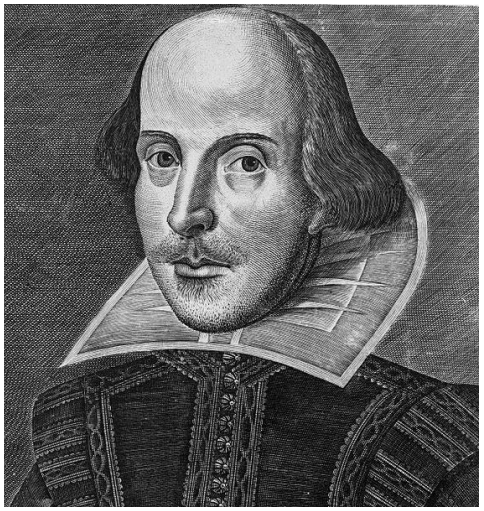
Design as art and use:
to see things as in themselves they really are not.

Image removed due to copyright restrictions. Original image can be viewed at https://www.tate.org.uk/art/archive/items/tga-7050ph-1118/nash-black-and-white-negative-laocoon.

This is Paul Nash's photograph (1941) of the Laocoon. Nash looked at "fertile images" to reveal alternative realities, and found "unseen landscapes" observing the "vitality" of things – "to find, you must be able to perceive." Seeing shapes is always vital in this way.

[Artists*] probably occasionally observed in a tree-trunk or clod of earth and other similar inanimate objects certain outlines in which, with slight alterations something very similar to the real faces of Nature was represented. They began, therefore, by diligently observing and studying such things, to try to see whether they could not add, take away or otherwise supply whatever seemed lacking to effect and complete the true likeness.

On Sculpture
Leon Batista Alberti (1464)



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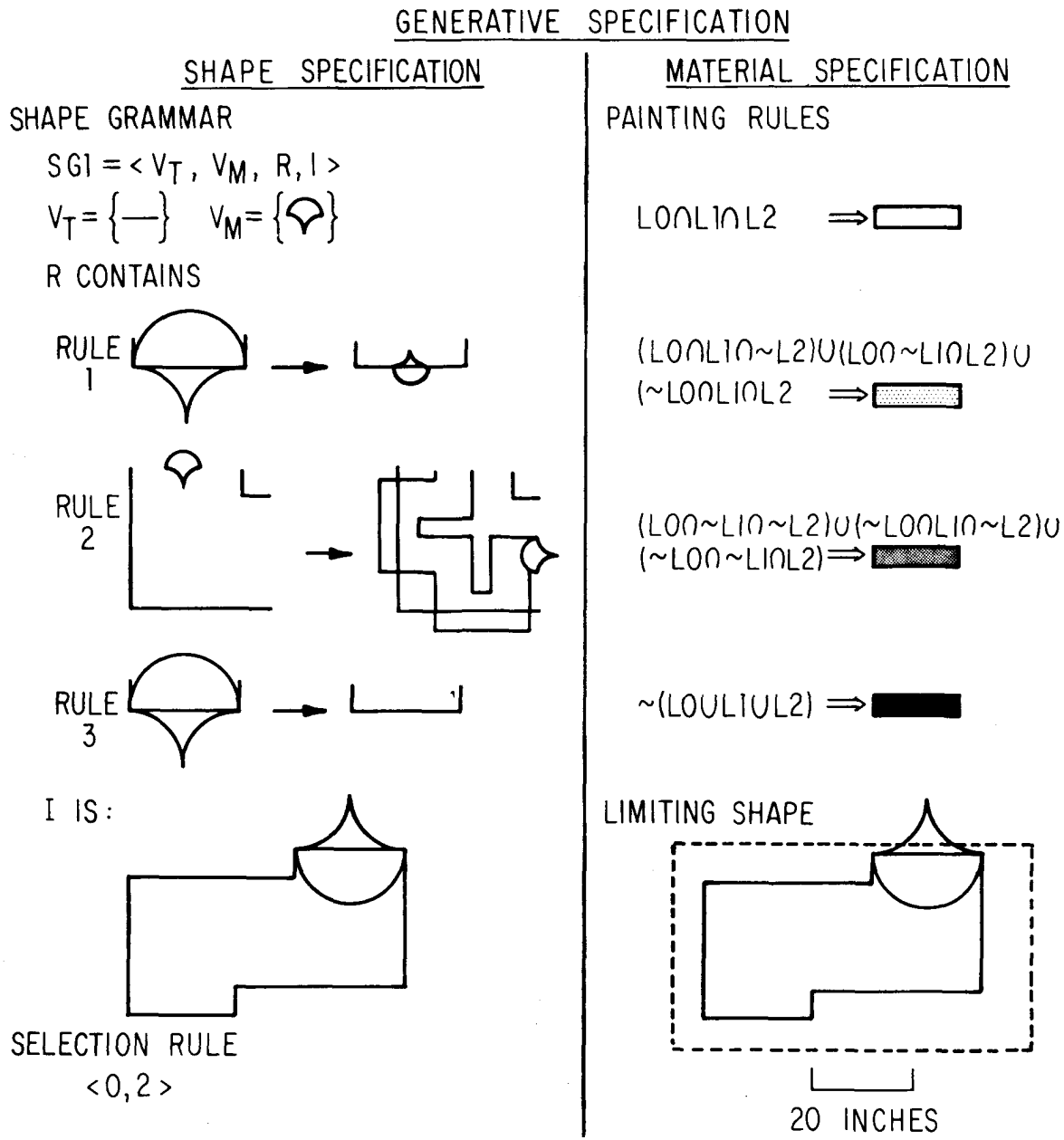
Such tricks hath strong imagination,
That if it would but apprehend some joy,
It comprehends some bringer of that joy;
Or in the night, imagining some fear,
How easy is a bush supposed a bear!

A Midsummer Night's Dream
William Shakespeare (1594-1596)

Nor do lineaments have anything to do with material.



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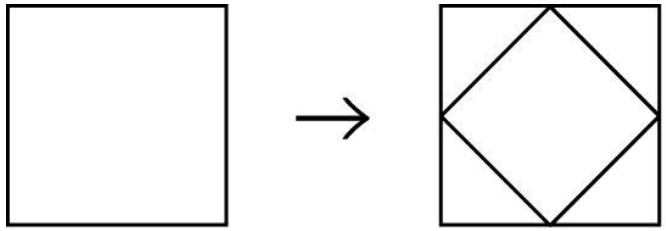
Shapes, symbols, and rules – embedding vs identity.

Seeing shapes

this → that

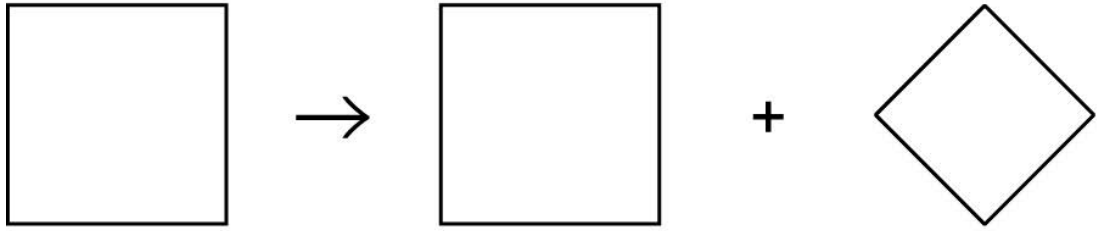
Embedding: dimension i ≥ 0.



Coding with symbols

description of this → description of that

Identity is a special case of embedding: dimension i = 0.

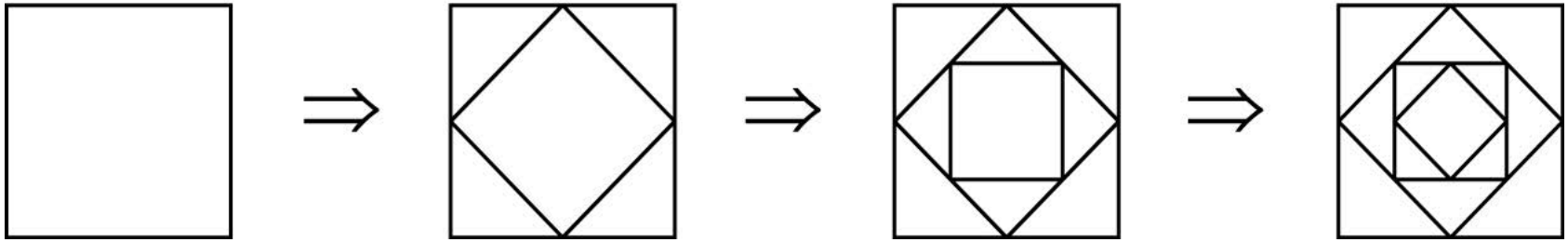


$square_1$

four lines, etc.

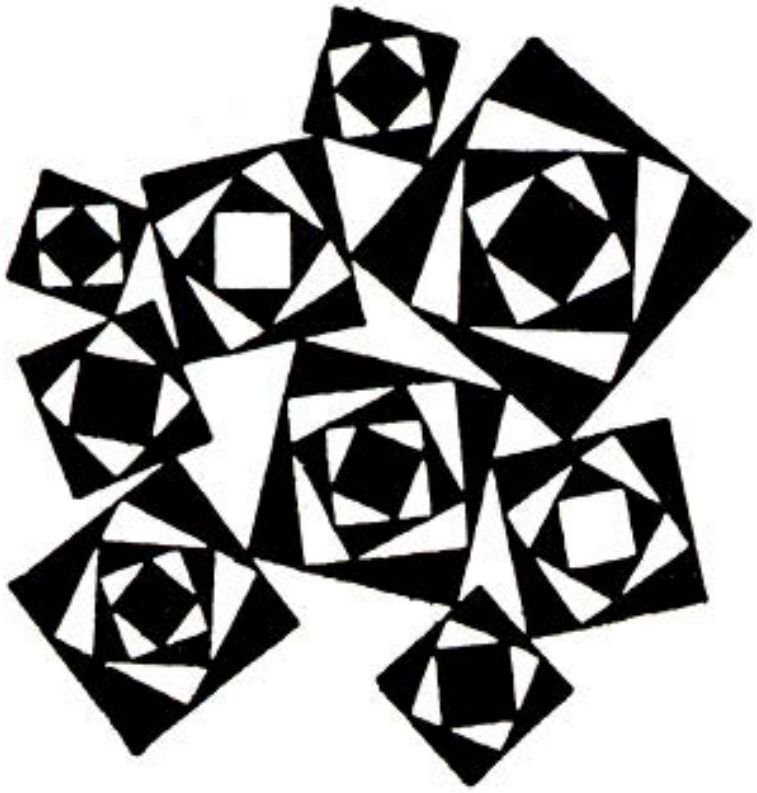
$square_1 + square_2$

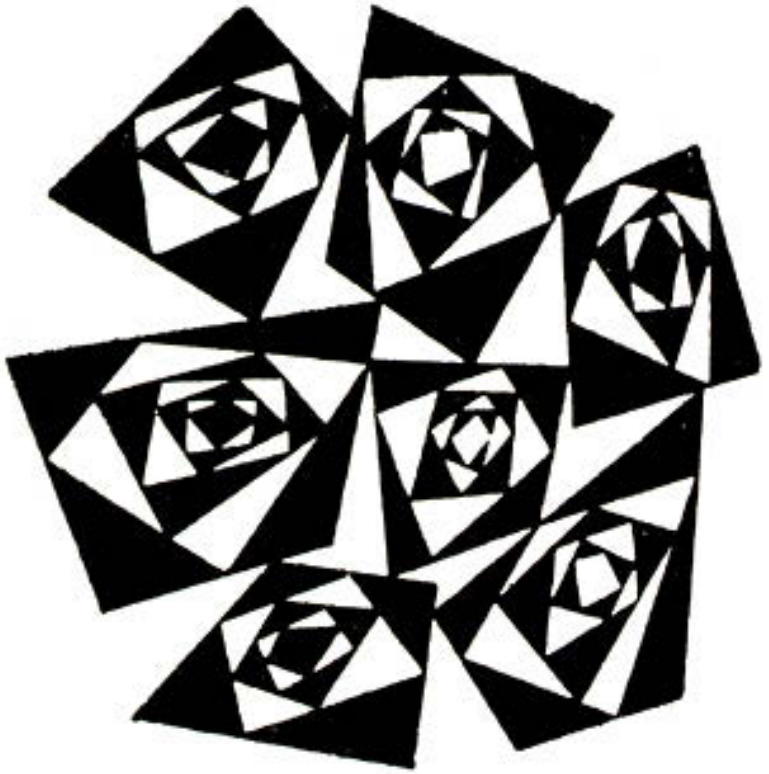
$square_2 = (\sqrt{2}/2)\ square_1$ rotated 45°



Shapes are like landscapes; they overgrow any plan.*
How easy is a bush supposed a bear!

