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UMI
simplicity and complexity 
through a progressive ordering system

by
Kwanhee Lee

A THESIS SUBMITTED IN PARTIAL FULFILLMENT 
OF THE REQUIREMENTS FOR THE DEGREE 
MASTER OF ARCHITECTURE

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Houston, Texas 
March, 2002
ABSTRACT

simplicity and complexity
through a progressive ordering system

by
Kwanhee Lee

Proportion is a way to perceive a whole world as parts, and to change the parts into a system in terms of human thought. As a relationship between form and number, meaning can be eliminated and then, reinvented by human intelligence to interpret the world continuously, but formation of order and disorder always exists by themselves. Therefore the thesis is to research the possibility of how a system, which has its own rule set up initially, makes up its own meaning and form in terms of a proportional concept which is self-referential, growing pattern, and order and disorder through several attempts.

To give form to number and number to form, the process in which a unit was set up, and changed, varied with simple permutations several times, and get a number of forms and shapes, then give order and name to make complexity from simplicity and pattern from seeming chaos is done. And in doing so, there are two ways to represent the order in a system: space progression and time progression.
Acknowledgments

I would like to thank
Nana Last, David Guthrie, David Brown, Mark Wamble, Mark Oberholzer,
Kathleen Roberts, Jyonghwa Lim, Jimin Park, John Montag,
And especially my family.
WHAT IS PROPORTION

- From the viewpoint of empathy, to know something is to belong to it. We can know and understand nature because we are of it, and mathematics is the key to this understanding because nature is essentially mathematical. But viewpoint of abstraction, to know something is to have made it oneself. We cannot know nature because we have not made it. But we can interpret it through mathematics because mathematics is our own creation.—
(The abstract from "PROPORTION", RICHARD PADOVAN)

Those two viewpoints eventually underlie two propositions. First, In both nature and human environment, there should be a medium to connect the human's rational mind with nature, and this is a critical point to understand nature because even though the medium is invented by human's, humans are also a section of nature. So humans, medium, and interpreted world by human's all might come from the same notion, in which proportion could be one of ways to understand both nature and humanity simultaneously. Second, in the relationship between humans and nature, humans can only perceive the world as their senses, and proportion could be the sensory mediator to interpret the relationship between humans and nature in terms of human viewpoint.

Therefore, the new meaning of proportion could be in giving measurement to human to figure out the relationship between humans and nature not by an absolute way of seeing but a relative way of seeing. There the proportional system exists everywhere and anywhere in the world, with thousands of different aspects.
PROPOSITION - 1

1. exists in everything.
2. could be a system of the world.
3. can interpret the world through human's rational mind.
4. is not static and __________, but dynamic and __________.
5. In architecture, number could be equivalent with __________.
FOR the DEFINITIONS
Form has its own language and could be exist by itself, but matter doesn't have their own manifestation and should be dependent on human's mind. This means that there are supposed to be infinite ways of thinking the world respectively and relatively. The being express a unconscious and static situation, whereas, Becoming is concerned with relative coexistence between human and environment.

FIRST  Put a subject into a space, make it feel the space as being

SECOND  A object, in the architectural space, shows own being and contains subject's being

THIRD  A subject and a object, mixed into the space, make their own way to becoming another level of space
In the matter of size, there is only arithmetic counting for each of parts, but, in scale, as critical not by absolute size or volume but the relationship between part and sub-part, part and whole, and other wholes as kitchen scale would interpret as a reflection of the city scale.
These images are for showing how the inside space could be transformed into outside. Column, containing a simple space with four walls which start to slide down, is changed into wall itself, after then, several different angled walls meet at some points for dividing another inside and outside spaces.
To lay down several different sizes of grid systems on the same plan

To abstract arithmetic progressions in terms of geometric progression

To fix up boundaries of each layer

To find out new proportional progressions

To draw new grid system
After layering over several different proportions, it reveal ordering gaps which make up new In-between spaces with neighboring boundaries, shows another growing pattern and give room for space to move and transform.
After layering over several different proportions, it reveals new proportional pattern from disordering.
STRAATEGIES AND TACTICS
STRATEGIES AND TACTICS

Starting from a unit, the endless circle is counted by way of three Strategies: A unit, One boundary, and Groups, and multiplication, subtraction, and addition are followed.

