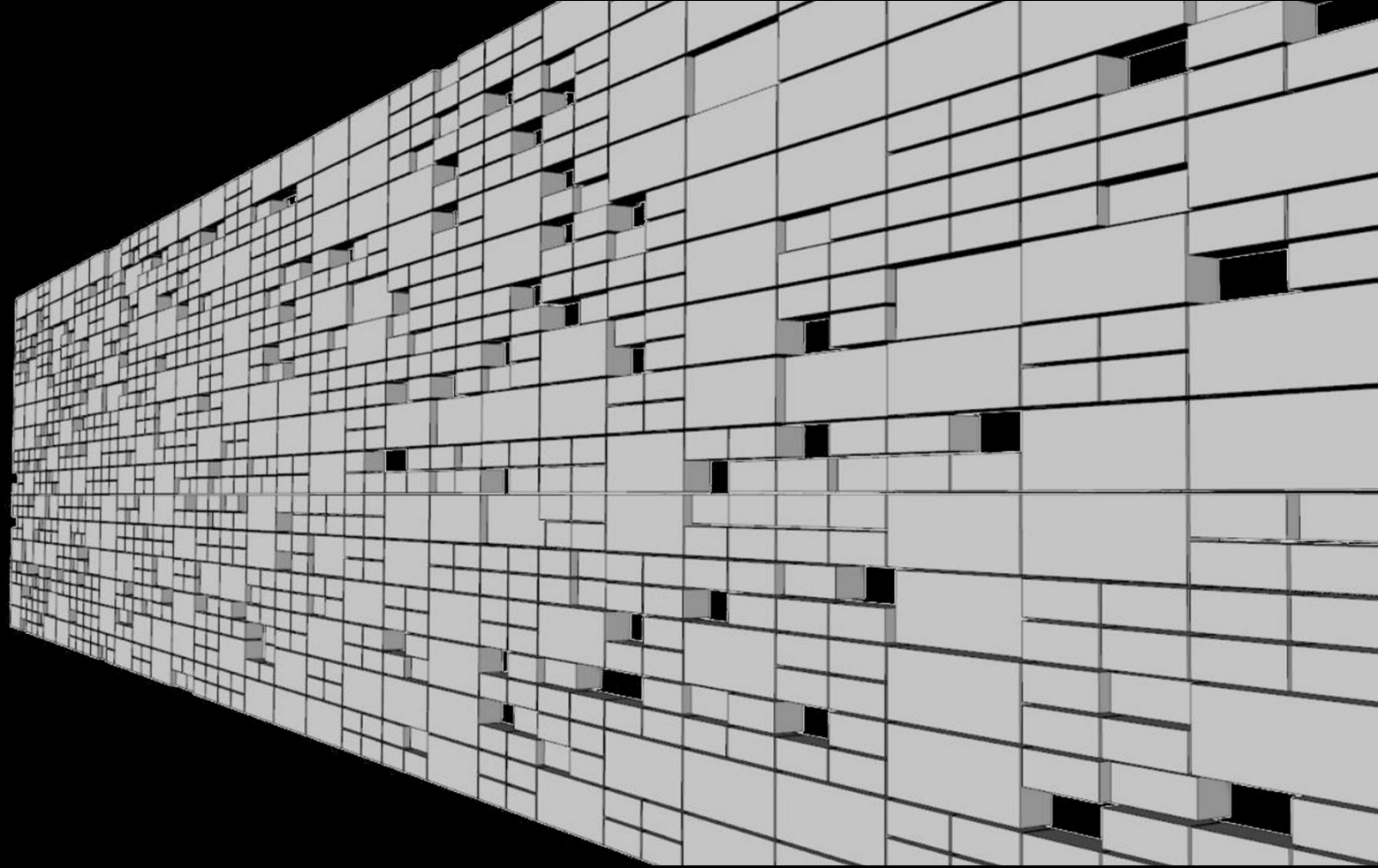
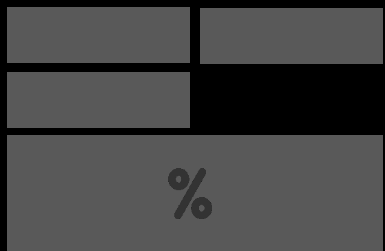
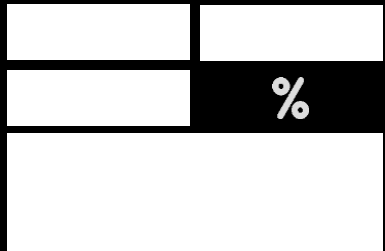
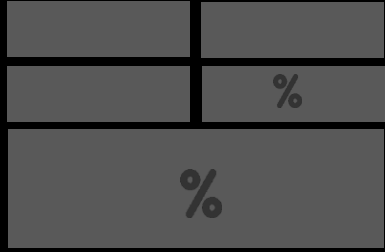
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