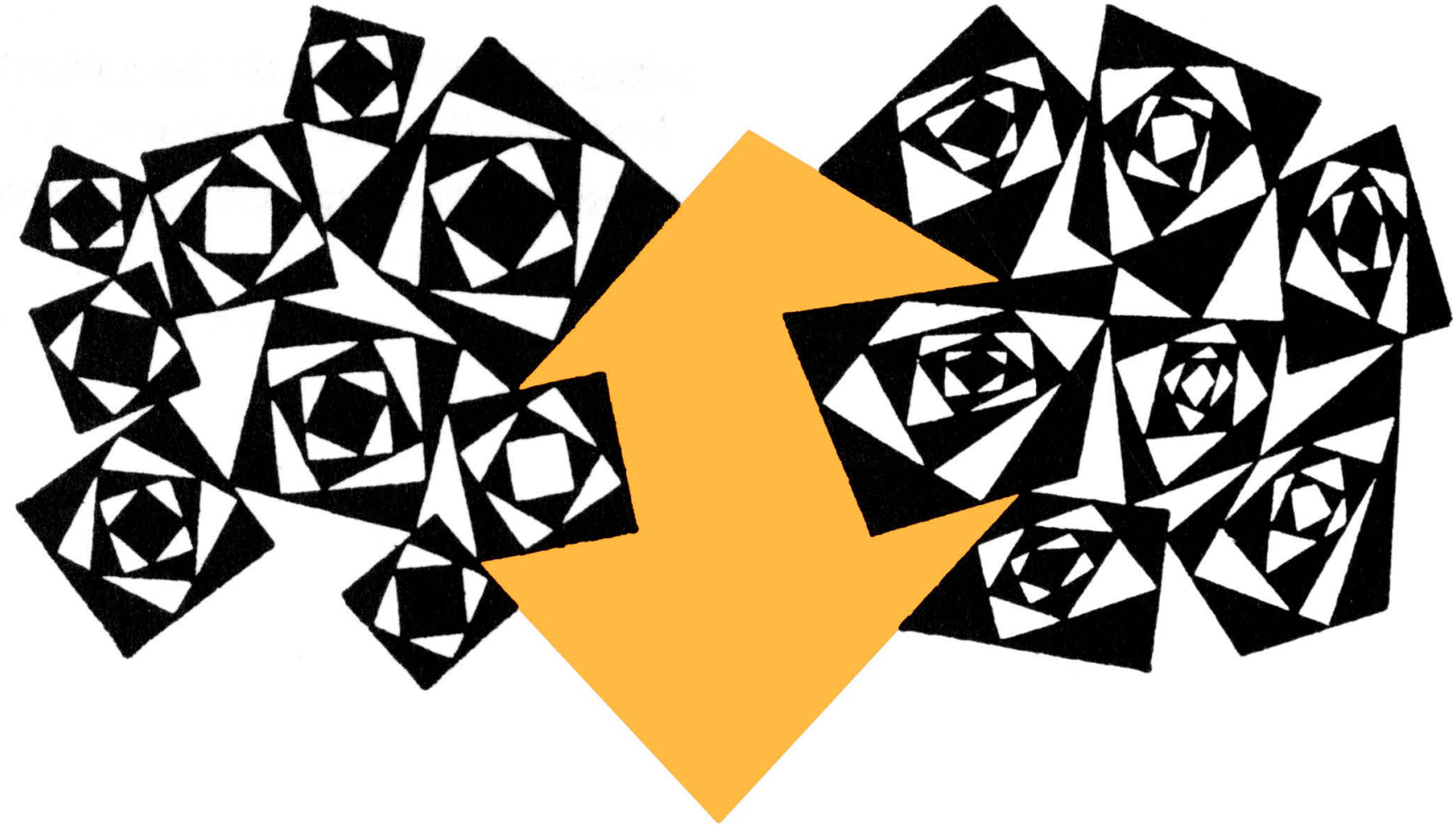
Squares and quadrilaterals, and surprises – triangles, chevrons,
a double arrow, a bigger square, and more and more.



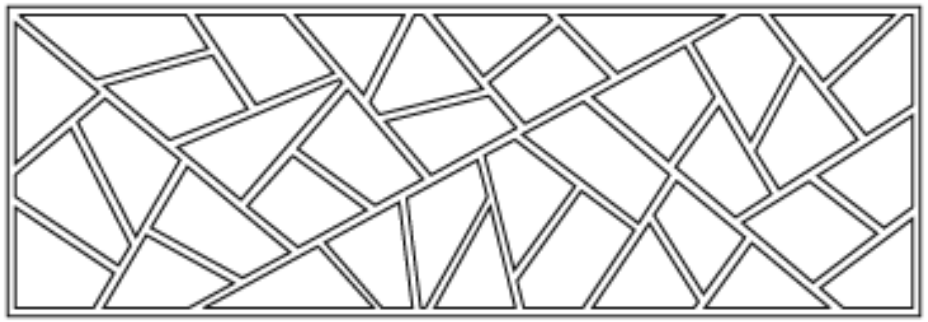


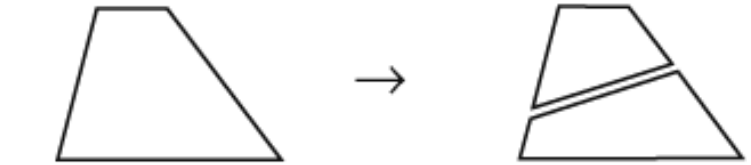
*This adds to Edmund Burke's description of gardens – things change inevitably to escape the discipline and fetters of designers (architects). Burke's sublime tests intention, and exceeds it in everything I see.

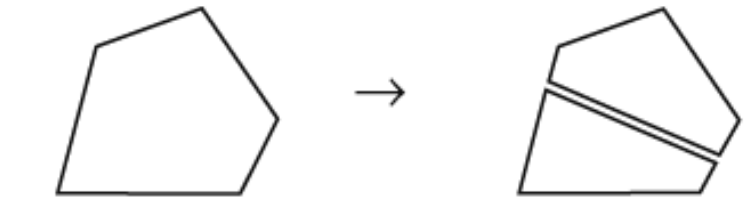
The negative is just as important as the positive.*

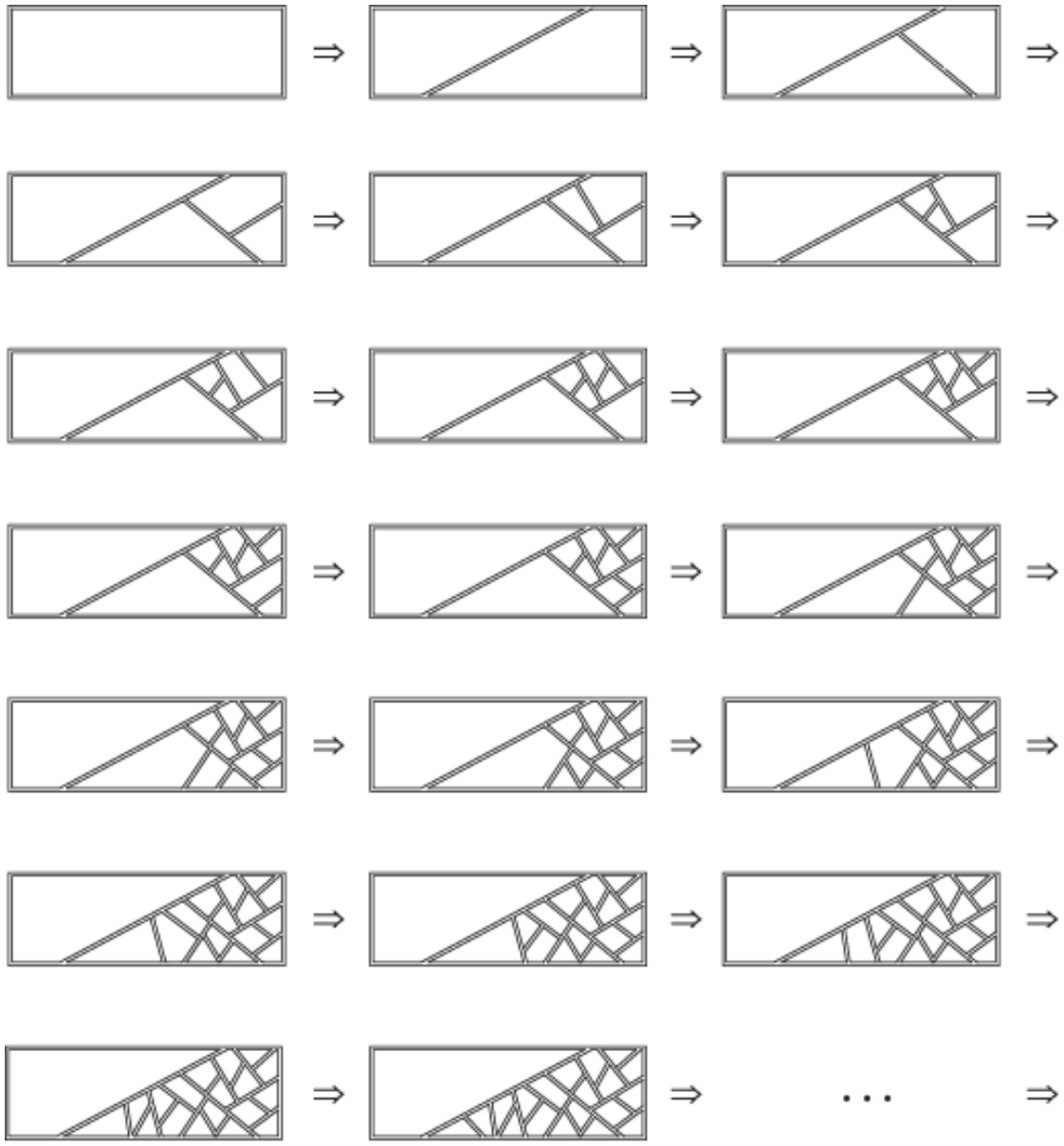


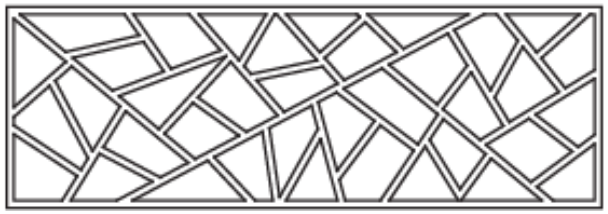
*There are black and white areas for squares and quadrilaterals, and there's the double arrow. This is all about seeing. Kelly agrees – "In my paintings I'm not inventing; my ideas come from constantly investigating how things look."