STRATEGIES

UNIT —— BOUNDARY —— GROUP

TACTICS

MULTIPLICATION

SUBTRACTION

I CALL THIS A UNIT

ADDITION
The Method of Counting

Ordering Part

Disordering Part

Arithmetic Progression

Geometric Proportion

Harmonic Proportion

Arithmetic Proportion

Geometric Progression

$\sqrt{2}$

$\sqrt{3}$

$\sqrt{5}$
ONE BOUNDARY

THE METHOD OF MEASURING

ORDERING PATTERN

DISORDERING PATTERN
GROUPS

THE METHOD OF FORMING

JUXTAPOSITION

SUPERPOSITION
TECHNOLOGY.strategies

Additional
Multiplicative
Subtractive
ADDITIONAL
MULTIPLICATIVE

VOLUMETRIC PROGRESSION

1 1 1
1 1 2
1 2 2
1 2 3

2 2 2
2 2 3
2 3 3
2 3 4

3 3 3
3 3 4
3 4 4
3 4 5

A A A
A A B
A B B
A B C
SUBTRACTIVE VOLUMETRIC PROGRESSION

Positive volume

To subtract Positive volume from a box

A box for subtracting
To get the negative volume

A reverse side image
ADDITIONAL MULTIPLICATIVE PLANE PROGRESSION

X - axis plane  Add Y - axis plane  Add Z - axis plane  X = X' + Y - Z  X = X' + Y - Z + Z
ADDITIONAL VOLUMETRIC PROGRESSION
1. FORM incorporated through INFINITE NUMBER
2. SOLID GRID added
3. IN BETWEEN SPACE BOX moved
4. Another . added

1. FORM incorporated through INFINITE NUMBER
2. SOLID GRID added
3. IN BETWEEN SPACE BOX moved
4. Another GRID added
5. transformed and varied
1. Separated with FRAME AND CELL
2. FRAME laid over on the CELL progression
3. Another put on
Closed view

making of and
I. INFINITE : FINITE

UNIT
BOUNDARY
GROUP

PROGRESSION

with tactics

PROGRESSION

INFINITE

FORM

NUMBER
PROPOSITION 2

1. Every Progression is continuously becoming.
2. There are two kinds of progression and proportion types; geometric and arithmetic progression.
3. Relationship between two elements must produce a third element which is not a member of itself.
4. Order progression makes a disorder progression.
5. Order is a balanced combination of unity and complexity.
A form may look like just one object, but it is composed of thousands of potential points, where each point can be marked out as a name. Given a new name, each point of the object gets new meaning, and the object includes all the possibilities of its intrinsic points. The object could be a point itself. Following this process, it can be supposed to be a never ended story, where no one knows final result or the final form. The form has two opposite characters; complexity, and simplicity. The simplicity and complexity looks like Yin and Yang and the positive and the negative. Like Möbius strip, Both come from each other and no difference between them originally. They have self-similar structure, Self-generating system for growing pattern.
The process is to give form to number and to give number to form. The former is to suggest a new system for growing pattern with numeric order and, the latter is to give new meaning to from to make specific growing pattern and form.

**Making Finite Thing**

FINITE

**Making Infinite Thing**

INFINITE

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**Matrix - Number**

<table>
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<th>How Many</th>
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**Numeric System**

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**Only Existed As Seen**

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<th>Give Measure To Space</th>
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**Order + Order**

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<th>= Complexity</th>
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**Complexity + Complexity**

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**Juxtaposition**

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BOX
GENESIS OF ORDER

PRIMITIVE BOX
UNIT
GENESIS OF CHAOS

TO BE SEPARATED BY CELL AND FRAME
UNIT

A - BOUNDARY
B - BOUNDARY
C - BOUNDARY
D - BOUNDARY

SPACIAL COMPOSITION
  - ARITHMETIC PROGRESSION
  - GEOMETRIC PROGRESSION

TEMPORAL COMPOSITION
  - MUSICAL PROGRESSION
A Unit is not size but a type of size and the basic element for scale. It has a potential and intrinsic rule in which exist both infinite number and finite form through time and space.
A - BOUNDARY permutation diagram

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING
A - BOUNDARY transformation