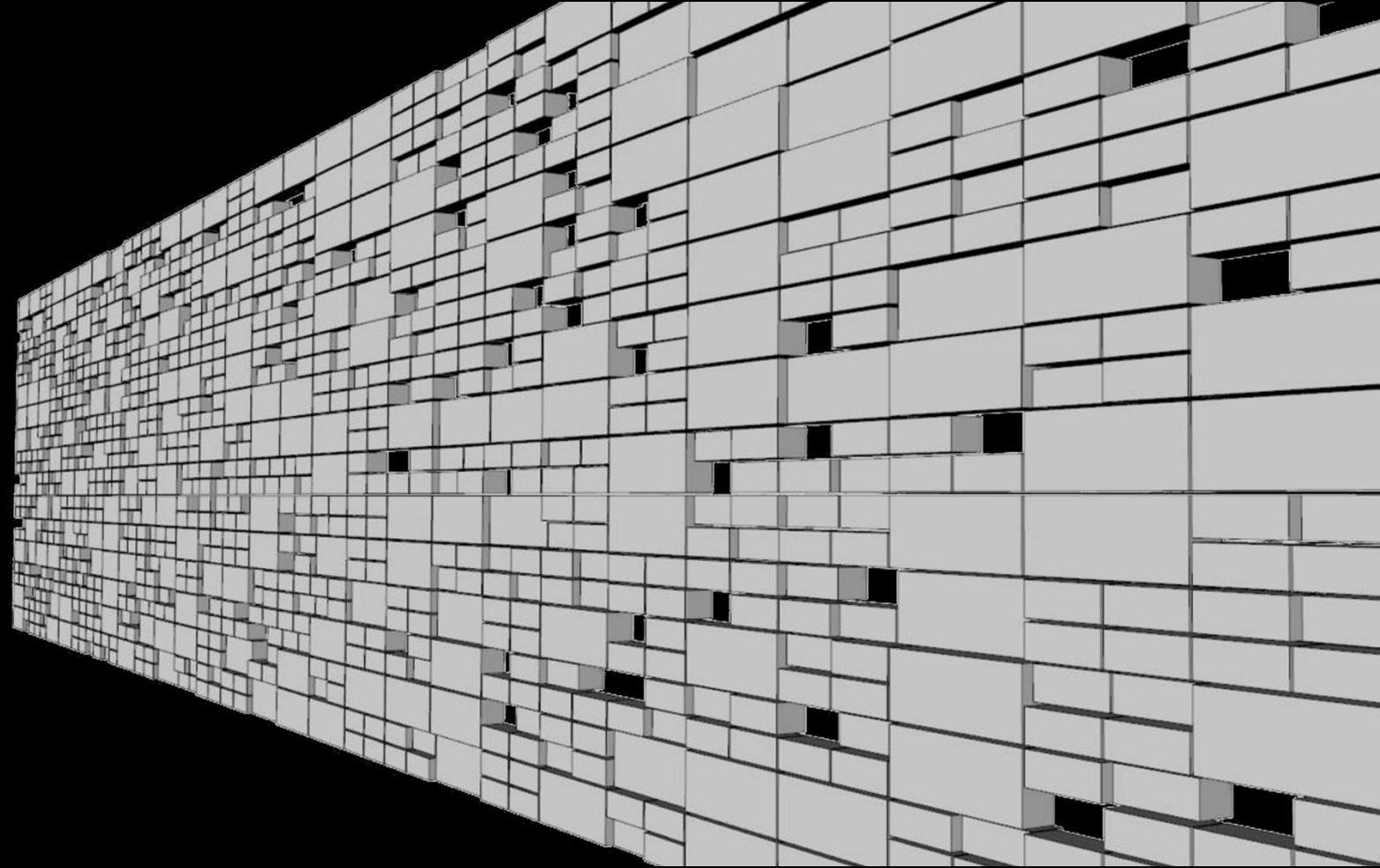
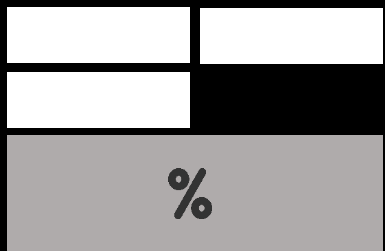
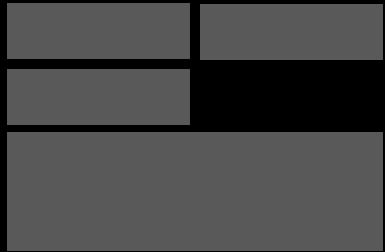
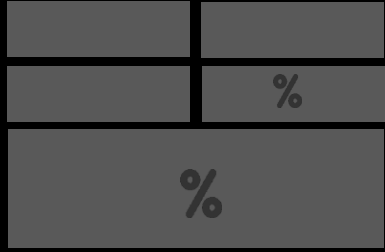
Advantages of an algorithmic approach



