Complexity & Emergence in Art, Architecture and City

복잡계와 예술건축도시의 창발

하태석

하태석

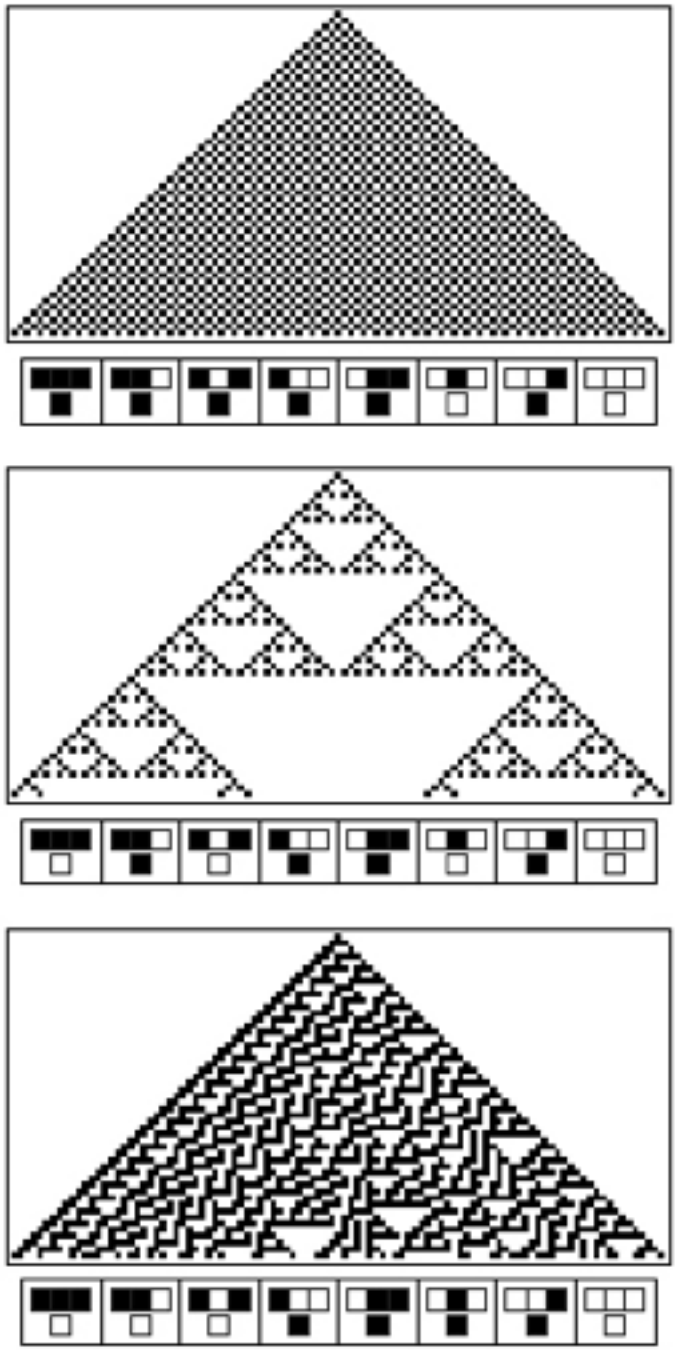
건축가/뉴미디어아티스트
영국왕립건축사

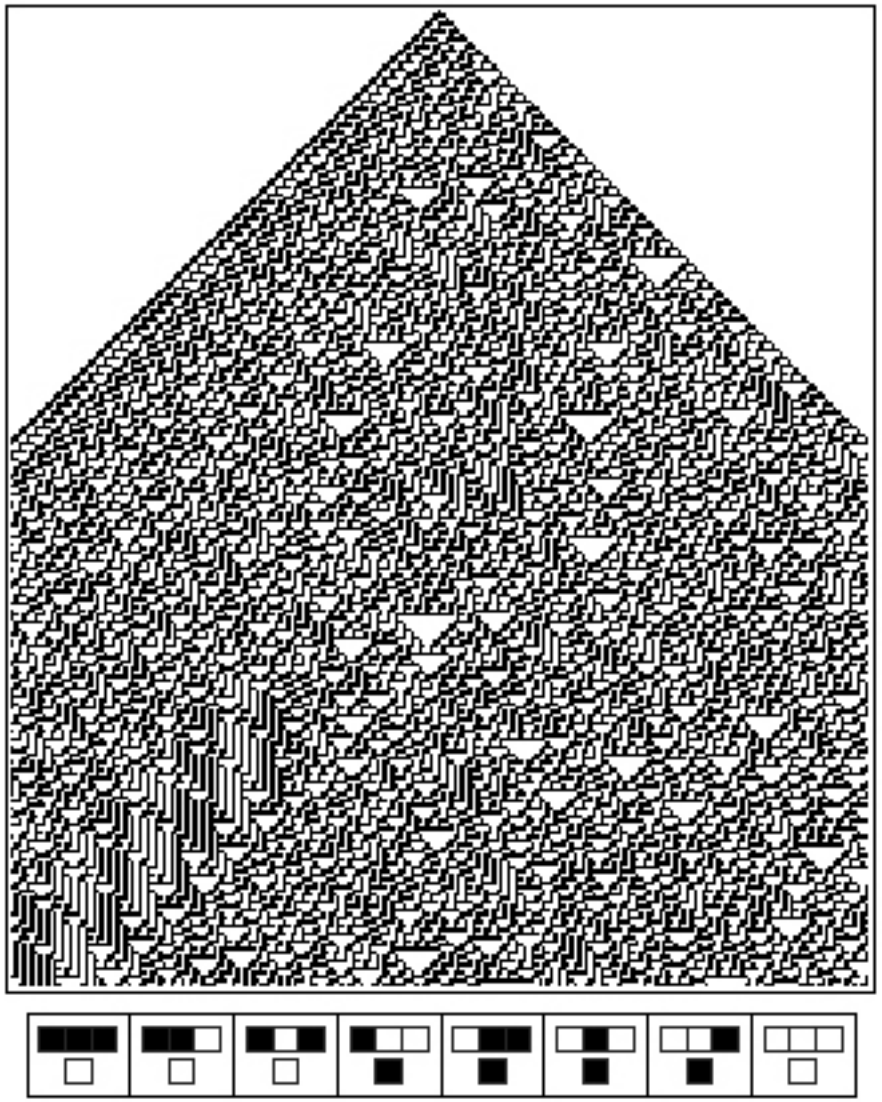
SCALe 대표
젊은건축가포럼코리아 위원장
건국대학교 건축전문대학원 겸임교수

복잡계
창발

Power of Ten

Eames





예술

건축

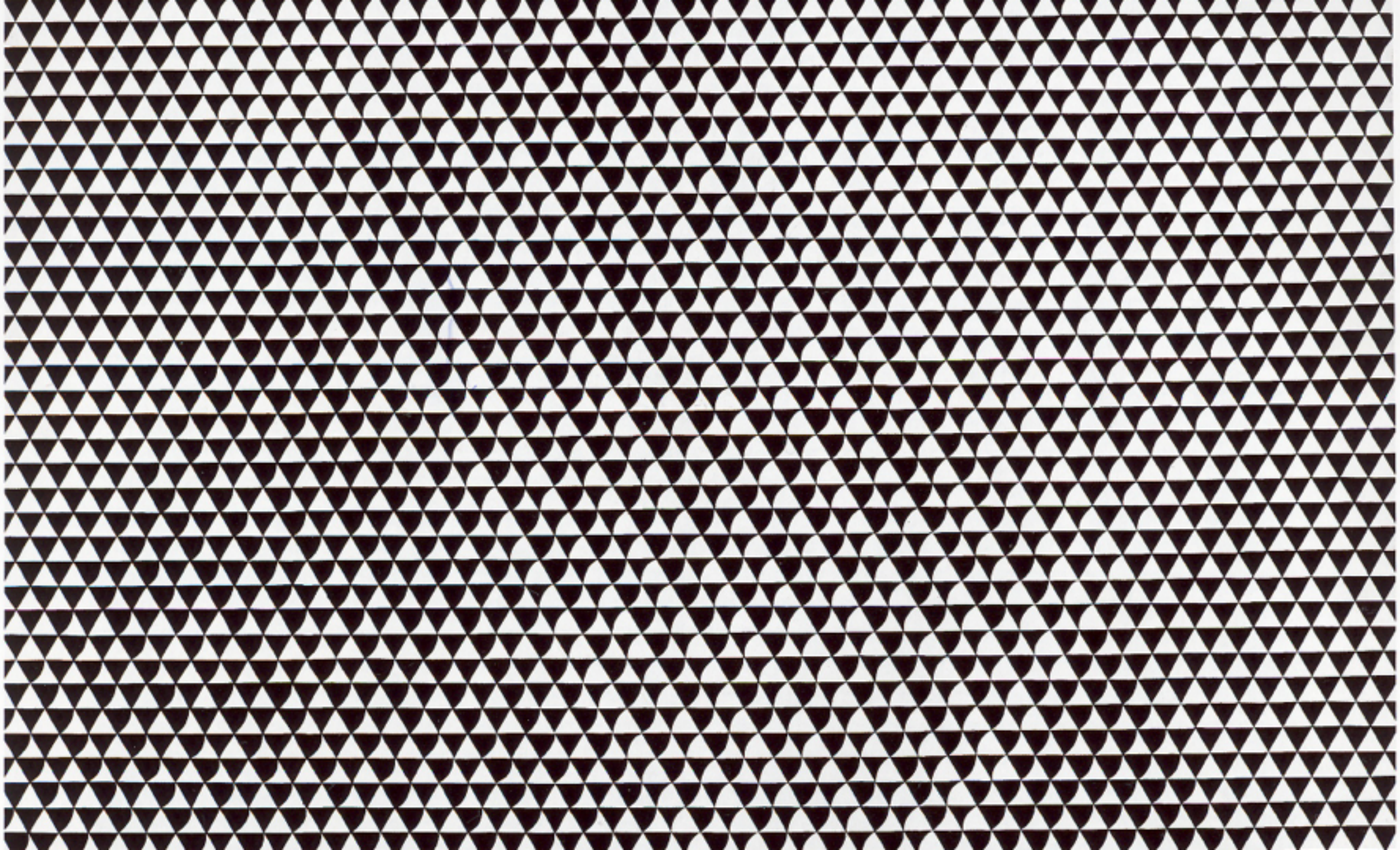
도시

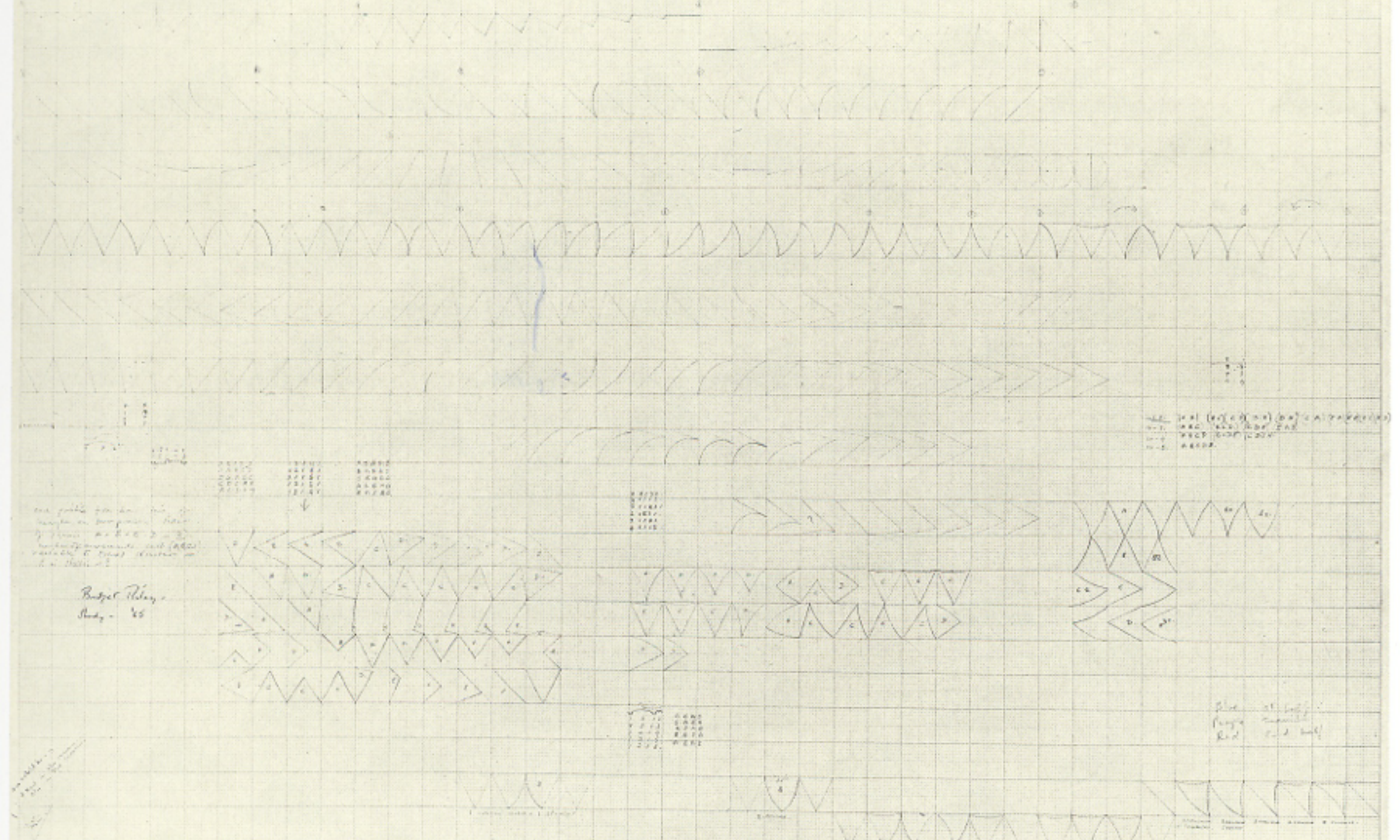
예술

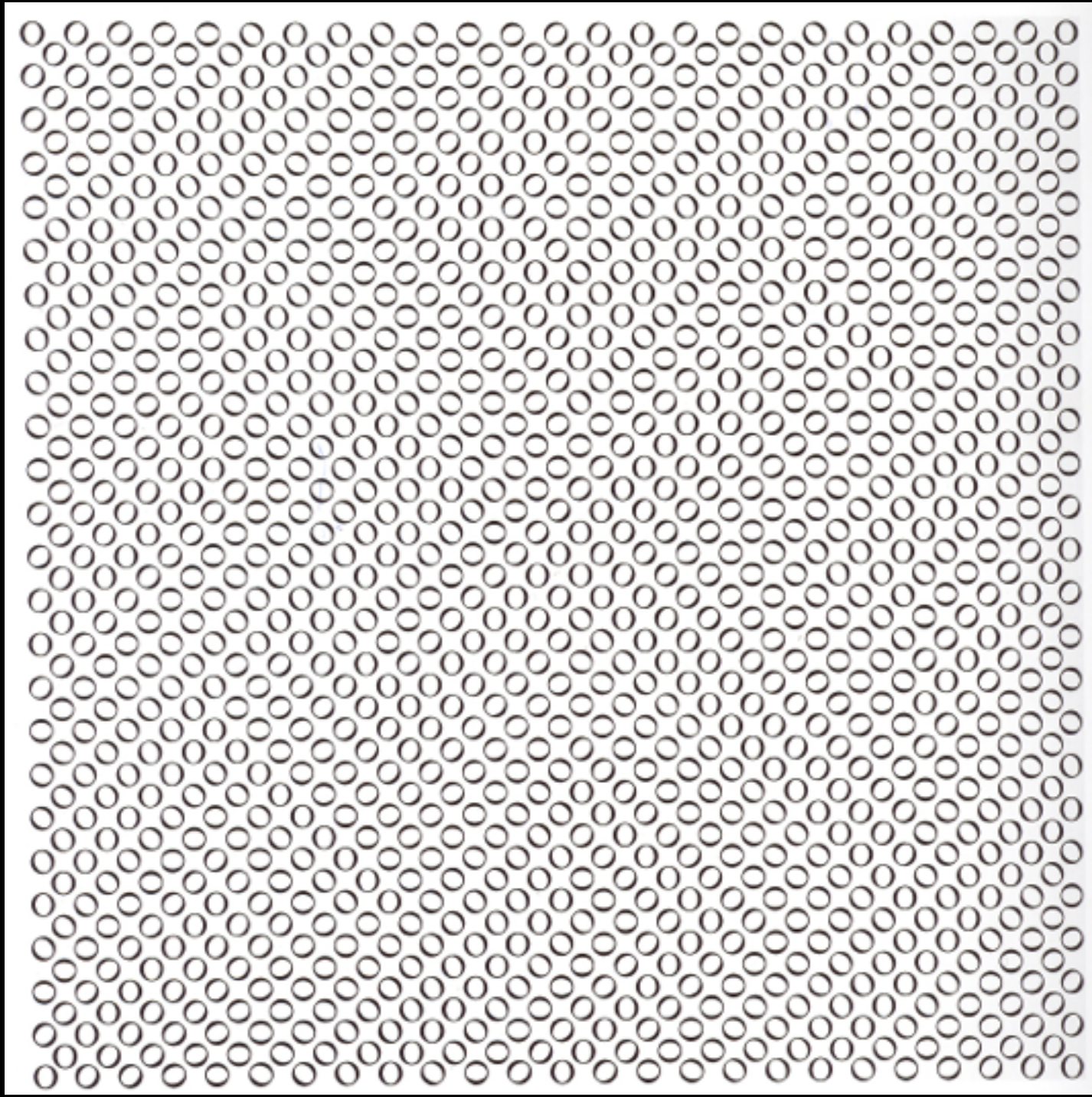
Bridget Riley

브리짓 라일리의 그림은 재현적이 아니라, 구성 부분들 간의 관계를 체계적으로 배열한 결과물인 감흥을 생성하는 다이아그램적 물질 조직이다. 라일리는 자연을 관찰하여 탈영역화시킨다. 이렇게 함으로써 라일리의 2차원적 공간은 뭔가 다른 것으로 탈바꿈할 수 있는 새로운 가능성과 잠재력으로 가득 찬다. 라일리의 작품은 자연의 패턴으로 만들어진 추상 기계이다. 다이아그램이 새로운 현실을 촉발시키듯 라일리의 작품은 또 다른 작품들을 낳는다. 그림의 조직을 생성시키는 것은 그림을 그리는 과정이다. 이는 강력한 효과(감흥)를 생성하기 위해 과정이 창조의 원동력이 되는 최초 사례 중의 하나이다.

Study for
Twist '63
B[illegible]



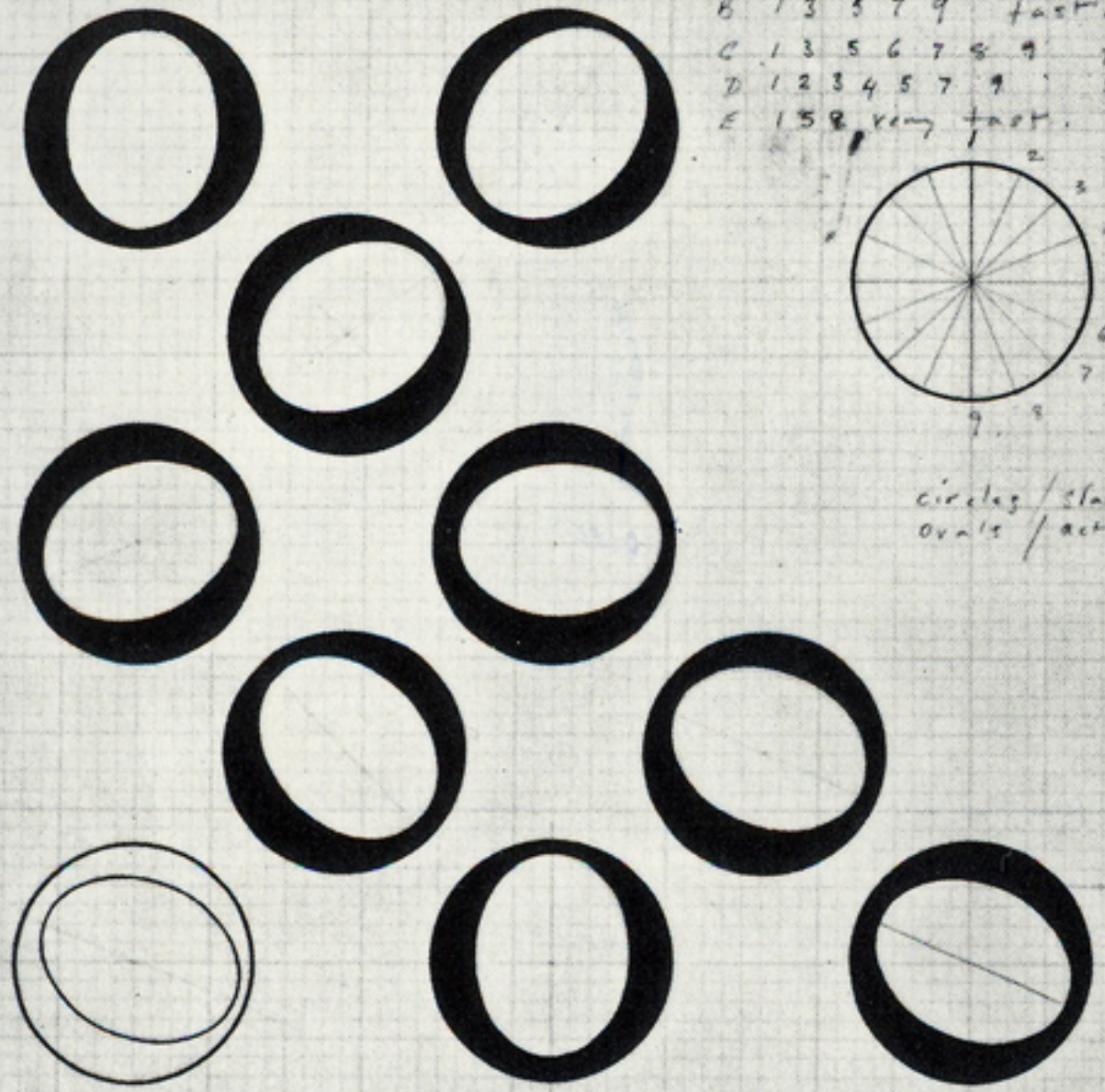

Bridget Riley
Study - '65

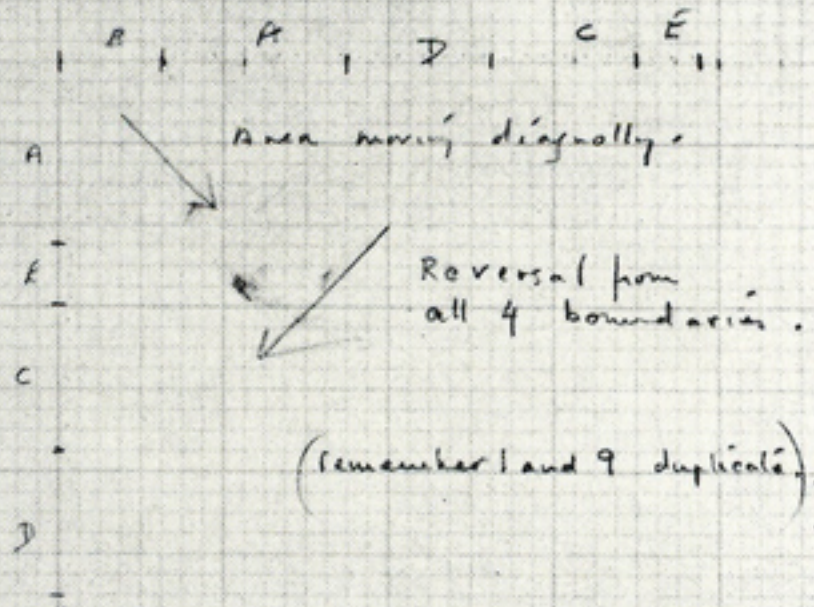


movements.