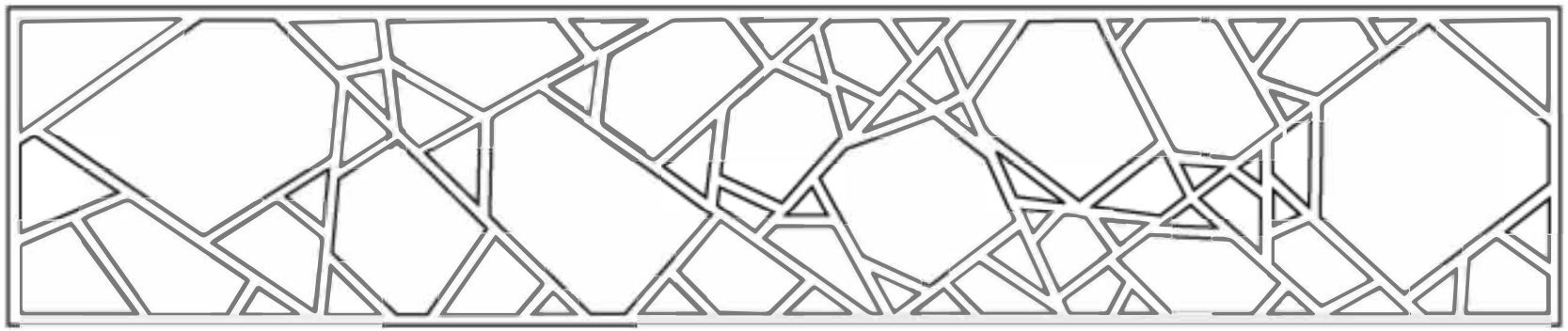


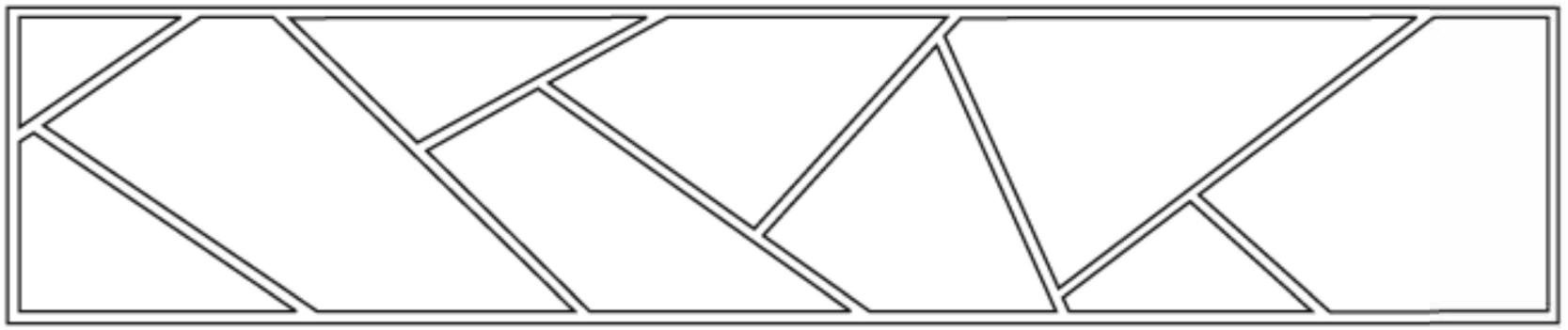


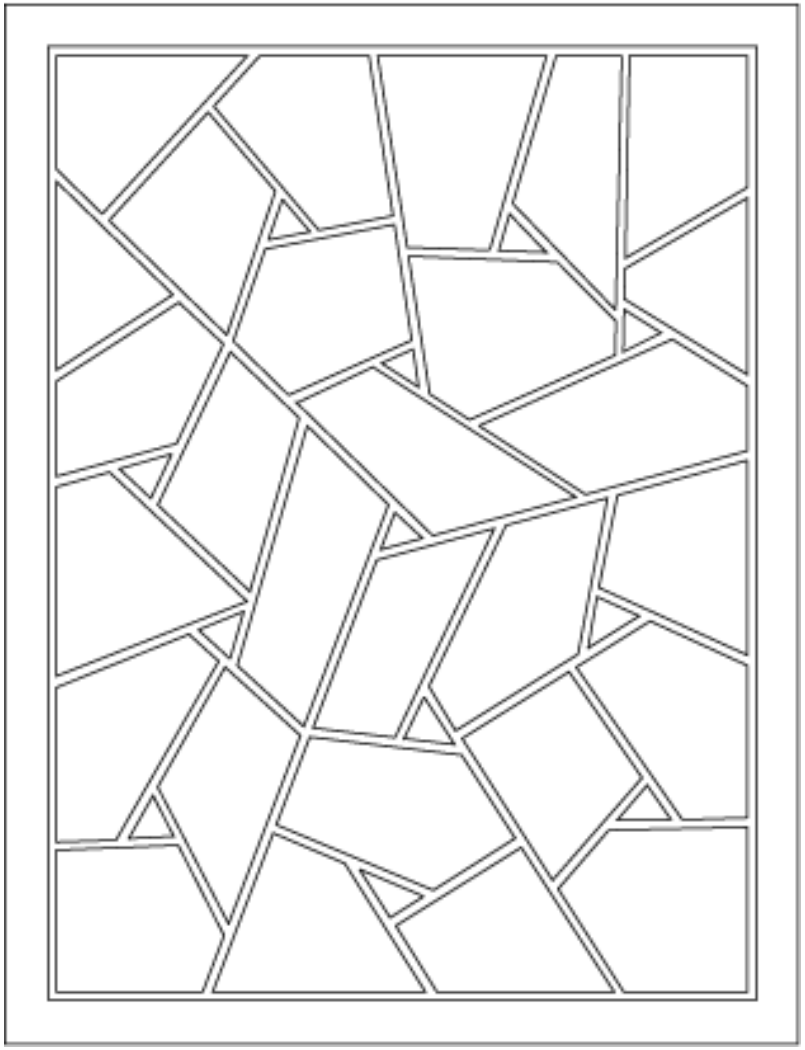


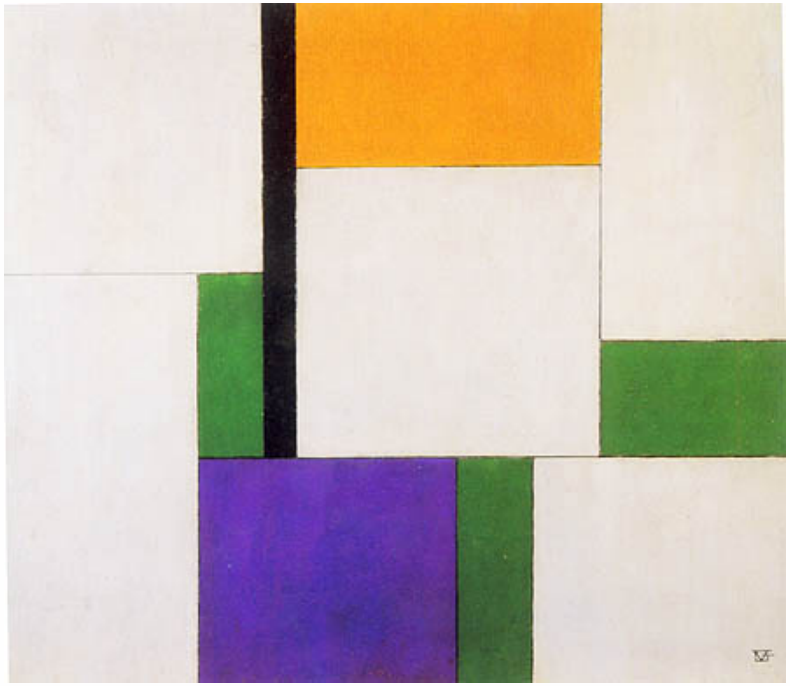












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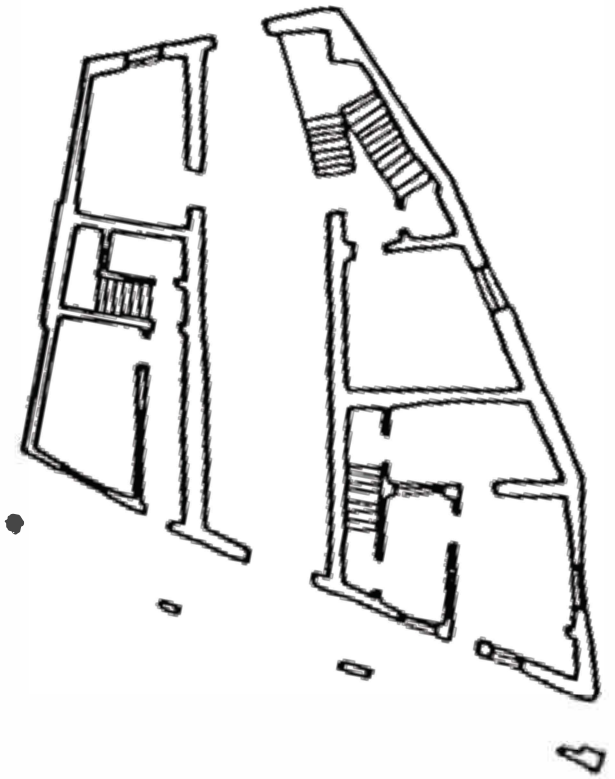