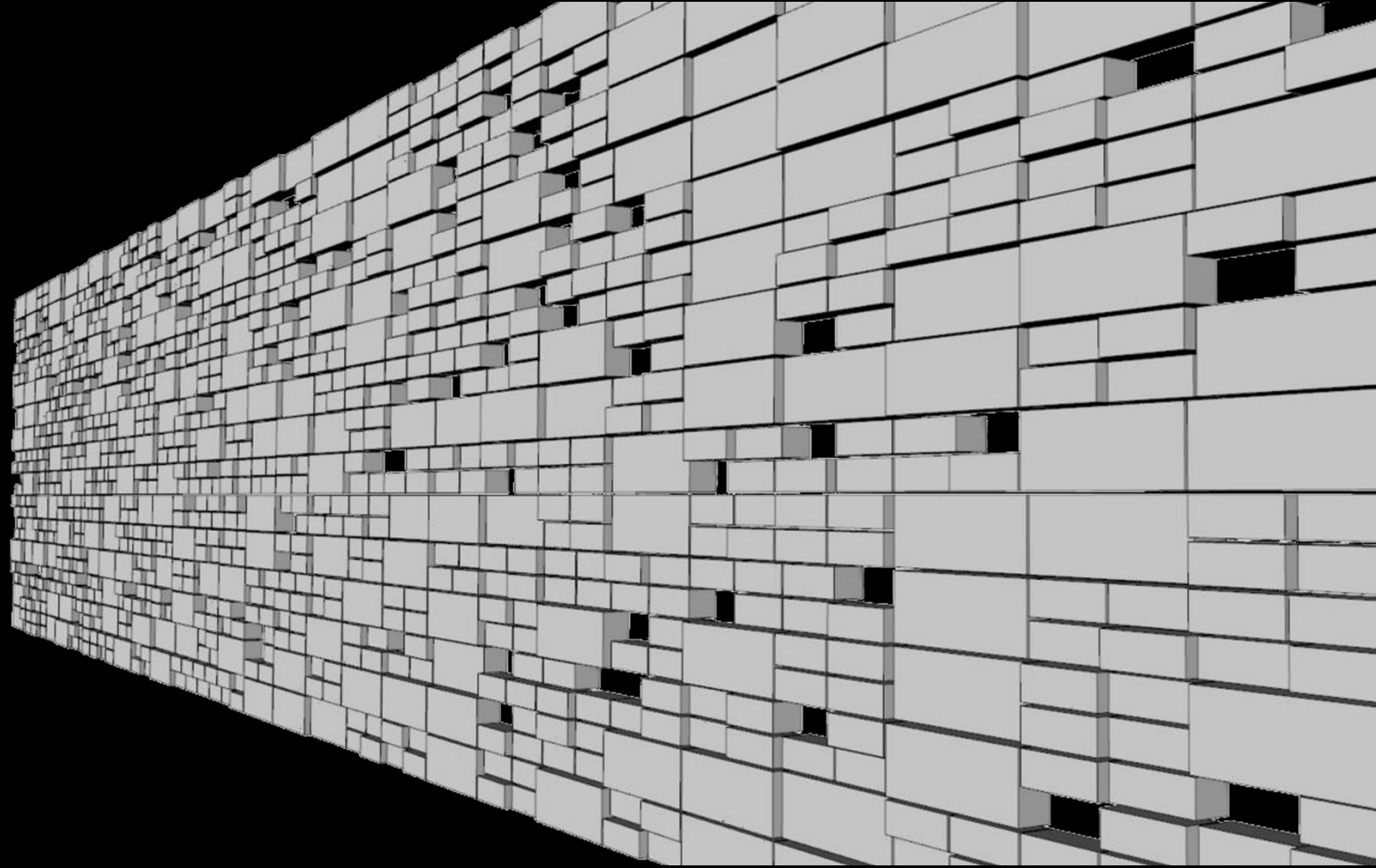
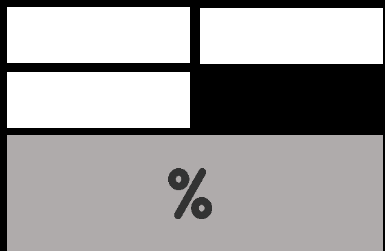
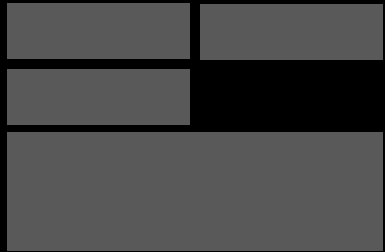
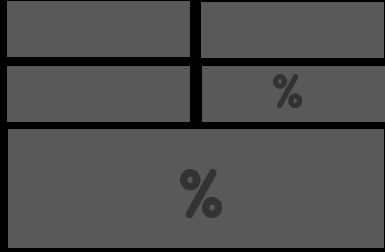
Advantages of an algorithmic approach



