

What is computation?

What is a shape grammar?

How are shape grammars used in design?

How is a shape grammar developed?

What is computation?

Algorithm for designing a gothic spire (Roriczer)

If you want to draw a base plan for a pinnacle, according to the masons' technique [derived] out of correct geometry, then begin by making a square as shown hereafter with the letters $a b c d$, so that it is the same distance from a to b as from b to d , d to c , and c to a , as in the figure drawn hereafter.

Then make the square equal in size to the preceding; divide [the distance] from a to b into two equal parts, and mark an e [at the midpoint]. Do the same from b to d and mark an h ; from d to c and mark an f ; from c to a and mark a g . Then draw lines from e to h , h to f , f to g , and g to e , as in the example of the figure drawn hereafter.

Then make the above-derived square equal in size to the preceding; divide [the side] from e to h into two equal parts, and mark a k [at the midpoint]. Do the same from h to f and mark an m ; from f to g and mark an l ; from g to e and mark an i . Then draw lines from e to h , h to f , f to g , and g to e , as in the example of the figure drawn hereafter.

Then make the two squares $a b c d$ and $i k l m$ equal in size to the preceding, and rotate the square $e h g f$, as in the example of the figure drawn hereafter.



Then when you eliminate the remaining lines that are not needed for the setting out, there remains such a form as shown below.

Procedure for defining the entasis of a column (Palladio)

The columns in each order ought to be form'd in such a manner, that the diameter of the upper part of the column may be smaller than at the bottom, with a kind of swelling in the middle.

As to the manner of making the swelling in the middle, we have no more to shew from VITRUVIUS but his bare promise; which is the reason that most writers differ from one another upon that subject.

The method I use in making the profile of the swellings is this; I divide the height of the column into three parts, and leave the lower part perpendicular; to the side of the extremity of which I apply the edge of a thin rule, of the same length, or a little longer than the column, and bend that part which reaches from the third part upwards, until the end touches the point of the diminution of the upper part of the column under the *collarino*. I then mark as the curve directs, which gives the column a kind of swelling in the middle, and makes it project very gracefully.

And although I never could imagine a more expeditious and successful method than this, I am nevertheless confirmed in my opinion, since Signor PIETRO CATANEO was so well pleased when I told him of it, that he gave it a place in his Treatise of Architecture, with which he has not a little illustrated this profession.

A B, the third part of the column, which is left directly perpendicular.

B C, the two thirds that are diminished.

C, the point of diminution under the collarino.

Computation is:

creative

descriptive

Algorithm for designing a gothic spire (Roriczer)

If you want to draw a base plan for a pinnacle, according to the masons' technique [derived] out of correct geometry, then begin by making a square as shown hereafter with the letters $a b c d$, so that it is the same distance from a to b as from b to d , d to c , and c to a , as in the figure drawn hereafter.

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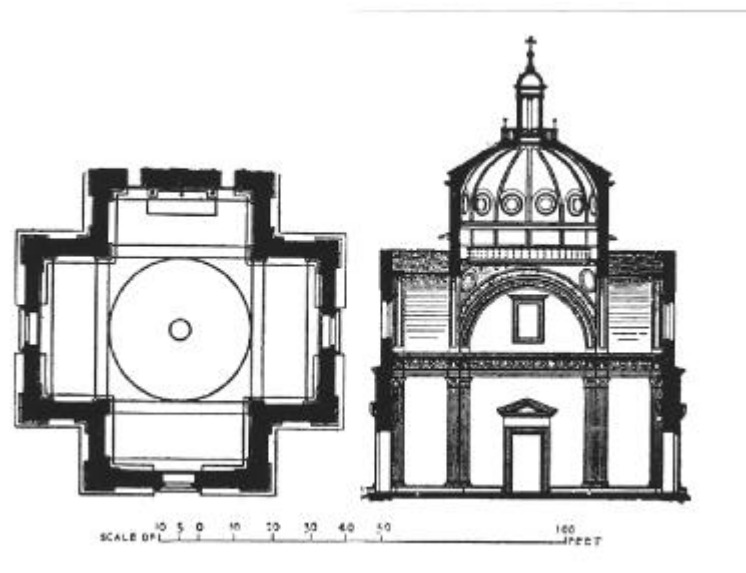
Then make the above-derived square equal in size to the preceding; divide [the side] from e to h into two equal parts, and mark a k [at the midpoint]. Do the same from h to f and mark an m ; from f to g and mark an l ; from g to e and mark an i . Then draw lines from e to h , h to f , f to g , and g to e , as in the example of the figure drawn hereafter.

Then make the two squares $a b c d$ and $i k l m$ equal in size to the preceding, and rotate the square $e h g f$, as in the example of the figure drawn hereafter.

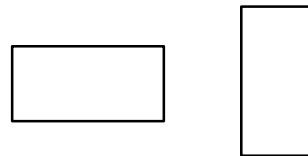


Then when you eliminate the remaining lines that are not needed for the setting out, there remains such a form as shown below.

What is a shape grammar?



Shapes



Spatial relation

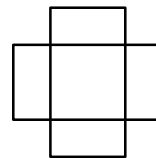
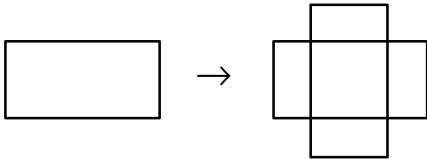


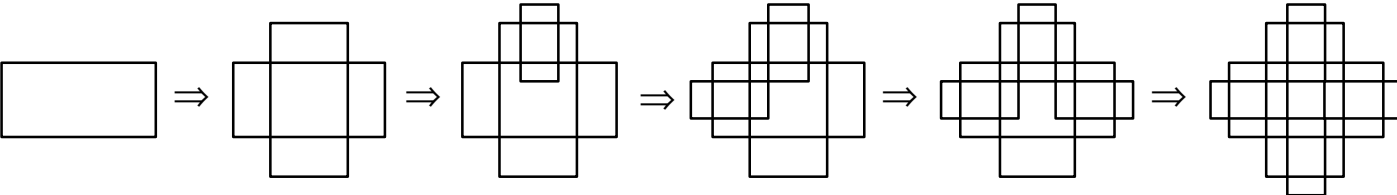
Illustration by Peter Murray, "the Architecture of the Italian Renaissance", Shoken Books Inc. 1963, Pp.96.

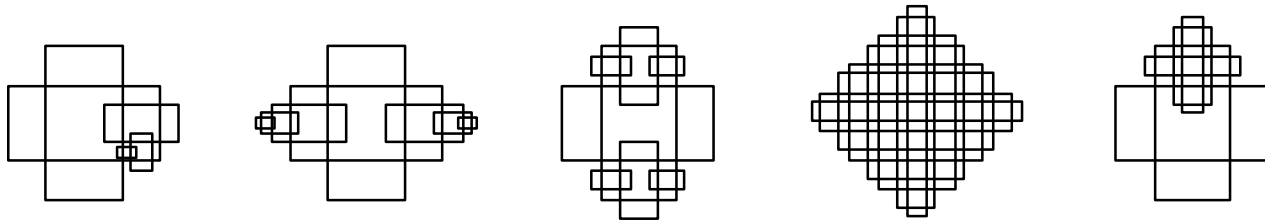
SHAPE GRAMMAR



rule

DERIVATION





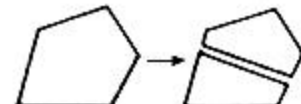
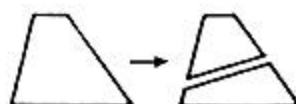
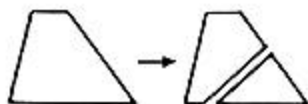
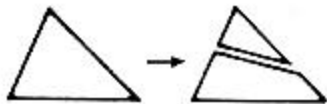
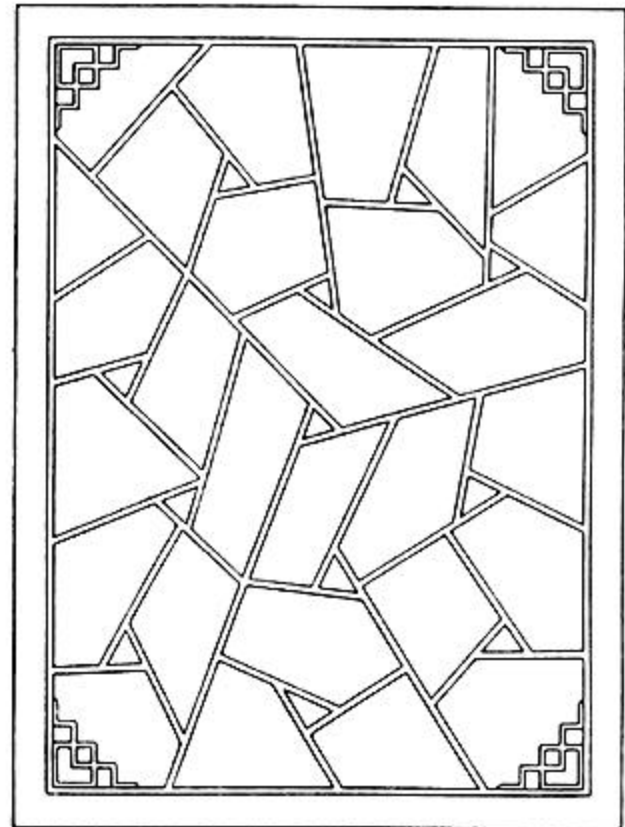
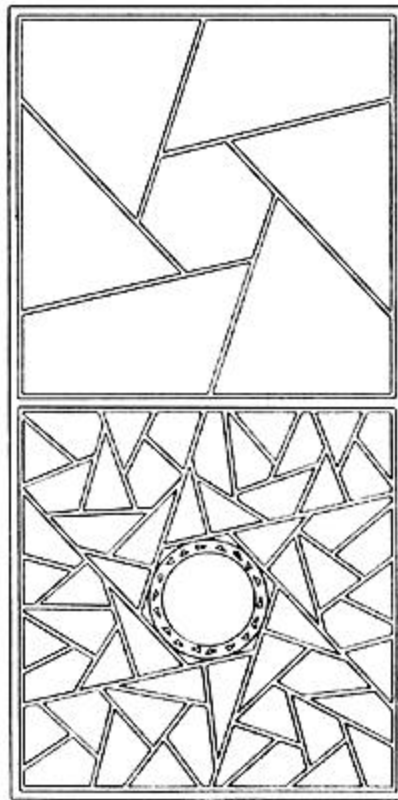
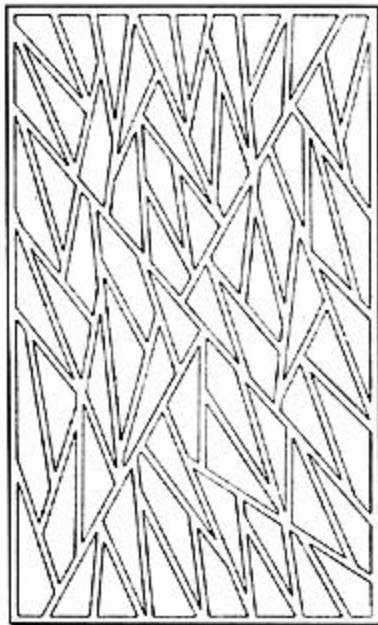
OTHER DESIGNS IN THE LANGUAGE

How are shape grammars used in design?