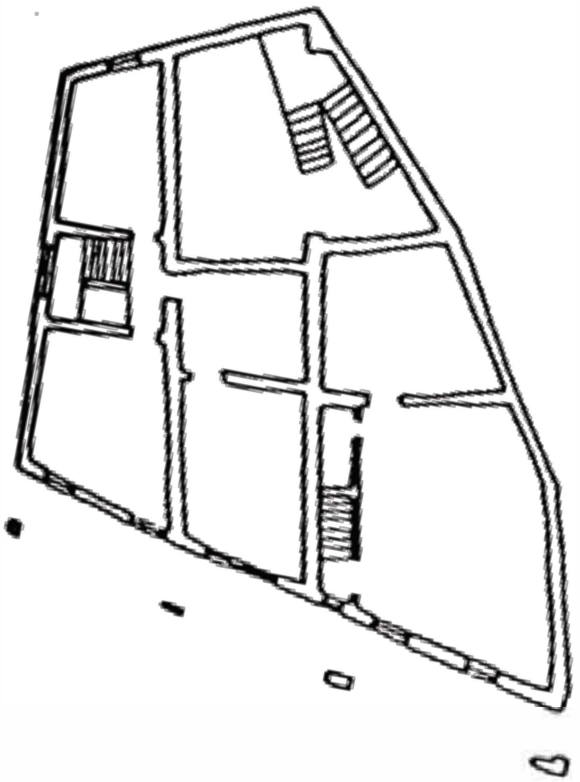

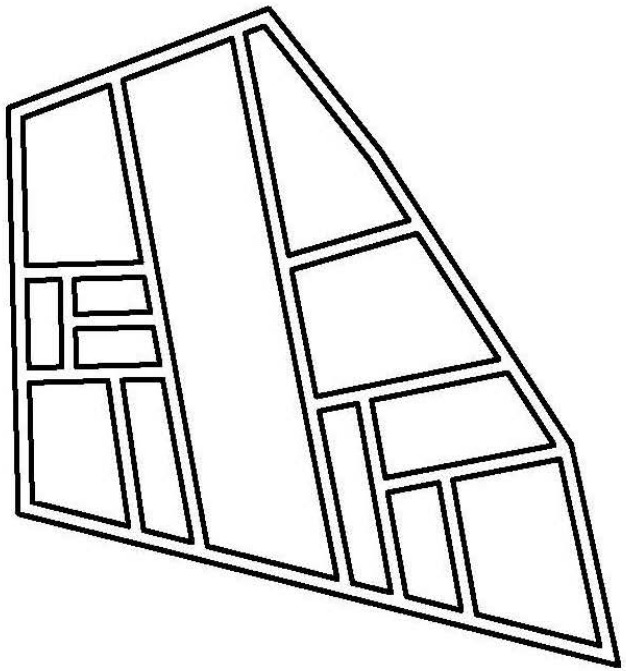

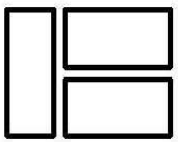

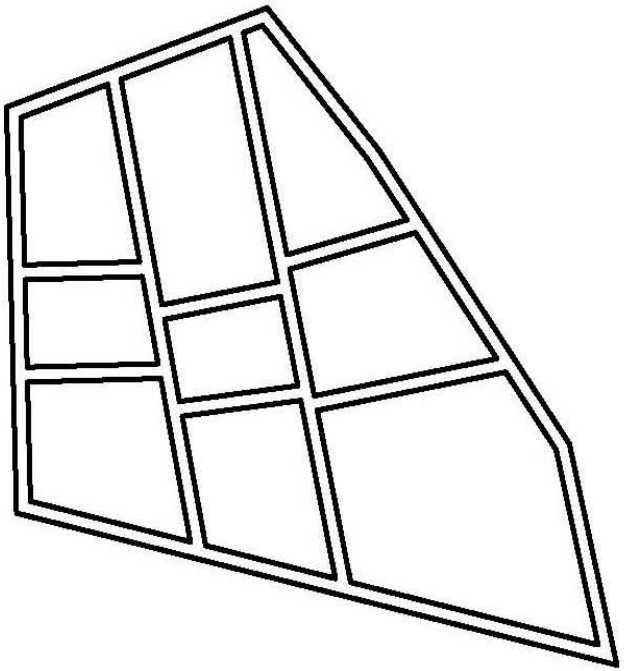

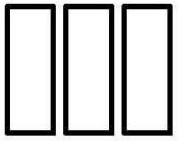

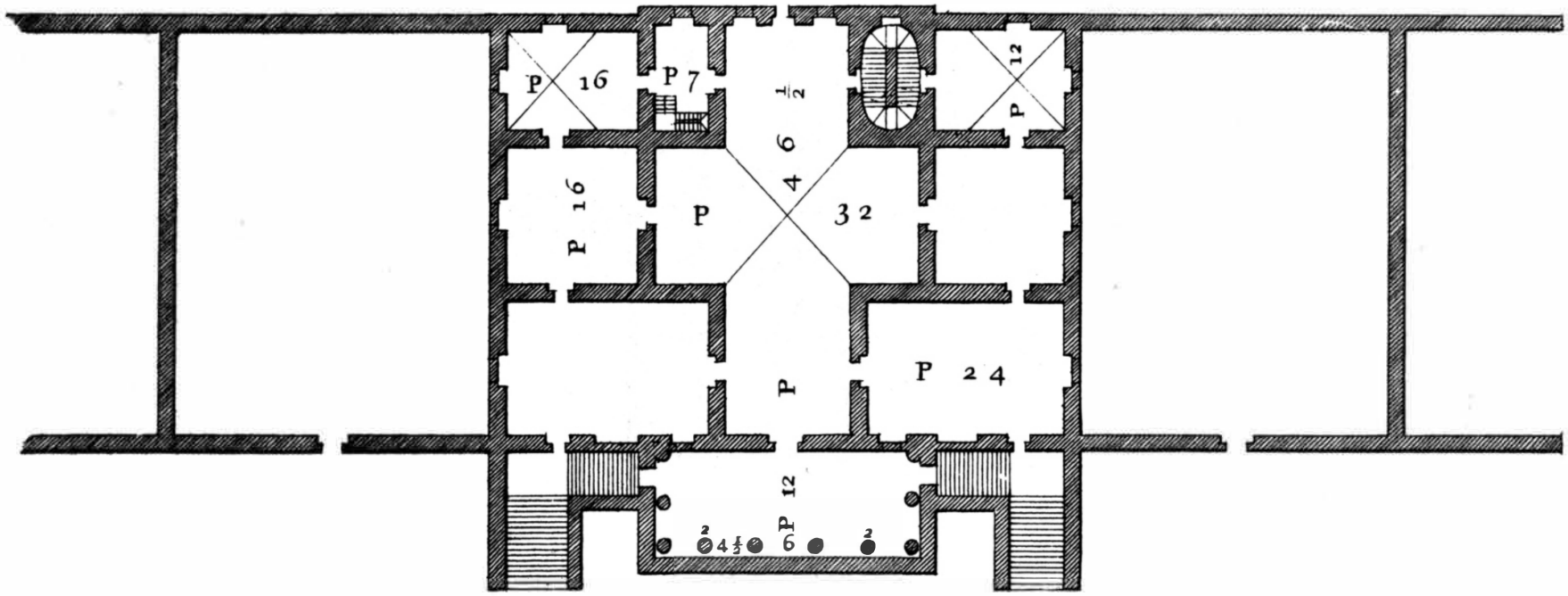

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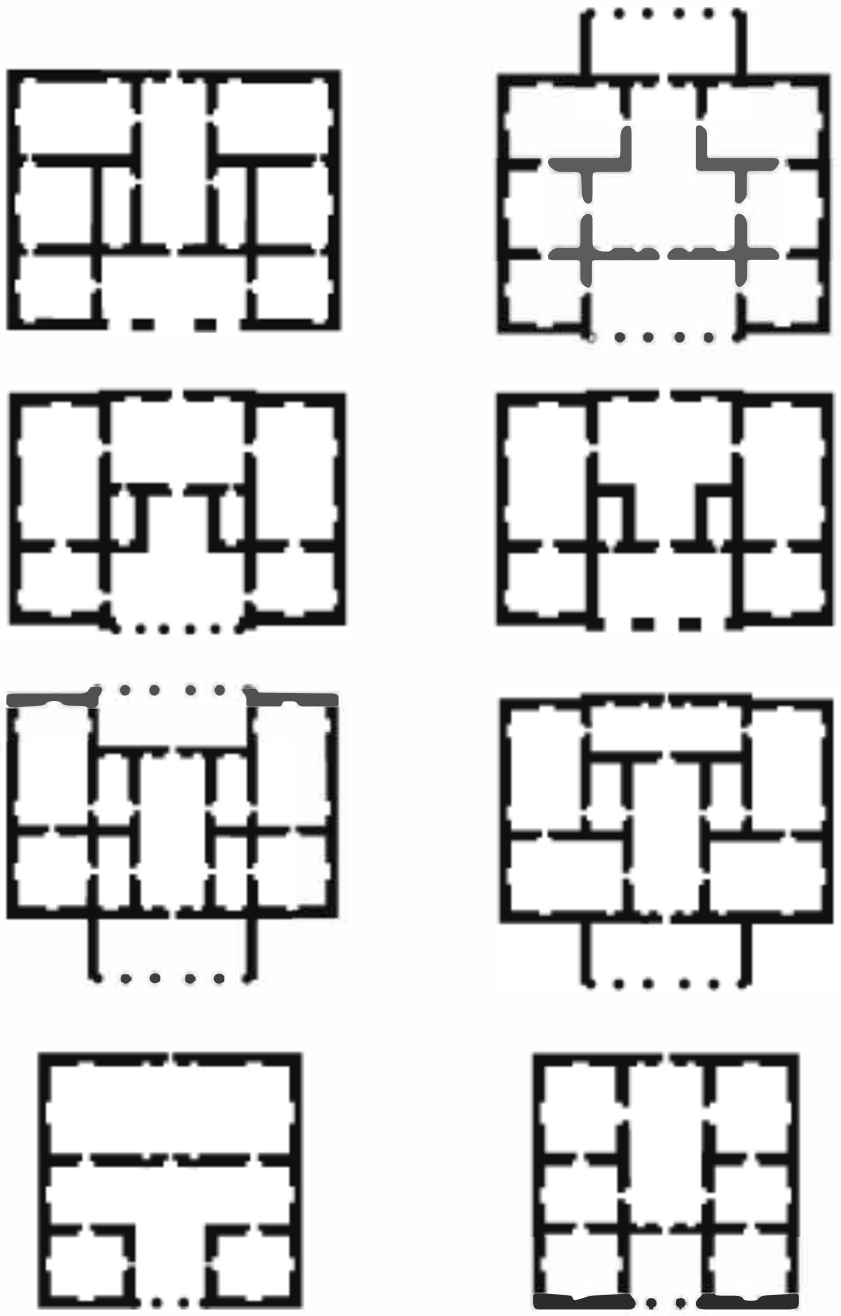

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How hard is it to divide and to compose lines and angles (spatial relations)?

All the power of invention, all the skill and experience in the art of building, are called upon in compartition; compartition alone divides up the whole building into the parts by which it is articulated, and integrates its every part by composing all the lines and angles into a single, harmonious work that respects utility, dignity, and delight. If (as the philosophers maintain) the city is like some large house, and the house is in turn like some small city, cannot the various parts of the house – atria, *xysti*, dining rooms, porticoes, and so on – be considered miniature buildings?

On the Art of Building in Ten Books
Leon Batista Alberti (1452)

All the power of invention is in schemas for seeing and doing.

Schemas are sets of rules – and good heuristics. Primary schemas

the *part* schema: $x \rightarrow prt(x)$

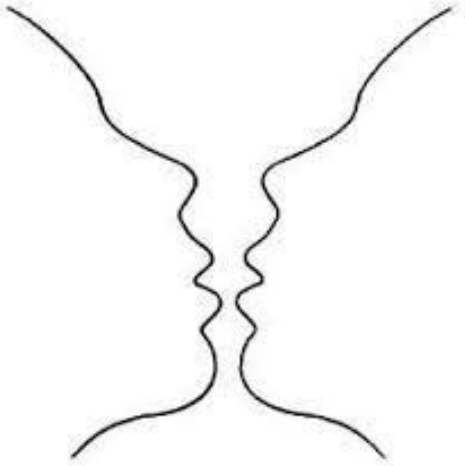
the *transformation* schema: $x \rightarrow t(x)$

the *boundary* schema: $x \rightarrow b(x)$

imply others, with subsets, copies, inverses, adding, composition, and Boolean expressions. Variables are assigned shapes as values to define different rules. For example, adding the schema $x \rightarrow x$ for identities that's a subset of the schema $x \rightarrow prt(x)$ for parts, and the inverse of the schema $x \rightarrow b(x)$ for boundaries gives the coloring book schema

$$x \rightarrow x + b^{-1}(x)$$

that fills in areas like the double arrow and keeps their outlines. Walls (poché) and rooms (spaces) in Palladio's villa plans are distinguished for alternate values of the variable x, as are black and white areas in inscribed squares, and sticks and openings in ice-ray designs. This is key in figure-ground reversals.



New ways to look at things – strange surprises.

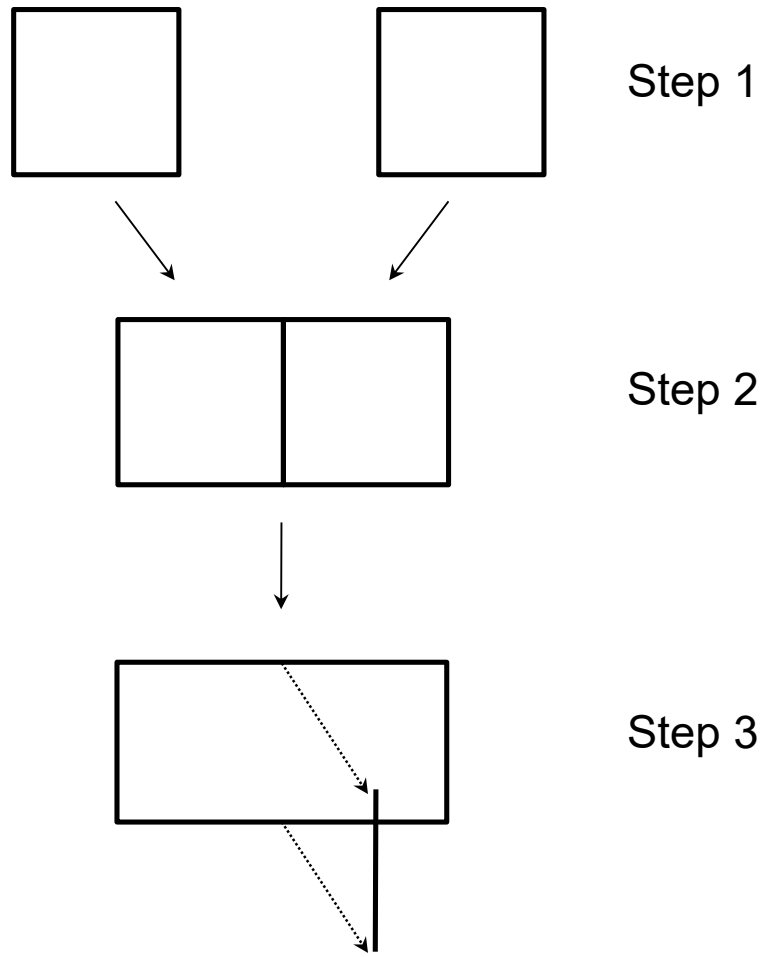
Ambiguity, emergence, epiphany, eureka (aha) moments, figuration, flexible purposing, impression, impulse, insight, intuition, invention, irony, negative capability, new perception, privileged moments, re-description, strong imagination, vitality.

My schemas describe rules, but aren't reductionist. Descriptions vary freely as I try rules, and disappear. Shapes fuse – what I do now needn't be what I see next. I can always go on, improvising anyway I please.

If this happens once, it must happen all the time – otherwise, it's a mystery. There's insight whenever I try a rule!

My perspective changes every time I try a rule.

Current systems are not only remarkably inflexible, but tend to hang on to ontological commitments more than is necessary. Thus consider this sequence of computer drawings. Suppose that the figure in step 2 was created by first drawing a [unit] square, then duplicating it, as suggested in step 1, and then placing the second square so as to superimpose its left edge on the right edge of the first one [$x \rightarrow x + t(x)$]. If you or I were to draw this, we could coherently say: now let us take out the middle vertical line, and leave a rectangle with a 2:1 aspect ratio [$x \rightarrow prt(x)$], as suggested in step 3 [cf. Wittgenstein]. But only recently have we begun to know how to build systems [with insight] that support these kinds of multiple perspectives on a single situation (even multiple perspectives of much the same kind, let alone perspectives in different, or even incommensurable, conceptual schemes).



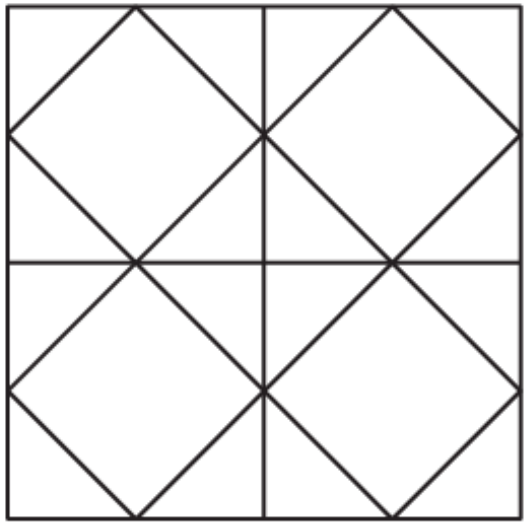
On the Origin of Objects
Brian Cantwell Smith (1998)
Computer Scientist/Philosopher/Dean

Improvisation by parts.
Wholes and parts vs building block structures.

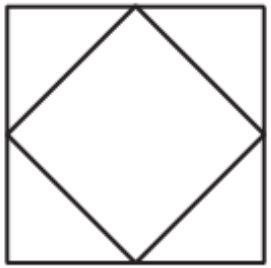
Does $x \rightarrow y + t_1(y) + t_2(y) + t_2t_1(y)$ imply $f(n+1) = 4n$, for $y = x$?

What happens for $0 \leq y < x$, and when $x \rightarrow \Sigma t(prt(x))$?