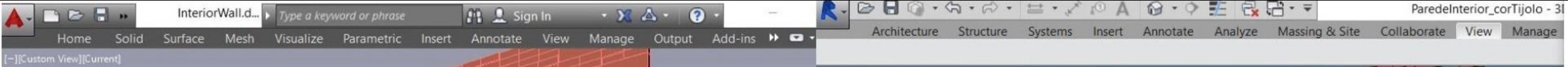
Advantages of an algorithmic approach



Advantages of an algorithmic approach



CAD / BIM portability



```
# Creation of a Big brick (60x20cm)
def brick(p, len_brick, height_brick, width_brick):
    pp = p + vxy(width_brick/2, len_brick/2)
    Big_brick = Big_brick + 1
    right_cuboid(pp, width_brick, len_brick, height_brick)

# Creation of four Small bricks (30x10cm)
def brick4(p, len_brick, height_brick, width_brick):
    side2 = len_brick/2
    height2 = height_brick/2
    pp = p + vxy(width_brick/2, side2/2)
    p1 = pp + vy(side2)
    p2 = pp + vz(height2)
    p3 = p1 + vz(height2)
    right_cuboids([p2, p3, pp, p1], width_brick, side2, height2)

# Creation of three Small bricks
def brick3(p, len_brick, height_brick, width_brick):
    side2 = len_brick/2
    height2 = height_brick/2
    pp = p + vxy(width_brick/2, side2/2)
    p1 = pp + vy(side2)
    p2 = pp + vz(height2)
    p3 = p1 + vz(height2)
    pts = [False, p3, pp, p1] if random(2) == 0 else [p2, p3, pp, False]
    right_cuboids_void(pts, width_brick, side2, height2)

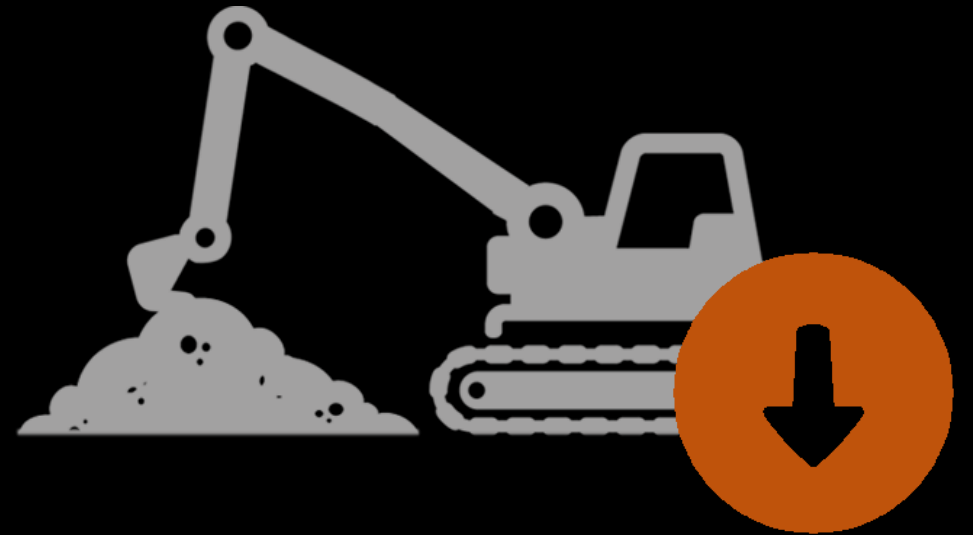
# Function to place bricks without voids (two types)
def bricks_full(p, len_brick, height_brick, width_brick, percent):
    n = 100/percent
    if random(n) < 1:
        brick4(p, len_brick, height_brick, width_brick)
    else:
        brick(p, len_brick, height_brick, width_brick)
```