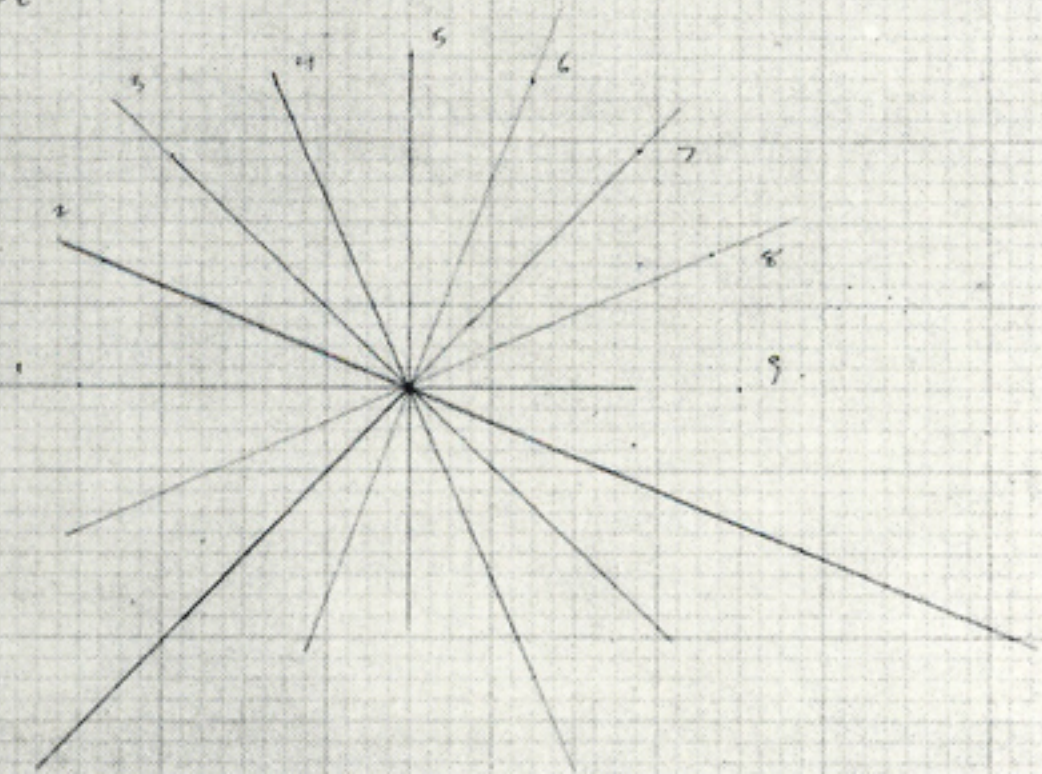
A 1 2 3 4 5 6 7 8 9 slow.
B 1 3 5 7 9 fast.
C 1 3 5 6 7 8 9 fast/slow.
D 1 2 3 4 5 7 9 slow/fast.
E 1 5 8 very fast.

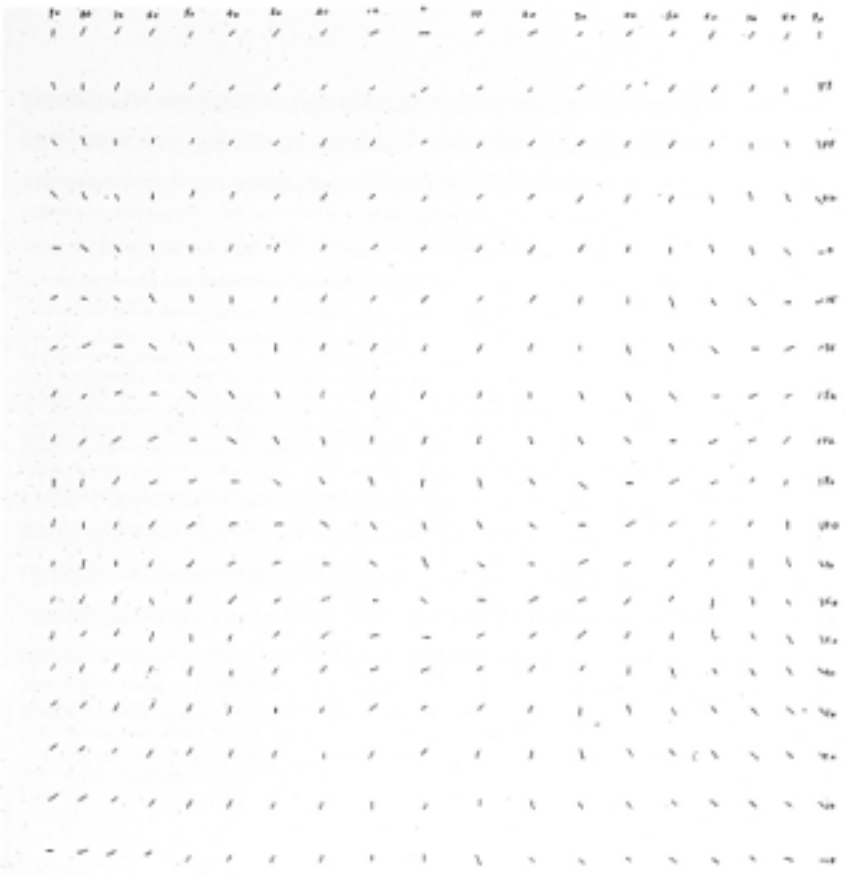
circles / static
ovals / active

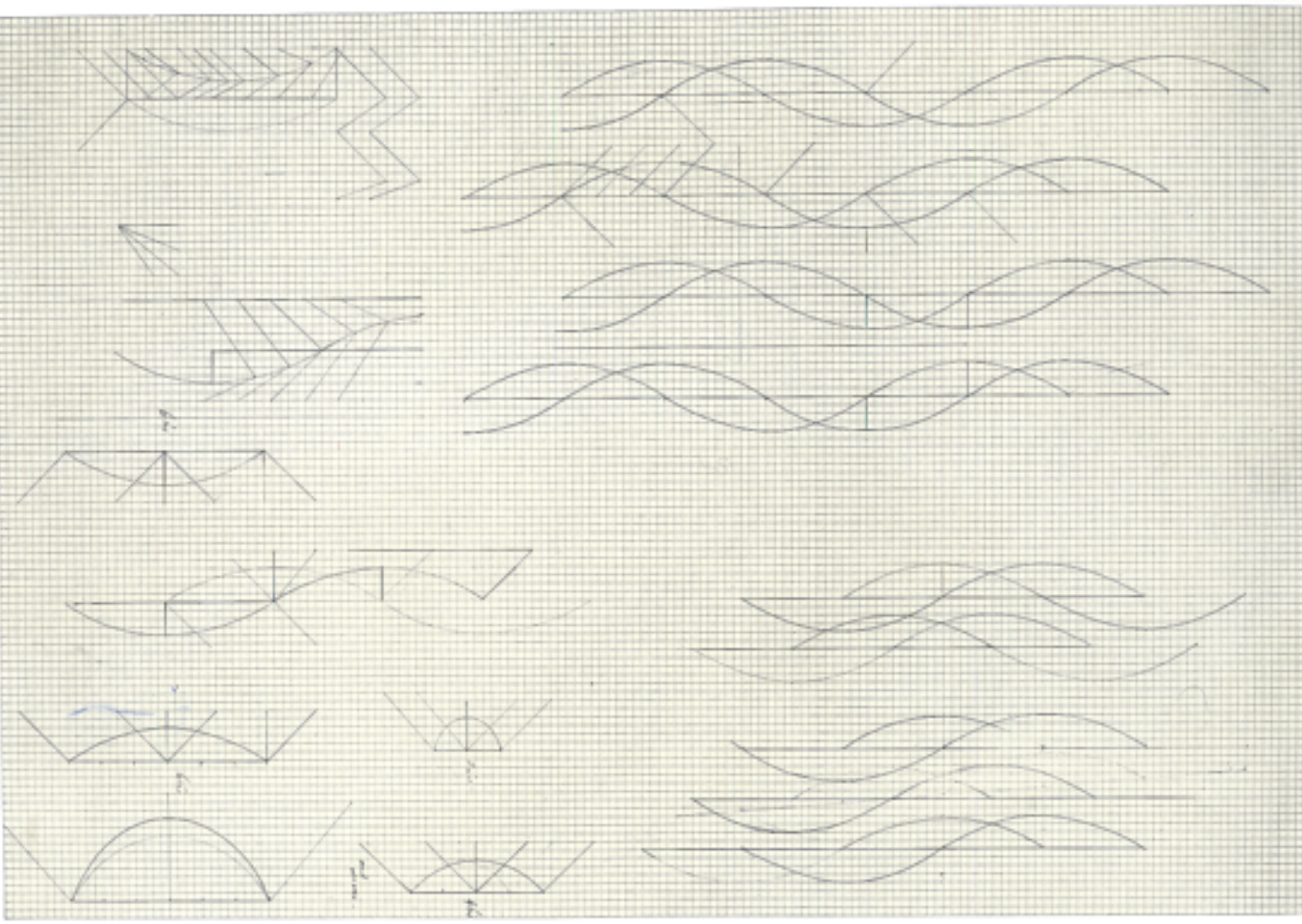




(remember 1 and 9 duplicate).



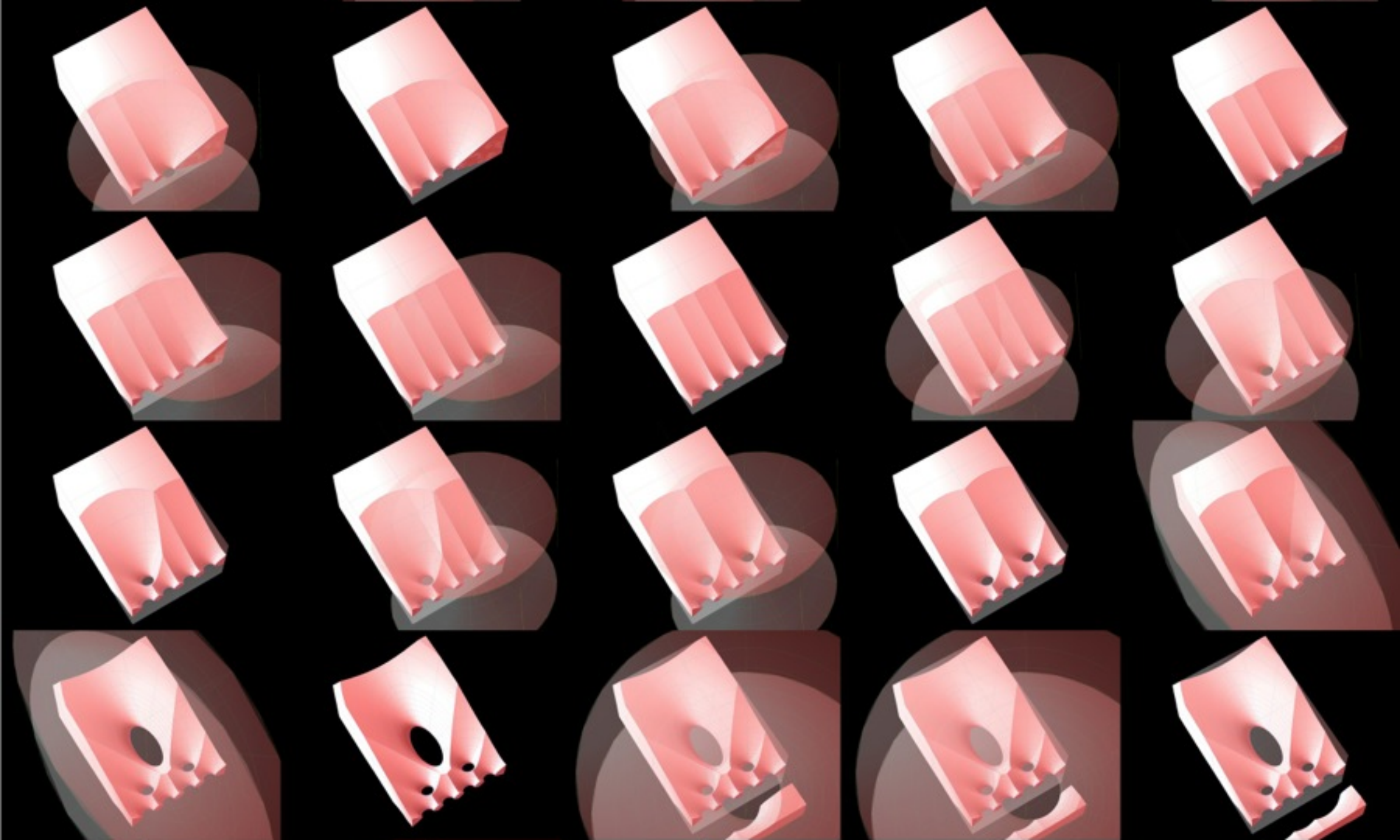


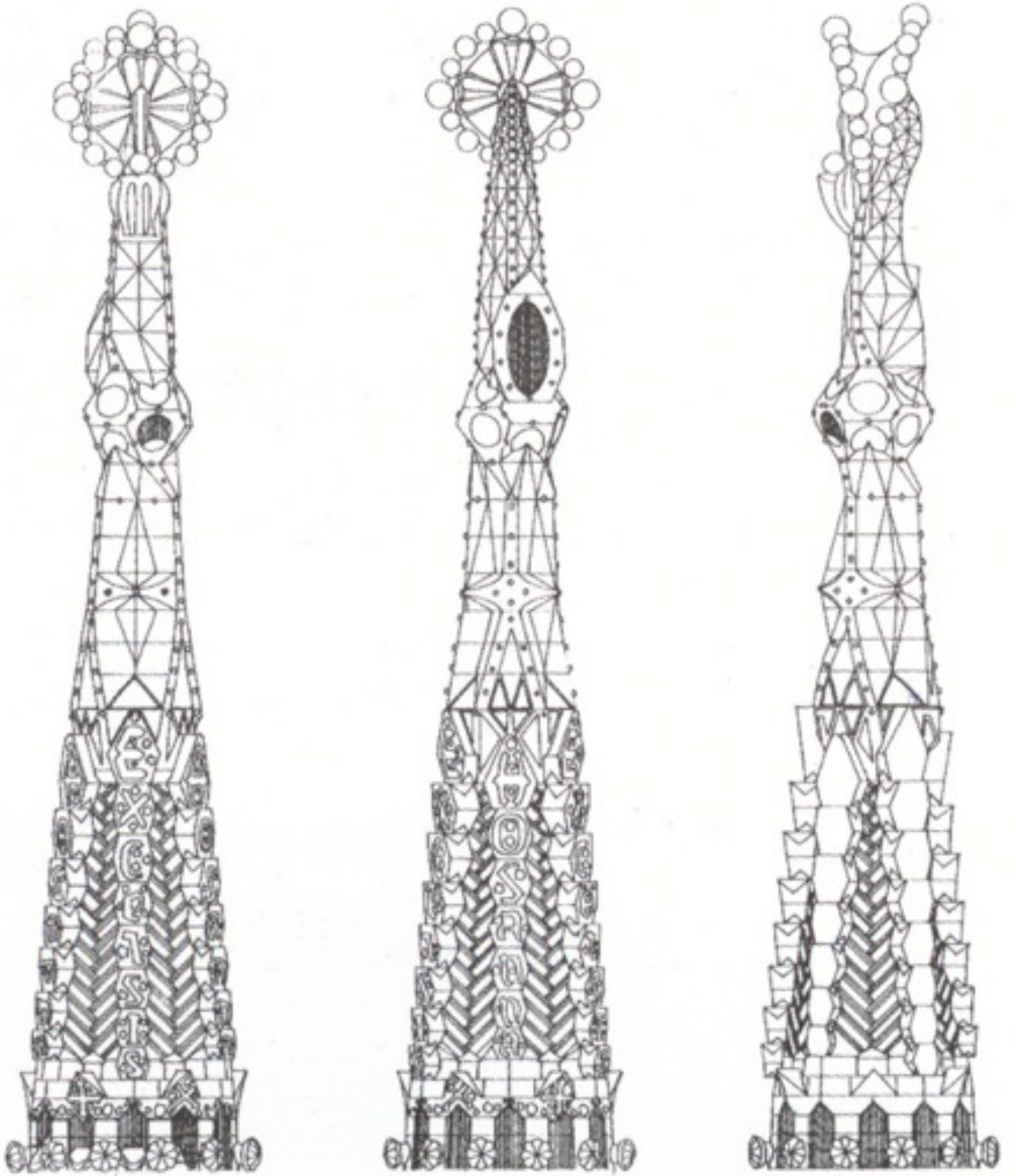


건축

Antonio Gaudi

가우디의 자연에 대한 통찰은 그의 건축이 통합적(integration)임과 동시에 종합적(synthesis)이라는 것에서 극명히 들어나는데, ‘종합(synthesis)’이라 할 때는 두 가지의 의미가 있다. 먼저 결합적 종합 (conjunctive synthesis)이 있다. 이는 축차적이며 통합적이며 첨가적인 절차를 밟는다. 일련의 의사결정이 누적되어 결과로서 나타난다. 다음엔 분리적 종합 (disjunctive synthesis)이 있다. 이 종합에서 의사결정은 이루어지지 않거나 유보된다. 모든 구성요소들이 독립적이며 다른 것과는 분리된 것이기에, 이는 통합적이지 않다. 결합의 종합에서는 그러나 전체는 부분의 합 그 이상인 반면, 분리의 종합에서는 부분들은 독립적이고 분리된 것으로 남아있다. 곧, 전체는 부분의 합 이상도 이하도 아니다. 해체주의자들은 물론 모더니스트들도 이러한 분리의 종합을 주로 다루어 왔었다. 그러나 한편 가우디의 성가족 성당에서는 결합의 종합이 이루어 진 것이다. 이러한 첨가적 과정은 전체 조직이 통합하게 하는데 이 성당의 창문을 생성시키기 위한 마크 버리 (Mark Burry)의 다이어그램은 이러한 방식의 작업의 특성을 명료하게 보여준다.