f(2) = 16 < 28

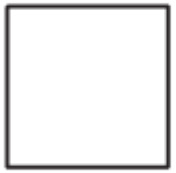


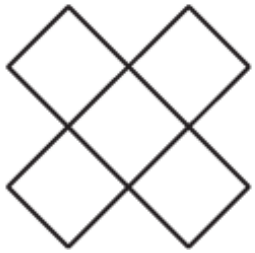
f(1) = 4

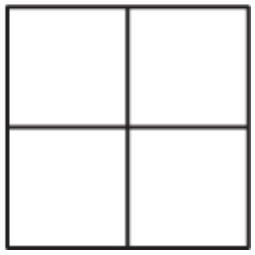


f(0) = 1

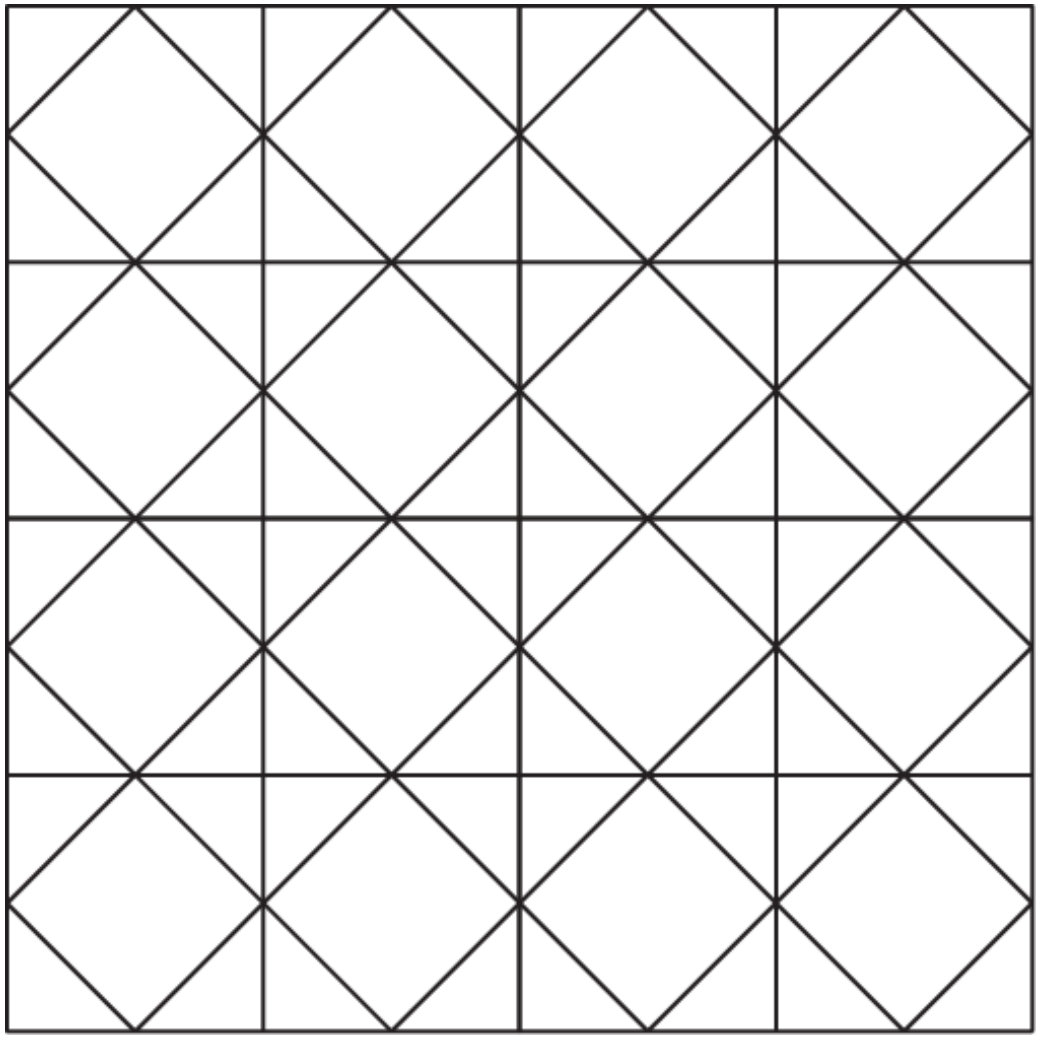
unit triangle



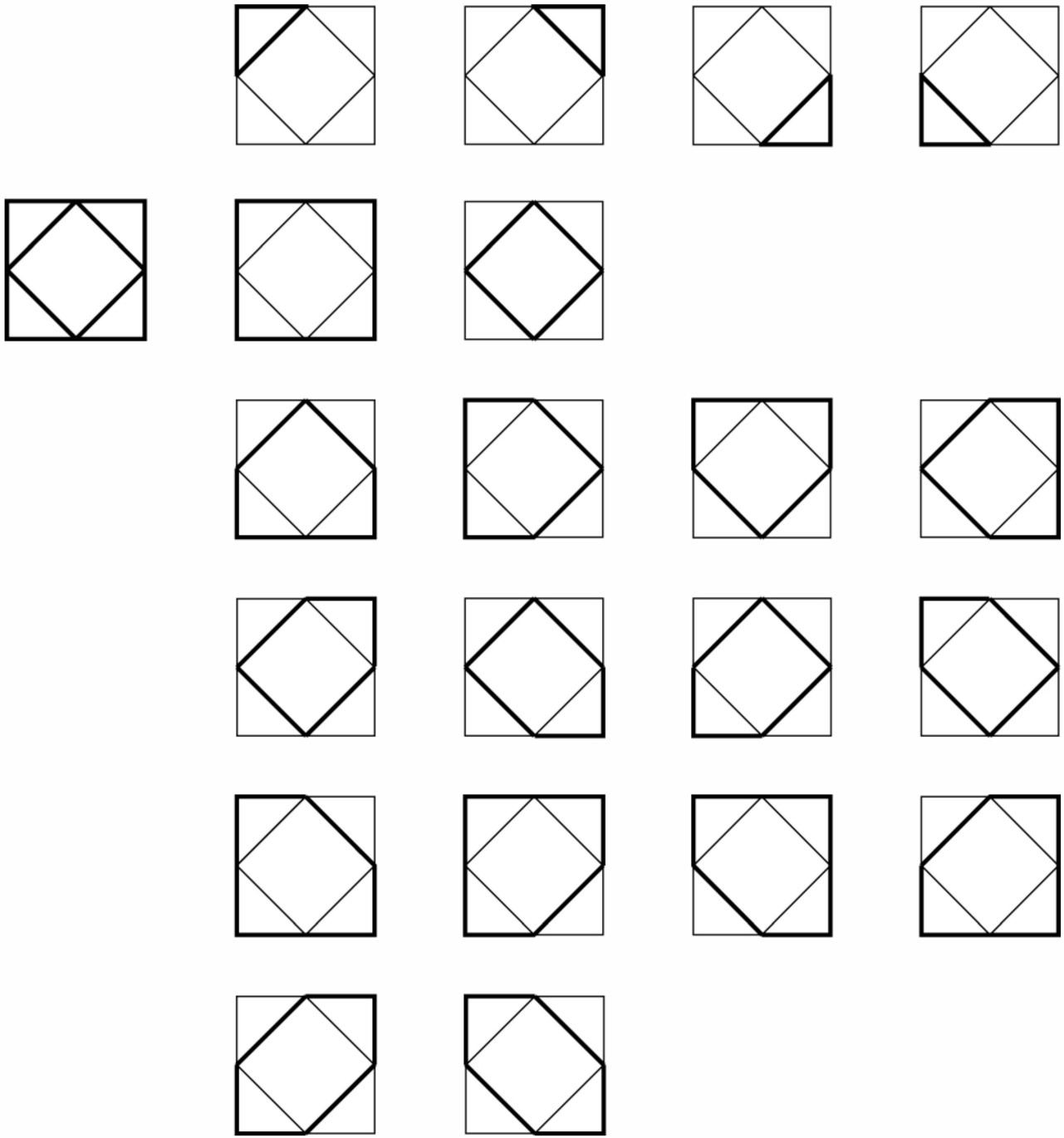




Many rules rely on the schema $x \rightarrow \Sigma t(prt(x))$.
What does this mean for art and design education?

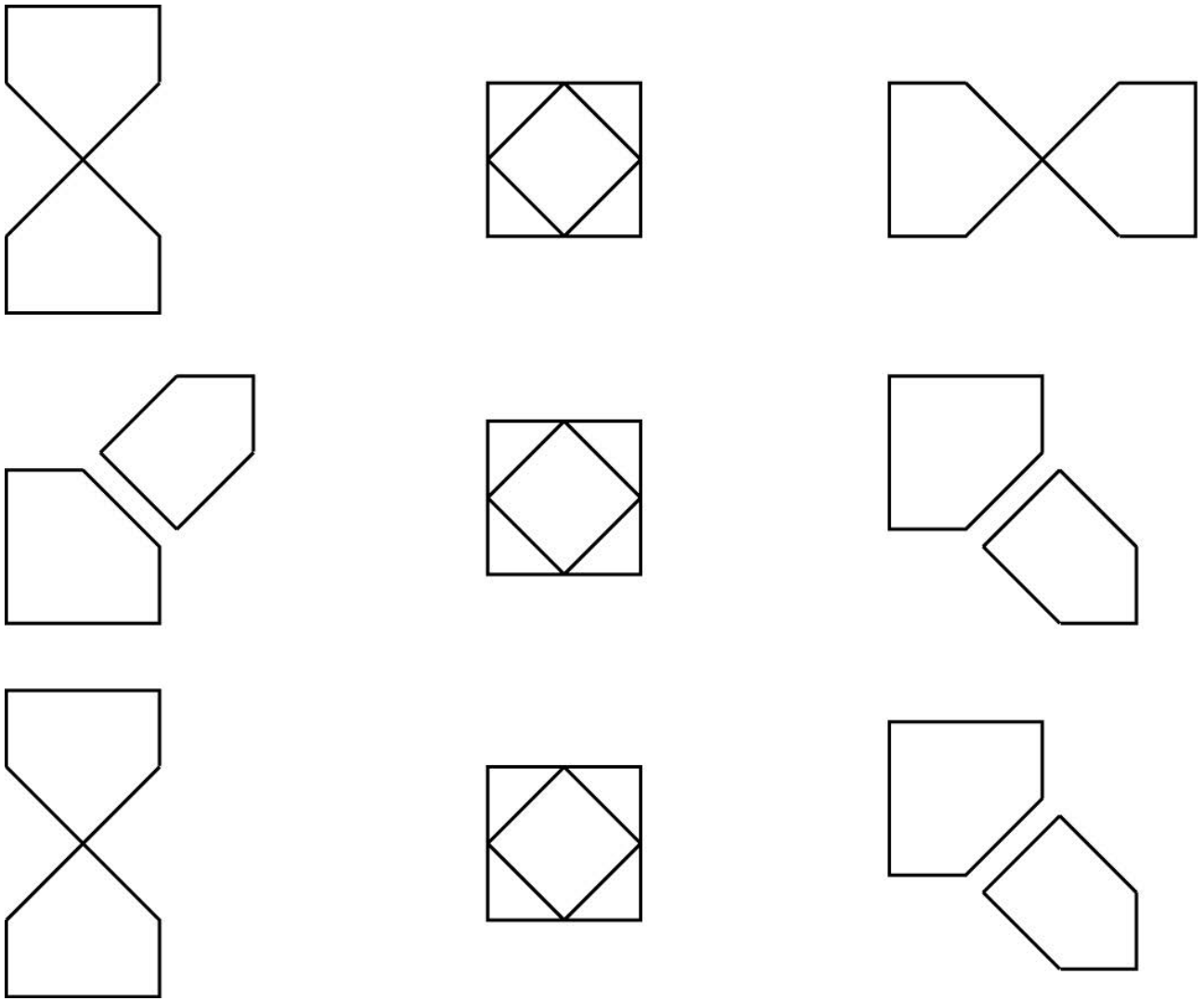


f(3) = 64 << 212

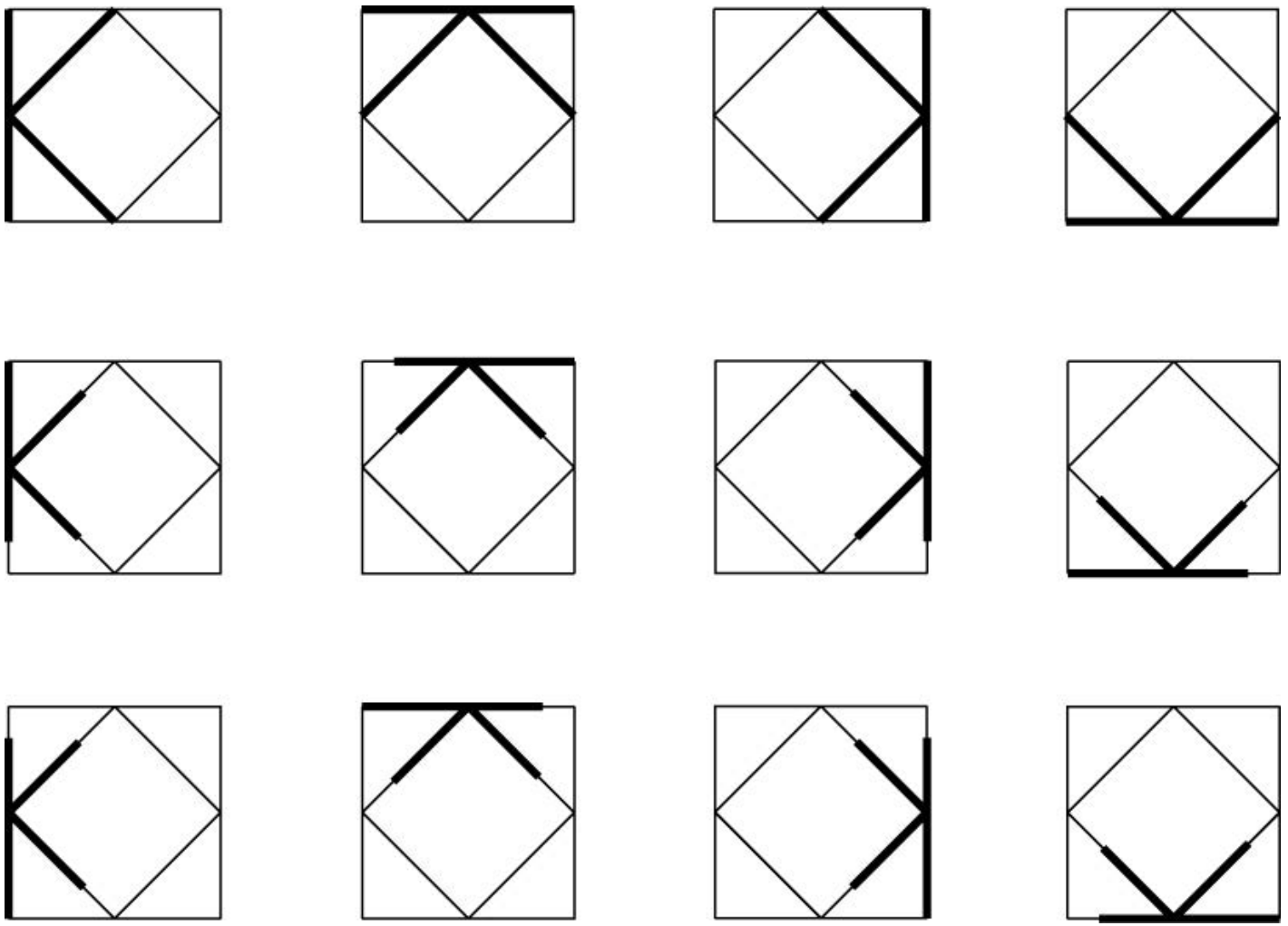


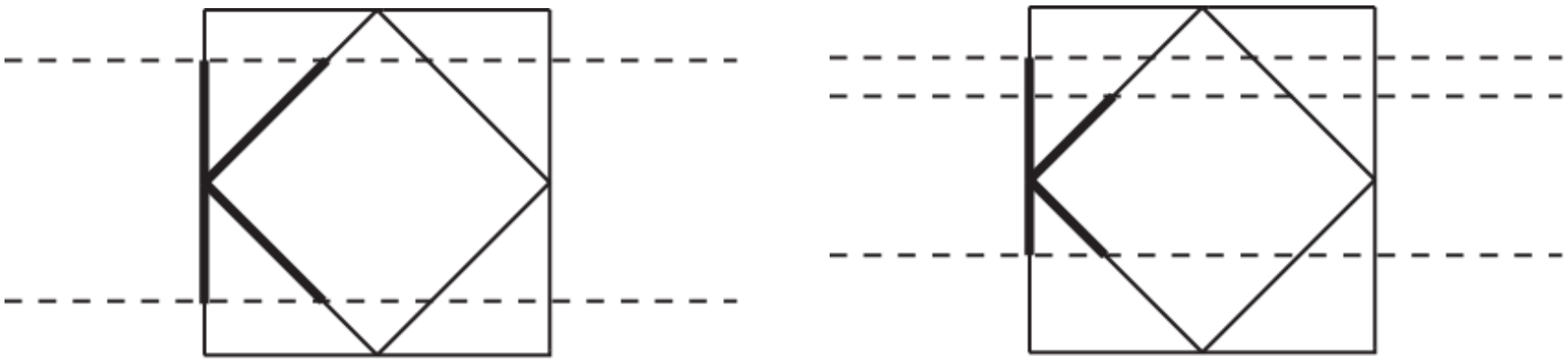
Translation isn't rotation – try the schema x $\rightarrow$ t(x) and see.

