48-747 Shape Grammars

KINDERGARTEN GRAMMARS
Developed by Friedrich Fröbel
Well known to designers because its formative influence on FLW
Based on a series of geometrical gifts
+ a system of categories of form

the kindergarten method
the gifts form a vocabulary – the building blocks
e.g., cubes, ½ cubes, ¼ cubes, oblongs and so on
the kindergarten method

based on the geometrical gifts

Verbal exposition and Visual exploration

{ Forms of Beauty

Forms of Life

Forms of Knowledge

+ a system of categories of form
forms of knowledge
forms of life
forms of beauty
Categories of forms suggest possibilities of design, in principle, the combination suggests a language (of designs)

Gifts constitute a vocabulary that gives rise to an pedagogical analogue in ...

the **studio** method
Vocabulary

Architectural and structural elements

Categories

Architectural programmes
Building types
Historical styles
Symbolic references
Aesthetic doctrines (manifestos)

the studio method
suggest a course of actions –
starting with a *vocabulary* (shapes)
- essentially, compositions– from shape to shape
  (free play with forms)

relationships between shapes (forms)

transitions
vocabularies
spatial relations arise whenever there are two or more shapes.
spatial relation between a cube and a quarter-cube
the number of shapes in the relations are identical and there is an **geometrical transformation** that maps every shape in one relation to a corresponding shape in the other relation.

**Equivalent** spatial relations arise **whenever**
Face to face. That is right.
Edge now are meeting quite.
Edge to face now we will lay,
Face to edge will end the play.

- Spatial relations specified by two blocks
- A face overlaps another face so that the faces share a vertex and edges intersecting at this point coincide
- The blocks do not interpenetrate

Let us play
Gift 5

cube

half-cube

quarter-cube

1.1

1.2

1.3

1.4

1.5

1.6

1.7

half-cube, half-cube: 2, 3

half-cube, half-cube: 2, 4

half-cube, half-cube: 3, 4

half-cube, quarter-cube: 2, 7

half-cube, quarter-cube: 3, 5

half-cube, quarter-cube: 4, 5

half-cube, quarter-cube: 4, 6

half-cube, quarter-cube: 4, 7

quarter-cube, quarter-cube: 5, 5

quarter-cube, quarter-cube: 5, 6

quarter-cube, quarter-cube: 5, 7

quarter-cube, quarter-cube: 6, 6

quarter-cube, quarter-cube: 6, 7

quarter-cube, quarter-cube: 7, 7
Gift 6
part of playing is seeing
seeing leads to
constructing
playing with spatial relations
recapping the studio method via the kindergarten
suggest courses of actions – essentially, compositions – from shape to shape (forms)

relationships between shapes (forms) ➔ PLAY

SHAPE RULES
	ransitions
rules when coupled with categories, which offer meaning & purpose, give rise to a ...
a constructive paradigm
the grammar paradigm
why rules?

| Rules offer greater precision and control than spatial relations |
| Rules are simpler than designs because they are localized |
| Rules increase the power of observation |
| Rules offer explicit and detailed descriptions of knowledge |
| Rules shift from simple possibilities to a realm of knowledge (i.e., languages of designs) |
| Rulers allow for the exploration of alternatives |
| Rules can be modified systematically to incorporate new ideas and changing circumstances |

so ... let's look at **rules**
fall into two categories:

**Additive rules**  \[ x \rightarrow s + t \quad x \in \{s, t\} \]

**Subtractive rules**  \[ s + t \rightarrow x \quad x \in \{s, t\} \]

“forming” spatial relations

“breaking” spatial relations

rules
additive rules
subtractive rules
rule application

from the same relation

under different transformations
Rules can be aided by annotations

Technically, equivalent to labeled elements

Additive rules
\[ \langle x, P \rangle \rightarrow \langle s + t, Q \rangle \quad x \in \{s, t\} \]

Subtractive rules
\[ \langle s + t, P \rangle \rightarrow \langle x, Q \rangle \quad x \in \{s, t\} \]

annotated rules
Annotations serve three purposes:

• add or destroy symmetry
• increase or decrease ambiguity
• help deal with interpenetration

Labels are generally used to avoid such problems

Labels are also used to demarcate stages in this play

**annotations and labels**
rule application according to the symmetry of the lhs
spatial ambiguity

shape rule 10
shape rule 11

shape rule 12
shape rule 13

shape rule 14
shape rule 15

shape rule 16
shape rule 16
shape rule 17

shape rule 2
shape rule 3

shape rules 2, 3
shape rule 2

shape rule 5
shape rule 6

shape rule 7
shape rule 8
shape rule 9
interpenetration
funny things happen under subtractive rules
Given a corpus of designs find the **simplest** grammar that specifies the designs

Solution to the problem involves identifying hidden structures more often than not, vestiges of these hidden structures have been erased

**subtractive rules** compound the inference problem
two grammars
more grammar examples in the kindergarten paper
motivated by Frederick Froebel’s Kindergarten model of free play and creativity through his gifts.

paradigm: child’s play
Play is the purest, the most spiritual, product of man at this stage, and is at once the prefiguration and imitation of the total human life, –of the inner, secret, natural life in man and in all things.

It produces, therefore, joy, freedom, satisfaction, repose within and without, peace with the world.

The springs of all good rest within it and go out from it.