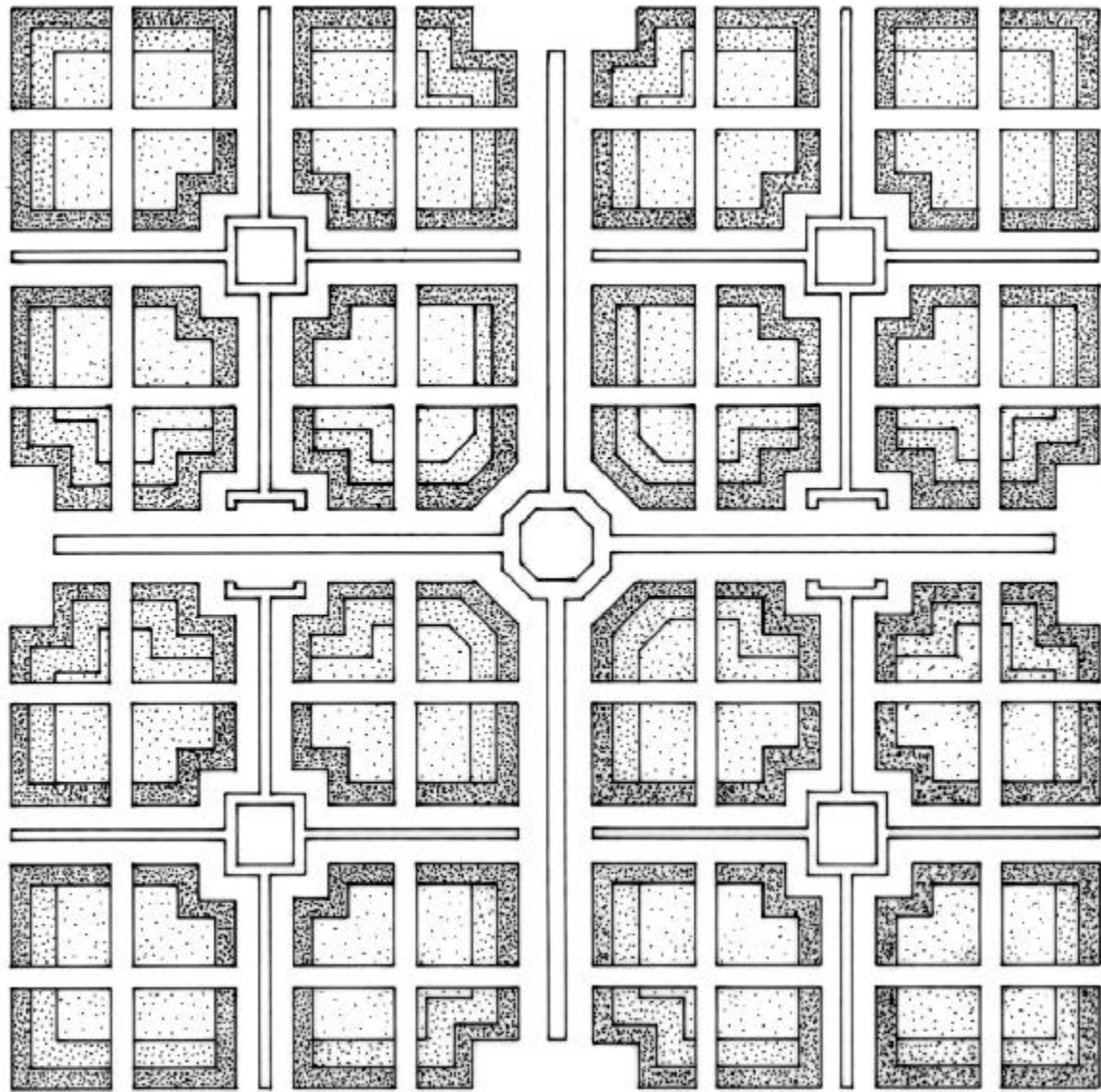
Shape grammar applications

analysis

original design



Ice-ray grammar



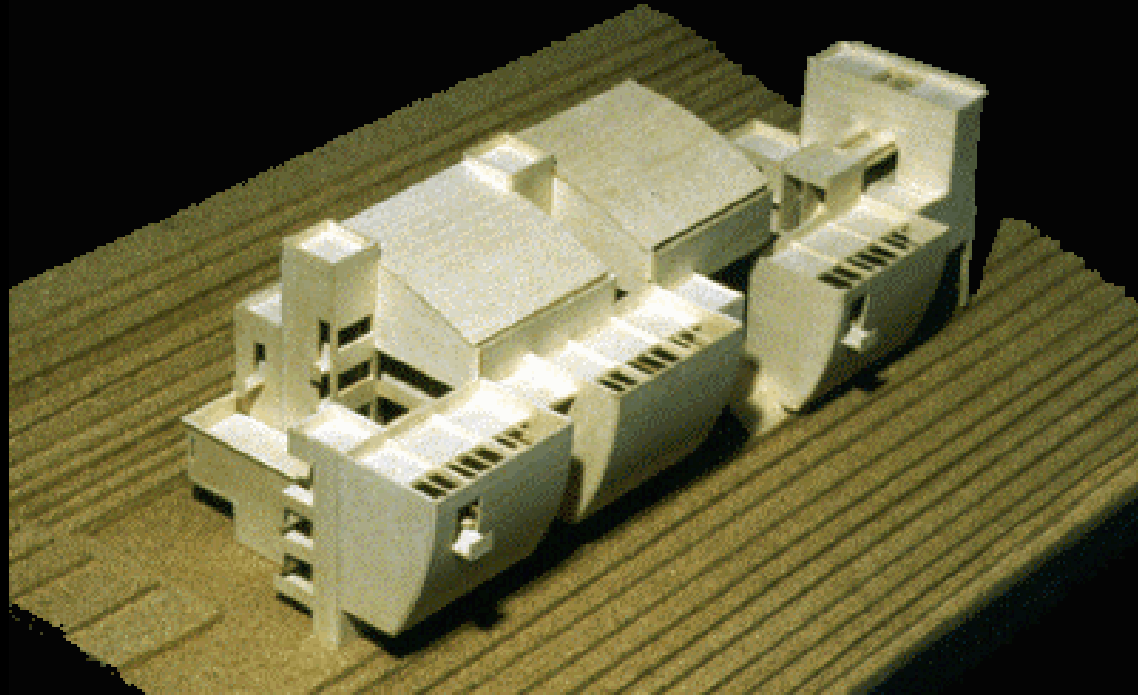
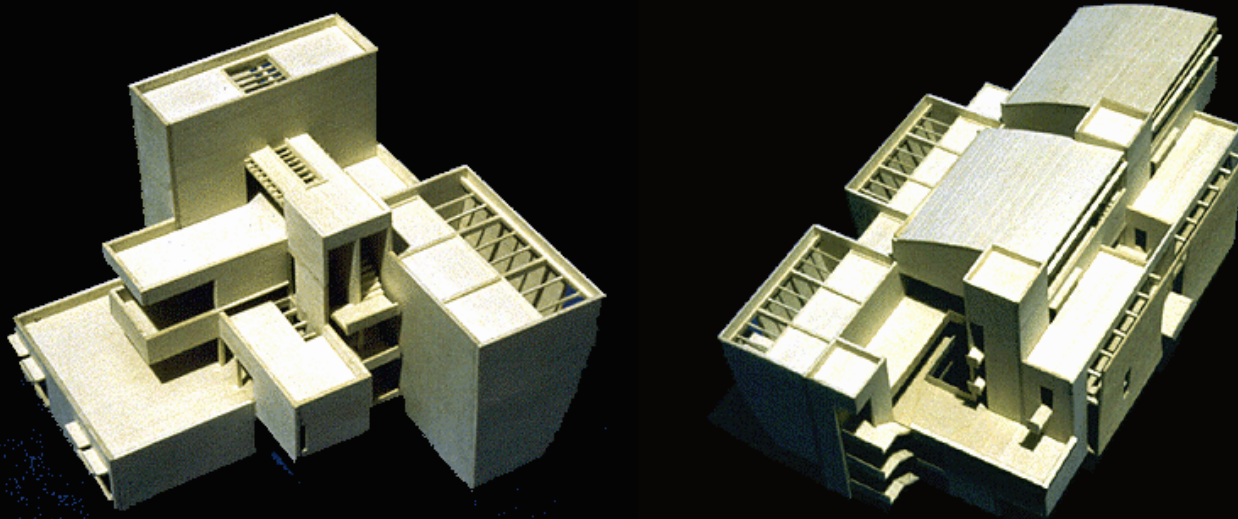
Mughul garden grammar