Rules may not predict or control the insight I have,
but there's insight every time I try a rule.



Letters are easier than polygons – try K and k.





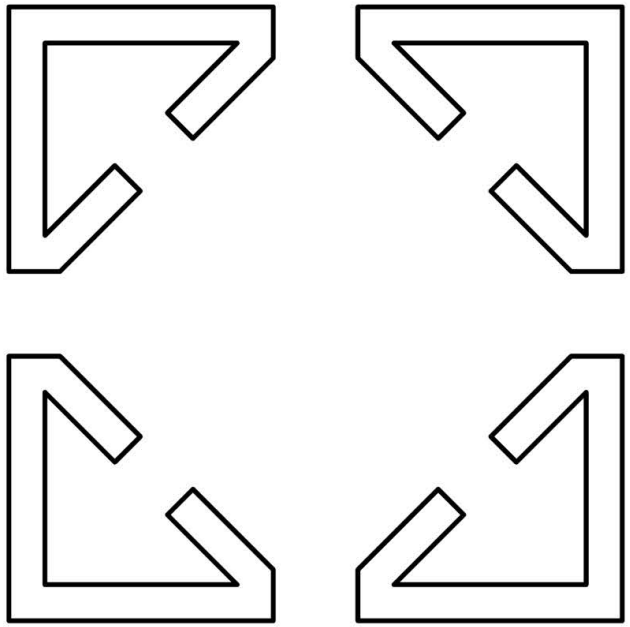
Freedom is a hard thing to preserve. In order to have enough, you must have too much. Nobody can draw the line in matters where [control] should begin or individual freedom leave off. We know you can divide men into two classes: one which is always trying to more and more control the conduct of its fellows, and the other class which is always trying to get more freedom.

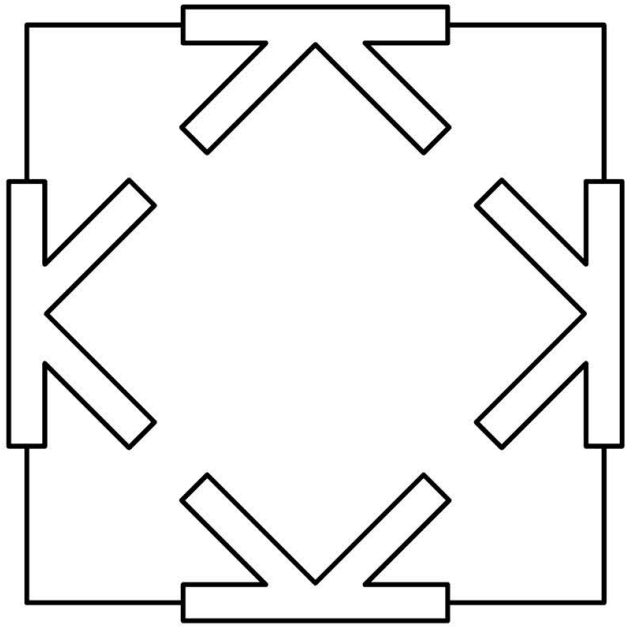
Clarence Darrow (1928)

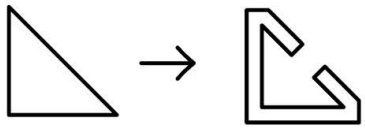
Is too much less than all there is?

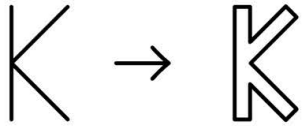
How hard is it to draw the line? What kind of folly is this?

Every parti is myriad designs – try triangles and K's
in a square inscribed in a square.

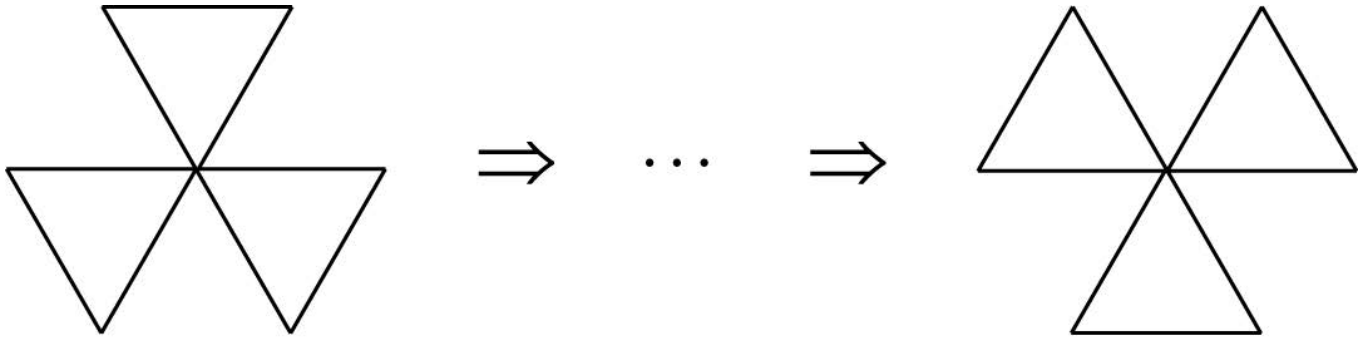


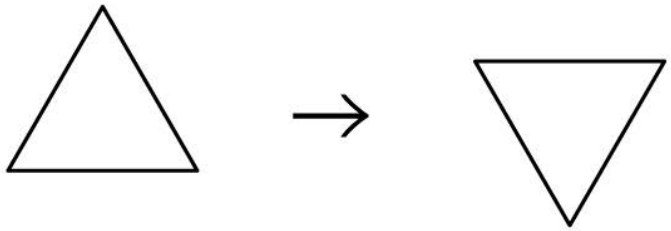


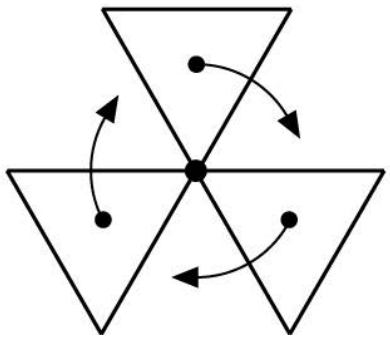




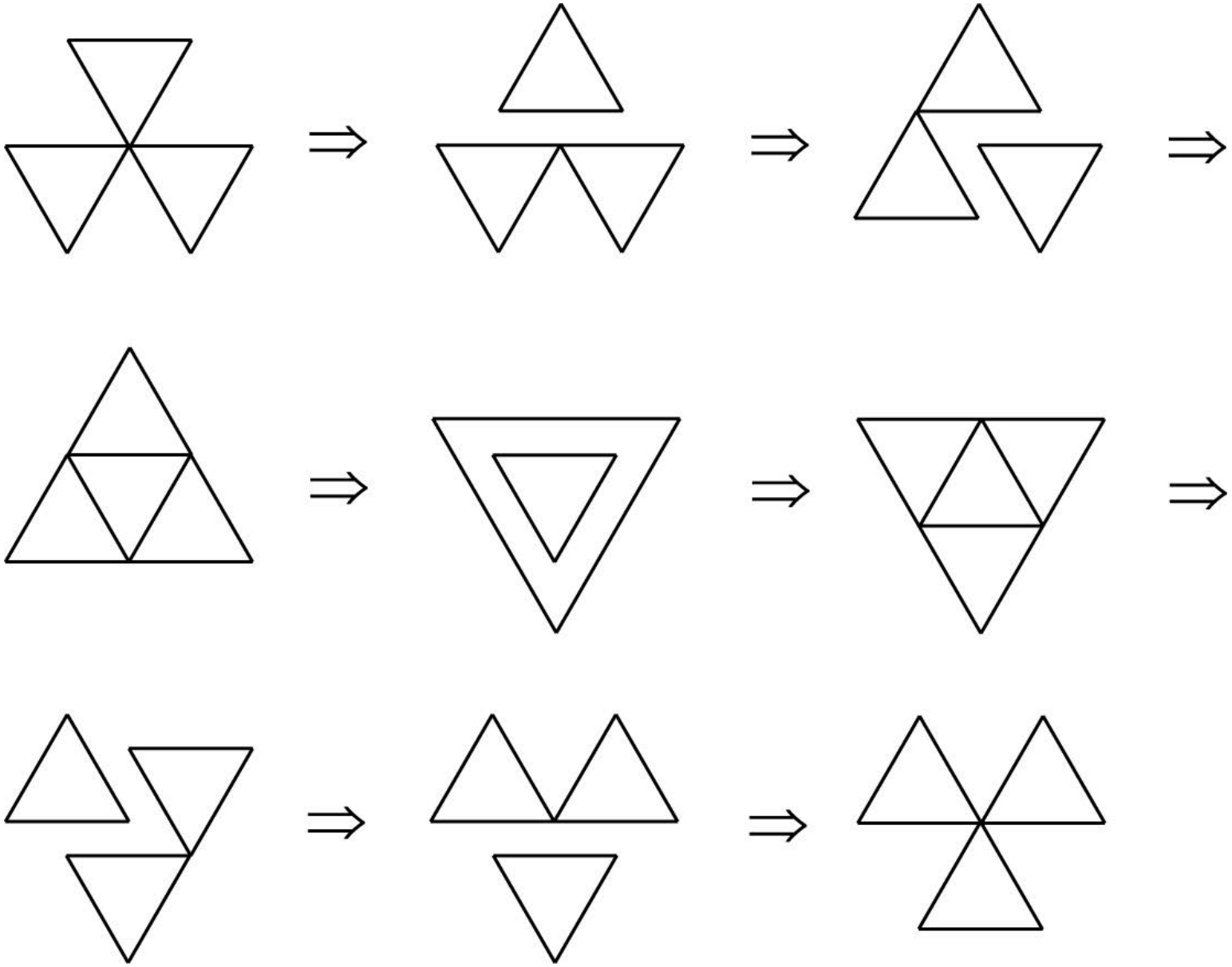
Centers don’t move – try the schema $x \to t(x)$ and see.





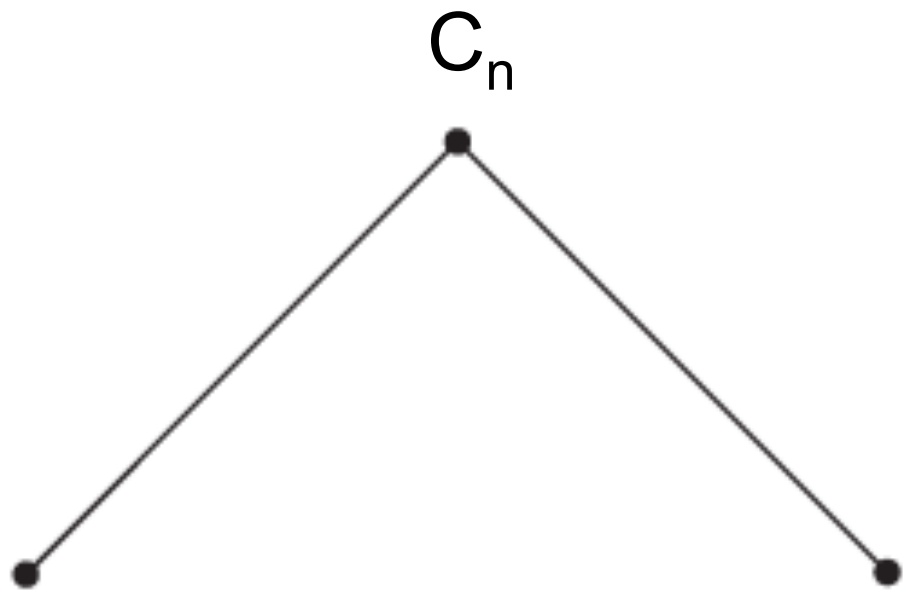


Shapes don’t have a memory – why parametric design is visually incomplete.