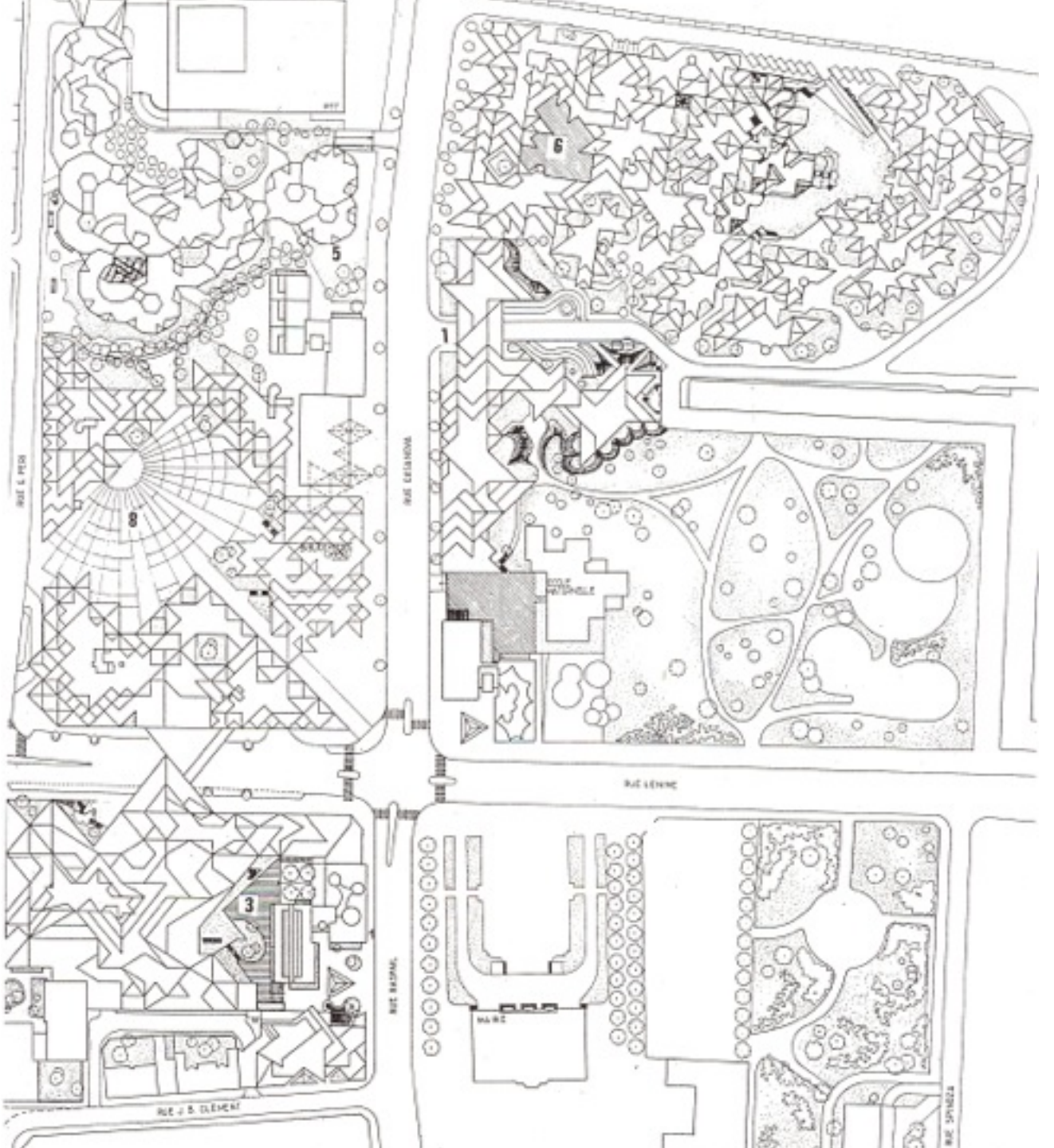


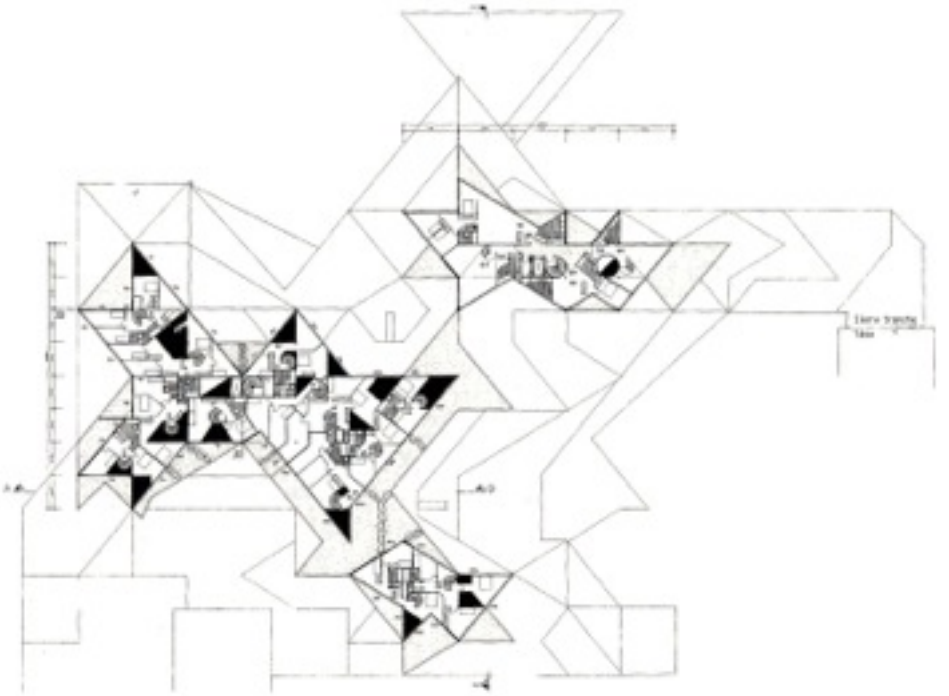

EXCELSIS
GOSPORD

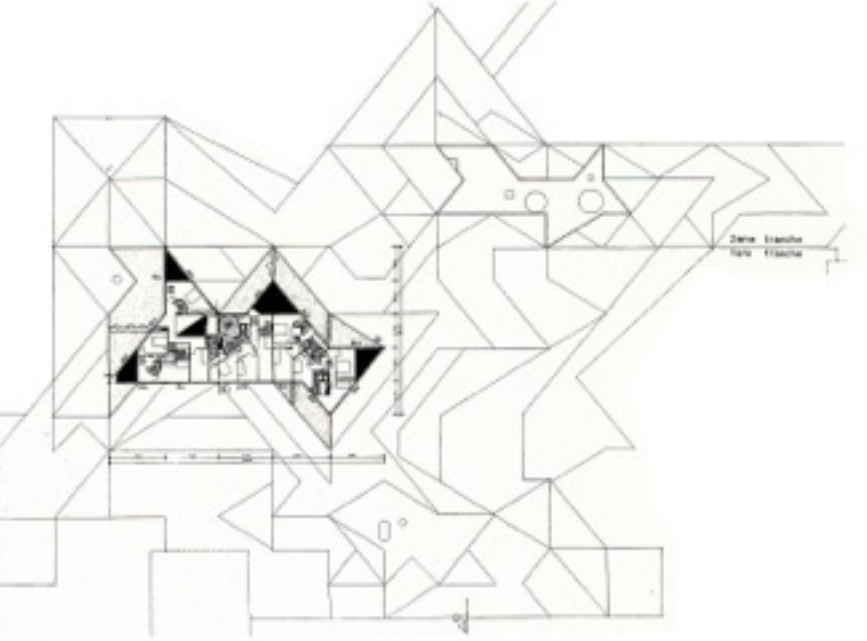
도시

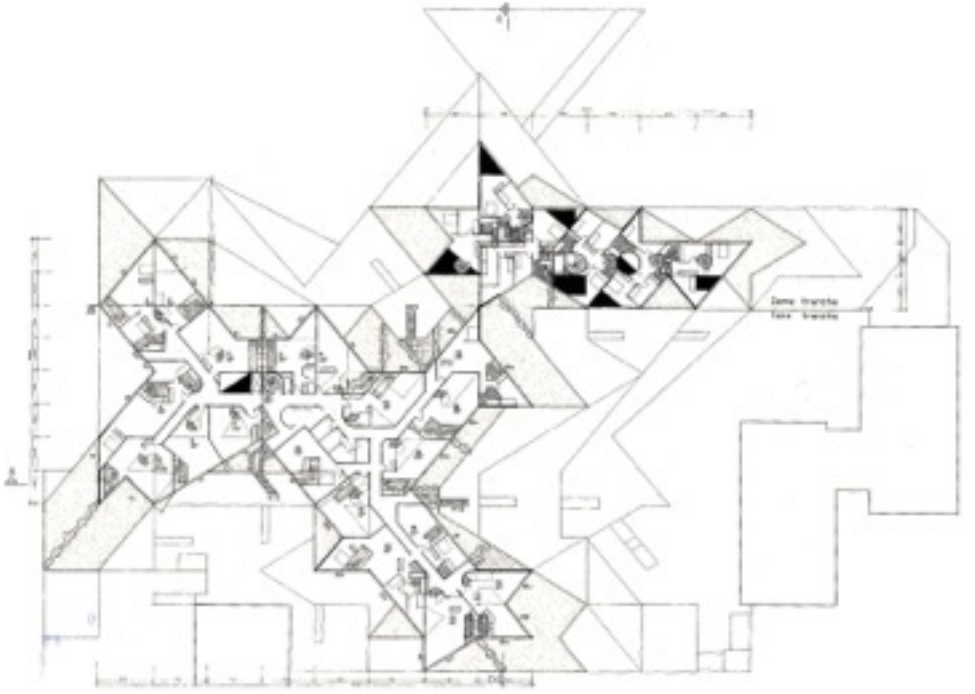
Jean Renaudie

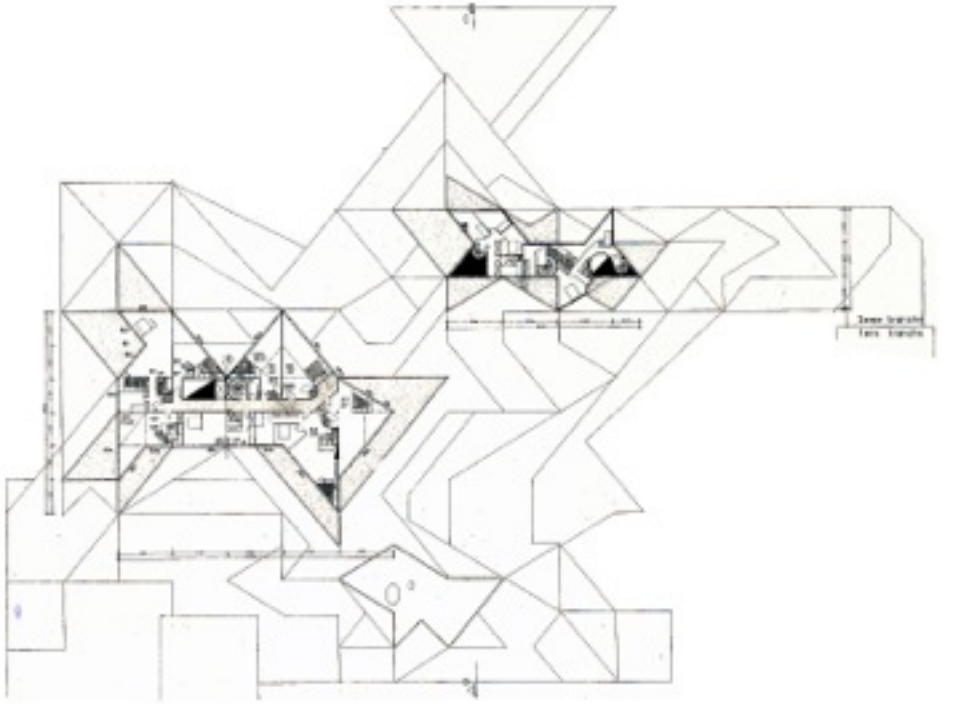
“기능을 혼합하고 중첩시키는 방법으로만은 복잡다단한 생명체 같은 도시 조직을 만들어내기 어렵다. 그보다는 기능을 의도적으로 결합하여, 전체가 각 부분의 총합보다 큰 하나의 복잡한 세트를 만들어내야 하는 것이다.” — 쟝 르노디