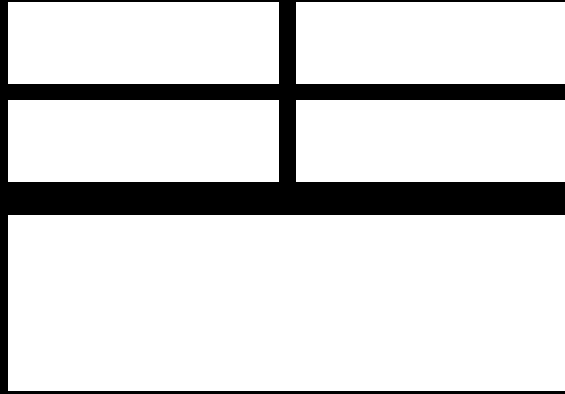
Manufacturing Stage



Manufacturing Stage



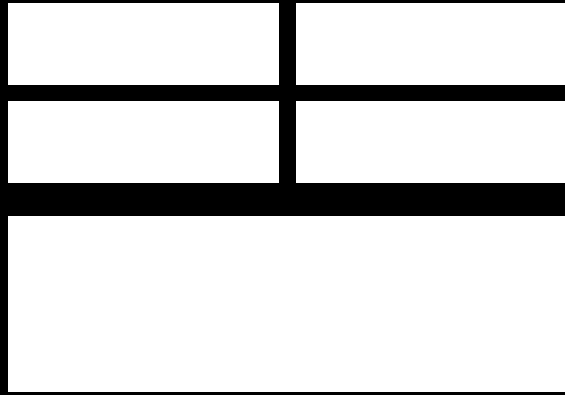
Manufacturing Stage



2 Sizes of Bricks



Manufacturing Stage

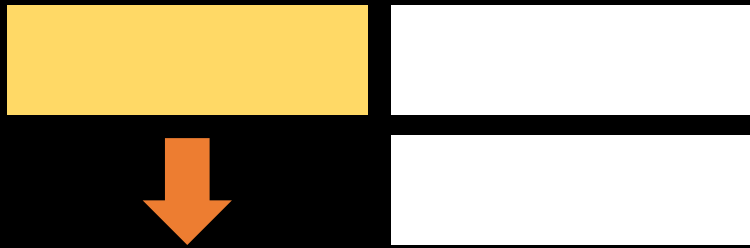


2 Sizes of Bricks



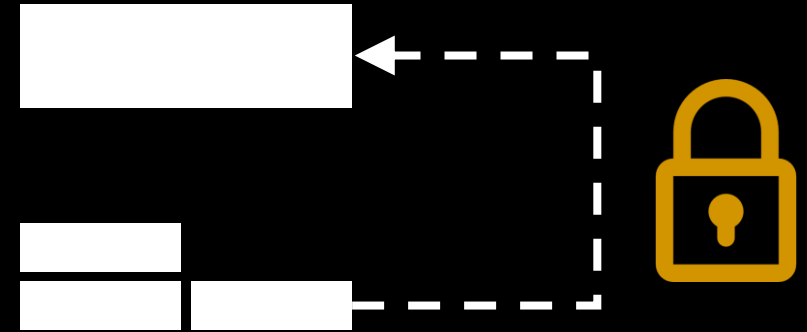
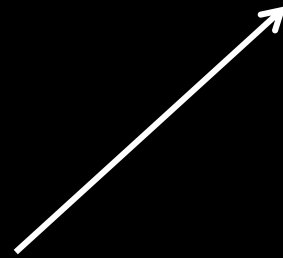
CHALLENGES

Façade voids



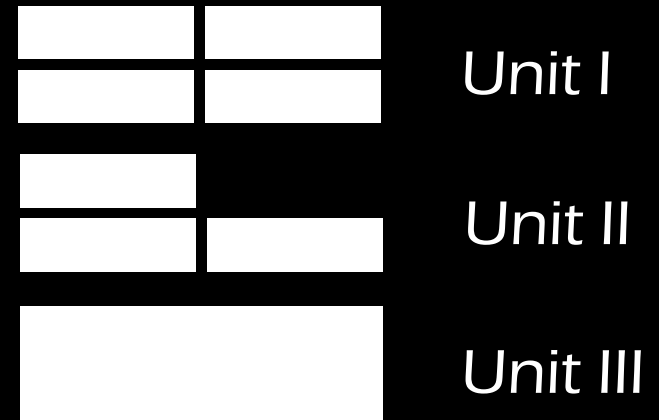
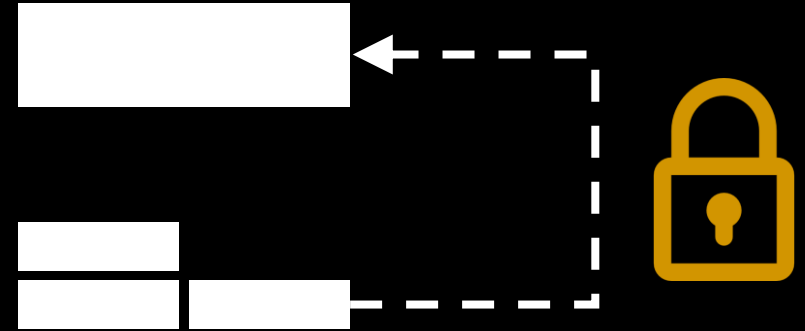
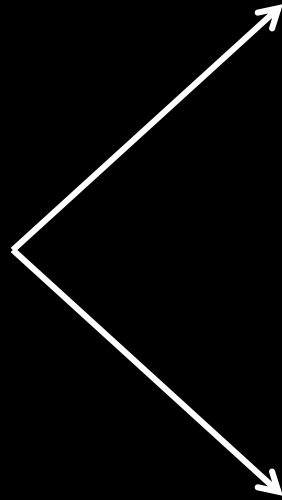
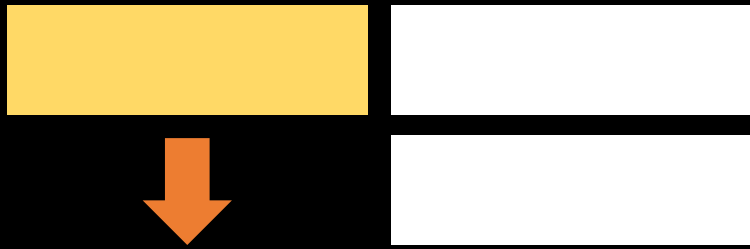
CHALLENGES