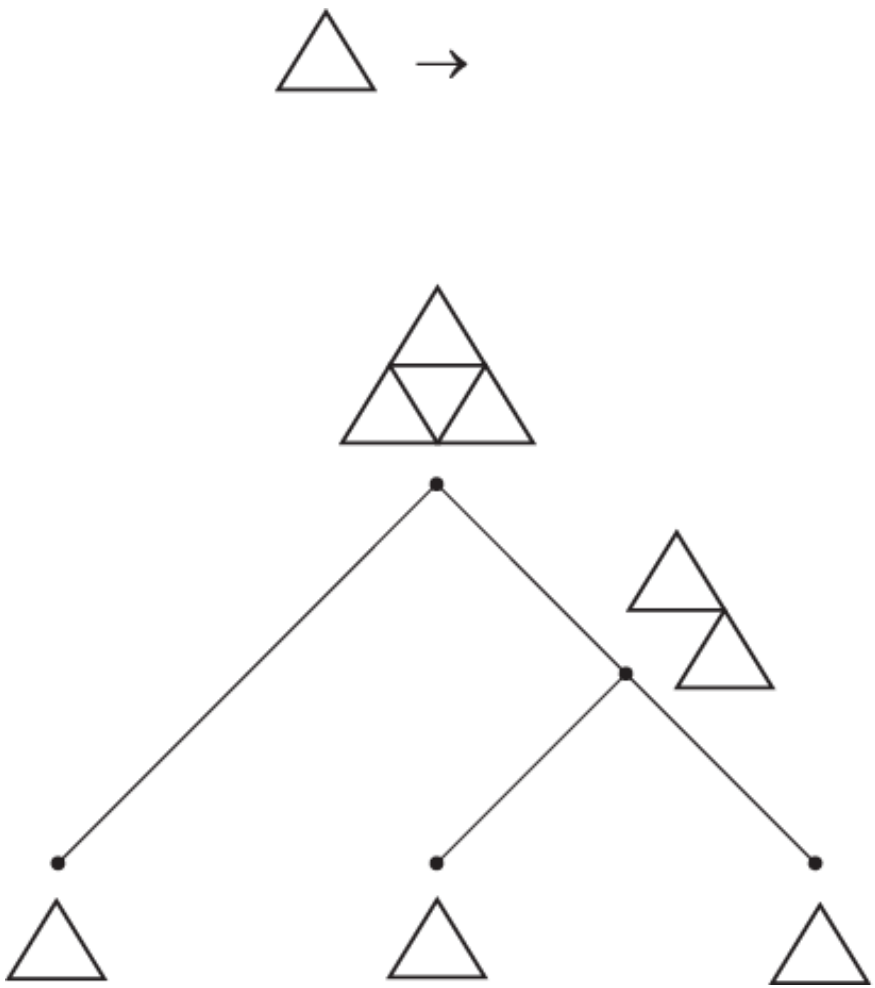


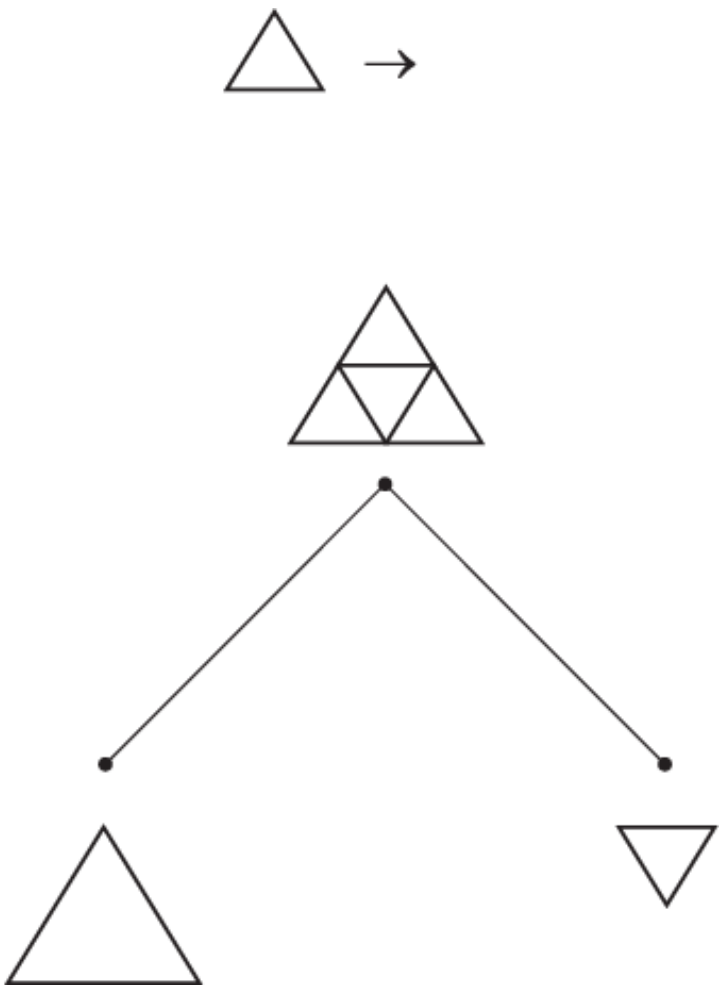
Recursive use of the part schema $x \rightarrow prt(x)$ to describe designs in trees.

Observation and understanding are hierarchical.

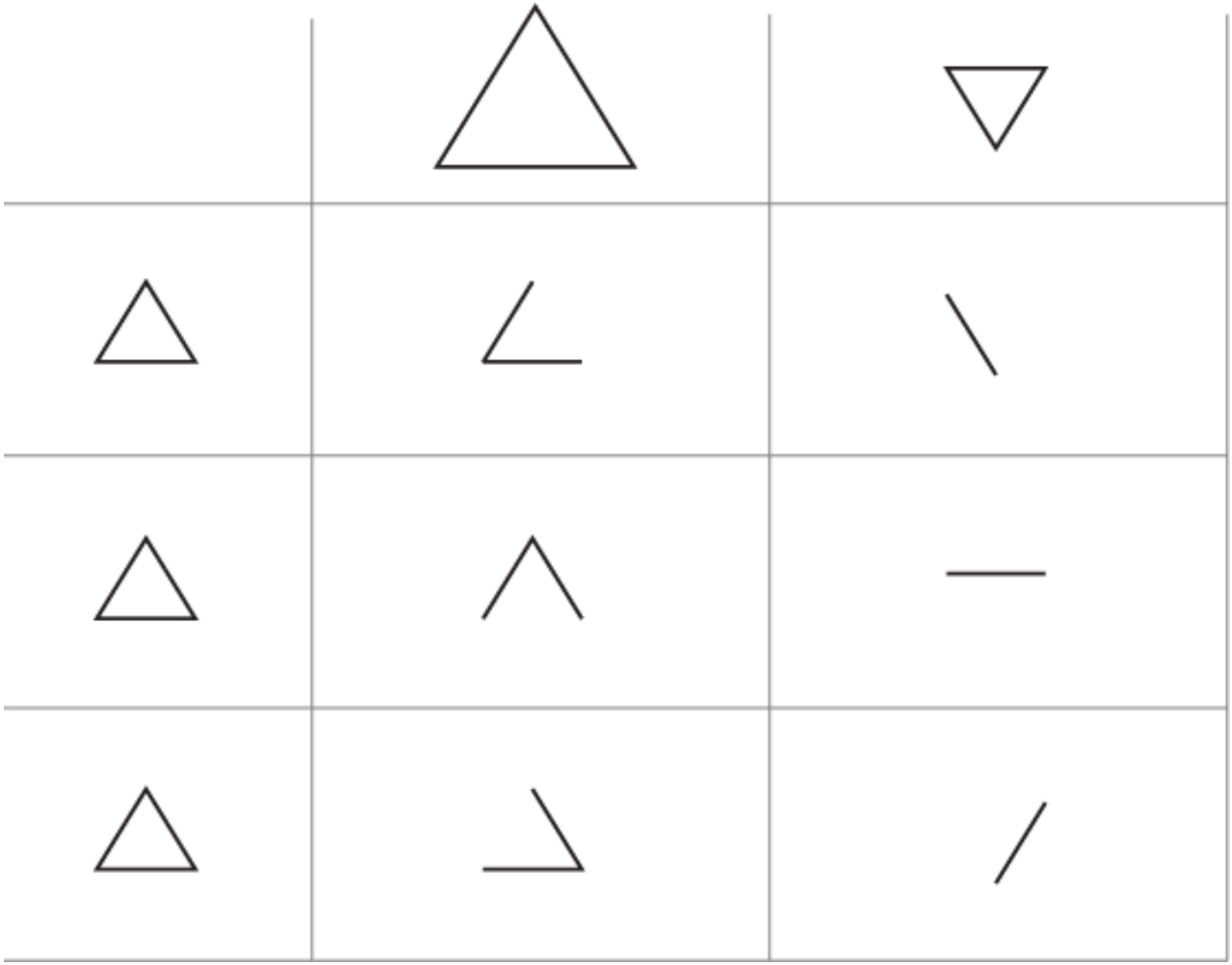


“Incommensurable” trees for an ambiguous design with a given vocabulary of triangles: 2 ≠ 3.

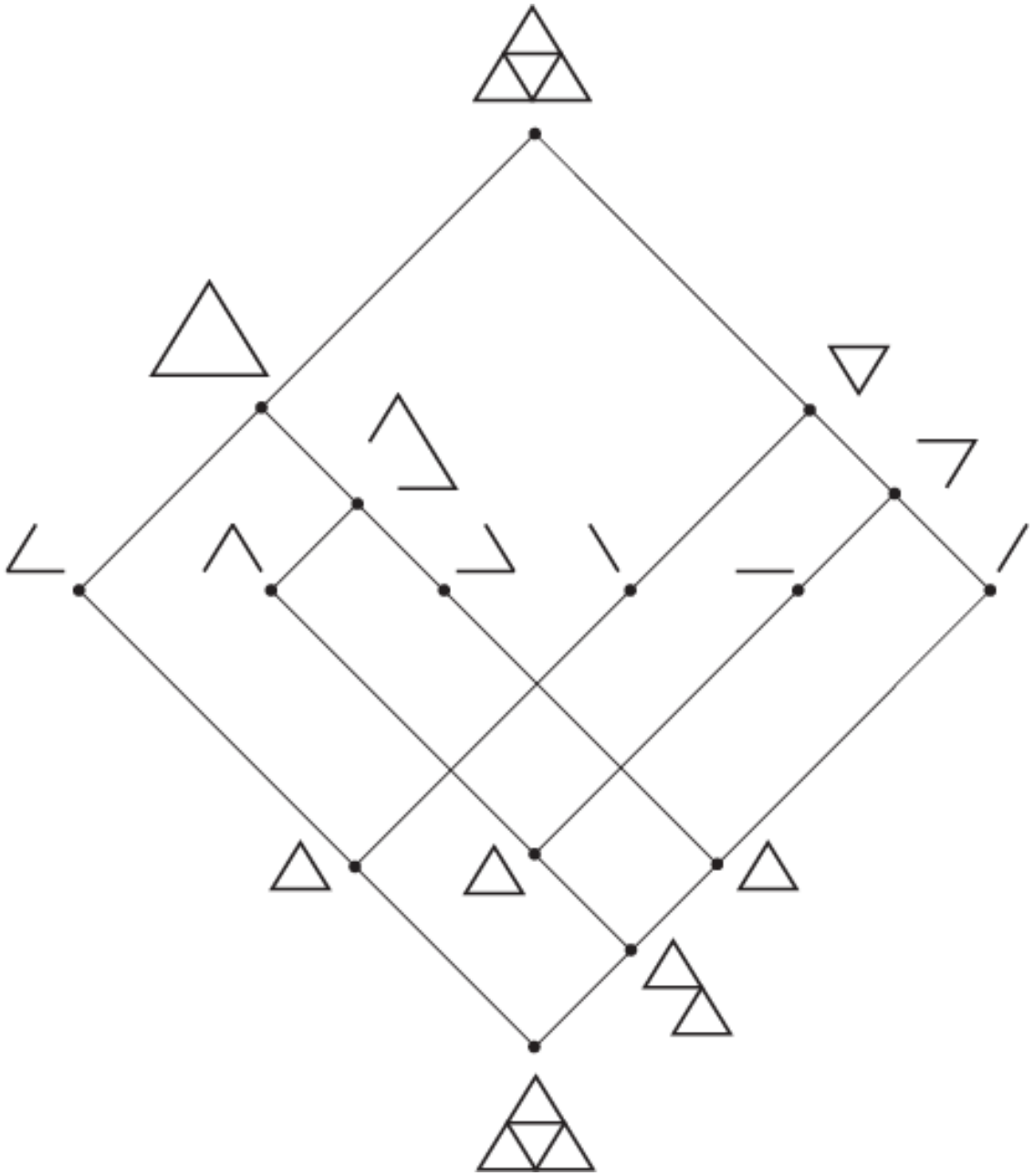




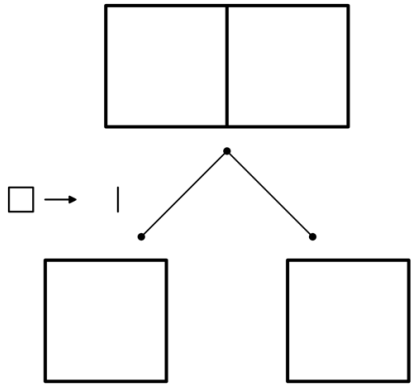
The schema $x + y \rightarrow x \cdot y$ merges trees in a vocabulary of parts – after the fact. What use is a vocabulary then?

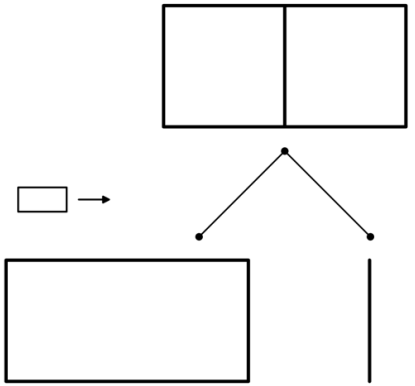


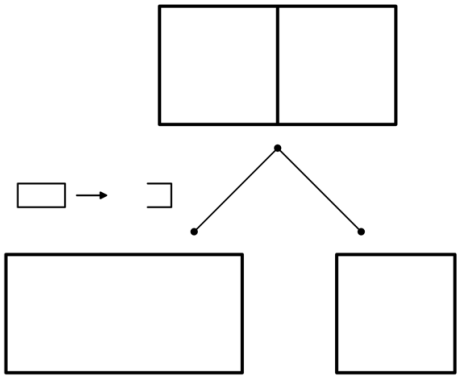
Insight vs observation and understanding.