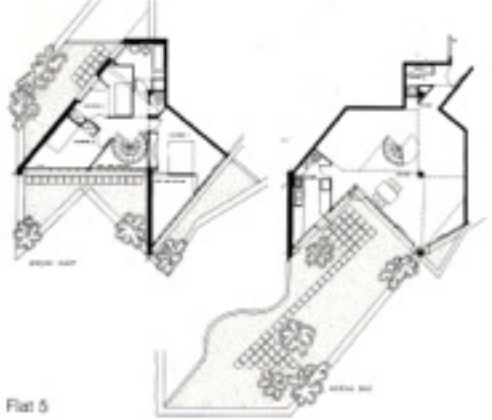

6
5
1
8
3
RUE LENINE
RUE J. B. CLEMENT
MAIRIE





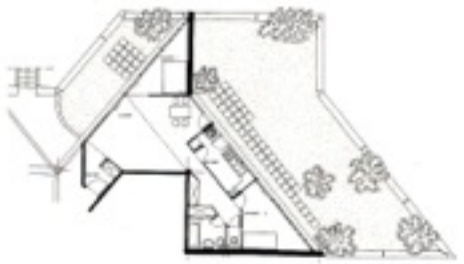




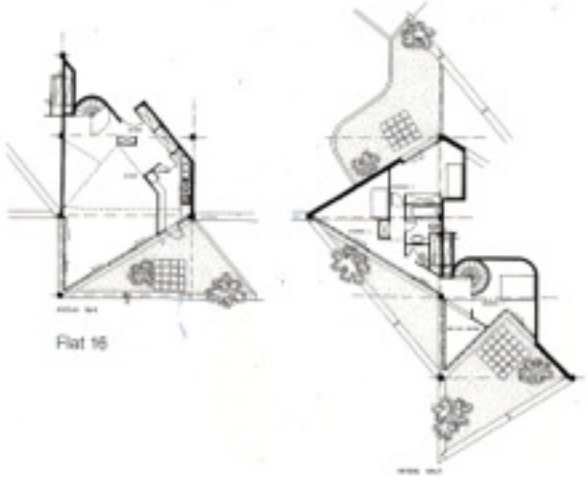


Flat 5

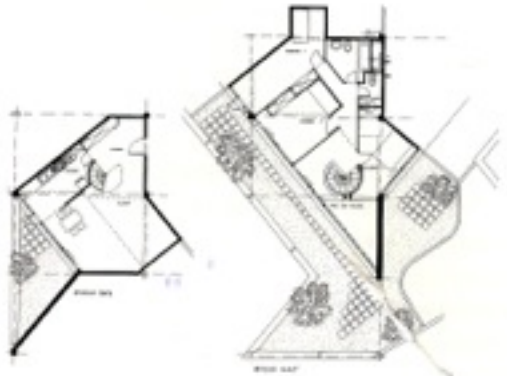
Flat 10



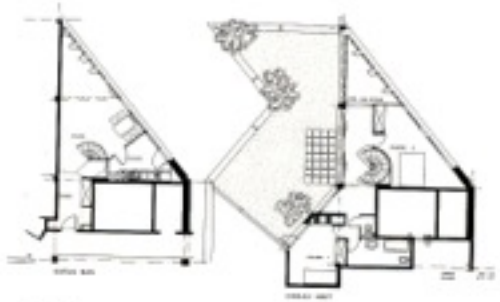
Flat 11



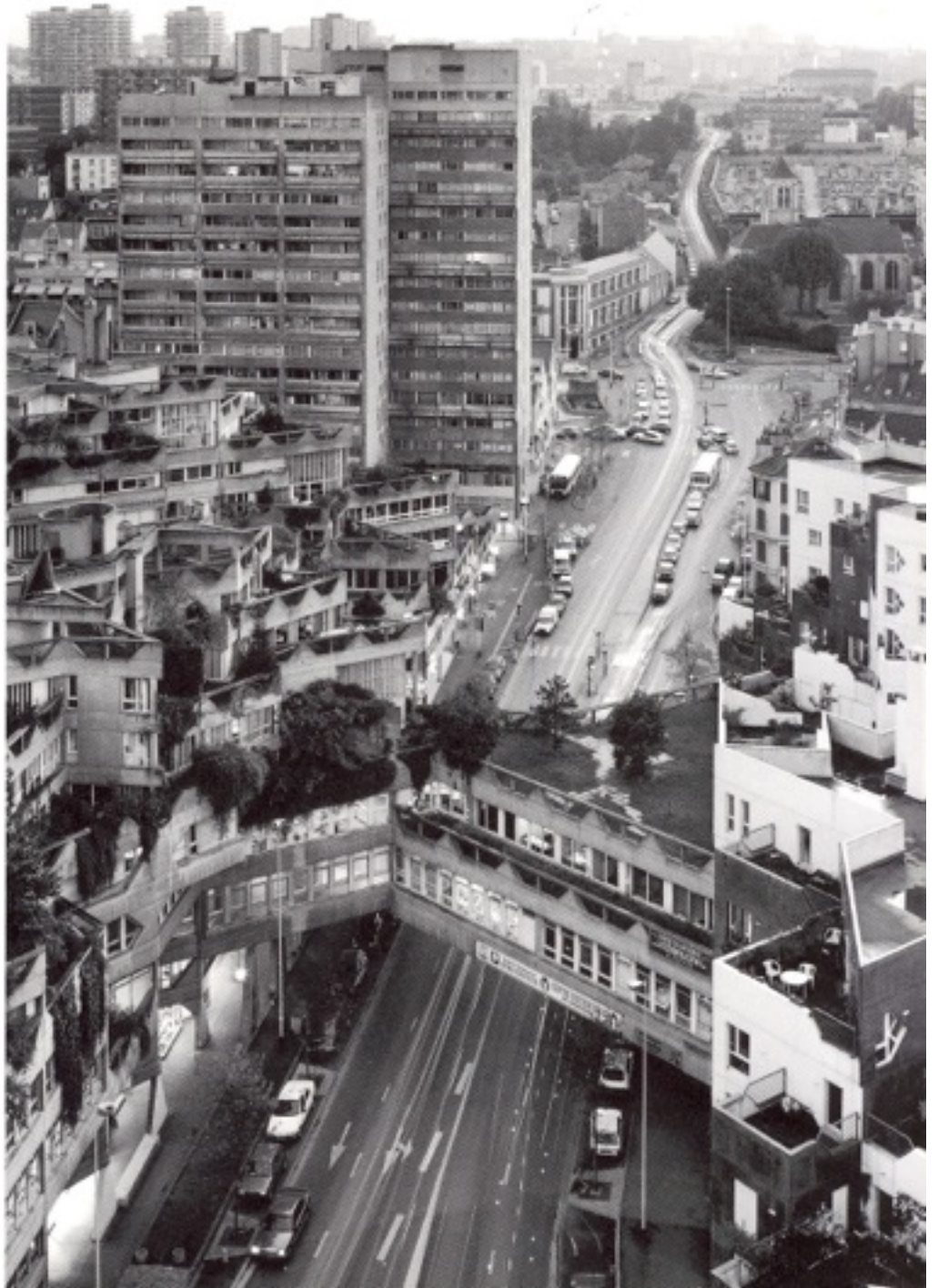
Flat 16



Flat 18



Flat 20

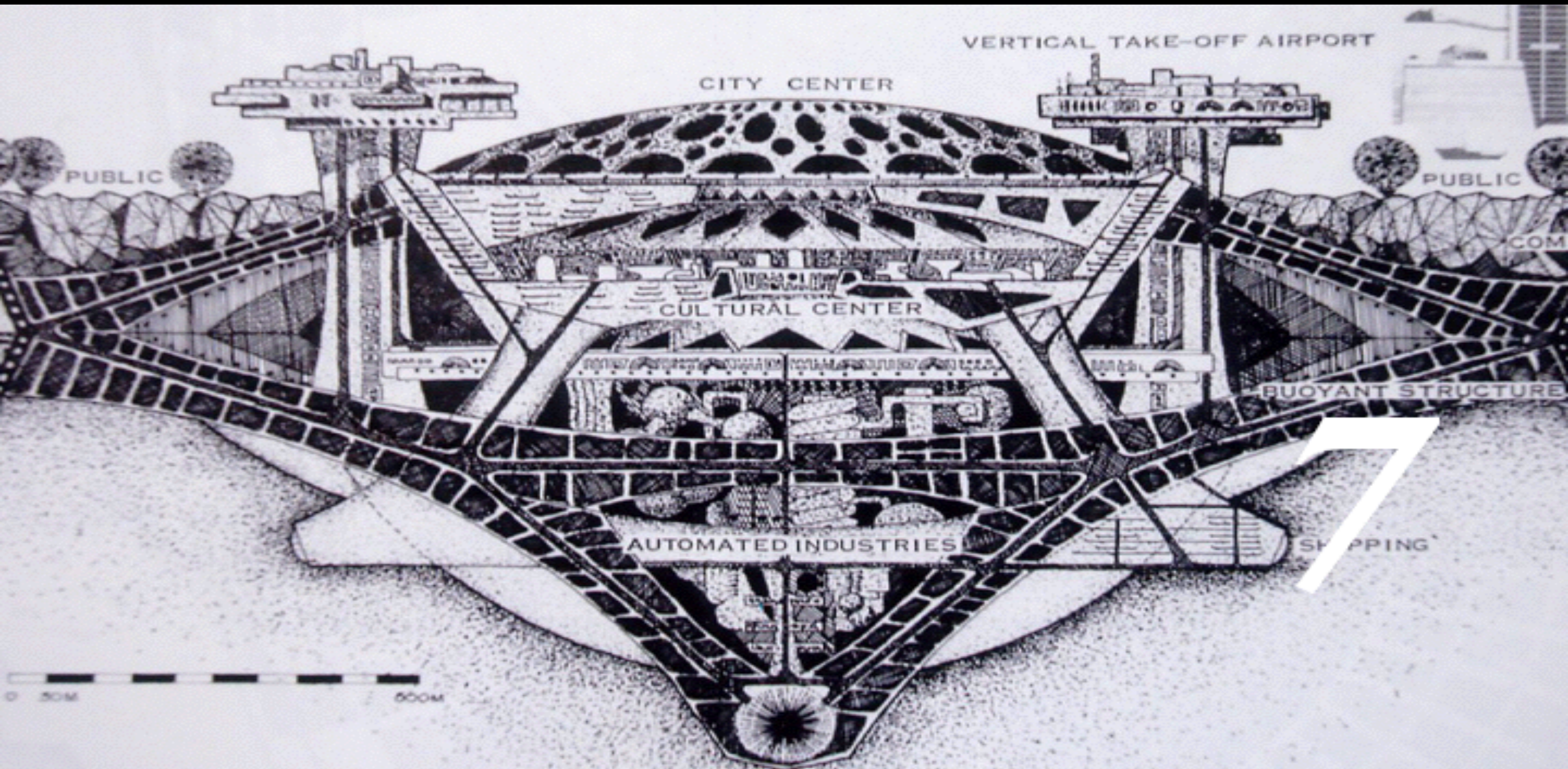


The whole is
more than sum of its
parts

부분

전체

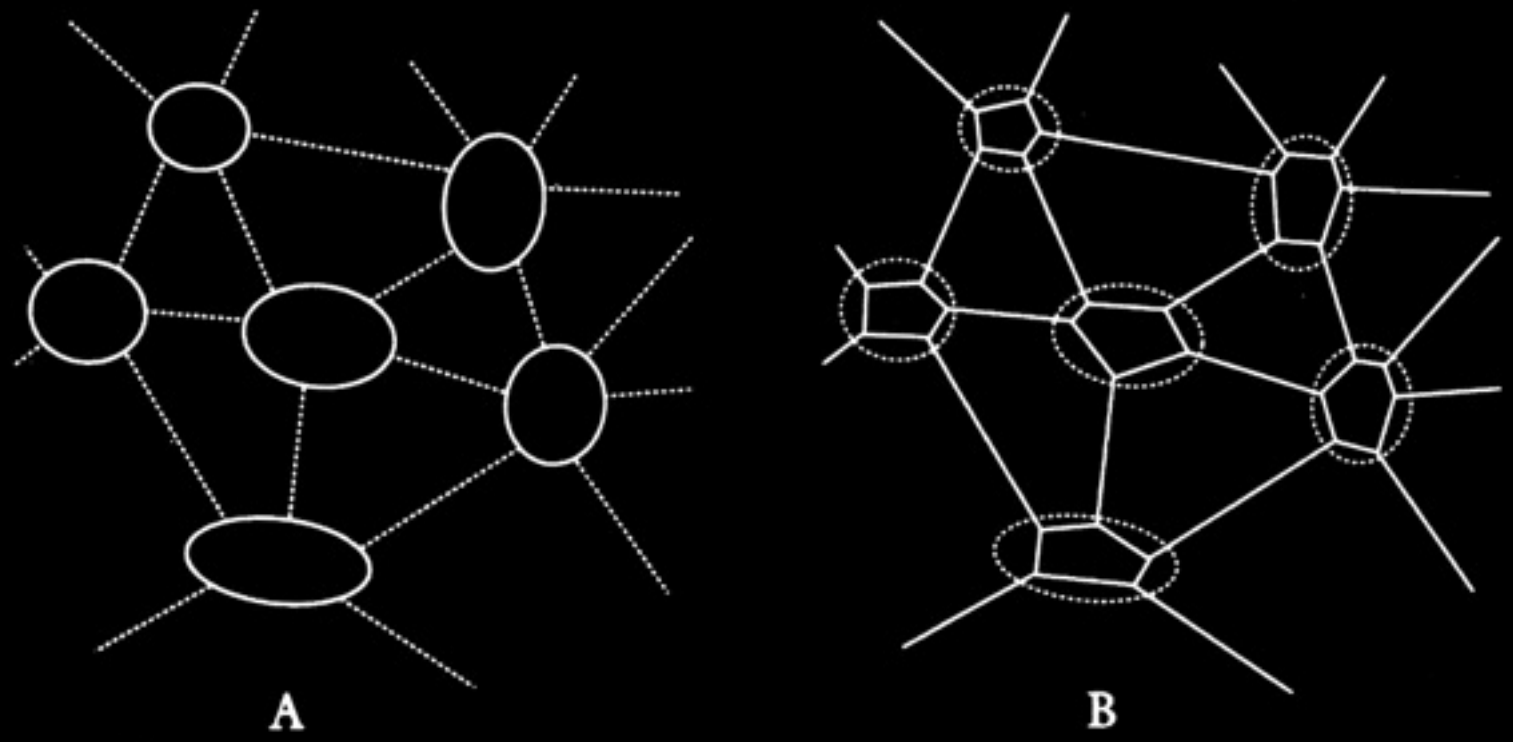
Paolo Soleri



7

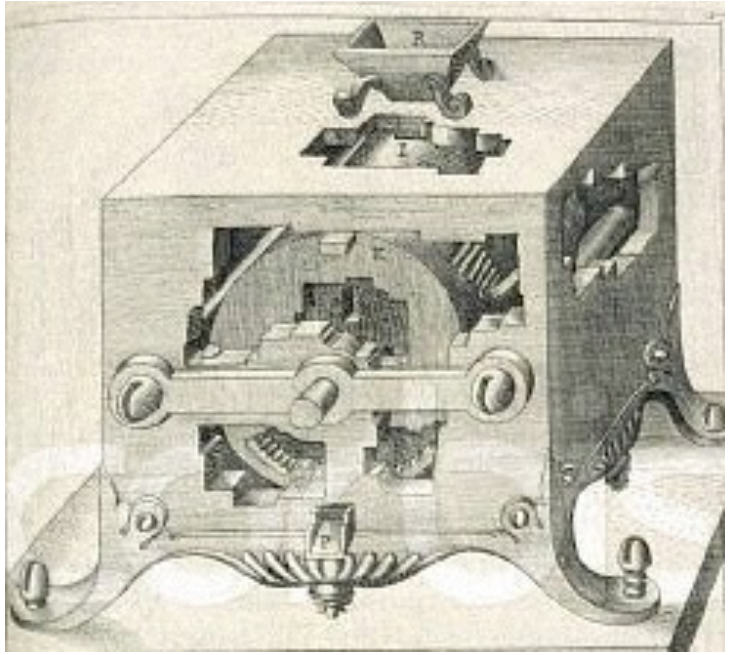
From Parts to Whole

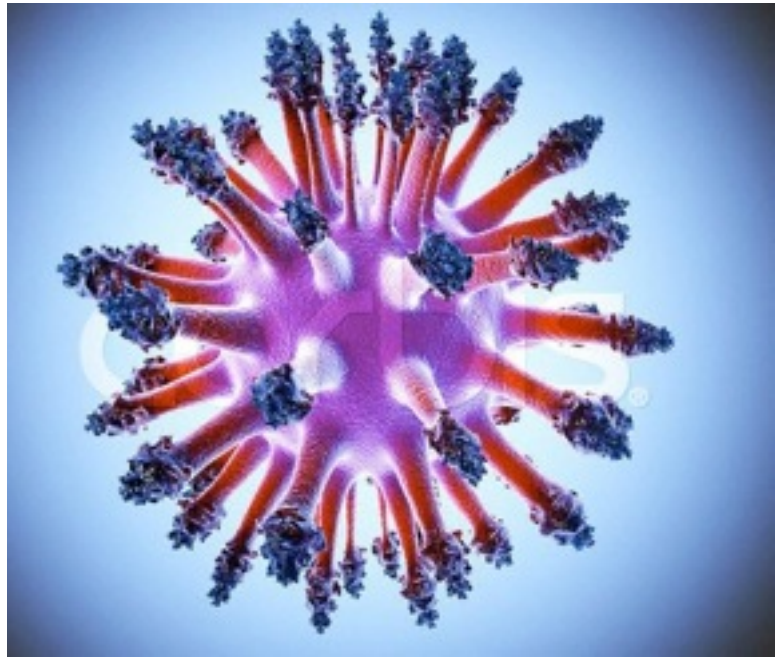
Shift from Objects to Relationships



From Structure to Process

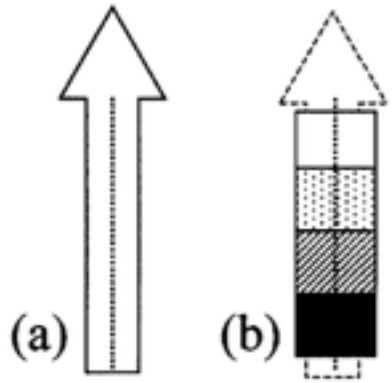
Shift from Machine to Self-organization

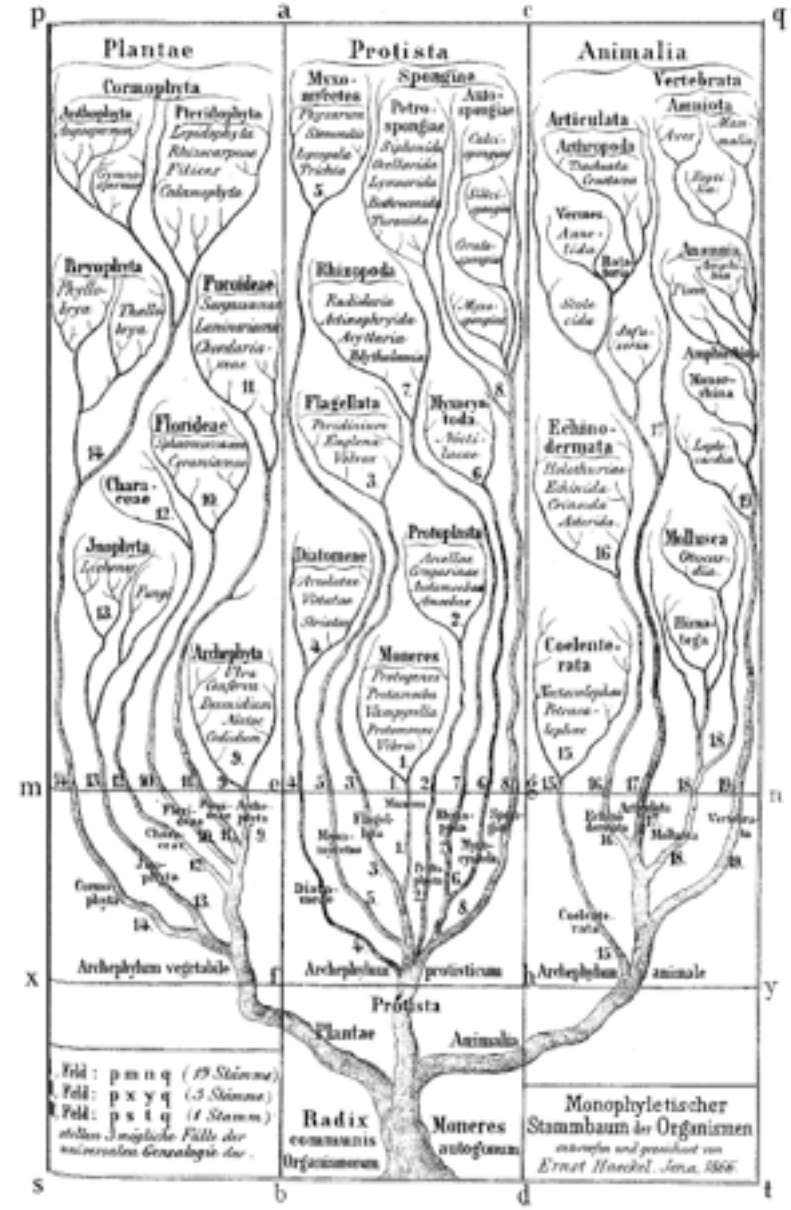




From One to Many

Shift from A future to Multiple future



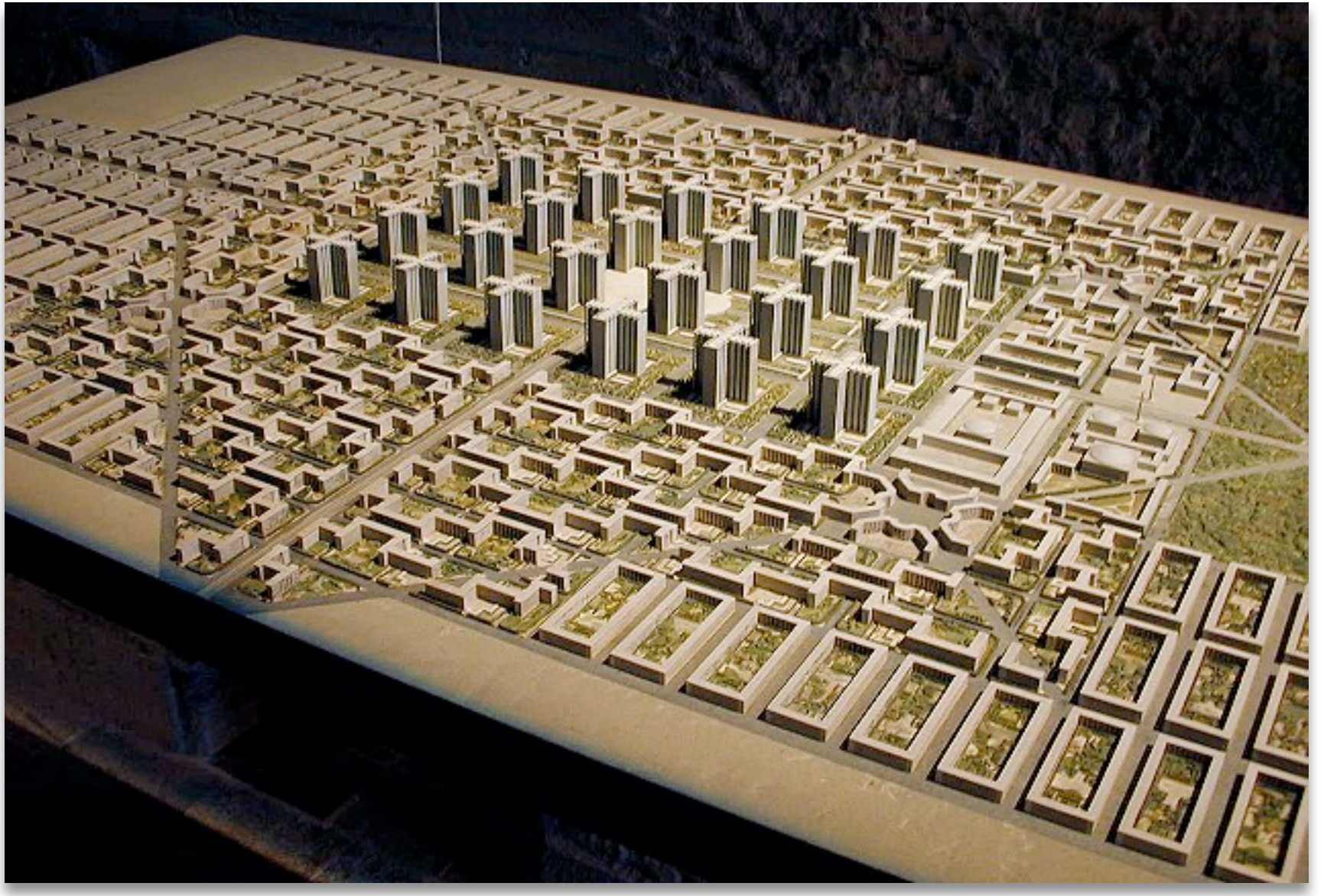


현대도시계획의 문제점

Machine City

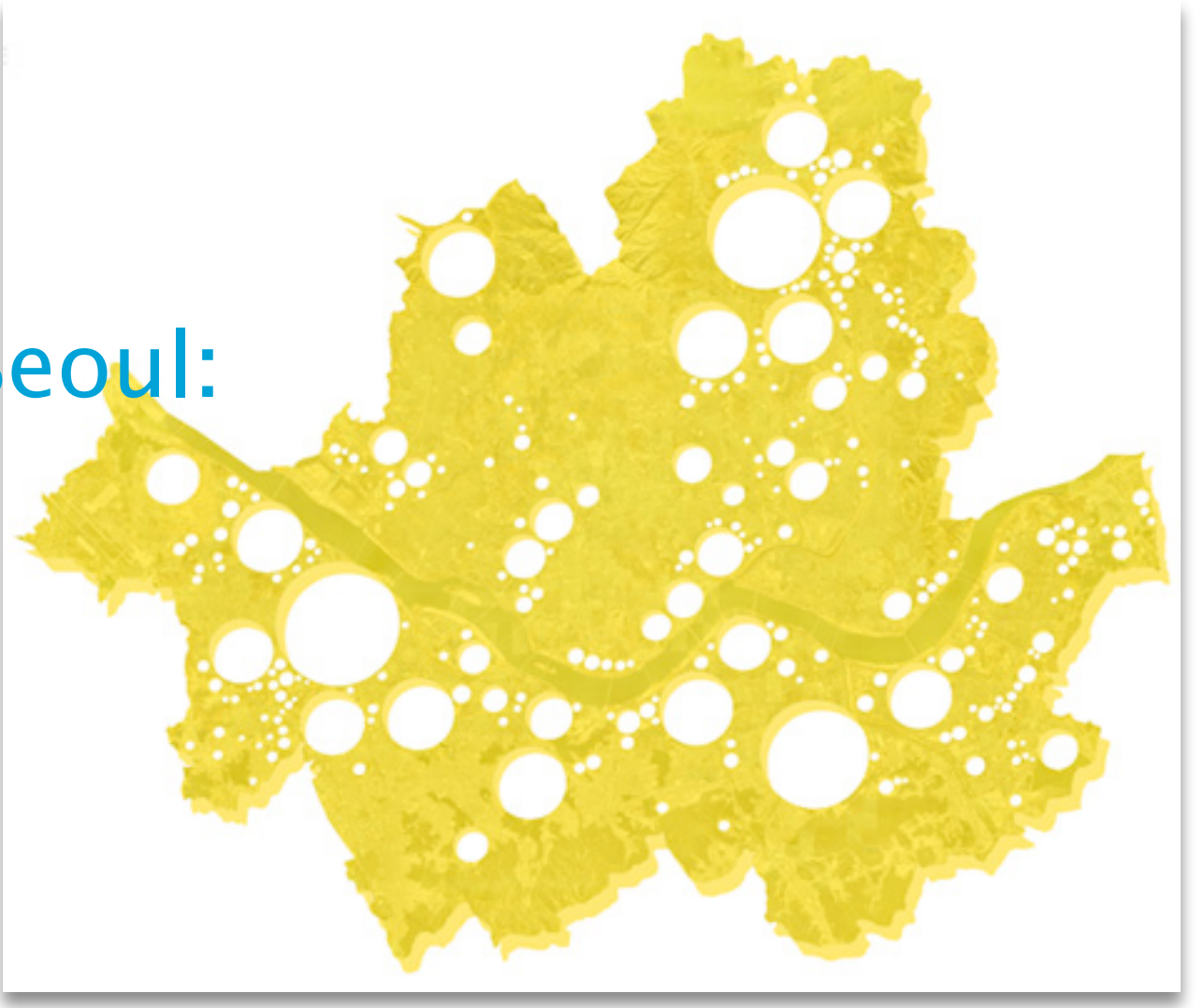
solution to 4 problems: inhabitation, work, recreation, circulation

Zoning



8.12%

Apartment blocks in Seoul:
Total area of Seoul is 606.37km2,
while total area of apartment blocks in Seoul: 49.25km2

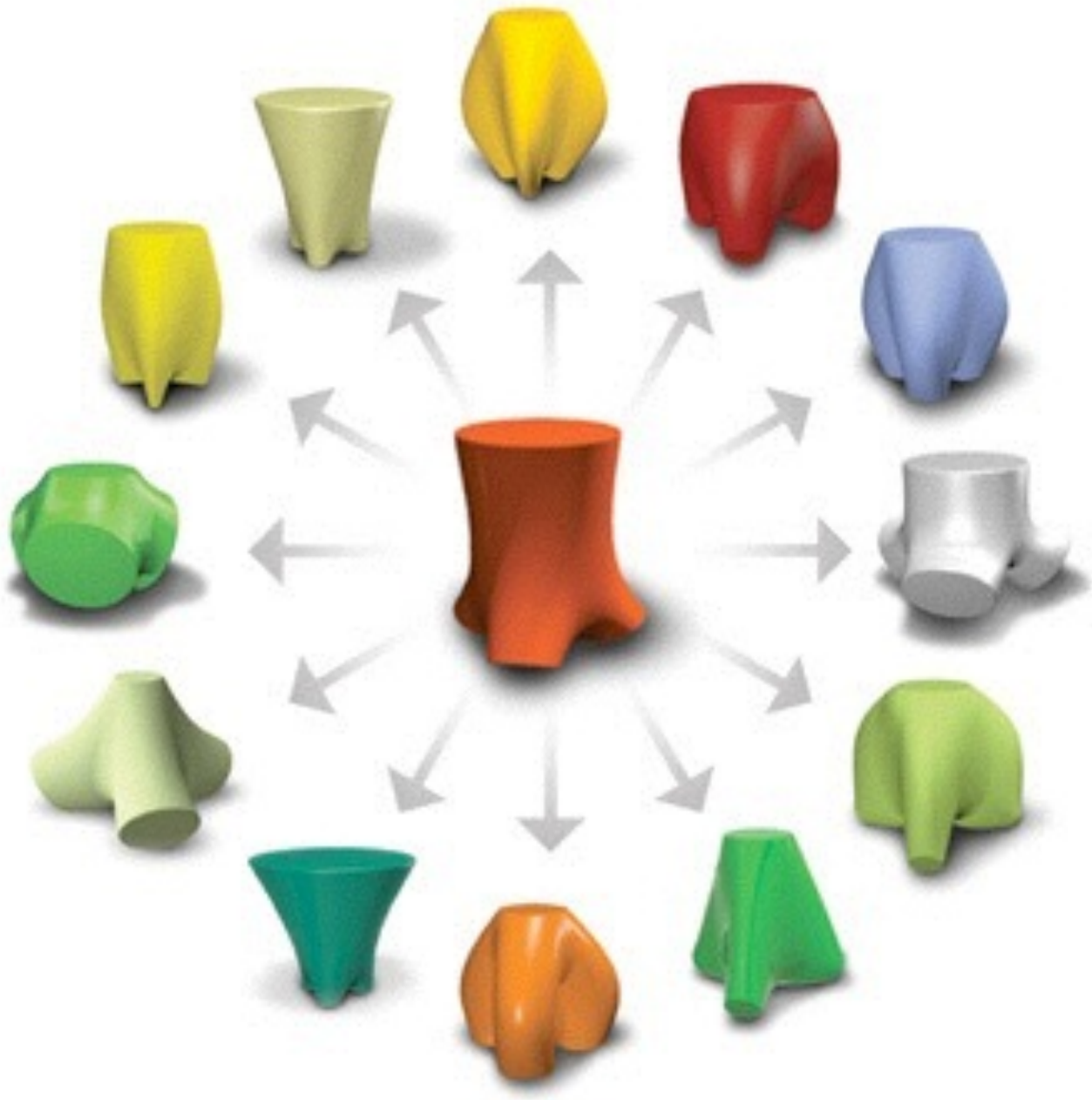


창발성을 향한 새로운 도시계획

Emergence vs Planning

Mass-production

Mass-customization



Academic
works

Academic
snowflake housing

Koch Curve

Rule
1. Divide the line segment into three segments of equal length.
2. Draw an equilateral triangle that has the middle segment from step 1 as its base and points outward.
3. Remove the line segment that is the base of the triangle from step 2.

Lv.1 Lv.2 Lv.3

Koch Snowflake

T(Triangle) Lv.1 Lv.2 Lv.3

Scale by 1/3

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Sungkyunkwan University

Professor / Director
TESOC HAH

Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

Drawing Title
Fractal Case Study
- Koch Curve

Drawing No.
001-1

Scale
Non Scale

Legend

Building Type

Depth1
- Countryside Housing Type
  or One-room Type

Depth2
- One-Room Type

Depth3
- Family Housing Type

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Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

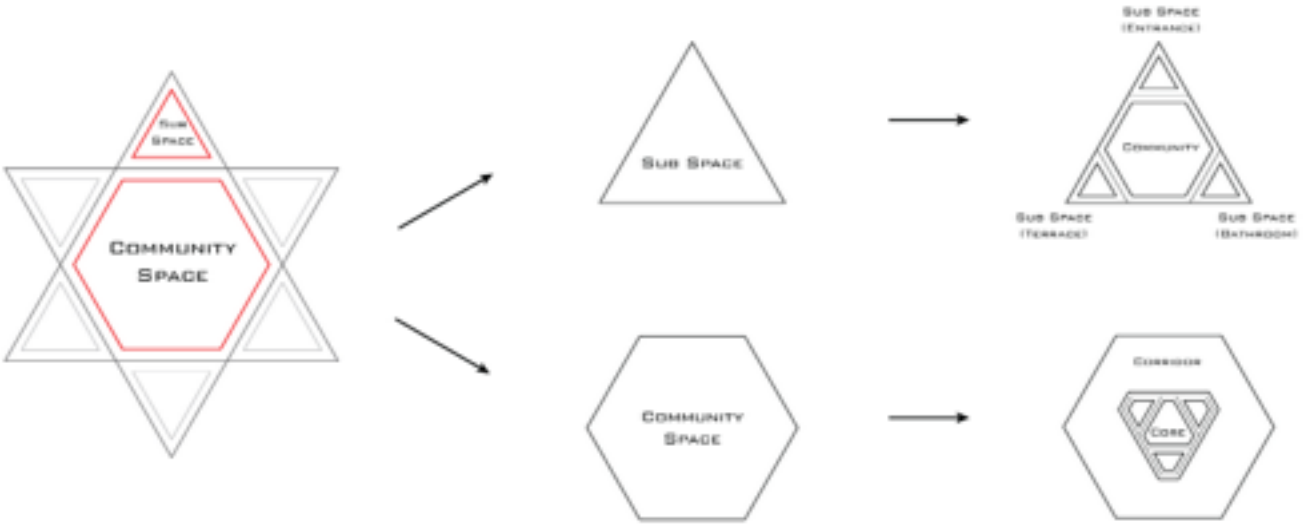
Drawing Title
Building Plan

Drawing No.
006-1

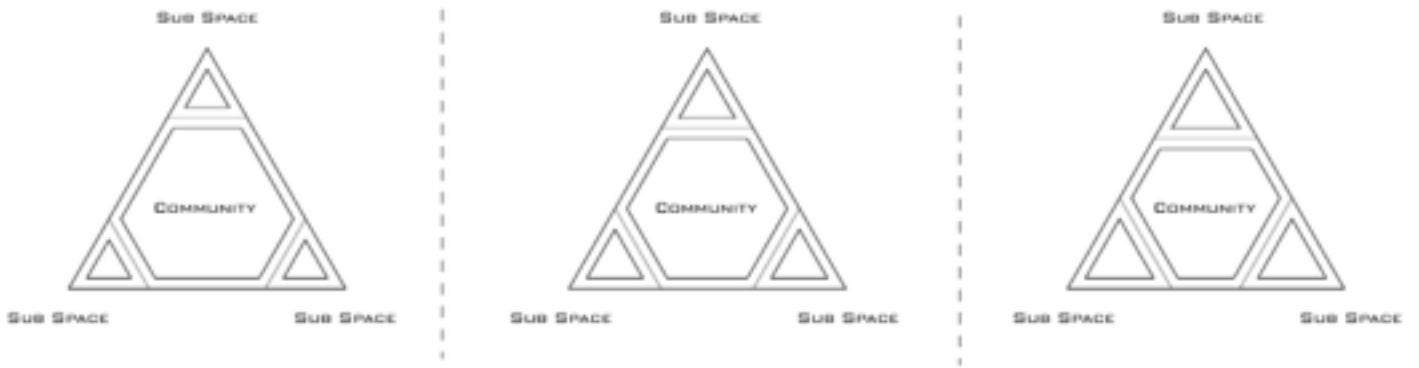
Scale
Non Scale

Legend

Fractal Development Process - Plan



Optimization - Dimension Control



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FRACTAL CITY:
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Course
Architectural Design Studio 6
Autumn 2009

Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

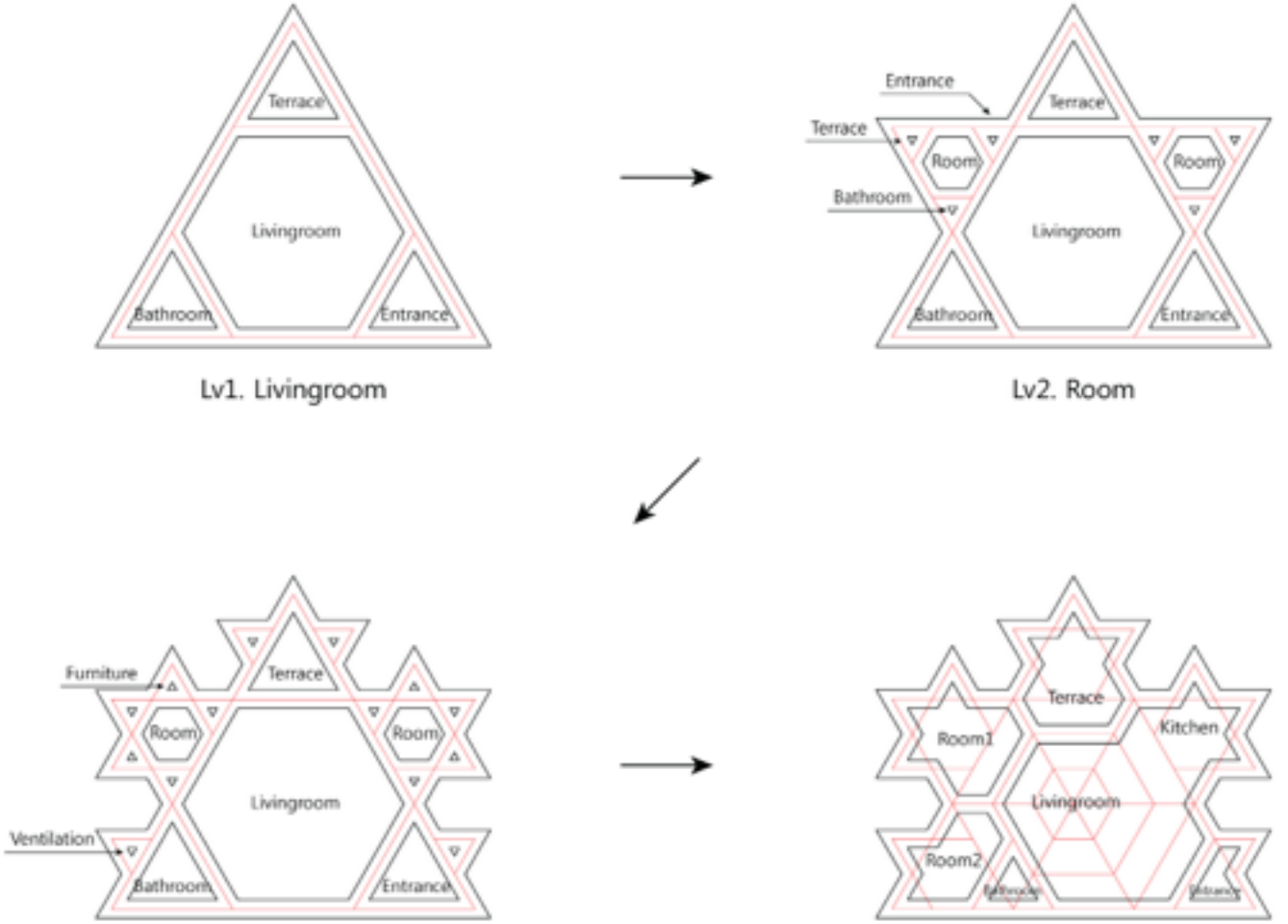
Drawing Title
Building Plan

Drawing No.
006-2

Scale
Non Scale

Legend

Fractal Development Process



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Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

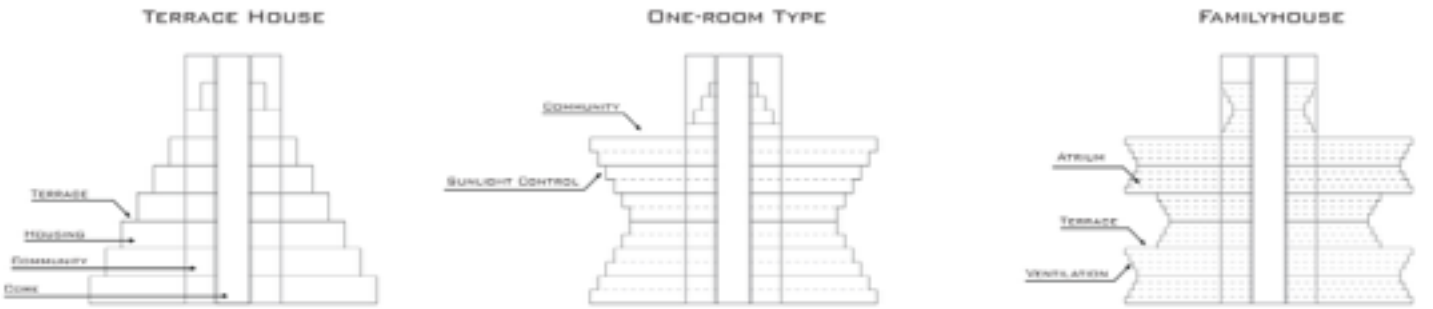
Drawing Title
Building Plan

Drawing No.
006-3

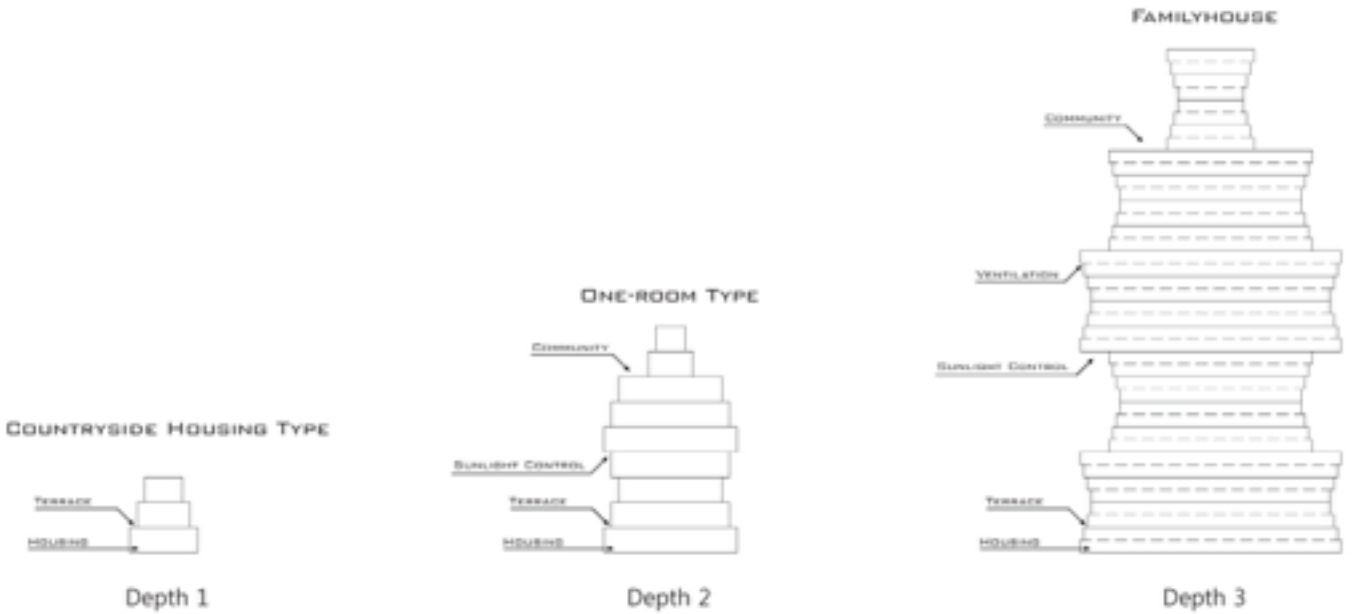
Scale
Non Scale

Legend

Fractal Development Process - Section



Optimization - Dimension Control



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Professor / Director
TESOC HAH

Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

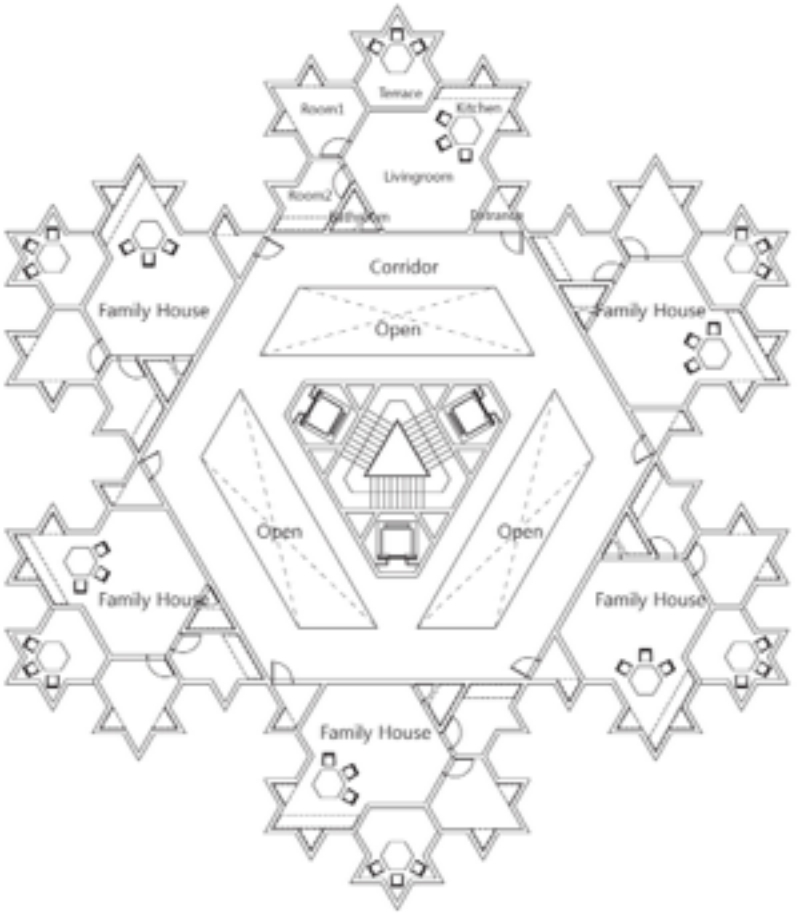
Drawing Title
Building Plan

Drawing No.
006-4

Scale
Non Scale

Legend

Building Type 1 - Family House



ECO-TYPE STUDIO
@Department of Architecture
Sungkyunkwan University

Professor / Director
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Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

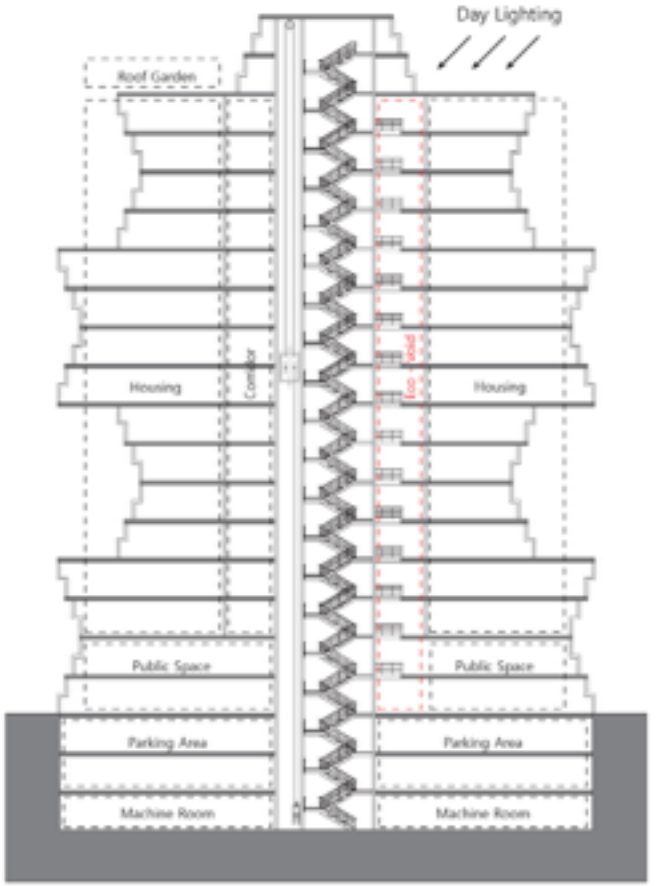
Drawing Title
Building Plan

Drawing No.
006-5

Scale
1/300@A4

Legend

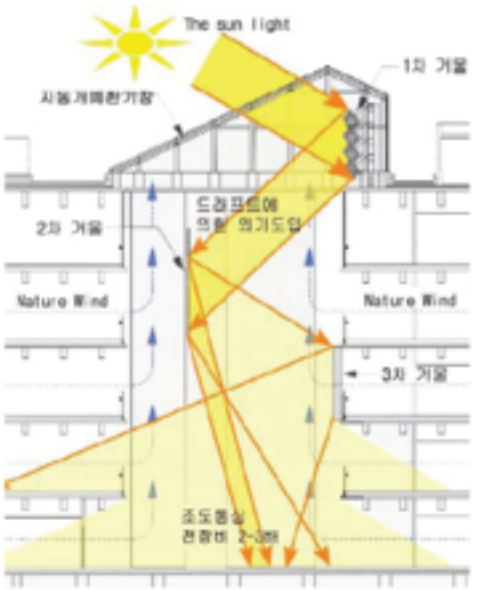
Eco System - Day Lighting & Natural Ventilation



Family House Section
Scale 1/500

Case Study
- Taisei Sapporo Branch Building

Concept Diagram



The Front View

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Sungkyunkwan University

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FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

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Snowflake Housing
Koch Fractal Boundary Housing System

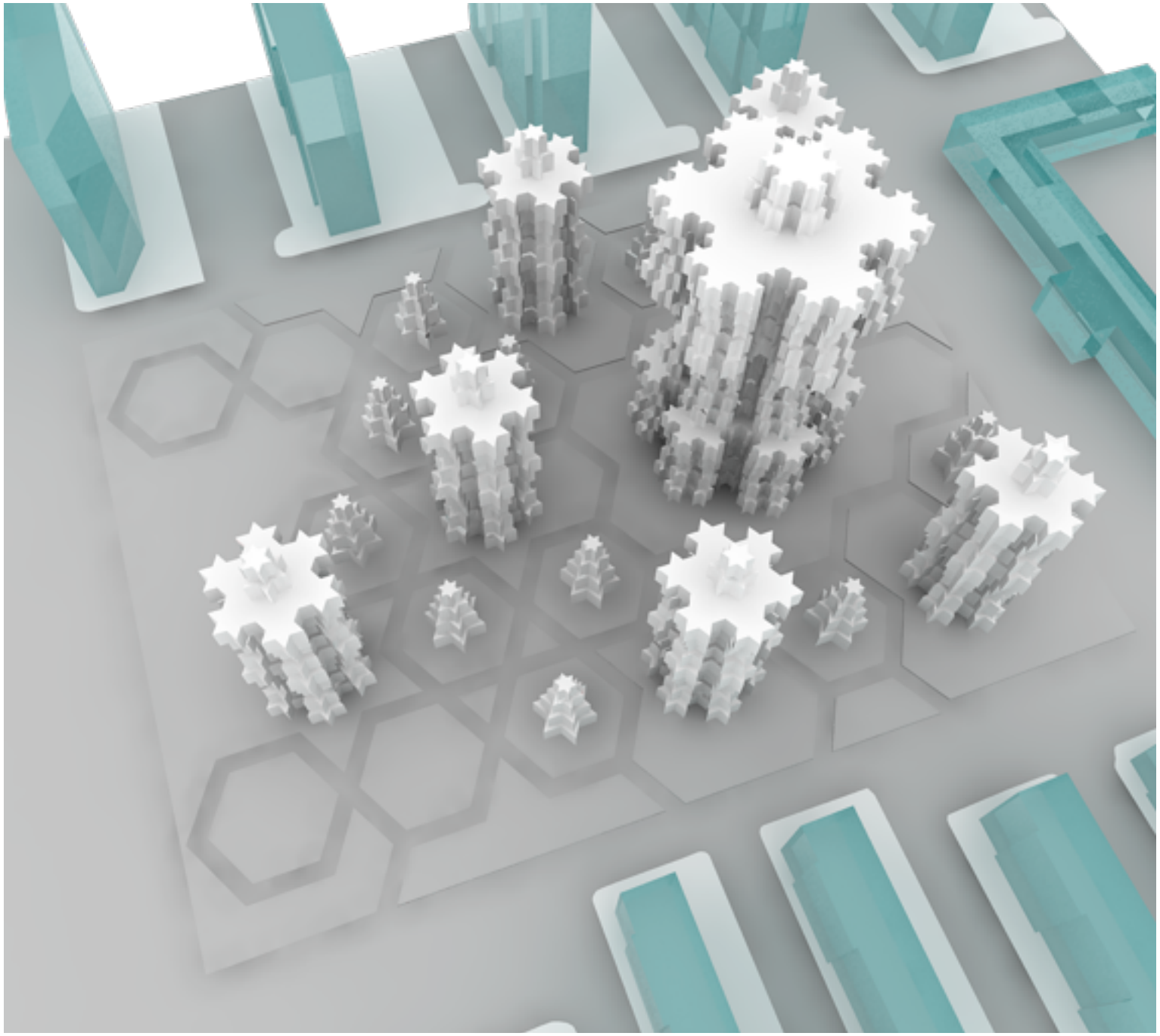
Student
SON JIN

Drawing Title
Building Plan

Drawing No.
006-10

Scale
Non Scale

Legend



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Sungkyunkwan University

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Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Snowflake Housing
Koch Fractal Boundary Housing System

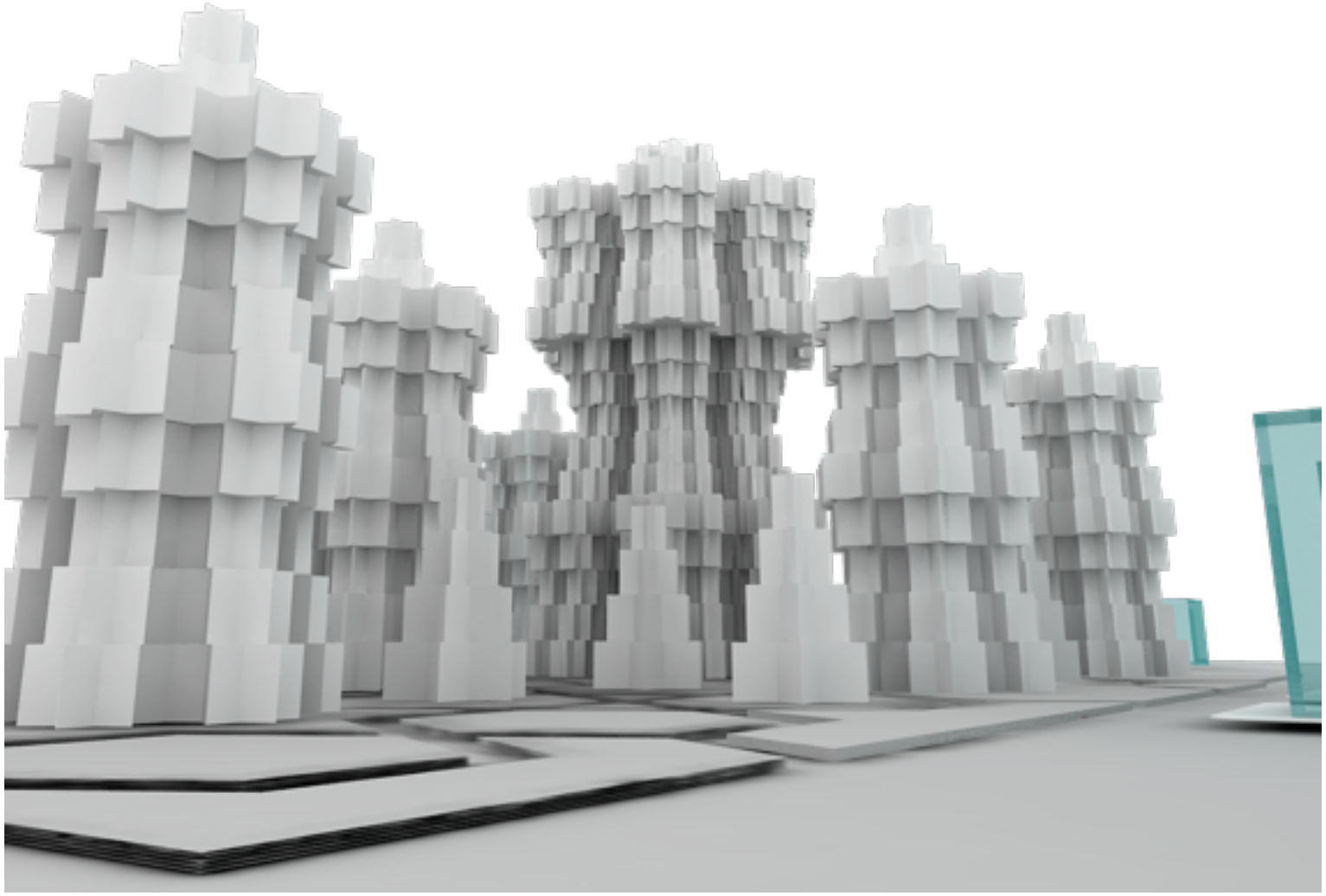
Student
SON JIN

Drawing Title
3D / Model Image

Drawing No.
008-1

Scale
Non Scale

Legend



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Sungkyunkwan University

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FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

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Snowflake Housing
Koch Fractal Boundary Housing System

Student
SON JIN

Drawing Title
3D / Model Image

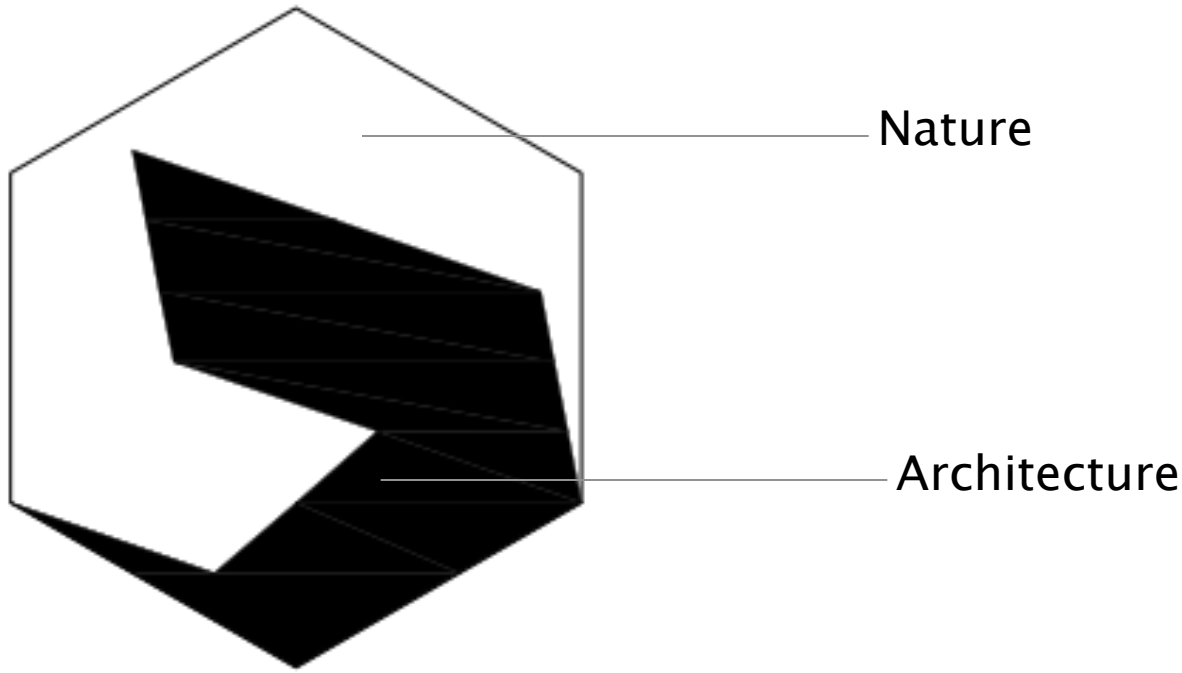
Drawing No.
008-1

Scale
Non Scale

Legend

Academic

peano-gosper housing



ECO-TYPE STUDIO
@Department of Architecture
Sungkyunkwan University

Professor / Director
TESOC HAH

Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Peano-Gosper Curve
figure-ground

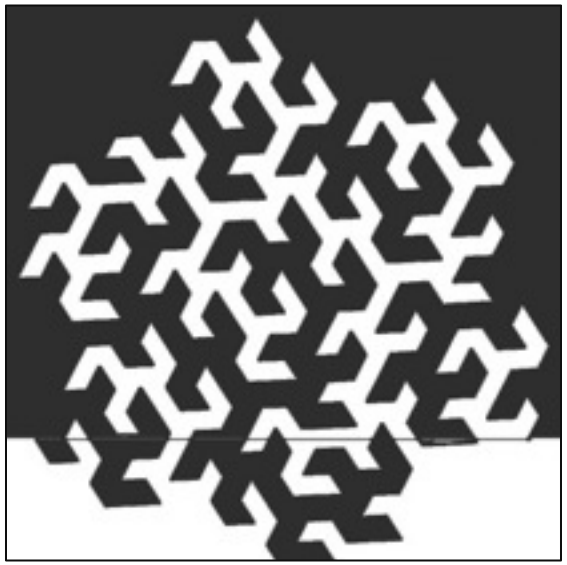
Student
Euiyeon Yim

Drawing Title
Catalogue

Drawing No.
001

Scale
none

Legend
Legend



Blur the lines between inside and outside

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@Department of Architecture
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FRACTAL CITY:
PARAMETRIC ECOLOGY II

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Autumn 2009

Project Title
Peano-Gosper Curve
figure-ground

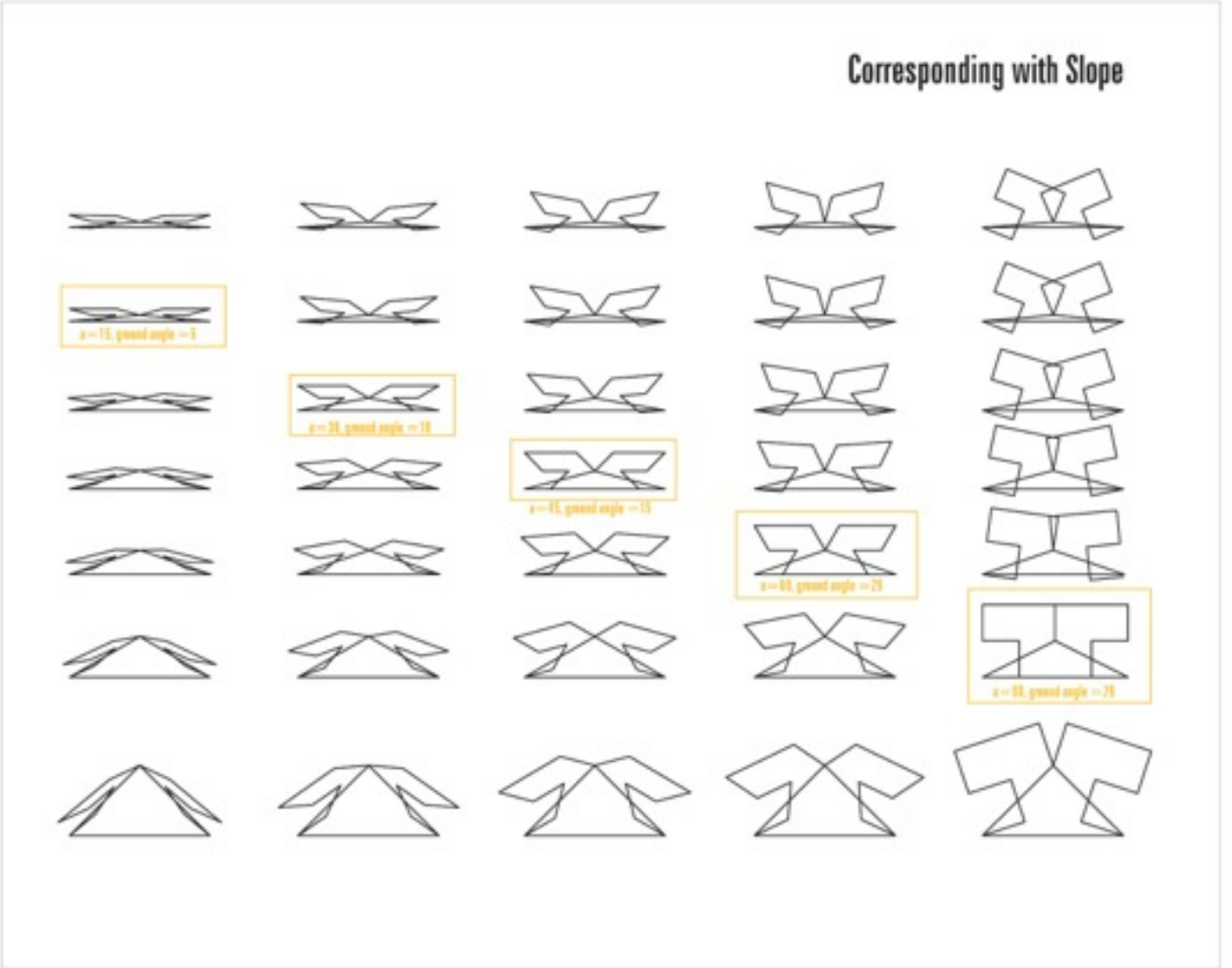
Student
Euiyeon Yim

Drawing Title
Catalogue

Drawing No.
001

Scale
none

Legend
Legend



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FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Peano Gosper Hill
Peano Gosper Curve

Drawing Title
Fractal Lv Develop

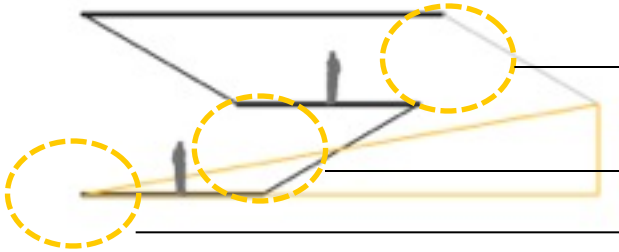
Drawing No.
08

Scale

Legend
--

경사지에 대응

Ground Angle : **10degree**



Form Angle : 30

Window – Sunligh

Stair

Slab

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Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