original design applications

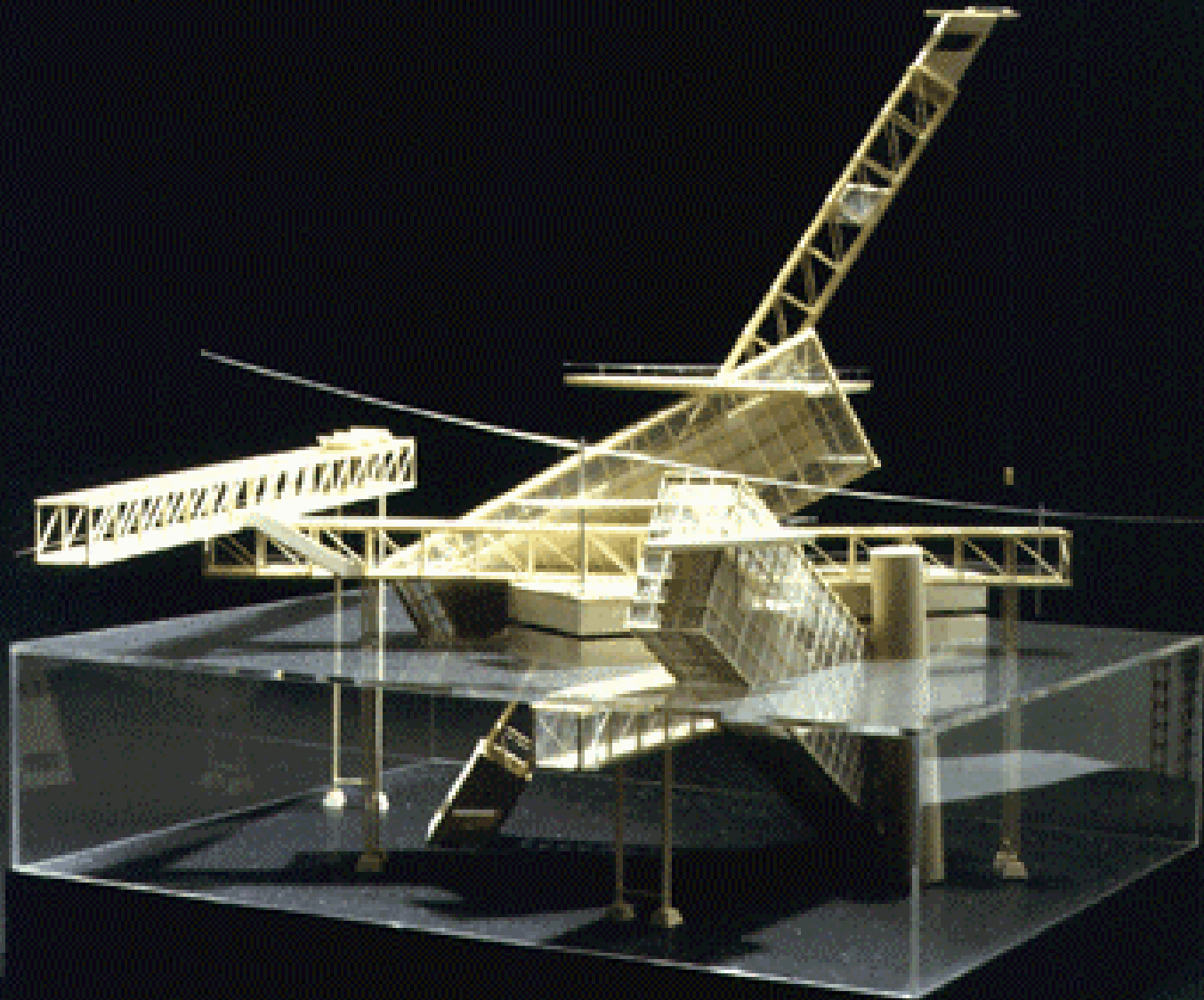


Apartment building in Manhattan

Cultural history museum in LA

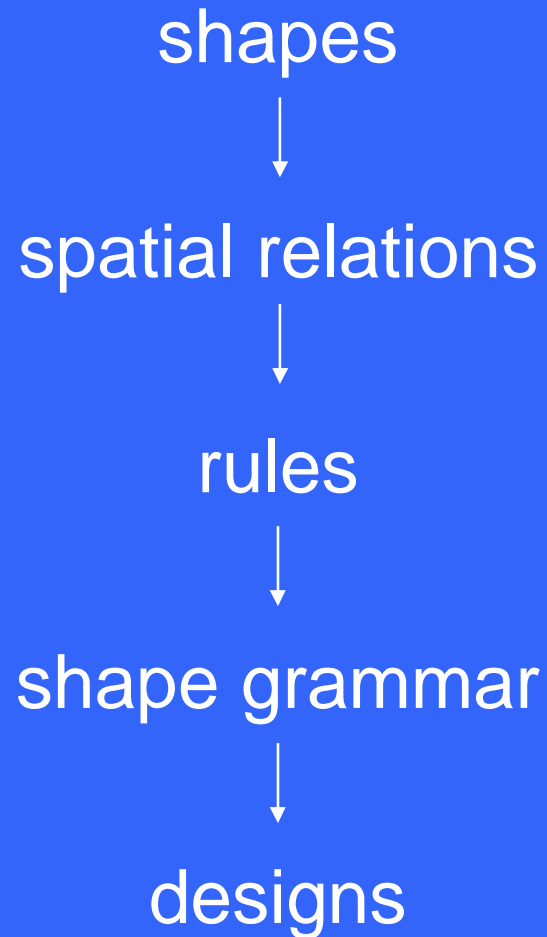


Ocean museum in California



How is a shape grammar developed?

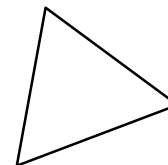
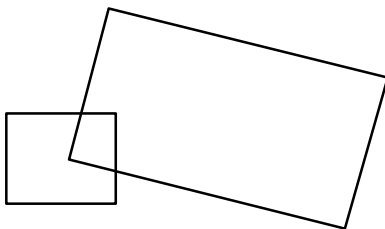
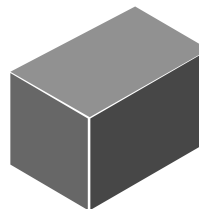
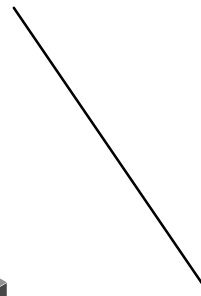
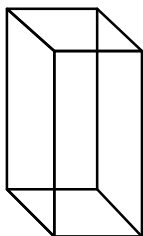
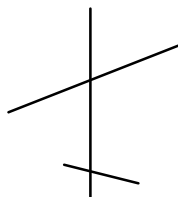
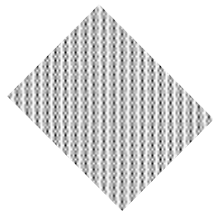
Stages of shape grammar development



shapes

basic components of
grammars and designs

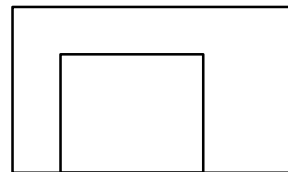
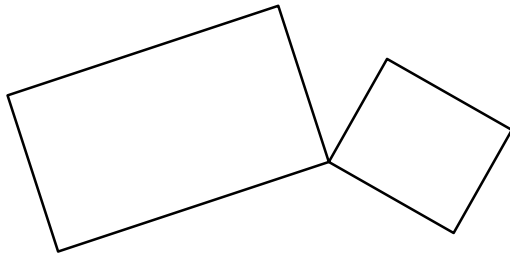
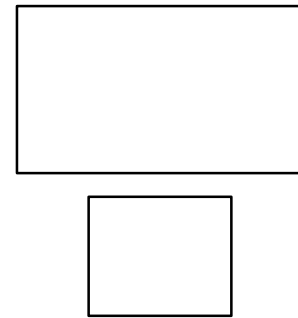
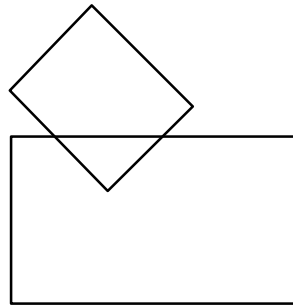
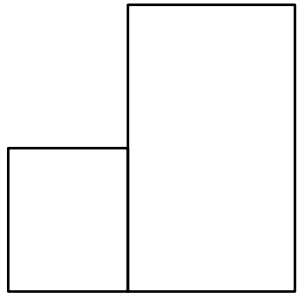
shapes



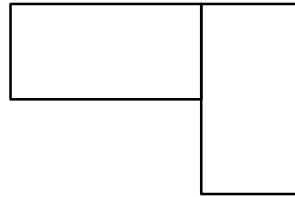
spatial relation

arrangement of shapes

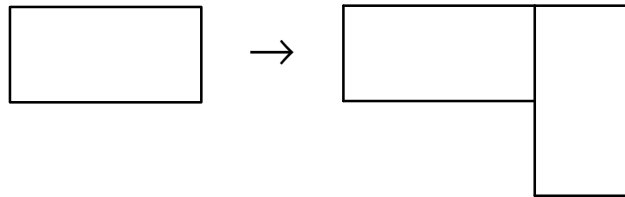
spatial relations



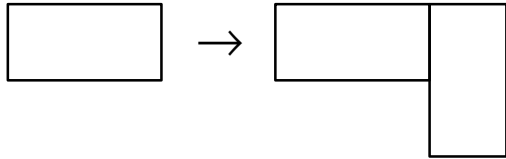
spatial relation



rule



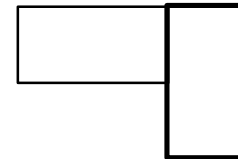
rule



shape

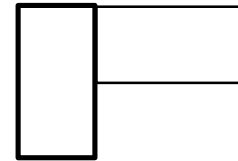


\Rightarrow



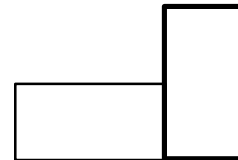
or

\Rightarrow



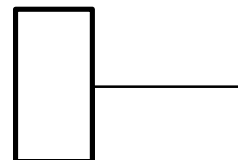
or

\Rightarrow



or

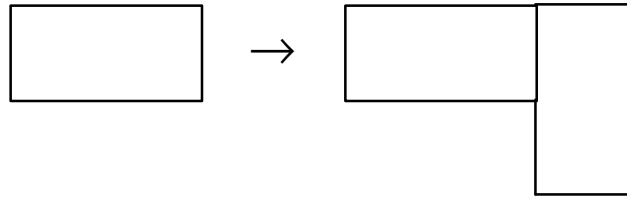
\Rightarrow



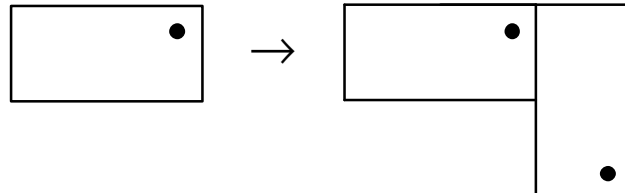
labels

symbols that say
how to apply a rule

rule



labeled rule



applying a labeled rule

$$A \rightarrow A + B$$

match the labeled shape A
with a labeled shape in a design

add the labeled shape B
to the design

spatial transformations

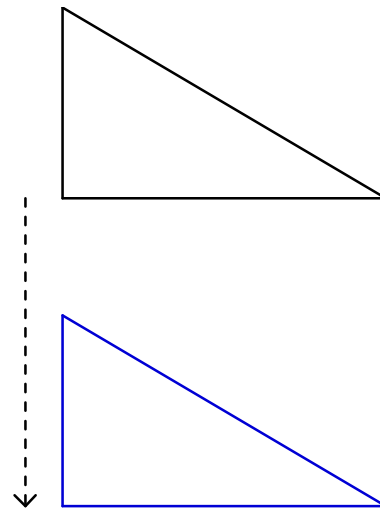
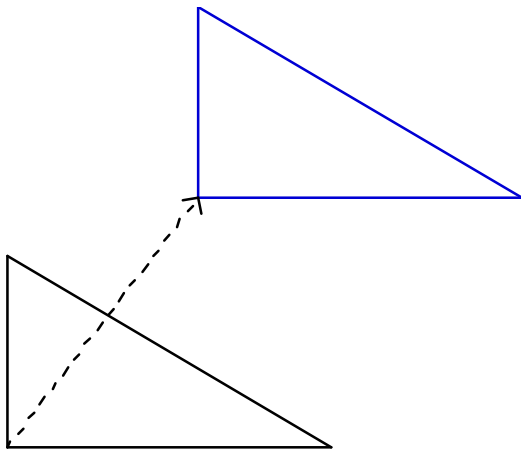
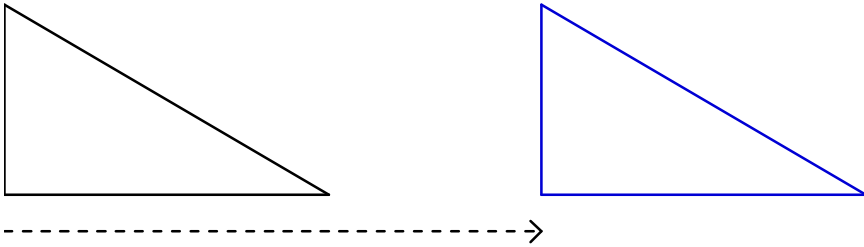
translation