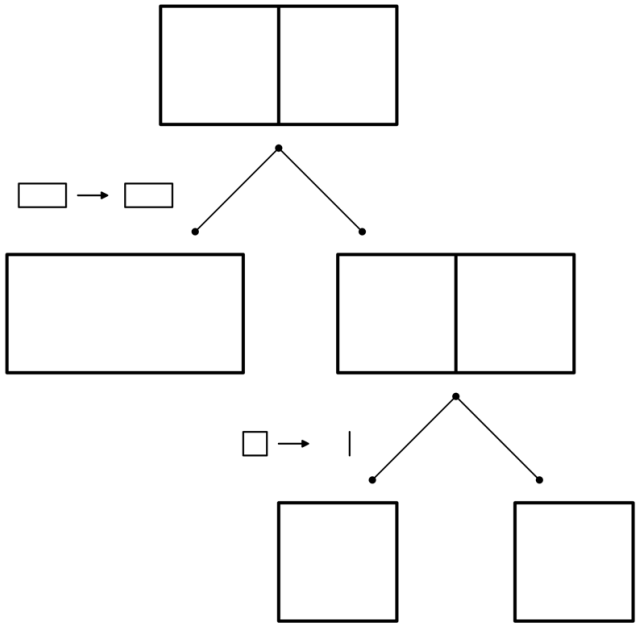


Overlapping parts: $0 \leq prt(x) \leq x$.

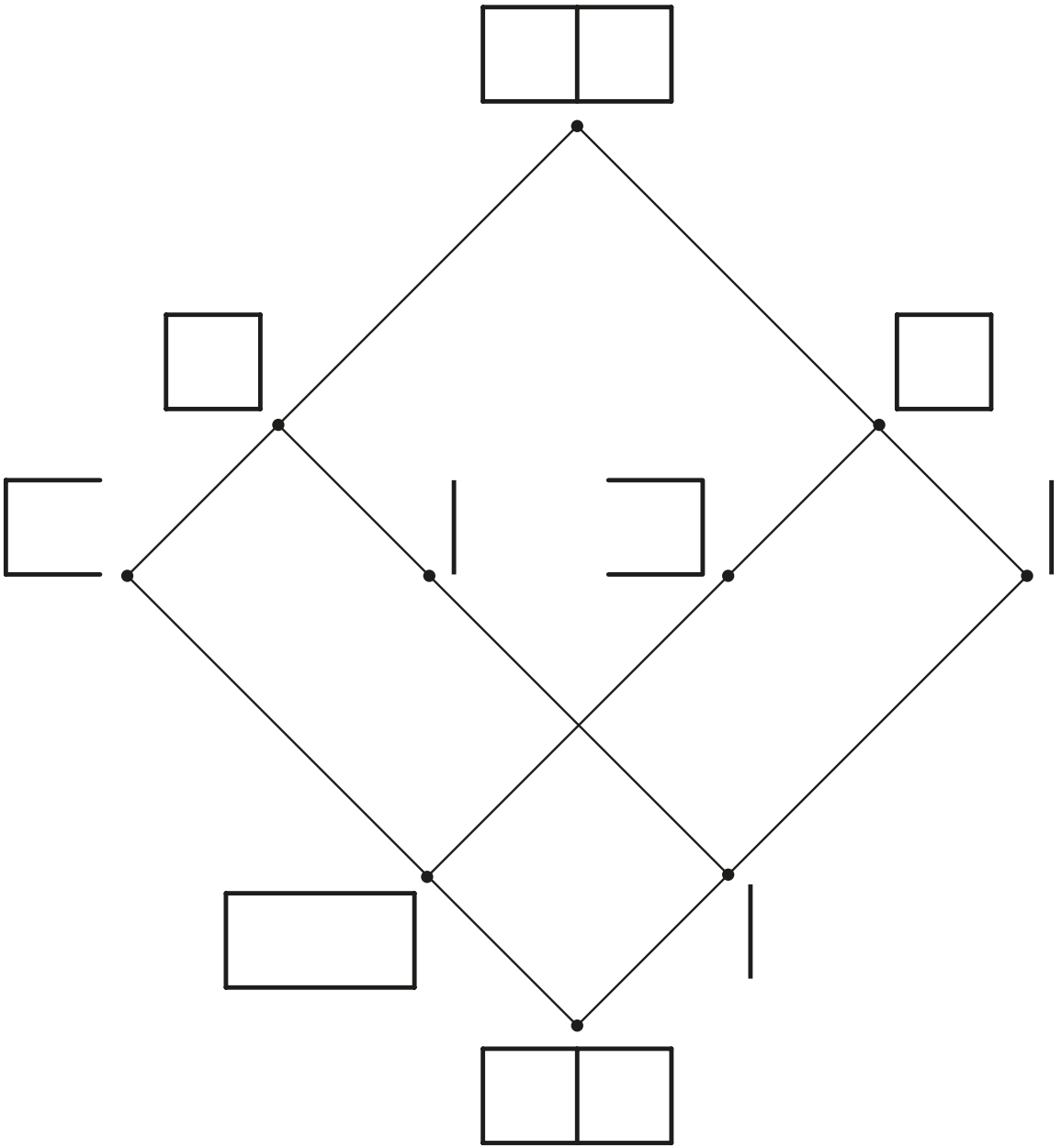








Isomorphic structures – incommensurable shapes.



Calculating with symbols – rules and words.

Recursion + Embedding
Higher-dimensional elements, shapes
Shape Grammars

Recursion + Identity*
Zero-dimensional units, letters and words
Turing Machines or “i ≥ 0” $\subseteq$ “i = 0”

Classical computation: Church-Turing thesis

*This is hard to show; it works for linear elements, conics, and no doubt more up the polynomial ladder. Is this good for everything I see? Maybe not – but if I take the embedding relation seriously and assume that it’s given, then classical computation is a special case of something more.

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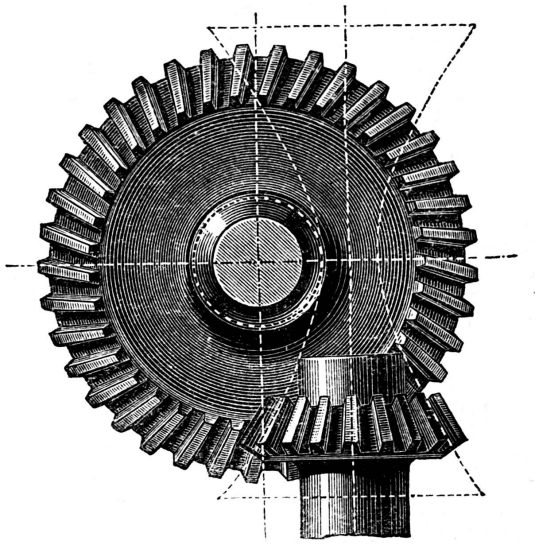
The goal is for painting to be like calculating.

Recursion and identity are enough to paint.

A picture is what you calculate – a metaphysical conceit.

Dimension i = 0.

Calculating includes painting.



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Fancy – “mechanico-corpuscular” invention.

Generate and test.

FANCY has no other counters [units] to play with, but fixities and definites. The Fancy is indeed no other than a mode of Memory emancipated from the order of time and space [but memory still, of fixities and definites]; while it is blended with, and modified by that empirical faculty of the will, which we express by the word CHOICE. But equally with the ordinary memory the Fancy must receive all of its materials [combinations] ready made from the law of association.

Biographia Literaria
S. T. Coleridge (1817)

Design is like oil painting.

Making complex designs that are implemented over a long period of time and continually modified in the course of implementation has much in common with painting in oil. In oil painting every new spot of pigment laid on the canvas creates some kind of pattern that provides a continuing source of new ideas to the painter. The painting process is a process of cyclical interaction between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggests new goals.

The Sciences of the Artificial
Herbert A. Simon (1981)

Detail of "The School of Athens" by Raphael.
This image is in the public domain.

What does Simon say? Would Epicurus agree?

Forms can proliferate in this way because the more complex arise out of a combinatoric play [swerve] upon the simpler. The larger and richer the collection of building blocks [atoms] that is available for construction, the more elaborate are the structures that can be generated.*

*Lucretius' epic poem *On the Nature of Things* limns the Epicurean swerve that lets atoms collide freely and link to create all things. Epicurus ties thinking to seeing, and welcomes plural causes, else we "fall away from the study of nature altogether and tumble into myth [adopt a single point of view when multiple perspectives are equally true]." This is the opposite of Ockham's Razor that's indispensible in logic and science, but it goes for art and design. Seeing and plurality are key in shape grammars – my perspective changes every time I try a rule, especially for things that aren't 0-dimensional. Does Simon's combinatoric play with building blocks tumble into myth?

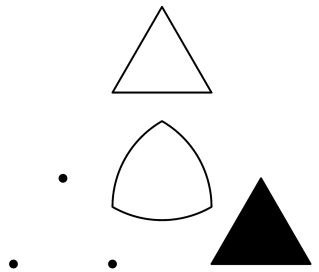
What would calculating be if von Neumann were a painter?

When you look at a triangle you see it's a triangle, and you see this whether it's small or large. It's simple to describe: a triangle is three lines arranged in a certain manner. Well, that's fine, except a triangle is also something whose sides are curved, and where only vertices are given, and something where the interior is shaded and the exterior is not. You see as a triangle many different things, all of which have some indication of a triangle in them, but the more details you try to put in a description of it the longer the description becomes.

The ability to see triangles is an infinitesimal fraction of the visual analogies [spatial relations] in geometry, which in turn is an infinitesimal fraction of all the visual analogies you can recognize, and describe. But you can't describe interpreting a picture, putting something into a picture. Everyone will put something into a Rorschach test, but this depends on his whole personality and history, and is supposed to be a very good method to infer what kind of a person he is.

Theory and Organization of Complicated Automata

John von Neumann (1949)



Calculating without symbols – rules and shapes.

Recursion + Identity
Zero-dimensional units, letters and words
Turing Machines

Recursion + Embedding*
Higher-dimensional elements, shapes
Shape Grammars or “i = 0” $\subseteq$ “i ≥ 0”

Real computation: Turing vs Newton

*This is easy to show, if not immediate. But even if shape grammars and Turing machines are equal somehow, shape grammars are a huge advance. Shape grammars are insight engines with rules for surprises. They make calculating like painting, as they extend Alberti’s account of the origin of art and design in seeing.

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My goal is for calculating to be like painting.

Recursion and embedding are needed to paint.
A picture isn't what I calculate – there are strange surprises.

Dimension $i \geq 0$.

Painting includes calculating.

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Imagination – “esemplastic” power.

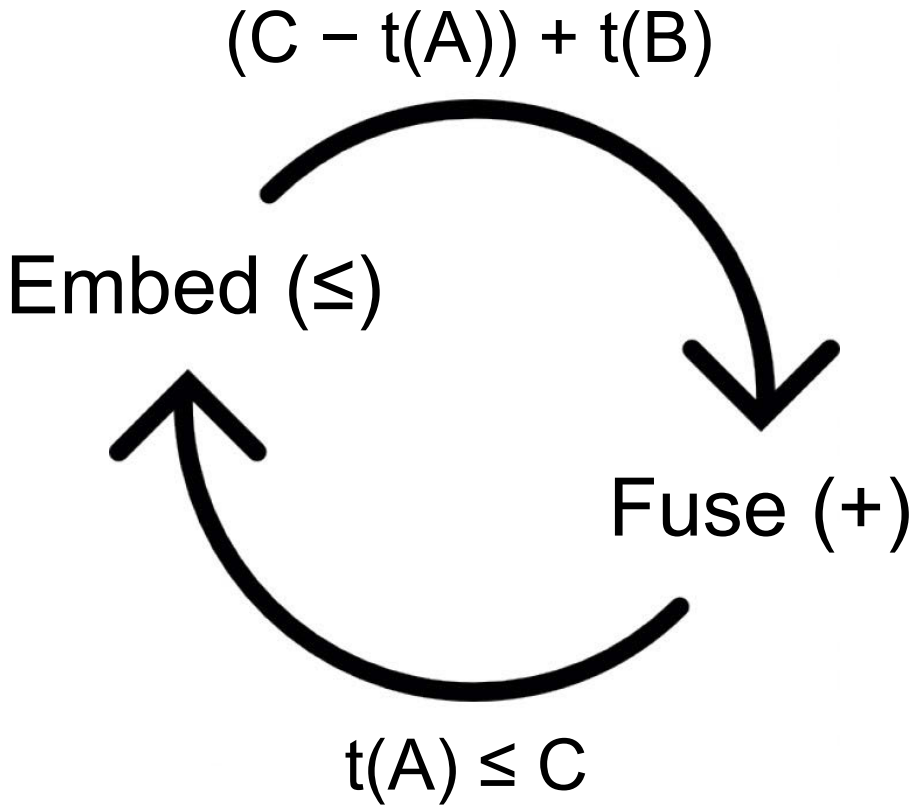
Thesis-antithesis-synthesis/indifference implies life.

The IMAGINATION dissolves, diffuses, dissipates [boundaries, to fuse memoryless wholes], in order to re-create . . . It is essentially *vital* [shape grammars drive a *metabolic* process in which shapes pulse to every rule I try in an embed-fuse cycle for new perception], even as all objects (*as* objects) are essentially fixed and dead.

Biographia Literaria
S. T. Coleridge (1817)

The embed-fuse cycle for new perception.

The shape C pulses to the rule A $\rightarrow$ B.



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The eye is more powerful than anything, swifter, more worthy; what can I say? It is such as to be the first, chief, king, like a god of human parts . . . *seeing all things and distinguishing each separate one*.

Rings

Leon Battista Alberti (1424)

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4.540 Introduction to Shape Grammars I
Fall 2018

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