Façade voids




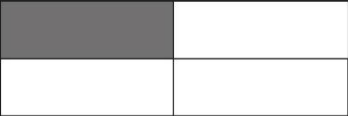


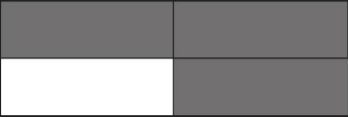



CHALLENGES

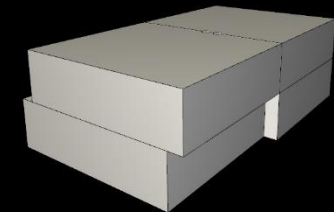
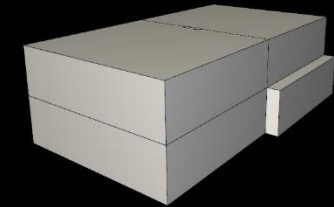
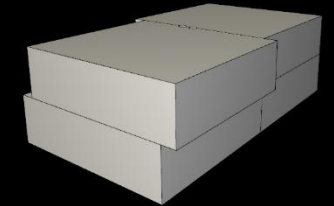
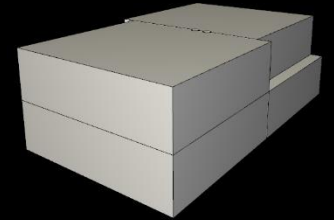
Minimize number of moulds