rotation

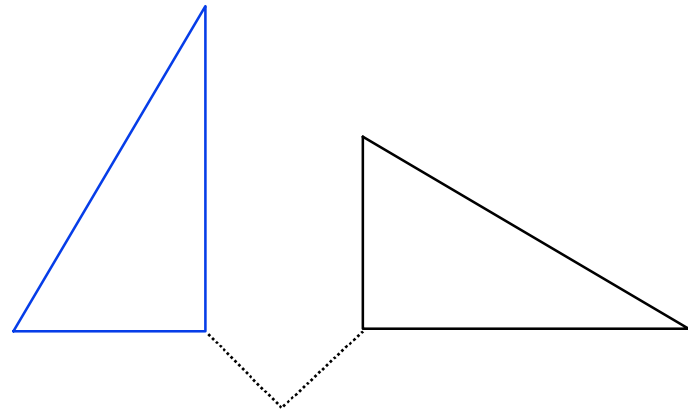
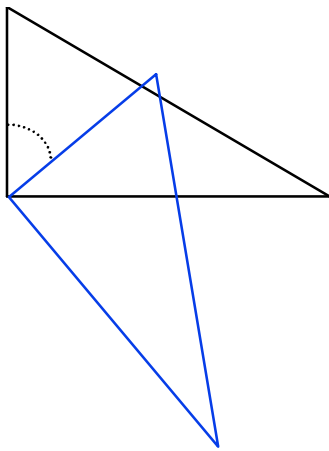
reflection

scale

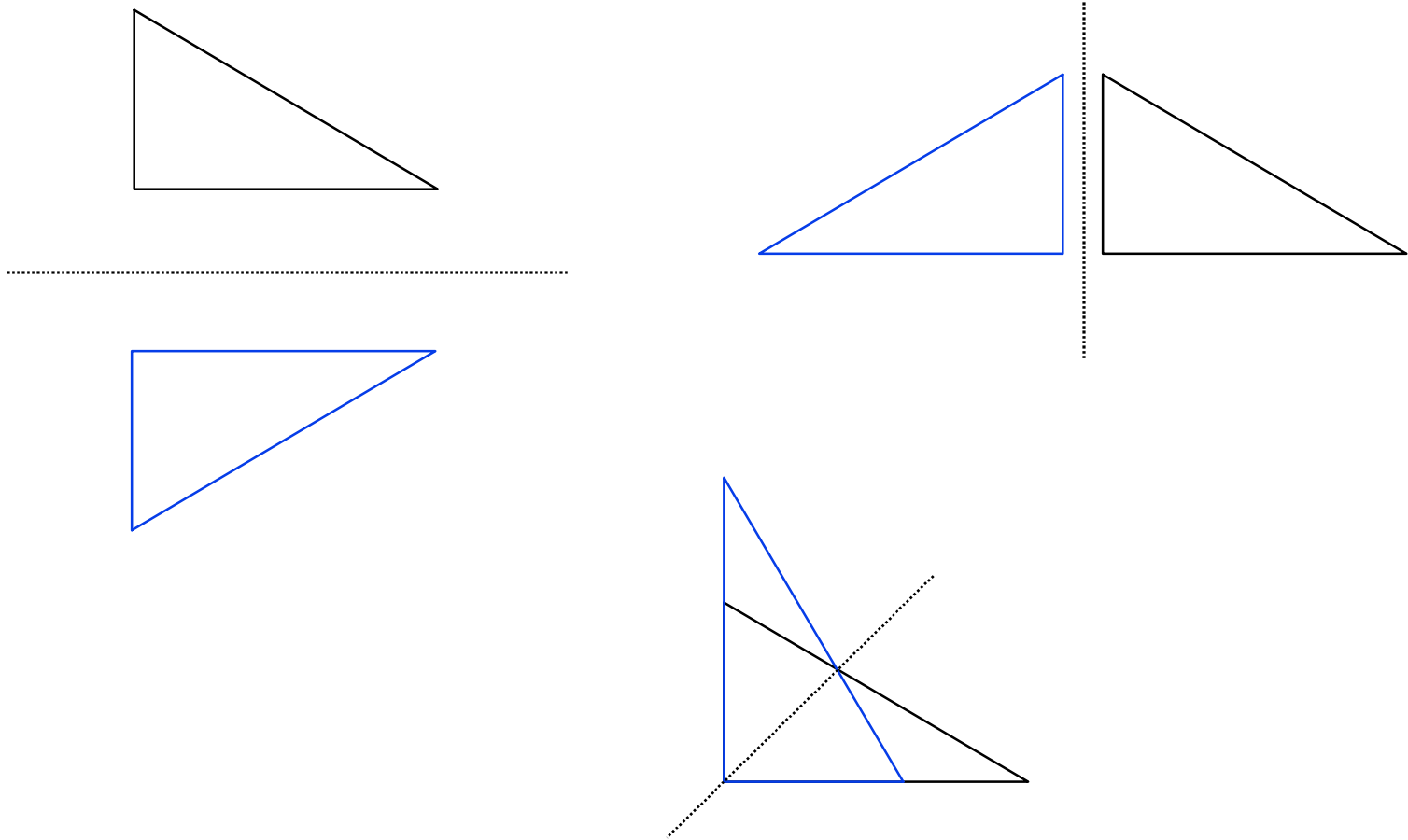
translation



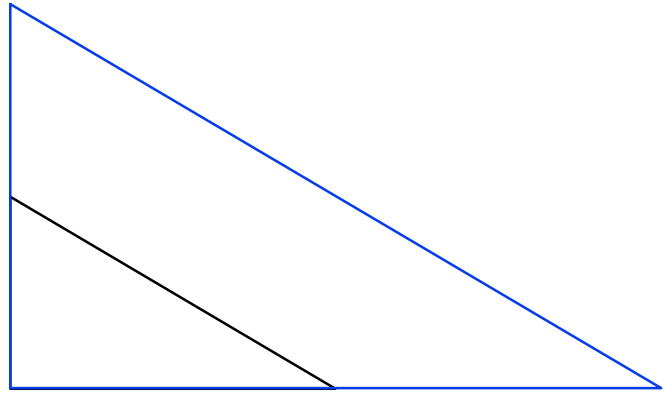
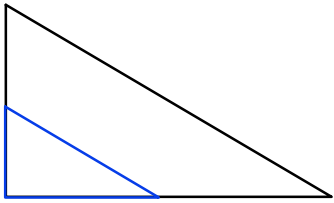
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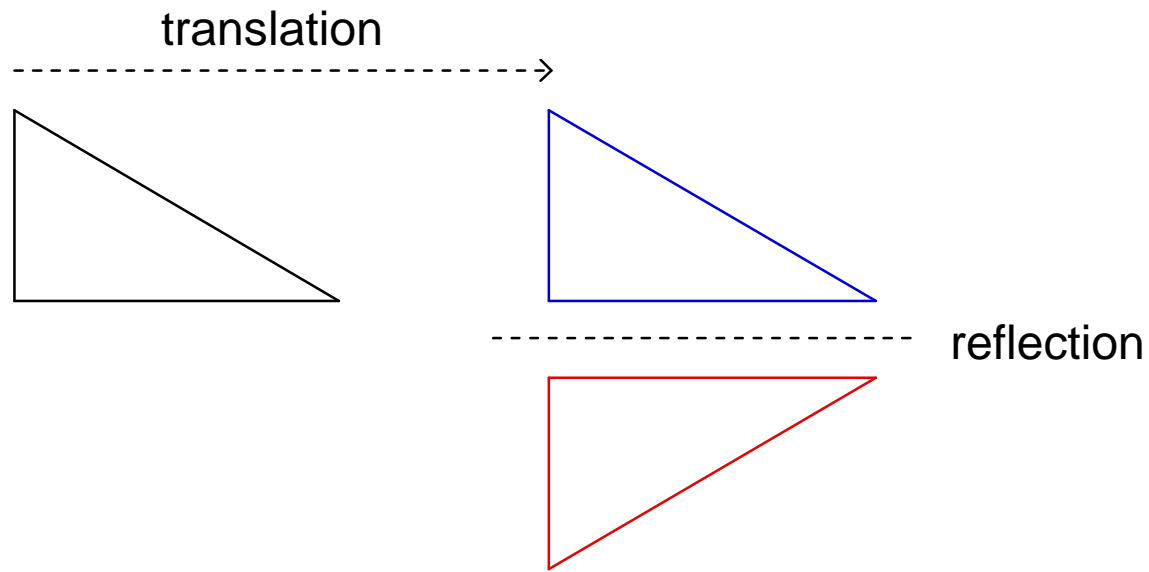
reflection