Transformed into units

axis transformation

axis transformation

axis transformation
**B - BOUNDARY permutation diagram**

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

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BOUNDARY B-1
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BOUNDARY B-3
(PATTERN - 1)
B - BOUNDARY permutation
C - BOUNDARY permutation diagram (0-68)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY C-1

PATTERN (only ordering pattern represented)
C - BOUNDARY permutation diagram (69-182)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY C-2

PATTERN (both ordering and disordering pattern represented)
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### BOUNDARY C-2-5 (DISORDER)

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**PATTERN - 1**

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**DISORDER**
C - BOUNDARY permutation diagram (183-250)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY C: 3

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PATTERN (only ordering pattern represented)
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BOUNDARY C-3-3: PATTERN - 2

C0 C183 C184 C185 C186 C187 C188 C189 C190 C191

C161 C162 C163 C164 C165 C166 C167 C168 C169 C170

C191 C192 C193 C194 C195 C196 C197 C198 C199 C200

C201 C202 C203 C204 C205 C206 C207 C208 C209 C210

C211 C212 C213 C214 C215 C216 C217 C218 C219 C220

9 sets

9 sets

6 variations

6 variations
D - BOUNDARY permutation diagram (0-124)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-1

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PATTERN (only disordering pattern represented)
### D - BOUNDARY permutation diagram (125-249)

**Naming - Come into Being**

**Permutating - Come into Becoming**

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**Pattern** *(only disordering pattern represented)*
D - BOUNDARY permutation diagram (250-374)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-3

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PATTERN (only disordering pattern represented)
D - BOUNDARY permutation diagram (375-499)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-4

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PATTERN (only disordering pattern represented)
**D - BOUNDARY permutation diagram (500-624)**

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-5

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**PATTERN (only disordering pattern represented)**
D - BOUNDARY permutation diagram (625-748)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-6

PATTERN (only dis ordering pattern represented)
D - BOUNDARY permutation diagram (749-873)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING
D - BOUNDARY permutation diagram (874-998)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-8

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PATTERN (only disordering pattern represented)
D - BOUNDARY permutation diagram (999-1123)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-9

PATTERN (only disordering pattern represented)
D - BOUNDARY permutation diagram (1124-1248)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-10

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PATTERN (only disordering pattern represented)
**D - BOUNDARY permutation diagram (0, 1249-1372)**

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

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**PATTERN (only disordered pattern represented)**
D - BOUNDARY permutation diagram (1373-1497)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-12

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PATTERN (only disordering pattern represented)
D - BOUNDARY permutation diagram (1498-1622)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-13

PATTERN (only disordering pattern represented)
D - BOUNDARY permutation diagram (1623-1747)
NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-14

PATTERN (only disordering pattern represented)
D - BOUNDARY permutation diagram (1748-1872)

NAMING - COME INTO BEING
PERMUTATING - COME INTO BECOMING

BOUNDARY D-15

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PATTERN (only disordered pattern represented)
After trying to do several attempts to research progressional forms, this stage is to materialize the concept of Groups in which formations of various applications is generated by juxtaposition and superposition in terms of Arithmetic and Geometric progression.
Geometric progression basically has come from the roots of 2, 3 and 5, and in which the irrational dimension and number were revealed. Therefore, to interpret the irrational geometry into whole number series, the continued fraction is used within the number of boundary B,C,D.
II CONTINUED FRACTION

\[ A = \frac{1}{1 - \frac{1}{2 - \frac{1}{2 - \frac{1}{1 - 1}}}} \]

\[ A = \frac{1}{1 - A} \]

\[ A = \frac{1}{1} \quad \frac{3}{2} \quad \frac{7}{5} \quad \frac{17}{12} \quad \frac{41}{29} \quad \frac{99}{70} \quad \frac{239}{169} \quad \frac{577}{408} \quad \frac{1393}{985} \]

\[ B = \frac{1}{1 - 1} \]

\[ B = \frac{1}{1 - \frac{1}{2 - \frac{1}{1 - 1}} \cdot 2} \]

\[ B = \frac{1}{1} \quad \frac{2}{1} \quad \frac{7}{4} \quad \frac{26}{15} \quad \frac{97}{56} \quad \frac{362}{209} \quad \frac{1351}{780} \]

\[ D = \frac{1}{1 - 2} \]