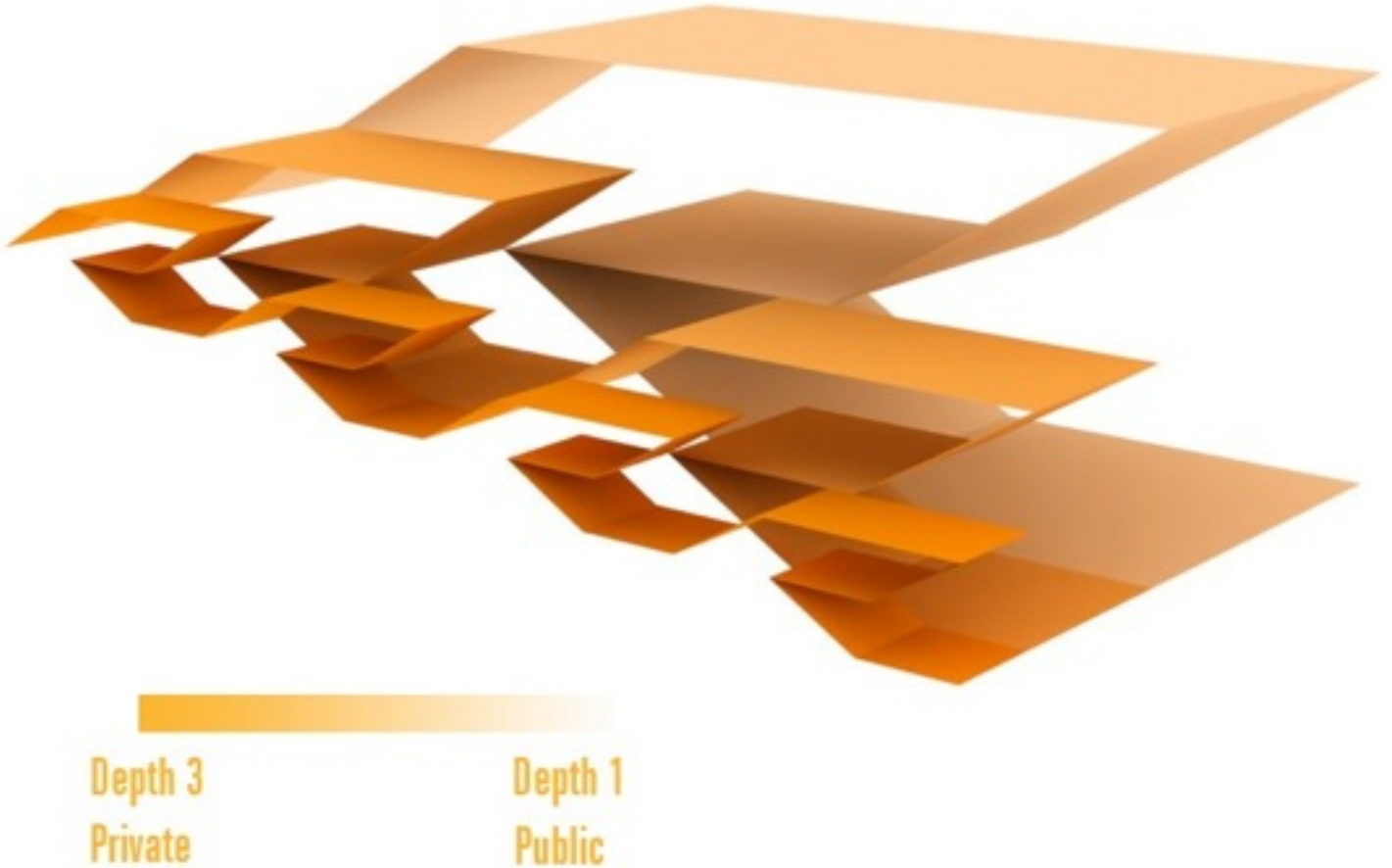
Project Title
Peano Gosper Hill
Peano Gosper Curve

Drawing Title
Fractal Lv Develop

Drawing No.
08

Scale

Legend
–



ECO-TYPE STUDIO
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TESOC HAH

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PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
Peano Gosper Hill
Peano Gosper Curve

Drawing Title
Fractal Lv Develop

Drawing No.
08

Scale

Legend
--

ECO-TYPE STUDIO
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Sungkyunkwan University

Professor / Director
TESOC HAN

Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

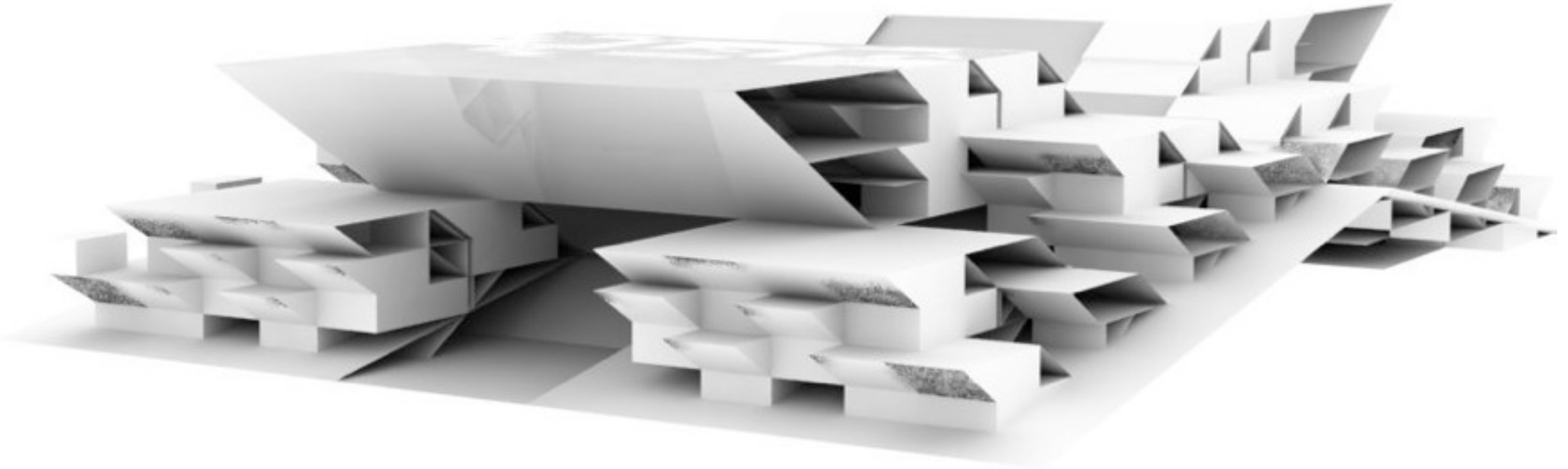
Project Title
Peano Gosper Hill
Peano Gosper Curve

Drawing Title
Main Section

Drawing No.
007

Scale

Legend
--



Academic

menger sponge housing

SUNG KYUN KWAN UNIVERSITY, SCHOOL OF ARCHITECTURE

PARAMETERIC ECOLOGY II:
FRACTAL CITY_ MENGER SPONGE

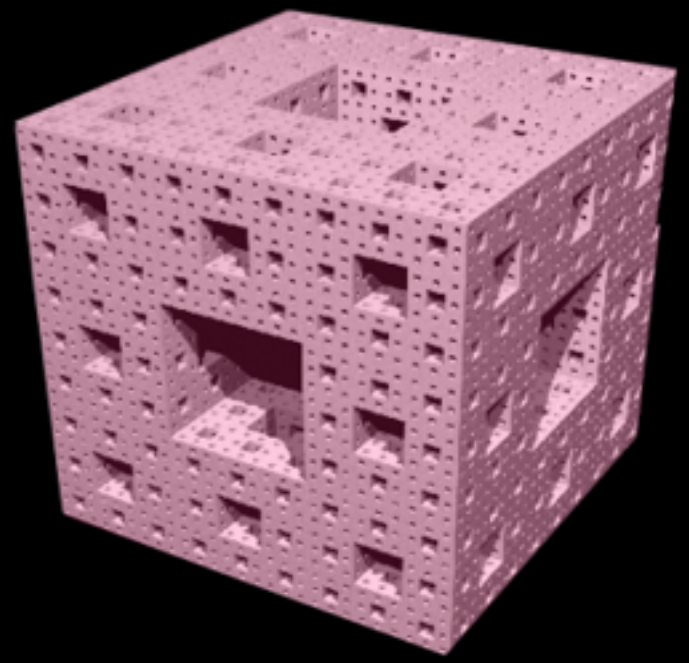
Collaboration with Nature : Climate action by Architecture

Tesoc Hah
Sustain Prototype Studio
Architecture Design Studio 6
Autumn 2009

?

AXIOM

GENERATOR



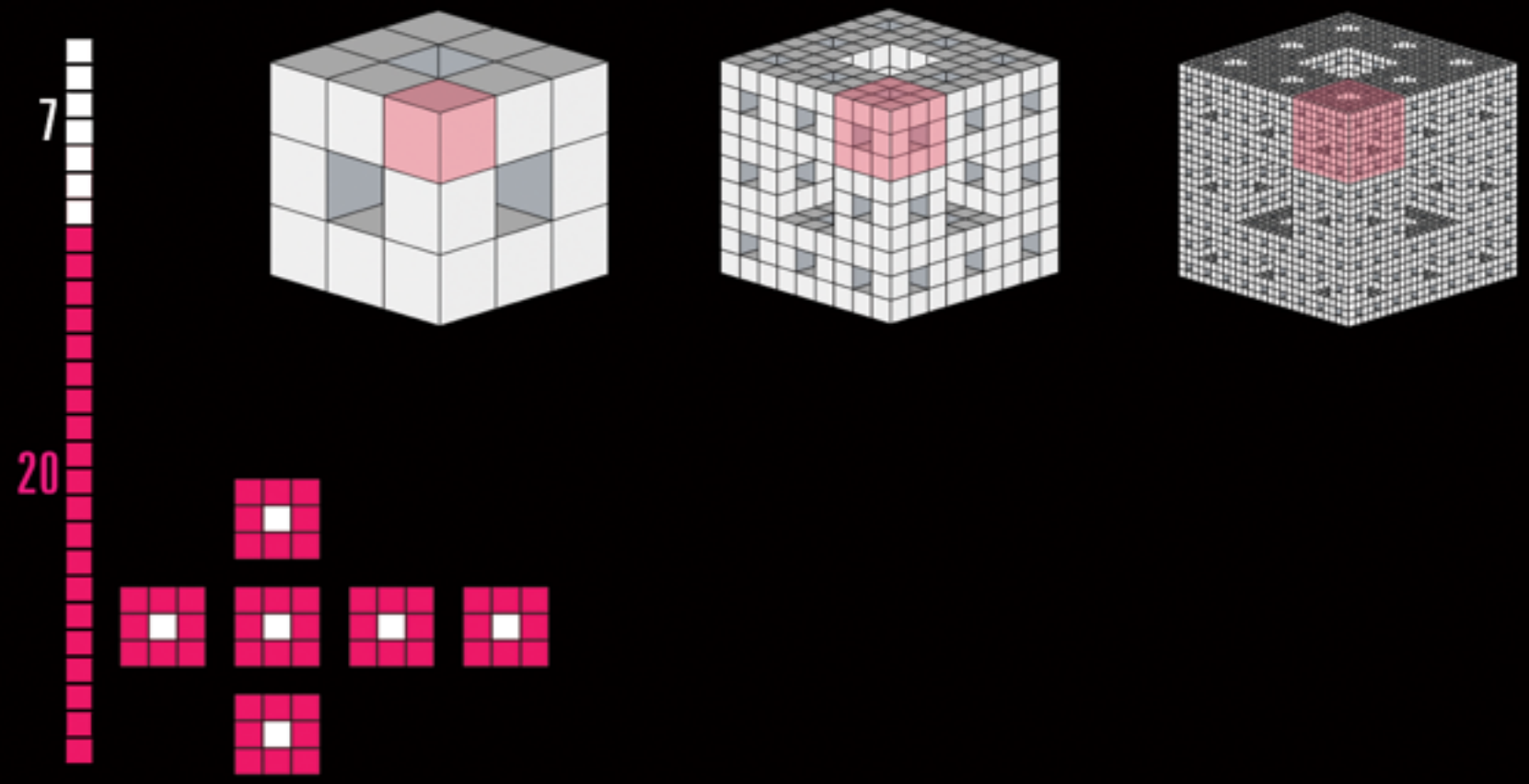
3 STEP
MENGER SPONGE

SUNG KYUN KWAN UNIVERSITY, SCHOOL OF ARCHITECTURE

PARAMETERIC ECOLOGY II:
FRACTAL CITY_ MENGER SPONGE

Collaboration with Nature : Climate action by Architecture

Tesoc Hah
Sustain Prototype Studio
Architecture Design Studio 6
Autumn 2009



ECO-TYPE
@Departu
Sungkyunk

Professor / Dire
TESOC HA

Subject
FRACTAL
PARAMET

Course
Architectu
Autumn 2

Project Title
PRACTA
MENGER S

Student
JO A HYU

Drawing Title
SUBTR

Drawing No.
001

Scale
1/100@

Legend
Legend

SUNG KYUN KWAN UNIVERSITY, SCHOOL OF ARCHITECTURE

PARAMETERIC ECOLOGY II:
FRACTAL CITY_ MENGER SPONGE

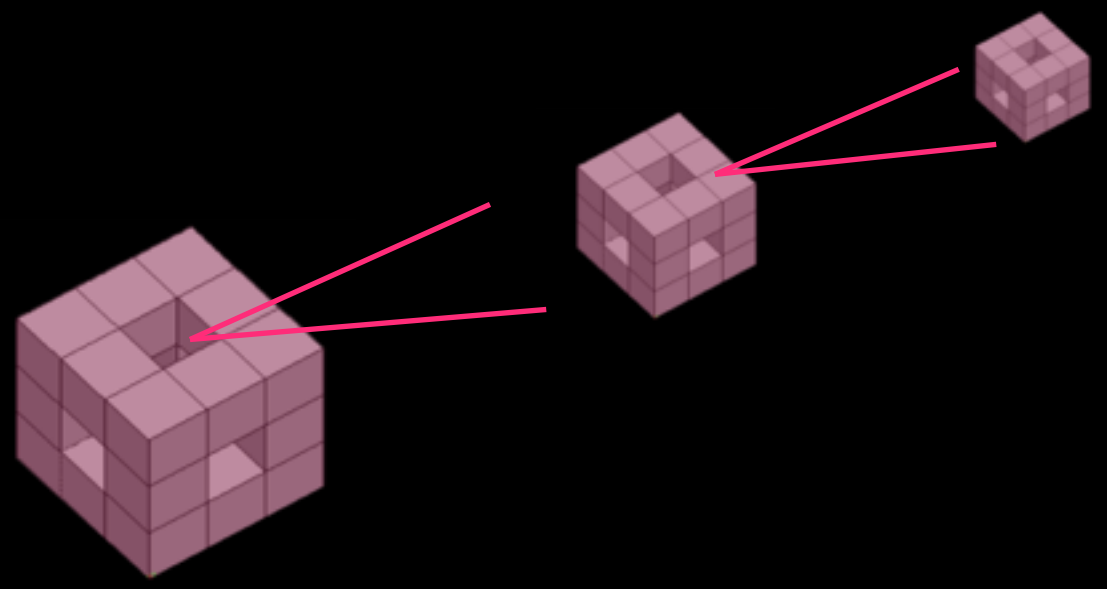
Collaboration with Nature : Climate action by Architecture

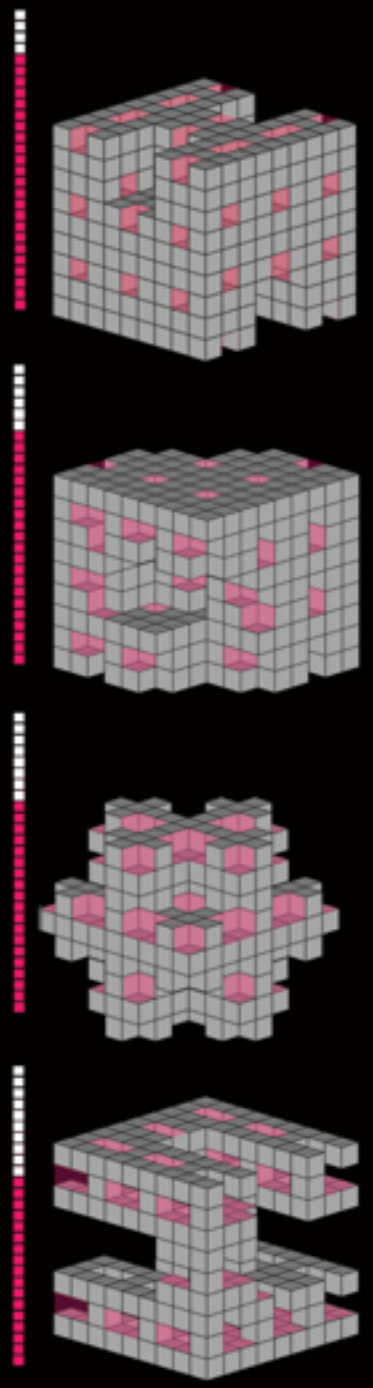
Tesoc Hah
Sustain Prototype Studio

Architecture Design Studio 6

Autumn 2009

GC.
MAKING
ROGIC .





DEPTH 2. DEPTH 2 LEVEL. TERRACE

TERRACE m2

396 m2 — 4761m2

TERRACE

702 m2 — 3969m2

TERRACE

648m2 — 3969m2

TERRACE

954m2 — 3249m2

ECO-TYPE STUDIO
@Department of Architecture
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Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

PRACTAL CITY
MENGER SPUNGE

Student
JO A HYUN

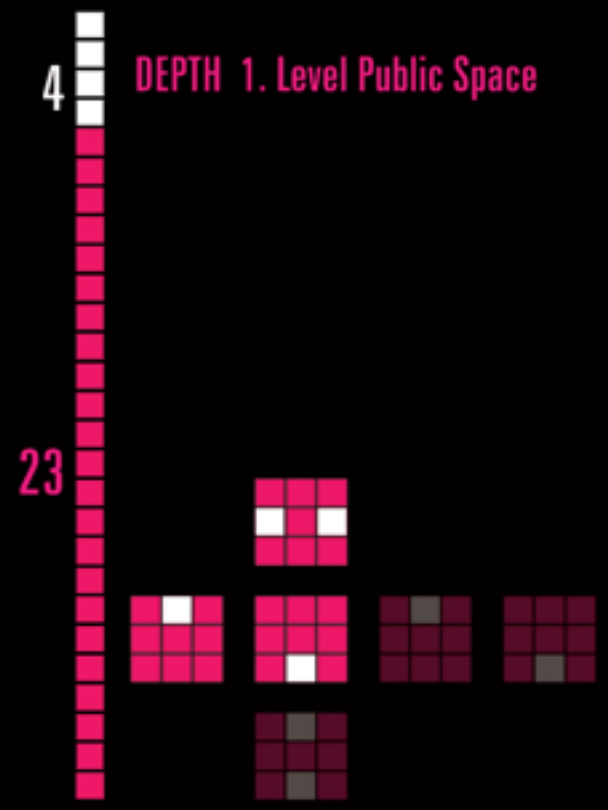
Drawing Title
T PIECES.

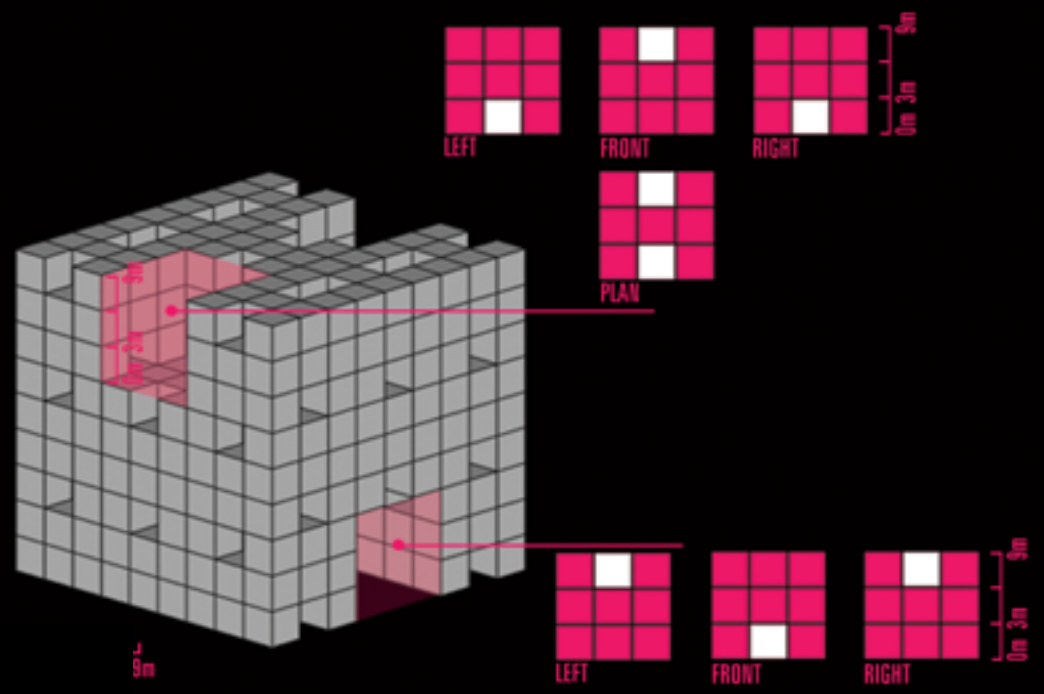
Drawing No.
001

Scale
1/100@A4

Legend

DEPTH 2.





ECO-TYPE STUDIO
@Department of Architecture
Sungkyunkwan University

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TESOC HAH

Subject
FRACTAL CITY:
PARAMETRIC ECOLOGY II

Course
Architectural Design Studio 6
Autumn 2009

Project Title
PRACTAL CITY
MENGER SPUNGE

Student
JO A HYUN

Drawing Title
SUBTRACT PIECES.

Drawing No.
001

Scale
1/100@A4

Legend
Legend

DEPTH 1. LEVEL PUBLIC SPACE

ENTERMENT

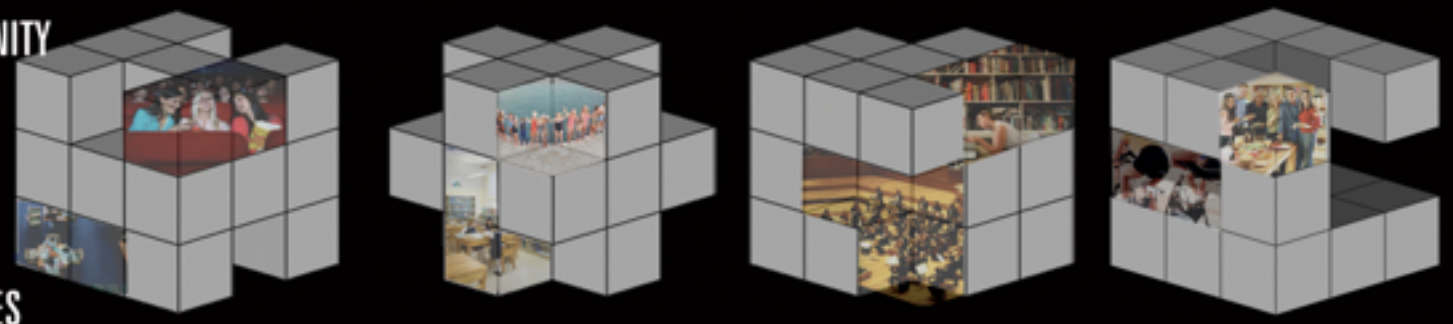
EDUCATION

COMMUNITY

SPORTS

SHOP

FACILITIES



PUBLIC BATH

MEETING ROOM

SHOP

RESTAURANT

SWIMMING POOL

HEALTH CLUB

COMMUNITY ROOM

CULTURE CENTER

LIBRARY

EXHIBITION

CONCERT HALL

THEATER

ECO-TYPE STUDIO
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Sungkyunkwan University

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TESOC HAH

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FRACTAL CITY:
PARAMETRIC ECOLOGY II

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Autumn 2009

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PRACTAL CITY
MENGER SPUNGE

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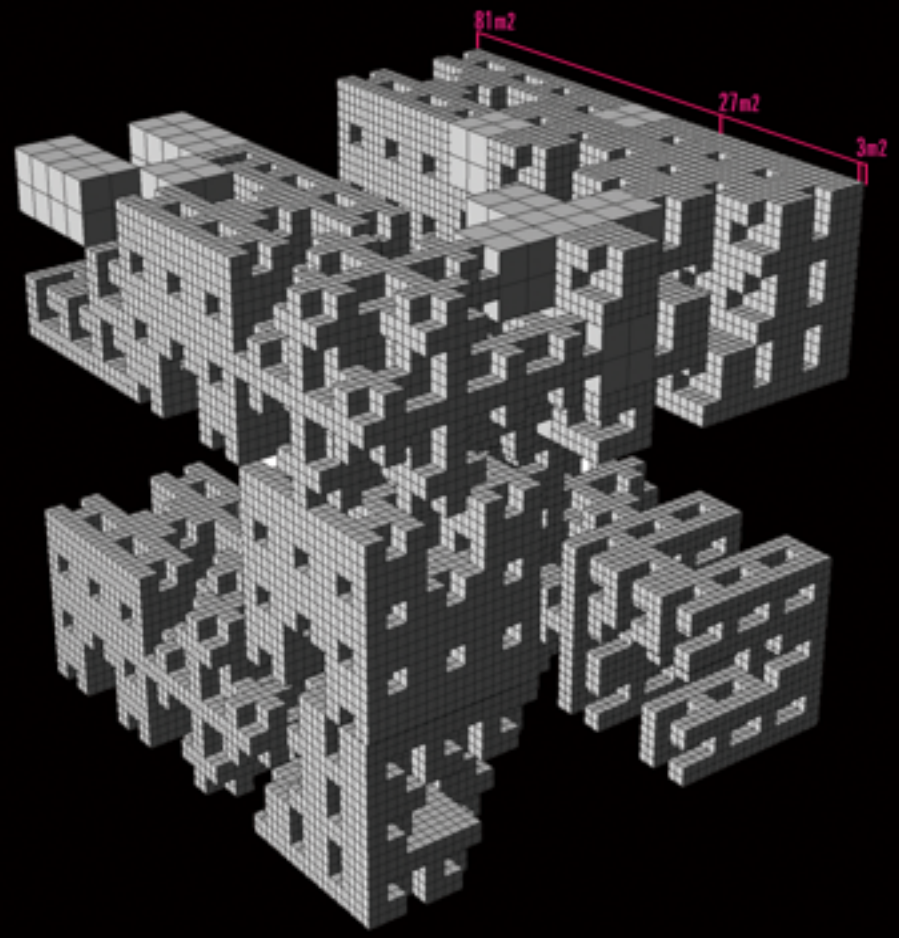
Drawing Title
SUBTRACT PIECES.