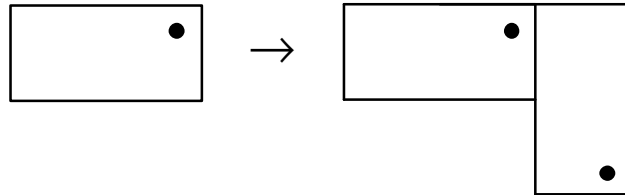
scale



combinations of transformations



labeled rule

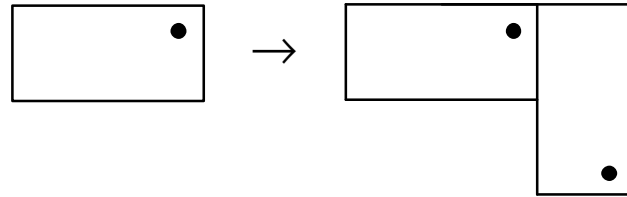


derivation

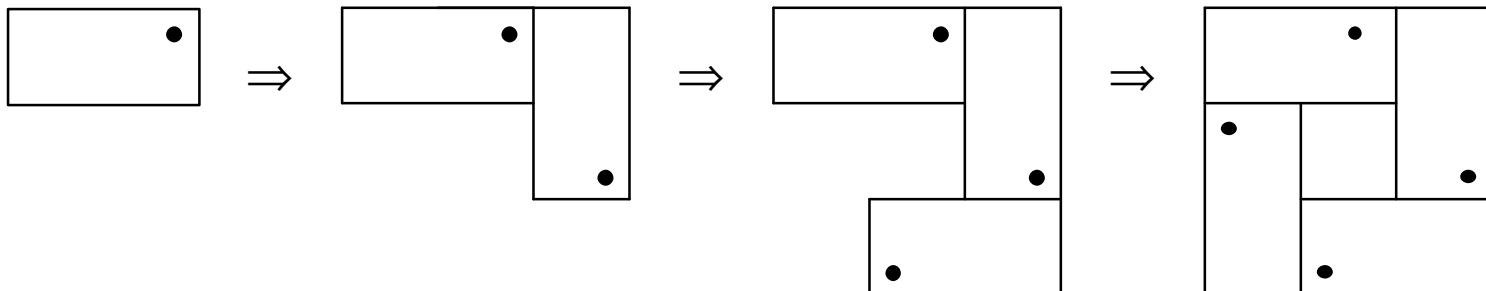
a sequence of designs where each design is generated from the previous design by applying a rule

design 1 \Rightarrow design 2 \Rightarrow design 3 \Rightarrow design 4 \Rightarrow . . .

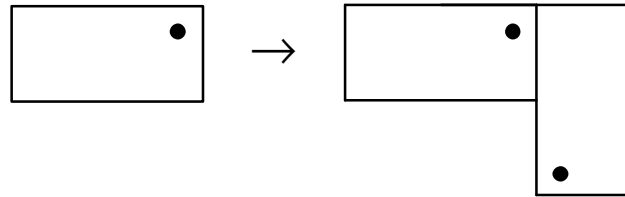
labeled rule



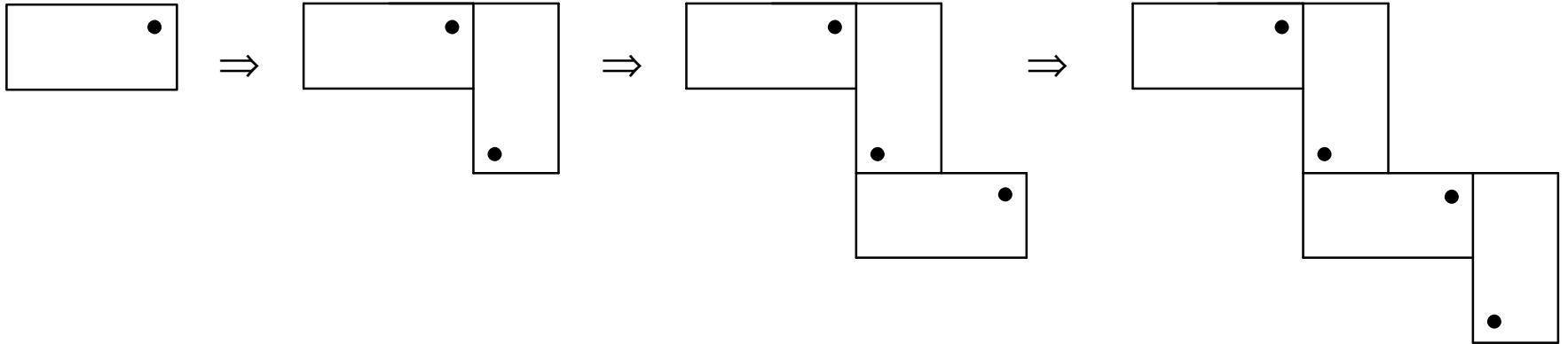
derivation



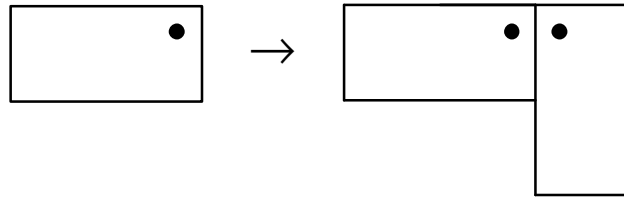
labeled rule



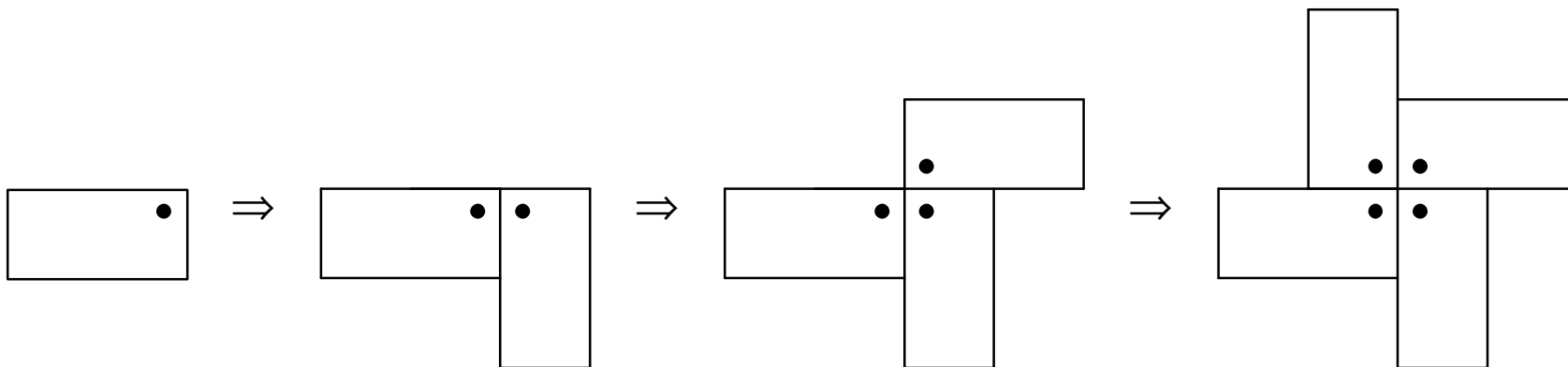
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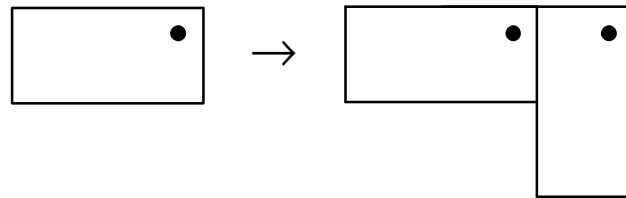
labeled rule



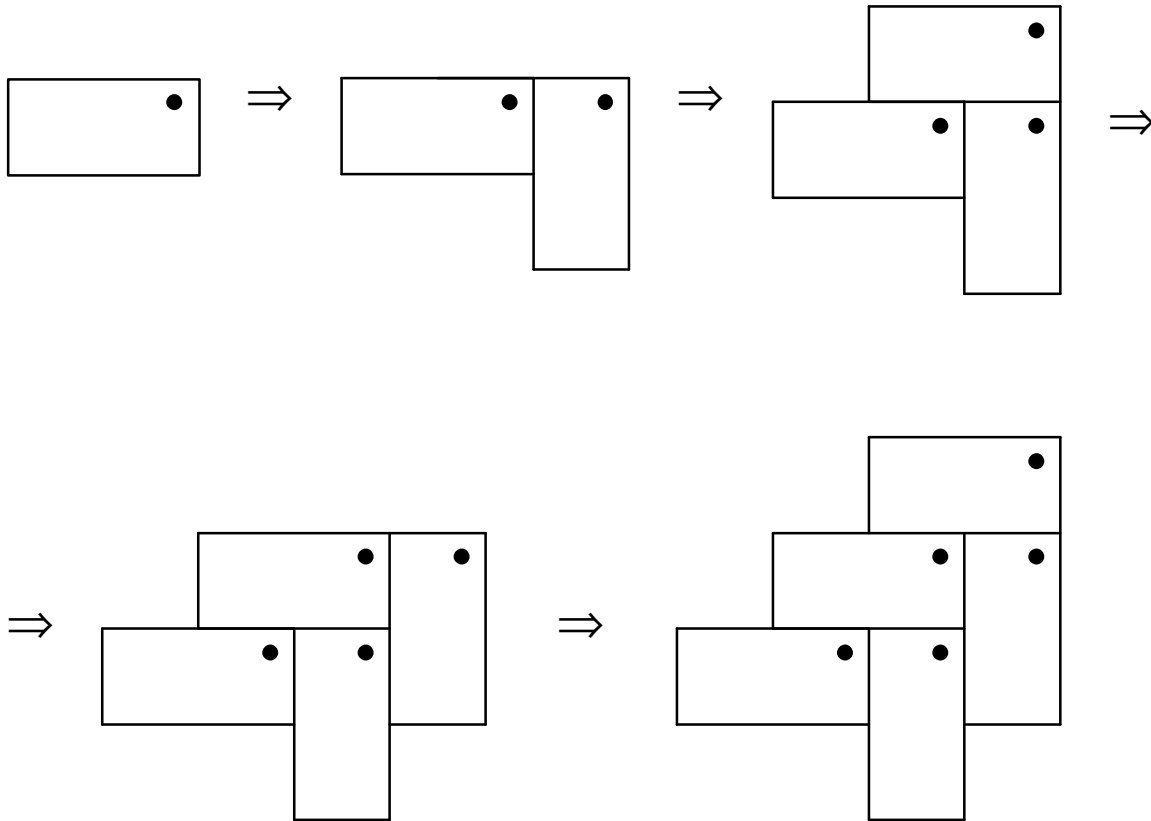
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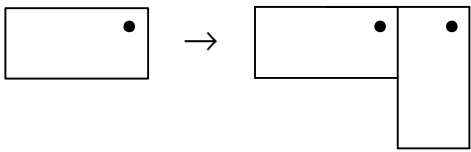
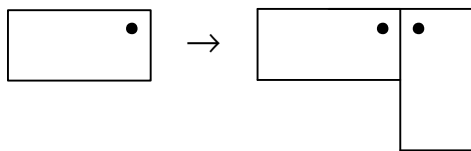
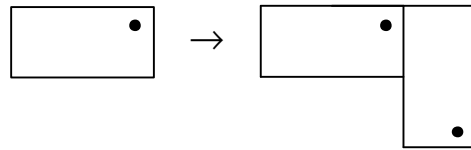
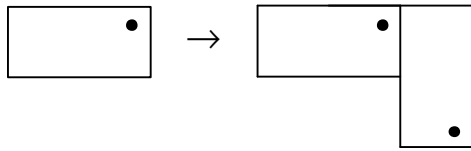
labeled rule