\[ D = \frac{1}{1 - \frac{1}{1 - \frac{1}{1 - 1}} \cdot 2} \]

\[ D = \frac{1}{1} \quad \frac{3}{1} \quad \frac{4}{1} \quad \frac{7}{1} \quad \frac{11}{1} \quad \frac{18}{1} \quad \frac{29}{1} \quad \frac{47}{1} \quad \frac{76}{1} \quad \frac{123}{1} \quad \frac{199}{1} \quad \frac{322}{1} \quad \frac{521}{1} \quad \frac{843}{1} \quad \frac{1364}{1} \]

\[ E = \frac{1}{1 - 1} \]

\[ E = \frac{1}{1} \quad \frac{3}{2} \quad \frac{4}{3} \quad \frac{7}{5} \quad \frac{11}{8} \quad \frac{18}{13} \quad \frac{29}{21} \quad \frac{47}{34} \quad \frac{76}{55} \quad \frac{123}{89} \quad \frac{199}{144} \quad \frac{322}{233} \quad \frac{521}{377} \quad \frac{843}{610} \]
GEOMETRIC PROGRESSION - 2

BOUNDARY

ORDERING PATTERN

1  3  7  17
1  2  5  12

CONTINUED FRACTION
C BOUNDARY

ORDERING PATTERN

1  3  7  17  41  99  239
1  2  5  12  29  70  169

CONTINUED FRACTION
D BOUNDARY

ORDERING PATTERN

CONTINUED FRACTION

1  3  7  17  41  99  239  577  1393
1  2  5  12  29  70  169  408  985
GEOMETRIC PROGRESSION - 3

B BOUNDARY

ORDERING PATTERN

1 2 7 26
1 1 4 15

CONTINUED FRACTION
BOUNDARY

ORDERING PATTERN

1  2  7  26  97
1  1  4  15  56

CONTINUED FRACTION
D BOUNDARY

1 2 7 26 97 362 1351
1 1 4 15 56 209 780

DISORDERING PATTERN

CONTINUED FRACTION
ORDERING PROGRESSION

DISORDERING PROGRESSION
GEOMETRIC PROGRESSION - 6

BOUNDARY

ORDERING PATTERN

\[
\begin{array}{cccccccc}
1 & 3 & 4 & 7 & 11 & 18 & 29 \\
1 & 1 & 2 & 3 & 5 & 8 & 13
\end{array}
\]

CONTINUED FRACTION

1
3
4
7
11
18
29

1
1
2
3
5
8
13

1
1
2
3
4
7

1
1
2
3
4
7

1
1
2
3
4
7

1
1
2
3
4
7
BOUNDARY

ORDERING PATTERN

CONTINUED FRACTION
The number used at volumetric progression is brought in, arranged, and simply matched with A boundary permutation.

A A A
A A B
A B B
A B C

1 1 1
2 2 2
3 3 3
4 4 4
CELL BASED PROGRESSION

FRAMES IN DISORDERING IN TERMS OF ORDERING CELL BOUNDARY

COEXTENSIVE SPACE BETWEEN ORDERING CELLS AND DISORDERING FRAMES.
FRAME BASED PROGRESSION

FRAME ORDERING IN TERMS OF DISORDERING CELL BOUNDARY

COEXTENSIVE SPACE BETWEEN DISORDERING CELLS AND ORDERING FRAMES
After building up form from the numbering of permutations, tracing back from the form to A-B-C-D boundary in reverse way to find numbers. Therefore, this analysis could be repeated perpetually.
With arithmetic progressional number, 0,2,4,6,8..., the number are replaced with C boundary permutation and the consecutive images of inside are arranged to show the relationship between order and disorder and scale consistence.
With arithmetic progresional number, 0, 10, 20, 30, 40, 50..., replacing the number with D boundary permutation.
Space and time has both ordering and disordering progression. To transform the spacial form into temporal expression is another way to make ordering complexity into disordering simplicity or vice versa, and here are several examples to show how formal elements can be changed into time-related musical notes.
GEOMETRIC PROGRESSION SCORE - 2

WITH 6 BOUNDARY

1 2 3 4 5 6 7 8 9

17 H BOUNDARY

1 2 3 4 5 6 7 8 9
BIBLIOGRAPHY


Crone, Rainer, *numerals, 1924-1977*