Drawing No.
001

Scale
1/100@A4

Legend
Legend



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JO A HYUN

Drawing Title
SUBTRACT PIECES.

Drawing No.
001

Scale
1/100@A4

Legend
Legend

UNIT TYPE

CORE	9M²
HALL	
SEMI PUBLIC	-KITCHEN -LIVING ROOM -PLAY GROND -LAUNDRY ROOM
TERRACE	
CORRIDOR	
BIG PUBLIC	-ENTERTAINMENT -EDUCATION -COMMUNOTY -SPORTS -SHOP -FACILITIES
UNIT	
GREEN	-FARM -PARK

UNIT 1		UNIT 1	BIG PUBLIC	BIG PUBLIC	BIG PUBLIC	UNIT 4		UNIT 4
UNIT 1	UNIT 1	UNIT 1	BIG PUBLIC	BIG PUBLIC	BIG PUBLIC	UNIT 4	UNIT 4	UNIT 4
UNIT 1	SEMI PUBLIC	UNIT 1	BIG PUBLIC	BIG PUBLIC	BIG PUBLIC	UNIT 5	SEMI PUBLIC	UNIT 4
UNIT 2	SEMI PUBLIC	UNIT 2	CORE	BIG PUBLIC	HALL	UNIT 5	SEMI PUBLIC	UNIT 5
UNIT 2	UNIT 2	UNIT 2	CORE	CORE	CORE	UNIT 5	UNIT 5	UNIT 5
UNIT 2	SEMI PUBLIC	UNIT 2	HALL	BIG PUBLIC	CORE	UNIT 5	SEMI PUBLIC	UNIT 5
UNIT 3	SEMI PUBLIC	UNIT 3	BIG PUBLIC	BIG PUBLIC	BIG PUBLIC	UNIT 6	SEMI PUBLIC	UNIT 6
UNIT 3	UNIT 3	UNIT 3	BIG PUBLIC	BIG PUBLIC	BIG PUBLIC	UNIT 6	UNIT 6	UNIT 6
UNIT 3		UNIT 3	BIG PUBLIC	BIG PUBLIC	BIG PUBLIC	UNIT 6		UNIT 6

-6 BLOCK
1st FLOOR

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@Department of Architecture
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TESOC HAH

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Autumn 2009

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MENGER SPUNGE

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JO A HYUN

Drawing Title
SUBTRACT PIECES.

Drawing No.
001

Scale
1/100@A4

Legend
Legend

CORE

HALL

SEMI PUBLIC

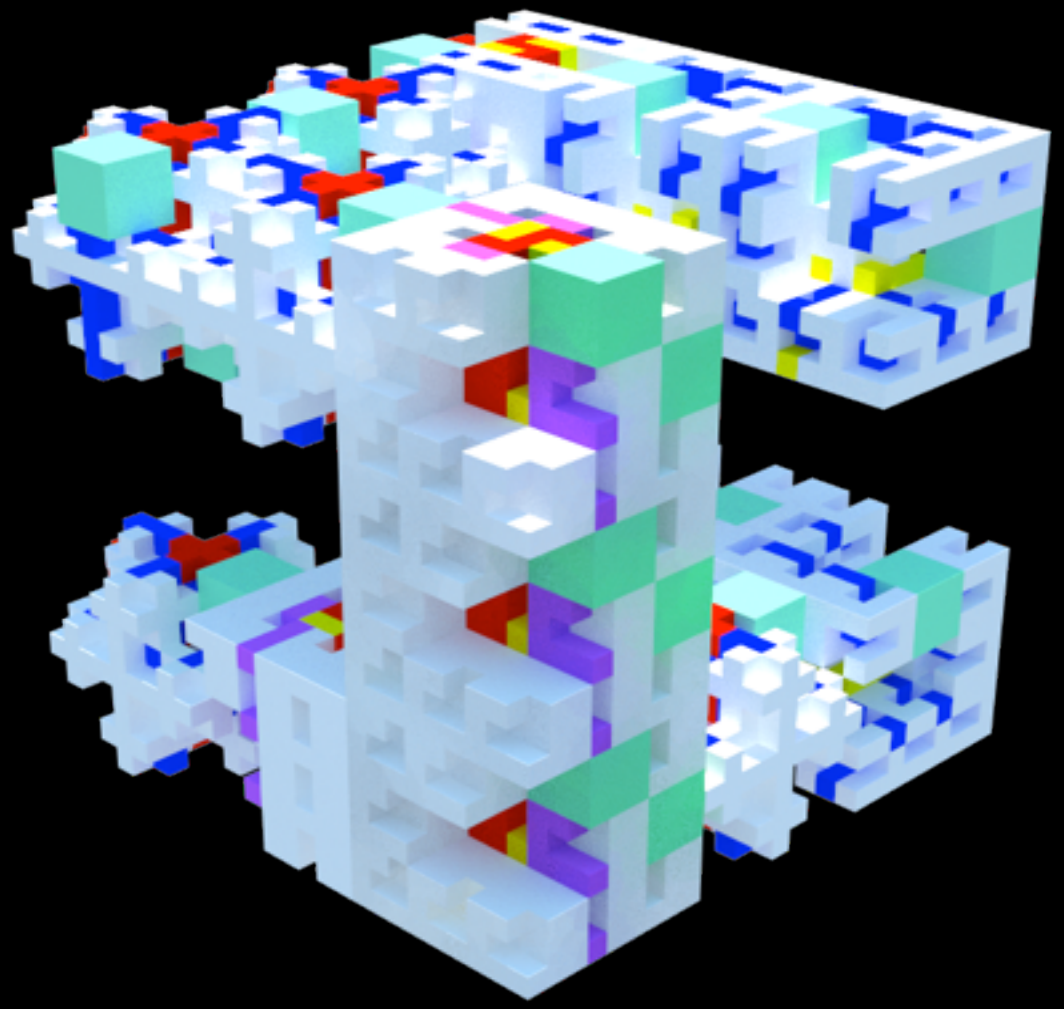
TERRACE

CORRIDOR

BIG PUBLIC

UNIT

GREEN



TYPE STUDIO
lepartment of Architecture
kyunkwan University

ıor / Director
IC HAH

CTAL CITY:
AMETRIC ECOLOGY II

itectural Design Studio 6
mn 2009

Title
ACTAL CITY
GER SPUNGE

HYUN

g Title
BTRACT PIECES.

g No.

0@A4

nd

Collective Museum

2013

National Museum of Modern & Contemporary Art, Korea

COLLECTIVE MUSEUM

함께 만드는 미술관

하태석 Tesoc Hah

시민들이 모두 참여하여 미술관을 함께 만들 수 있을까? '함께 만드는 미술관'은 개인들의 판단이 반영되어 미술관이 지어지는 과정을 담는 미디어 퍼포먼스이다. 참여가 늘어날수록 미술관은 점차 정교해지며 집단사고가 낳는 다양성과 새로운 방향성이 형태의 분화와 복잡성을 결정한다. 시민들의 참여가 미술관의 변이와 생성을 촉발하며 전시 마지막날 '함께 만드는 미술관'이 완성된다. '함께 만드는 미술관'은 디자인과정에서 발생하는 질문을 함께 생각해보는 일련의 과정으로 이루어져 있다. 각 단계의 결정들은 다음단계에 영향을 주며, 참여자는 각 단계 중 하나에 참여하며 미술관을 함께 만들게 된다.

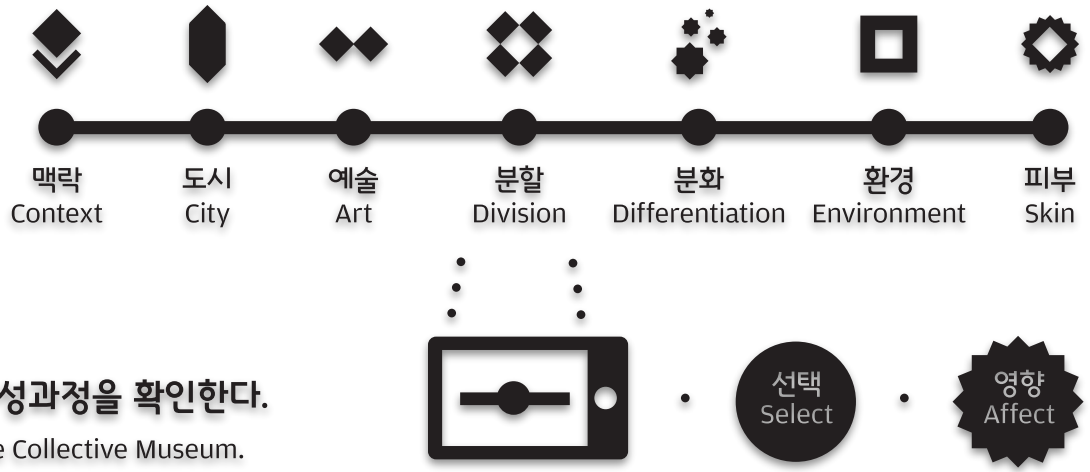
2013
인터랙티브 비디오프로젝션, 어플리케이션, 사운드
프로덕션 . SCALe
사운드디자인 . 태싯그룹

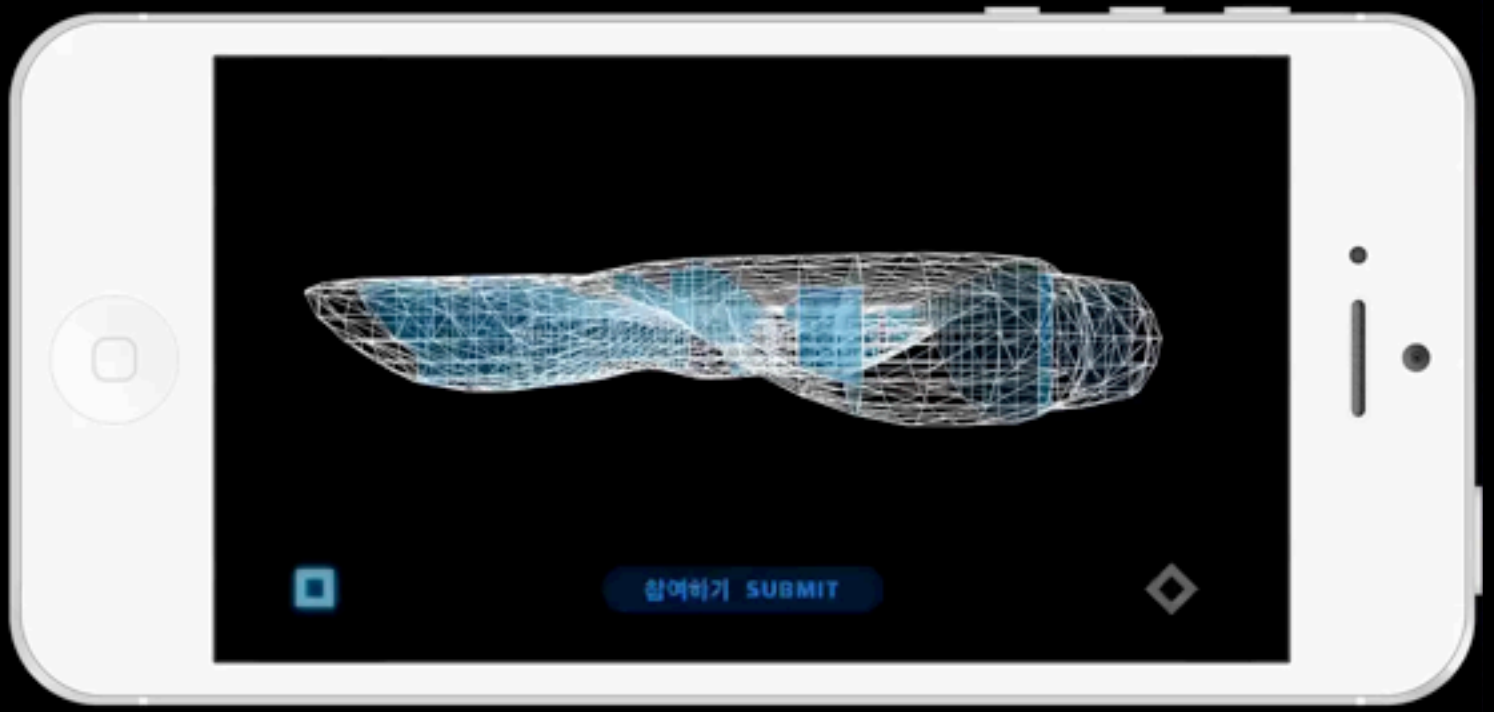
참여방법 How to Participate

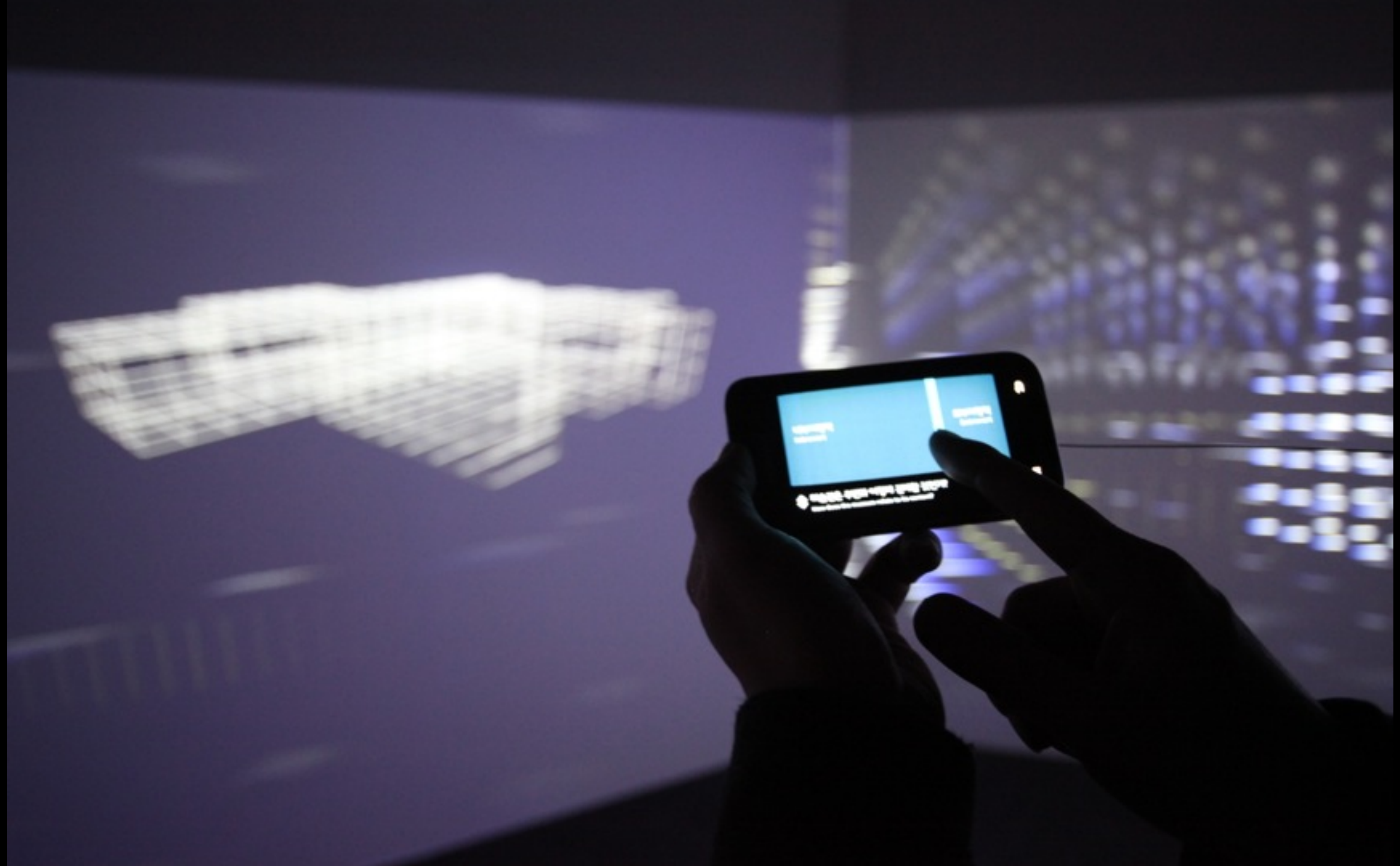
1. **전시장 스마트폰이나 앱을 다운로드하여 이용한다.**
   Use the smart phone from the exhibition or download the app.

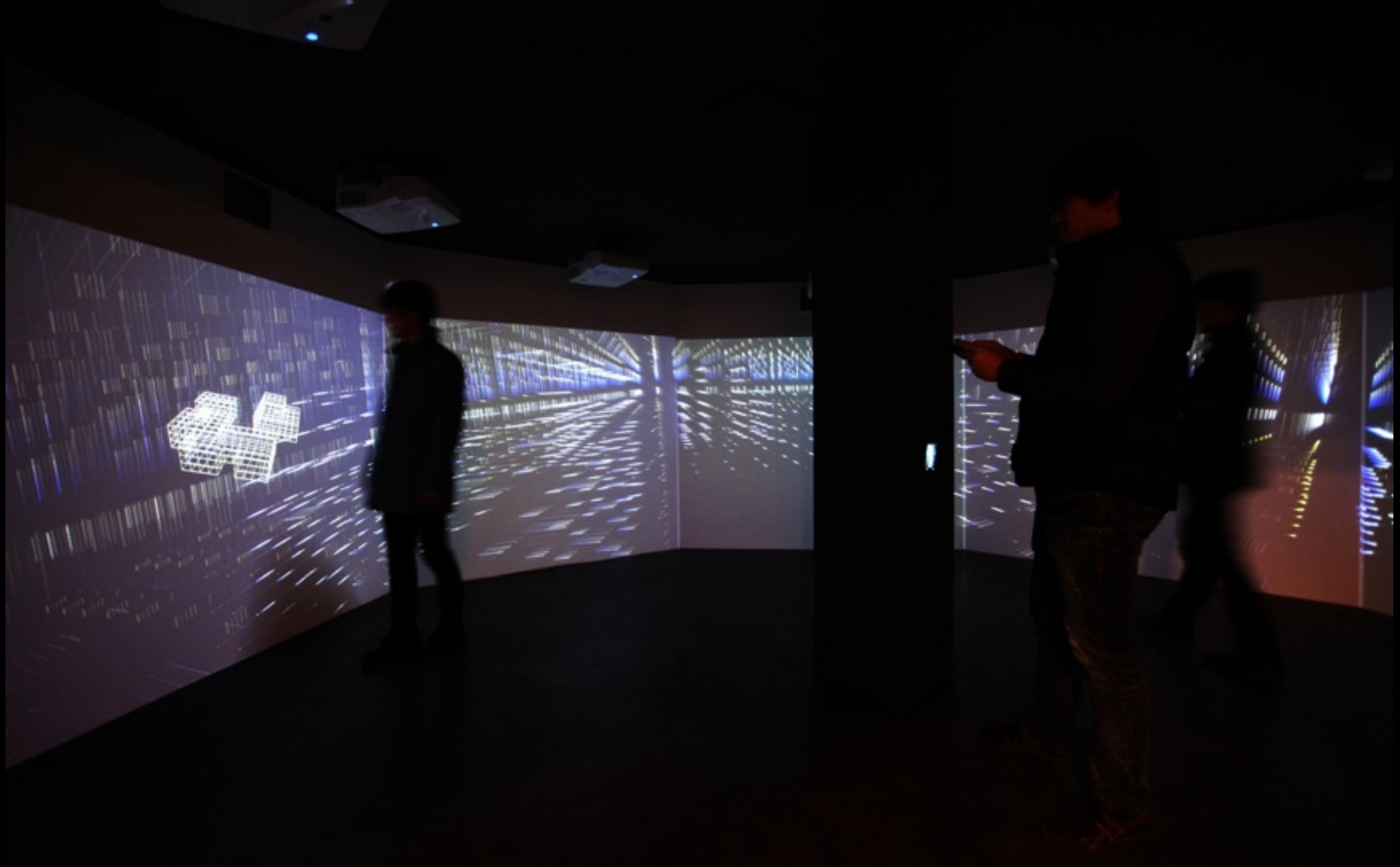
2. **'함께만드는미술관' 7단계 중 한 단계에 참여한다.**
   Participate in one of the steps built in the system.

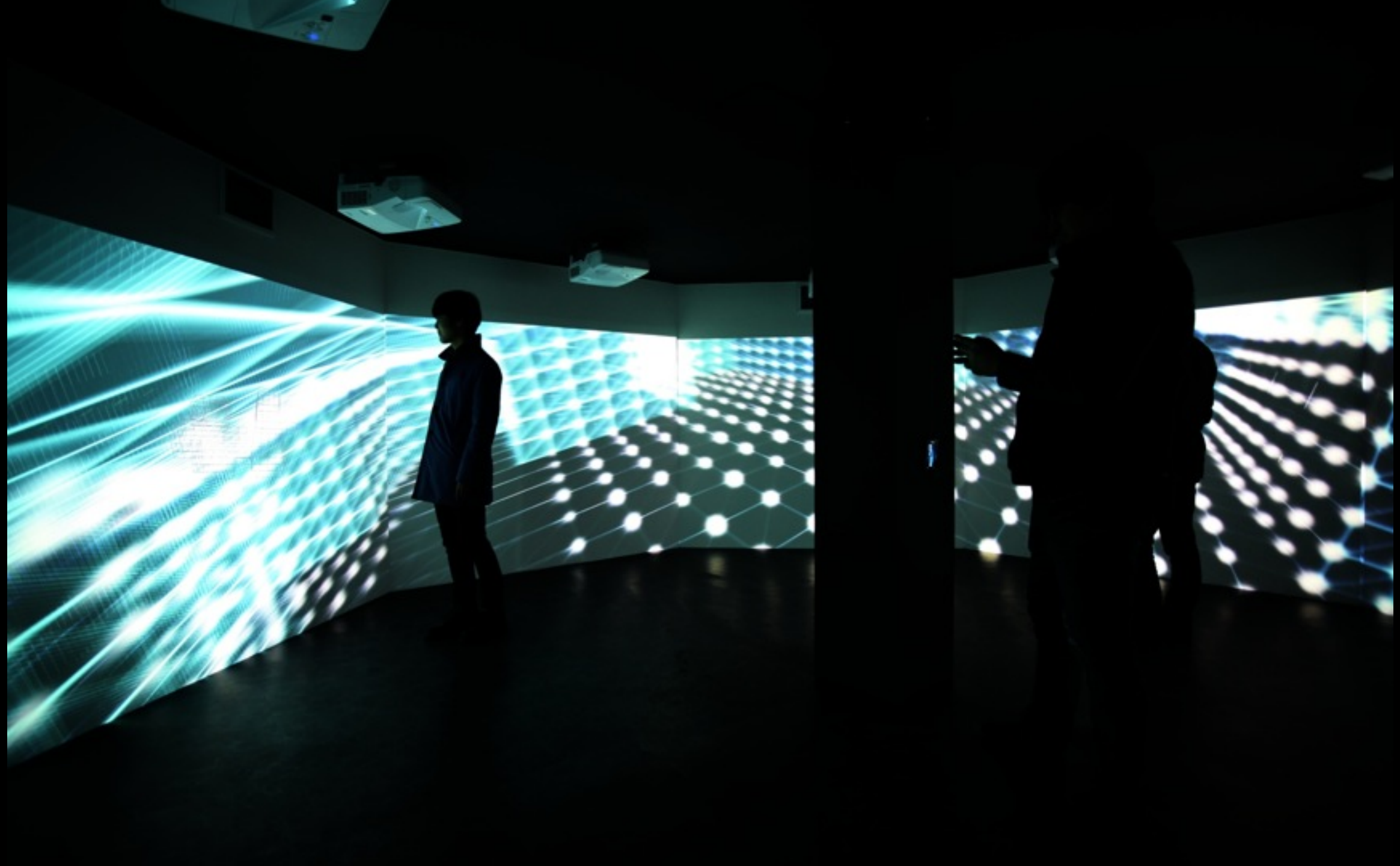
3. **실시간으로 내 생각이 반영되는 '함께만드는미술관'의 생성과정을 확인한다.**
   Check how your participation affects the generation process of the Collective Museum.