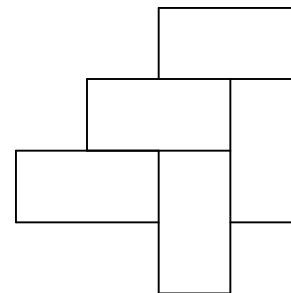
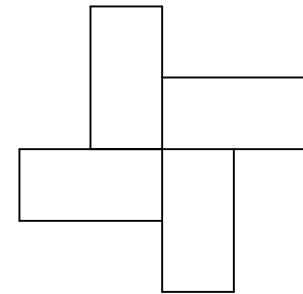
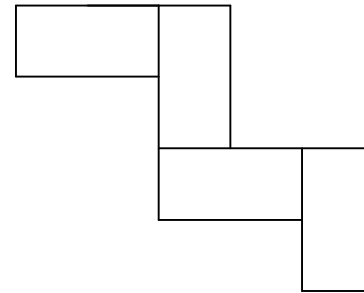
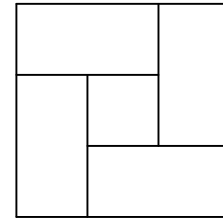
derivation



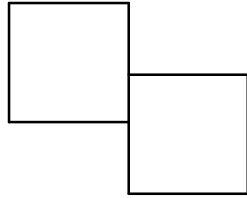
labeled rules



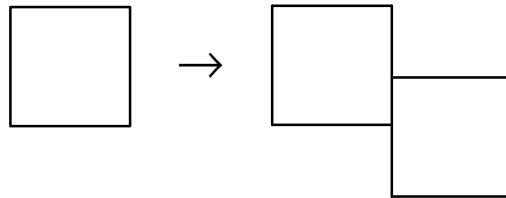
designs



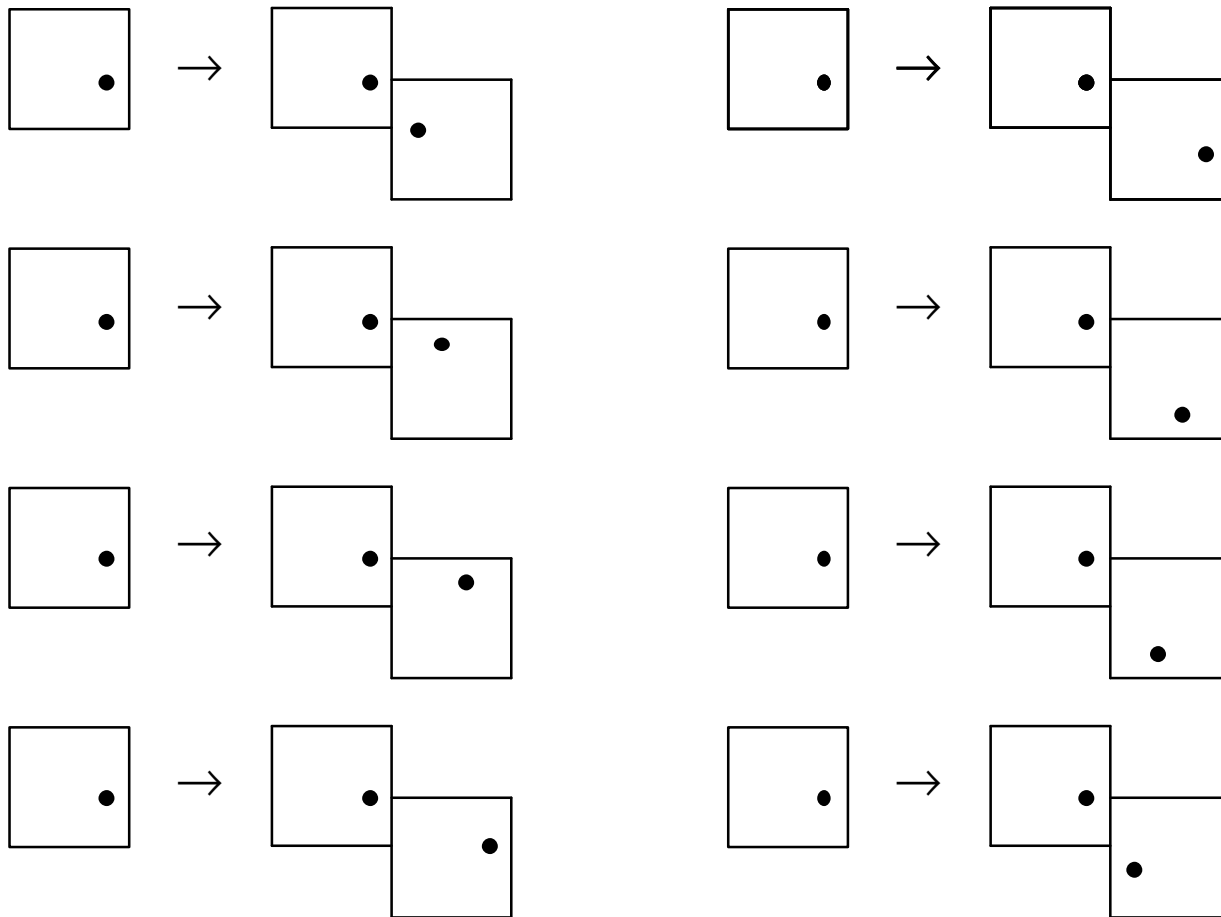
spatial relation



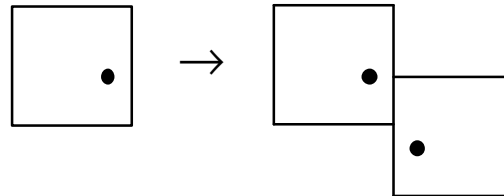
rule



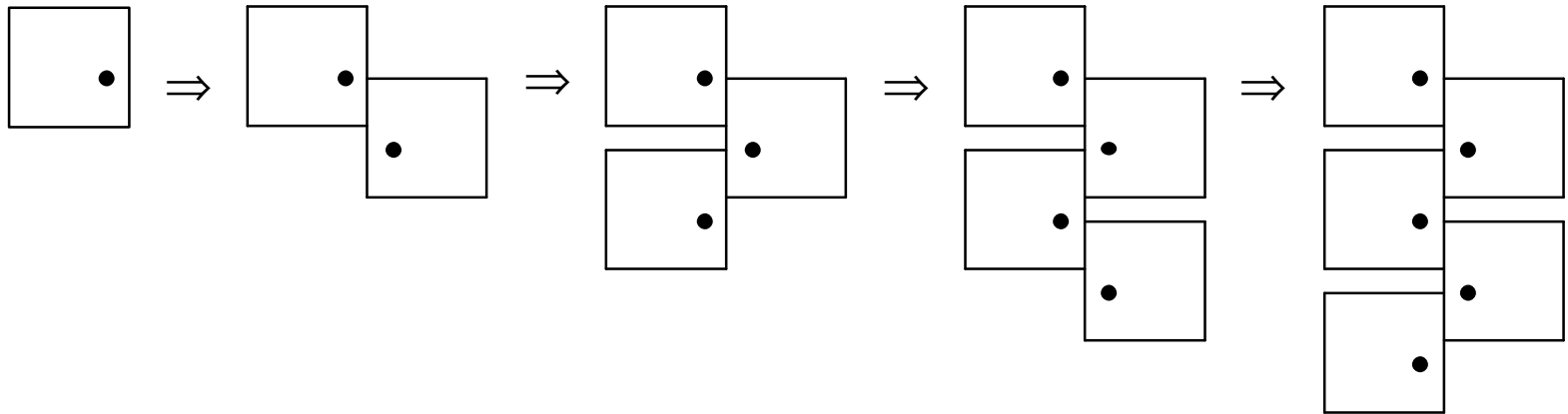
labeled rules



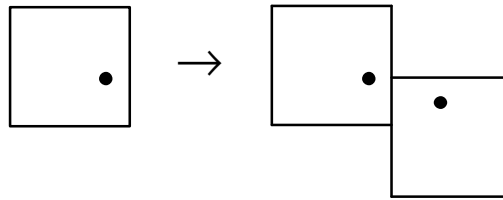
labeled rule



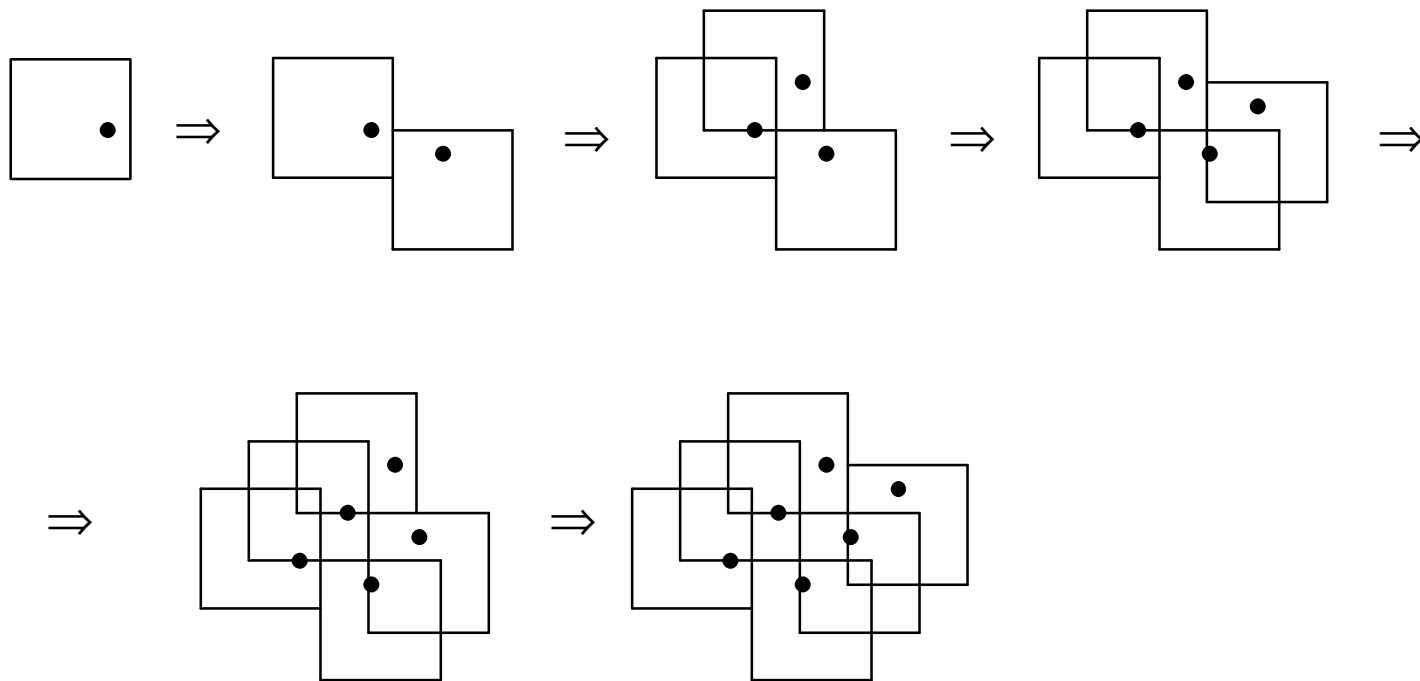
derivation



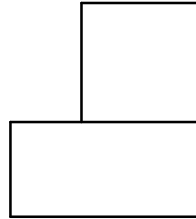
labeled rule



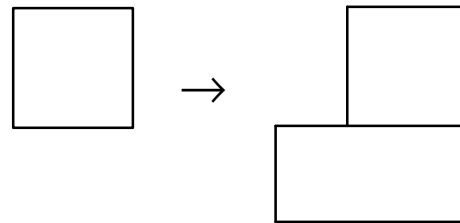
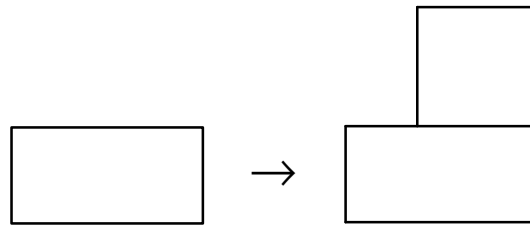