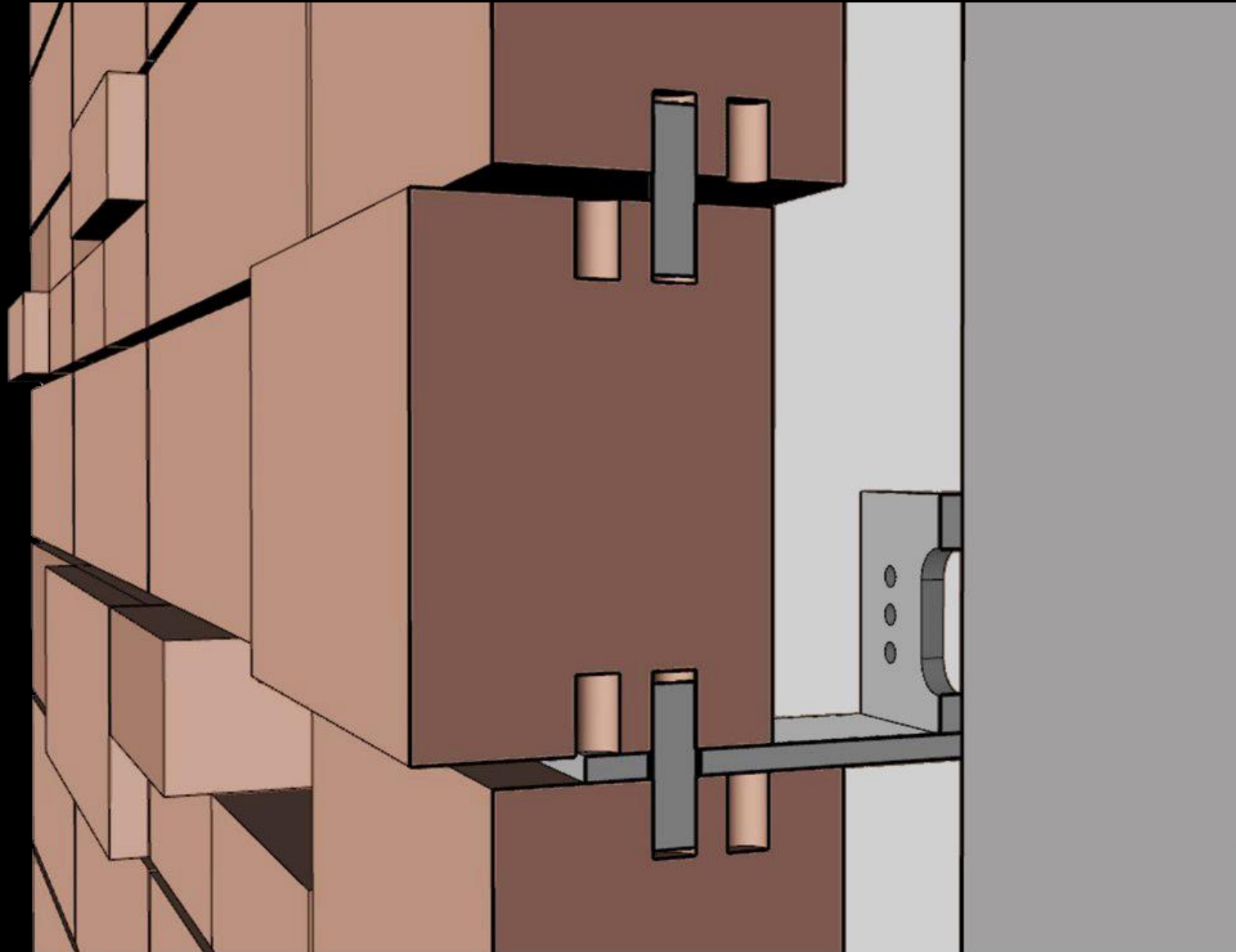
CHALLENGES

Minimize number of moulds

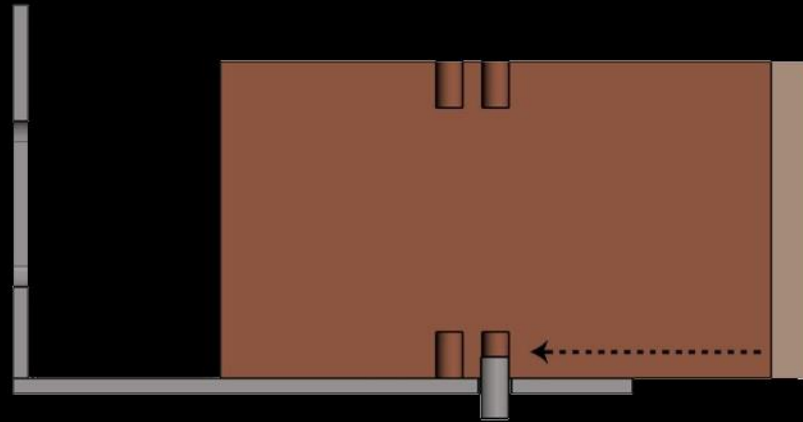
POSSIBLE VARIATIONS				
TYPOLOGY	 <p>A</p>	 <p>B</p>	 <p>C</p>	 <p>D</p>



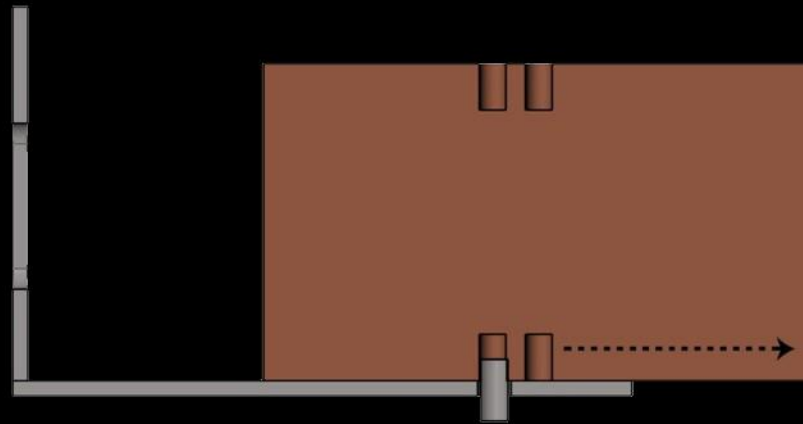
PLACEMENT OF THE BRICKS



PLACEMENT OF THE BRICKS



PLACEMENT OF THE BRICKS



TALLYING FOR FABRICATION

TYPOLOGY

QUANTITY

TYPOLOGY

QUANTITY



1619



385



387



99

REGULAR
BRICK



224



20

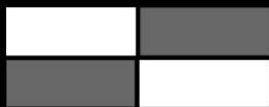


224



28

PROTRUDED
BRICK



45



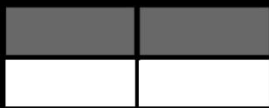
95



51



28



61



100

CONCLUSIONS

Advantages of an algorithmic approach

QUICKER CHANGES

LESS EFFORT

MORE DESIGN OPTIONS

SHORTER TIME

IMPROVED RESULTS

FEWER MODELING LIMITATIONS

BETTER DESIGN PRECISION

FEWER REPETITIVE TASKS



THANK YOU

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