참여하기 SUBMIT







Differential Life
Integral City

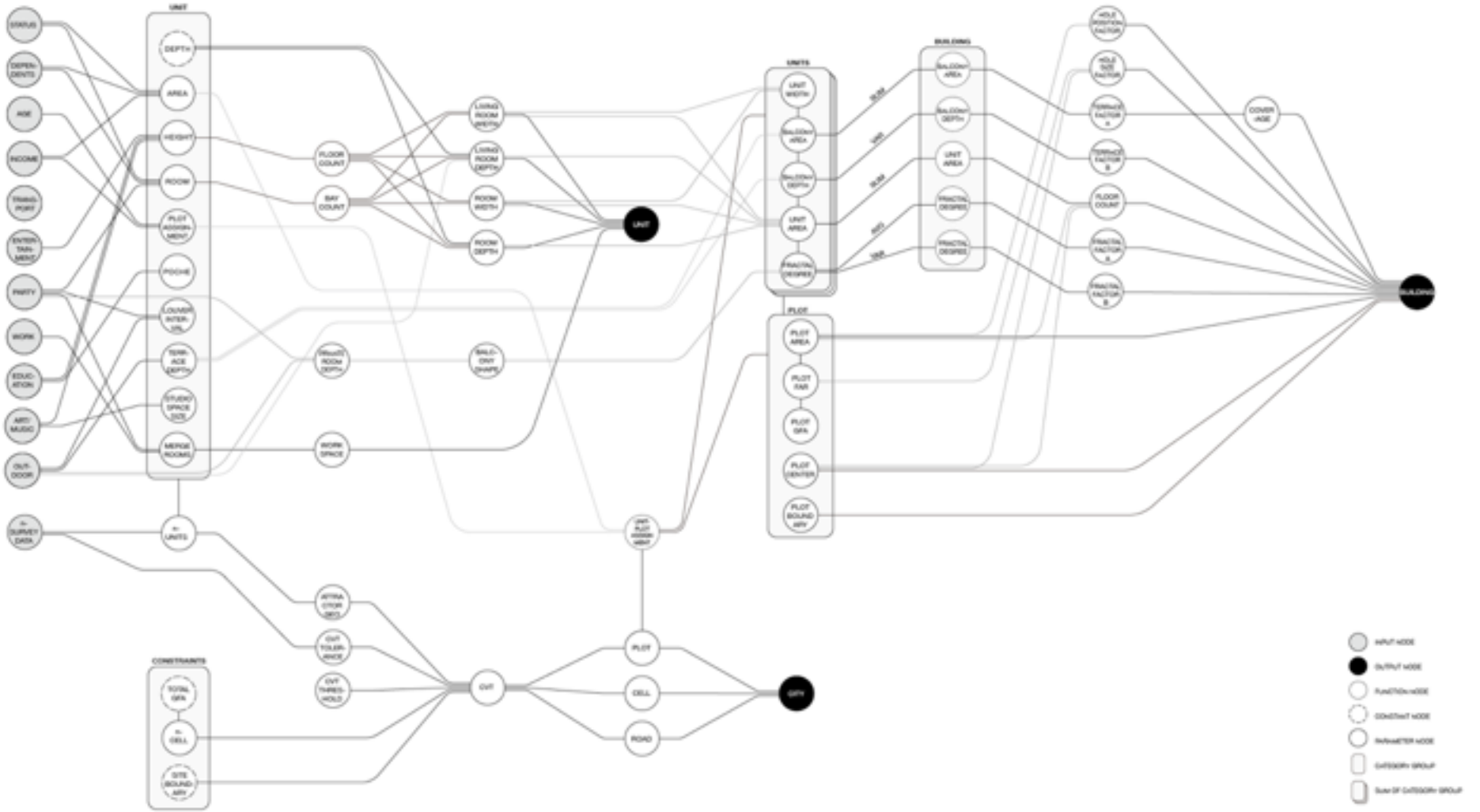
Collective Intelligence Urbanism

la Biennale di Venezia

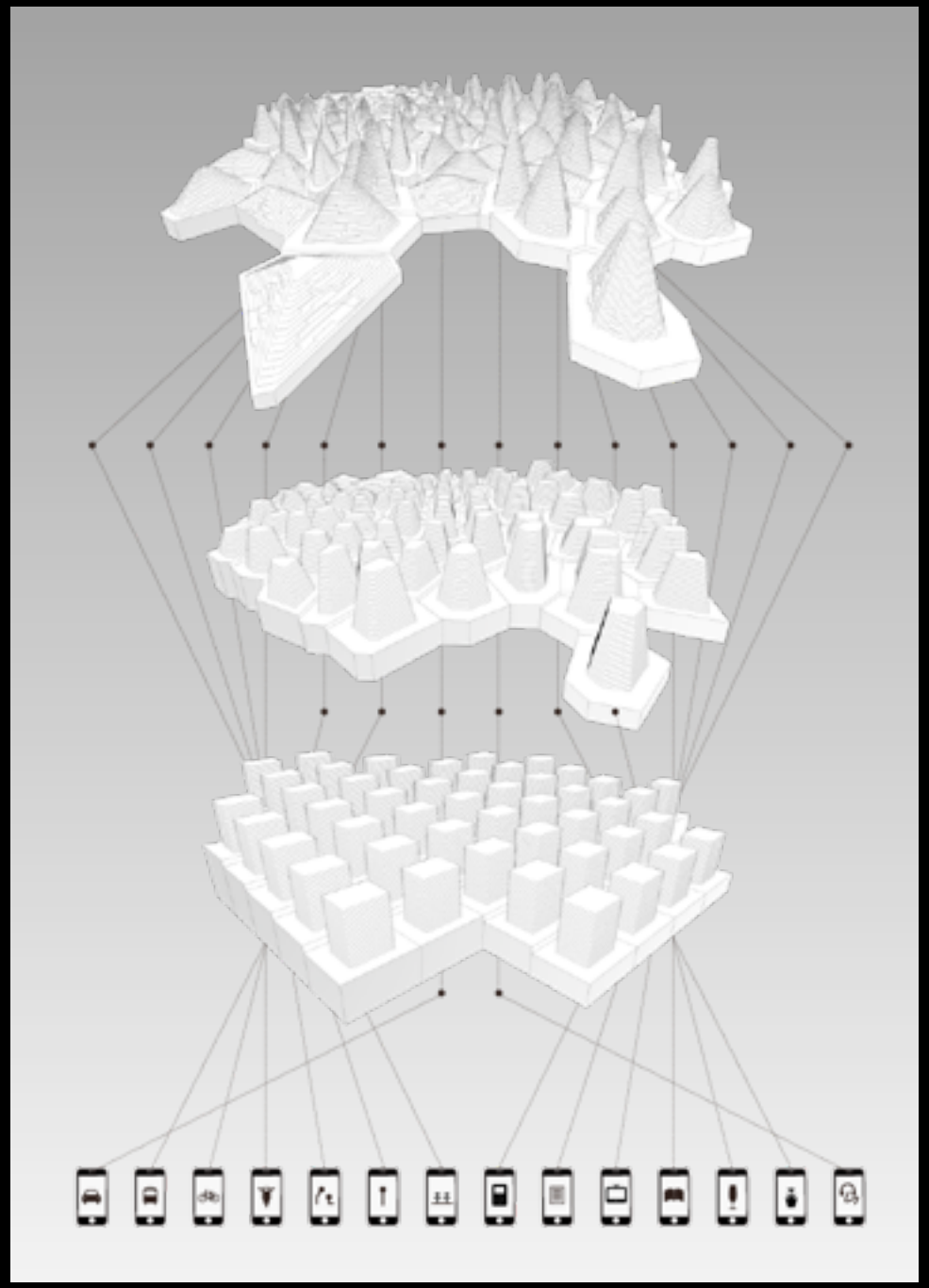
12. Mostra Internazionale di Architettura

Partecipazioni nazionali

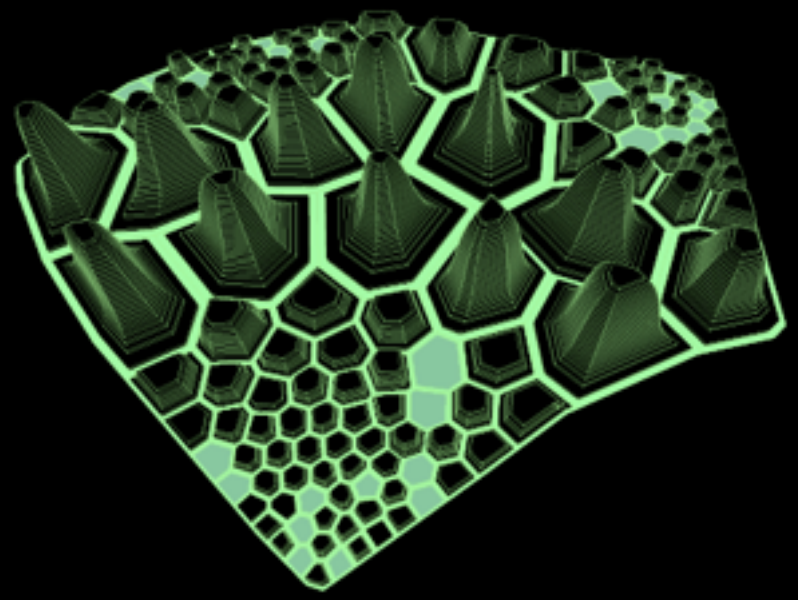
Parameter based Open Urban Design



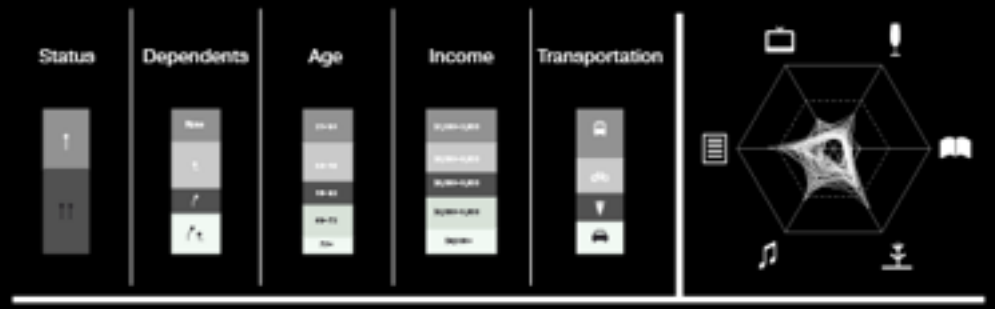
Collective Intelligence: A Generated City by Participation



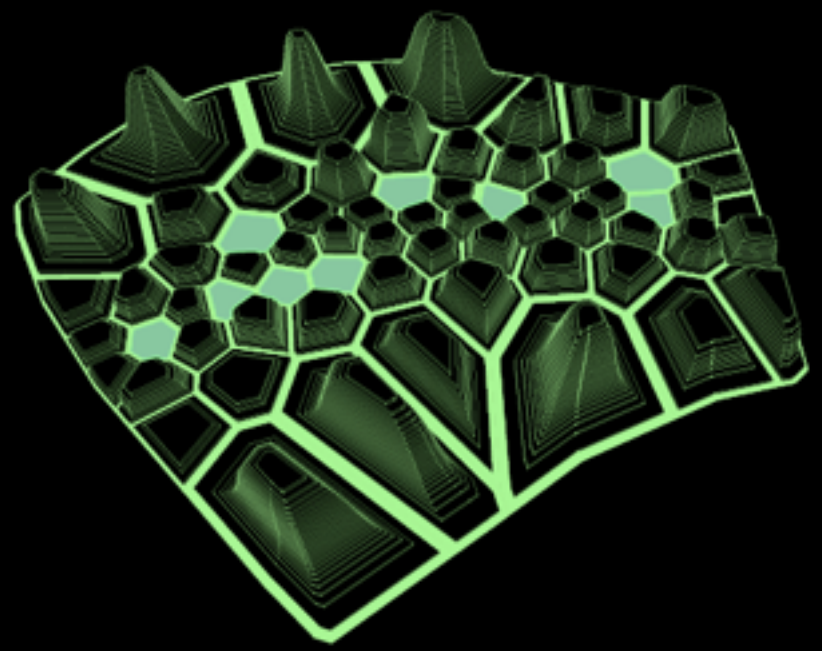
FAR 200%
No. of Units: 3654
No. of Plots: 89
(Building 67/ Park 22)



Generated Integral City by
Participation of Citizen. a



FAR 200%
No. of Units: 4036
No. of Plots: 67
(Building 57/ Park 10)



Generated Integral City by
Participation of Citizen. b

4:20 PM
thah@iarc.net
01-025
This is the first designed house for my wife & newborn baby! Love that big garden and arty music space.
35-48 year
$5000-$8000
Unit Features
Outdoor
Studio

4:20 PM
Differential Life Integral City
# of Participants:
100,209 citizens

Venice

Incheon

Changwon

Seoul

Tesoc Hah

Sustainable
Computational
Architecture
Lab
etc.

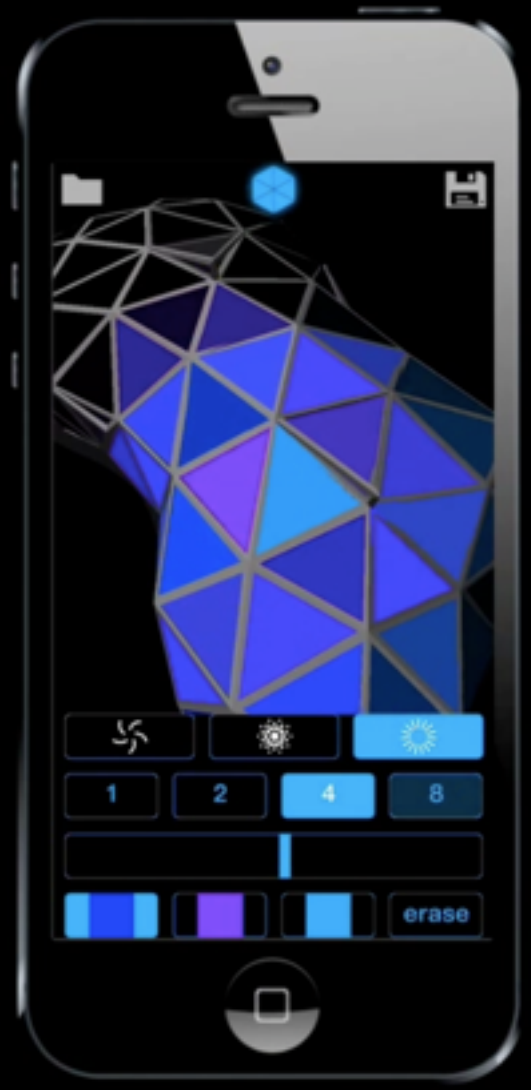
Xyndie
2012

SOAL ZIP
SOAL

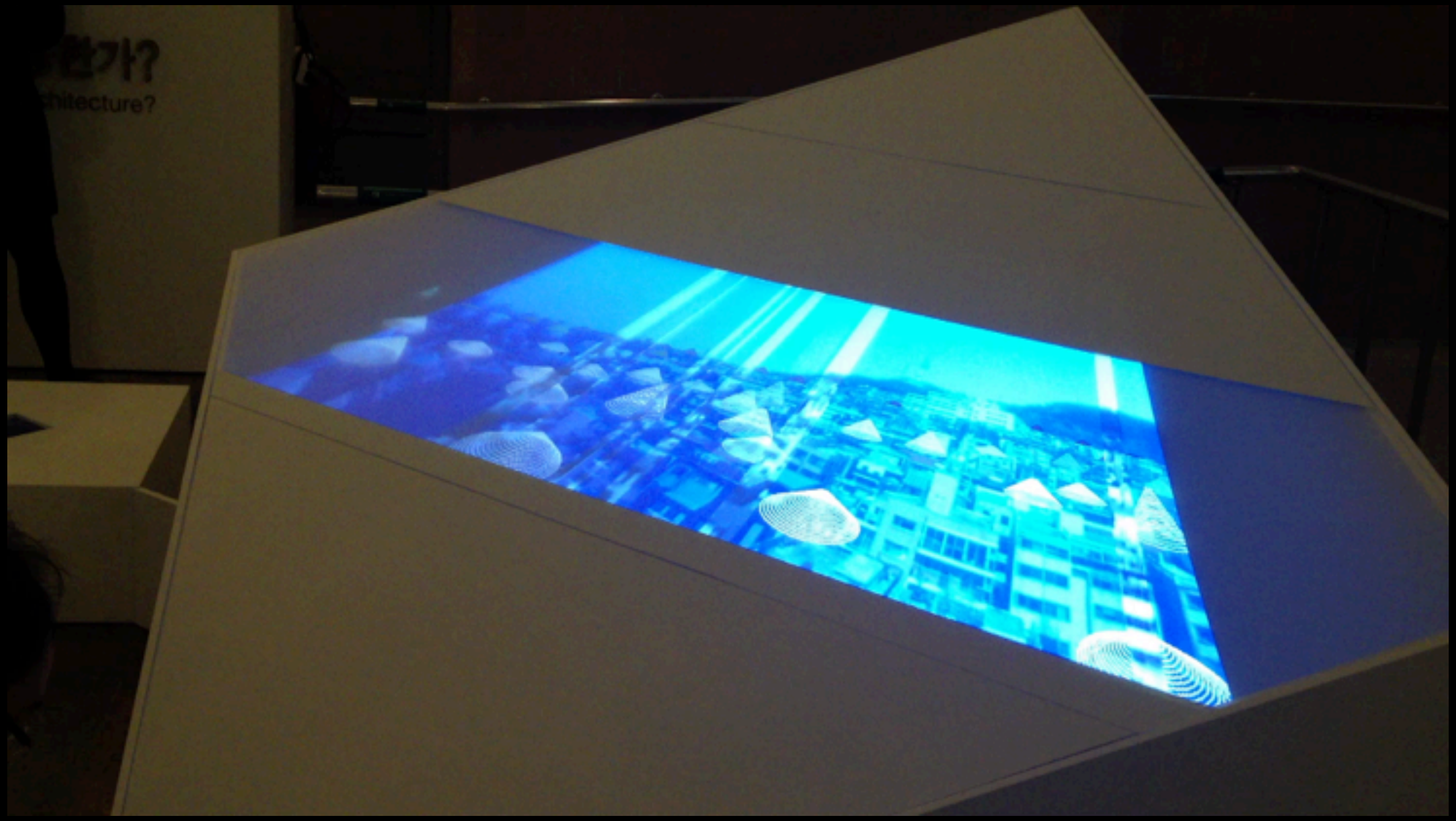
Hair A.1924
Concept Talking Bar
ANGELS
Lounge 4g
Soöl ZIP
XINDIE

ON Pocket Bar
3F
최강포차
최강포차
TICKET LOUNGE

일렉트로베리
이젠(Reflection on Your Eyes)

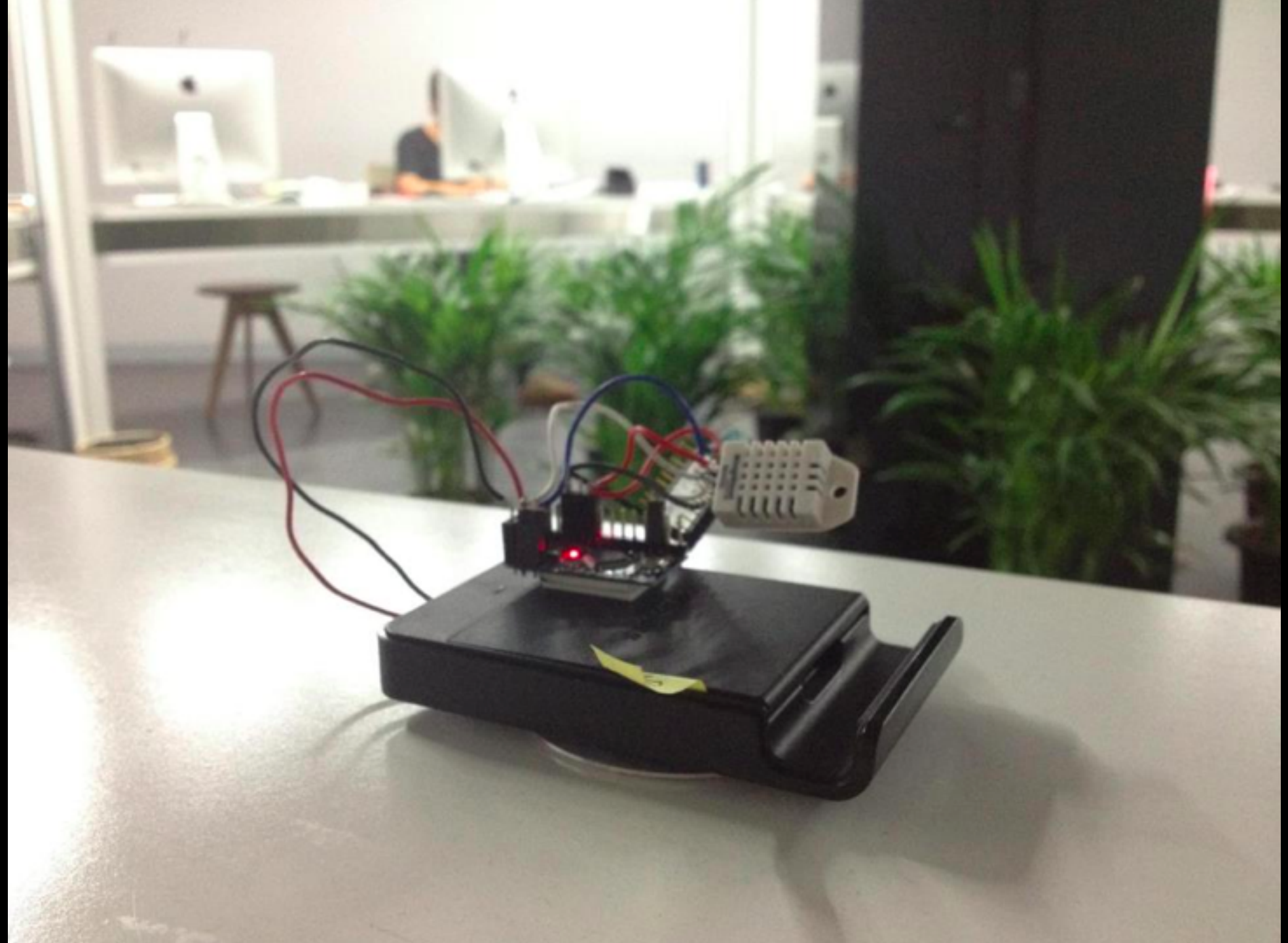

1
2
4
8
erase

Wind Vision
2012


hitecture?

SCALe Hexagon
2012

SKT
오후 11:54
SCALe
smart space
ON ON ON ON ON ON
OFF OFF OFF OFF OFF OFF
CH1 CH1 CH1 CH1 CH1 CH1
CH2 CH2 CH2 CH2 CH2 CH2
평상시
육각회담
강의



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