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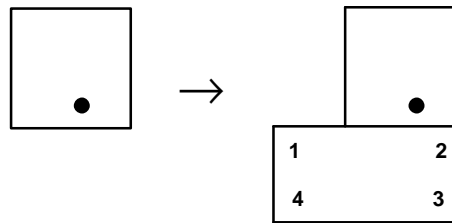
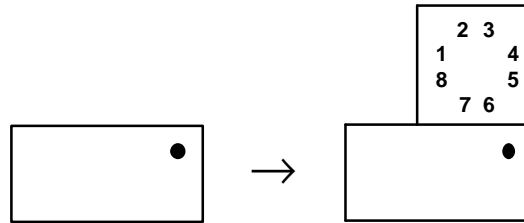
spatial relation



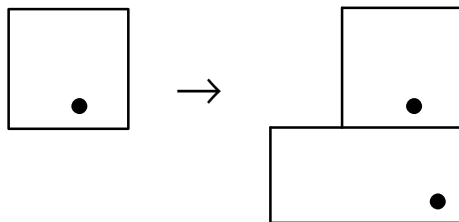
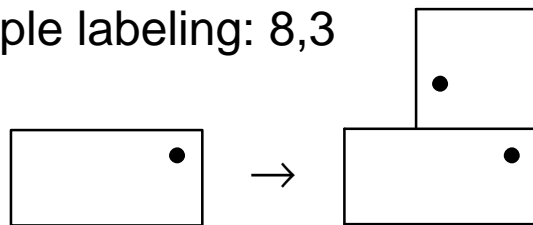
rules



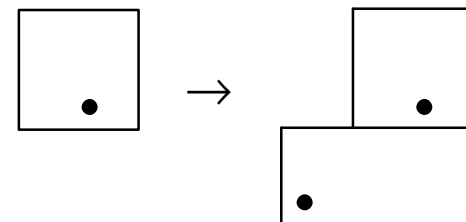
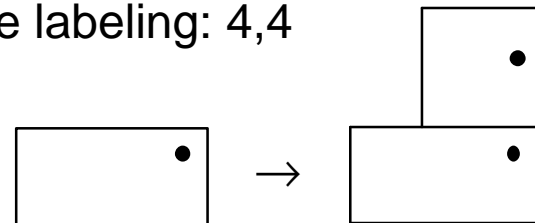
labeled rules



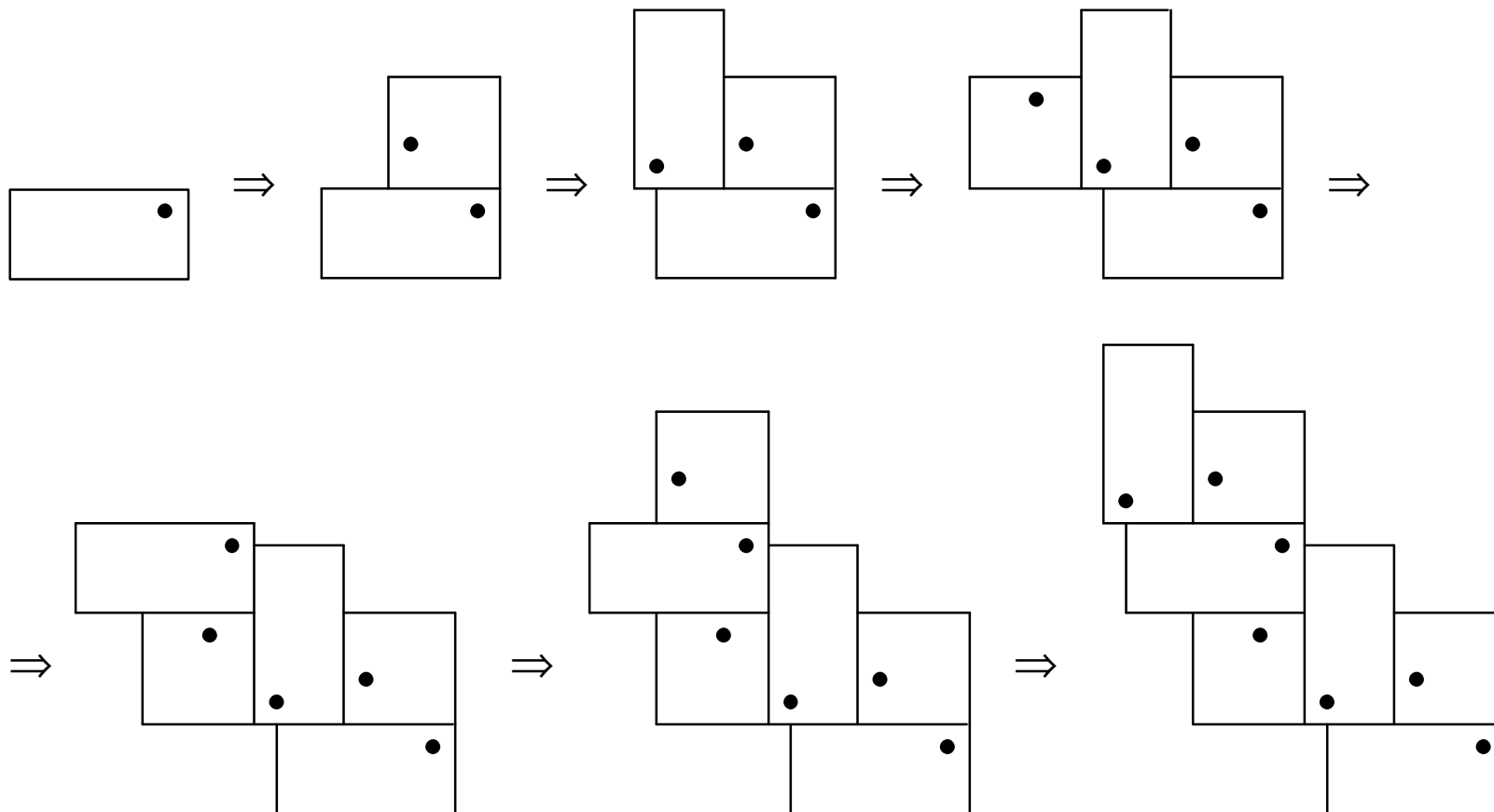
example labeling: 8,3



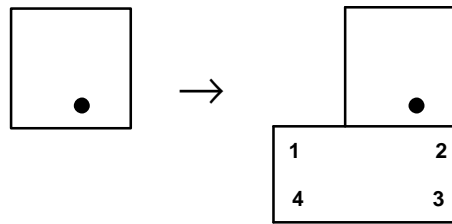
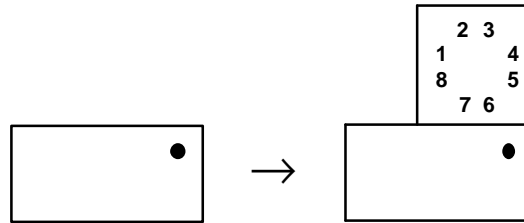
example labeling: 4,4



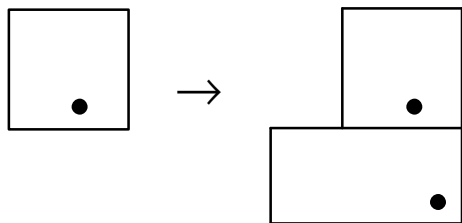
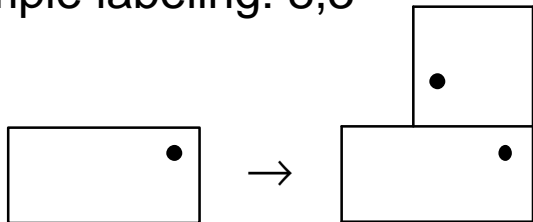
derivation (labeling 8,3)



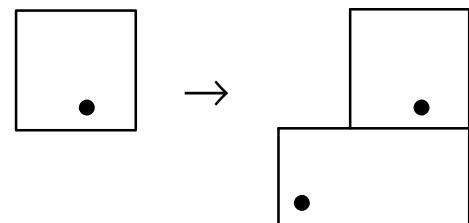
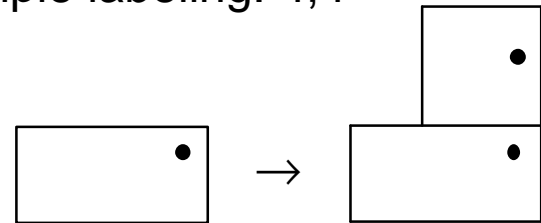
labeled rules



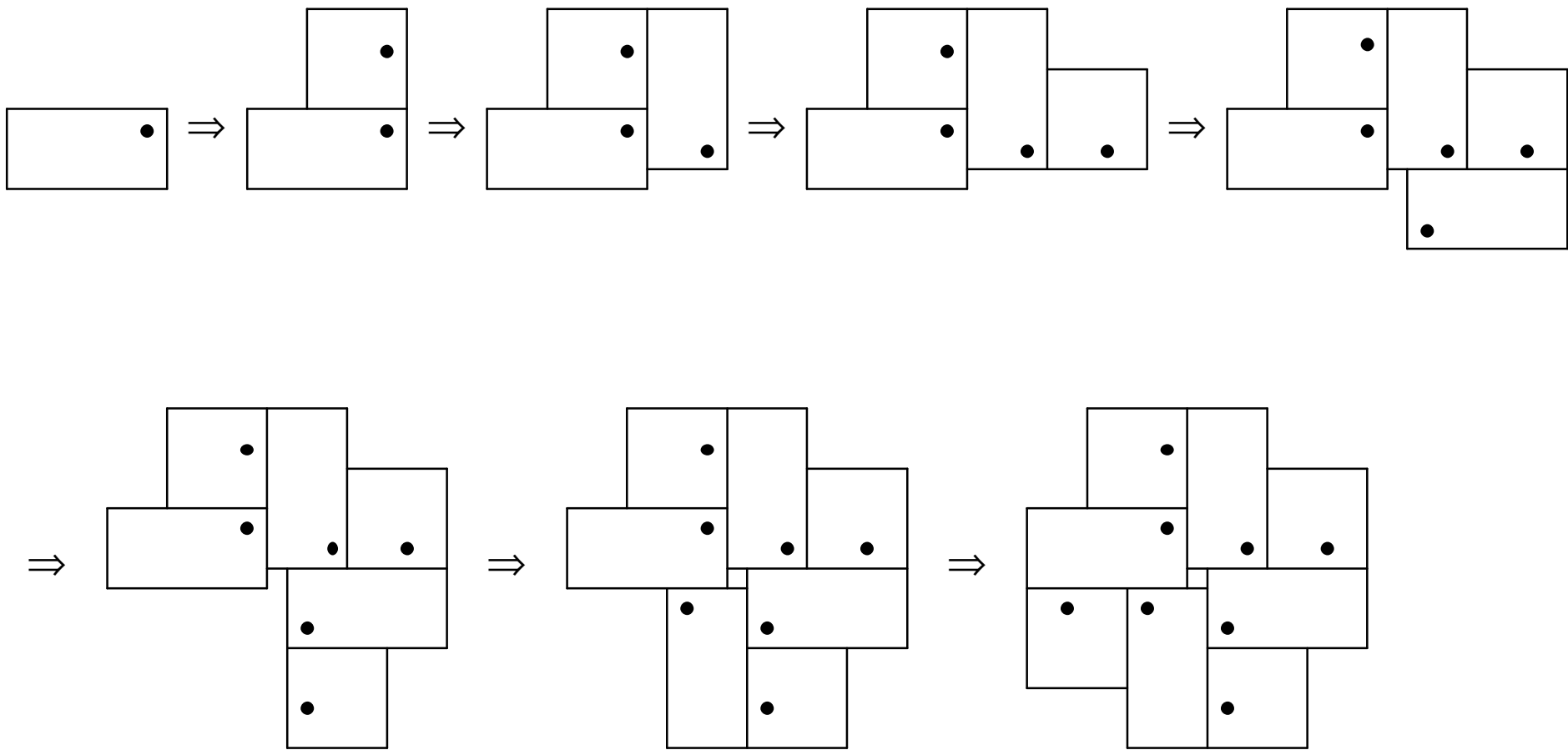
example labeling: 8,3

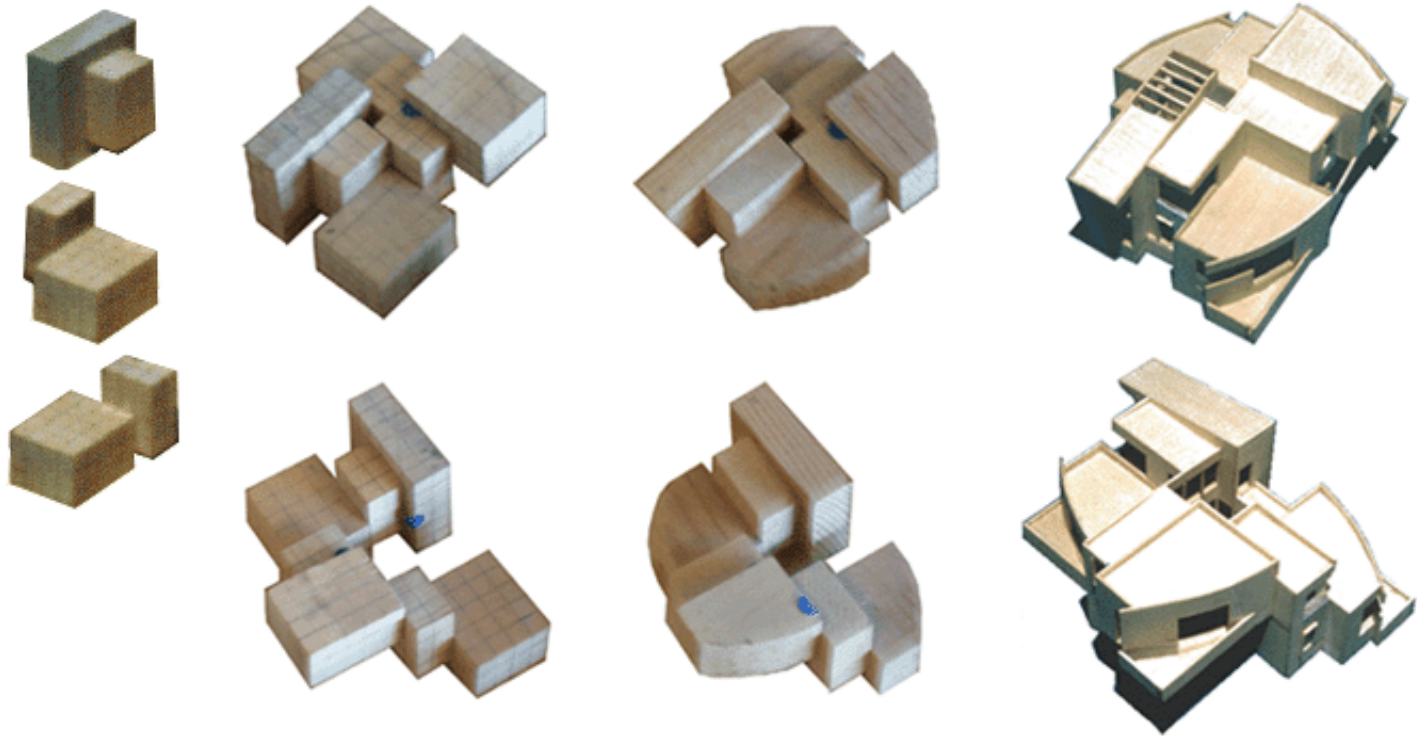


example labeling: 4,4

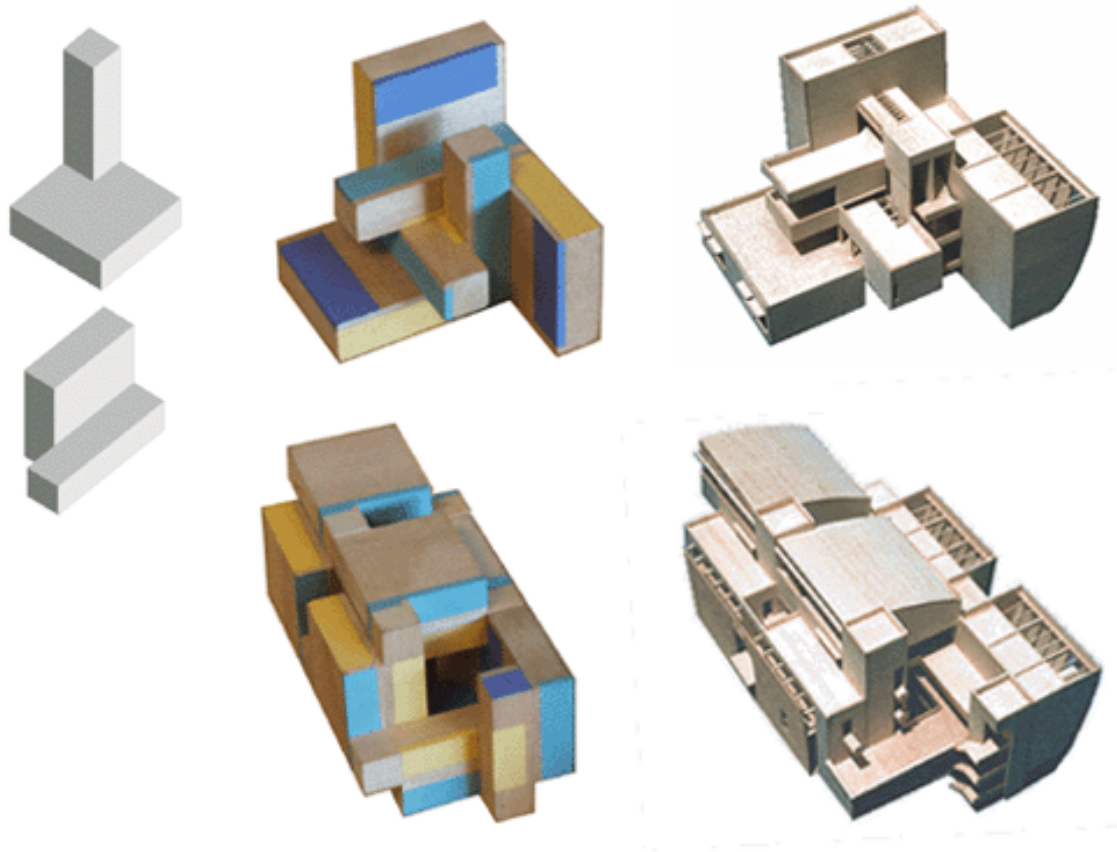


derivation
(labeling 4,4)





Courtyard houses in Malibu



Cultural history museum in LA

ASSIGNMENT

1. Go back to the example grammars from today's lecture. Try applying labeled rules that you did not do in class.
2. Read the online paper:
"Shape grammars in education and practice: history and practice"