

2006.06.28 Symposium of Digital Fab
design with folding / digital fold fab
(kccheung)

How can we make (almost) anything from a string of information that specifies a literal string of units, selected from a small, discrete batch of primitives?

**...the order of the units along the string
specify the overall structure...**

Two dimensions... finding a path that spans the entire figure...

(Saul Griffith – Ph.D. thesis, 2005)

How can we get from a description of an object to the digital information needed to most efficiently fabricate the object?

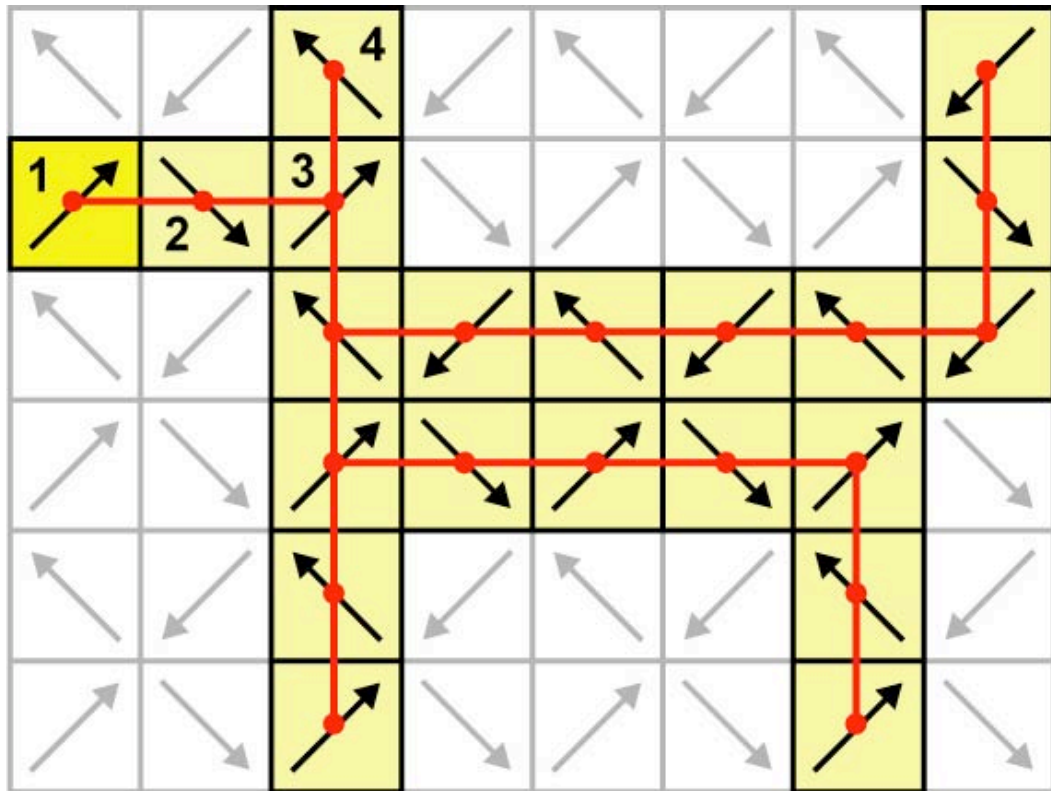
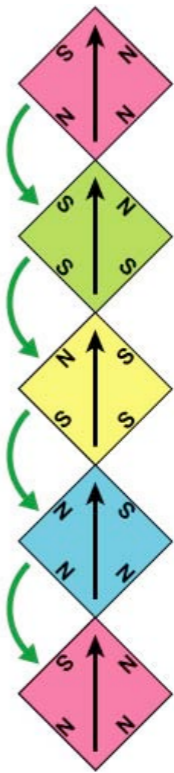
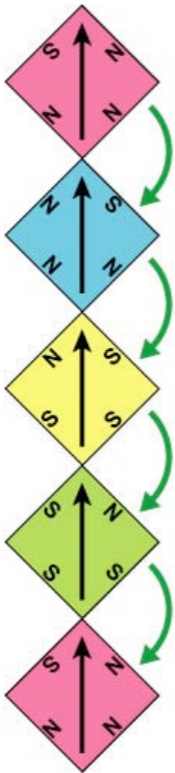


Figure 1b. A dog comprising square tiles without a Hamiltonian path. A spanning tree is shown in red lines connecting the nodes (red dots) at the centroid of each 'pixel'.



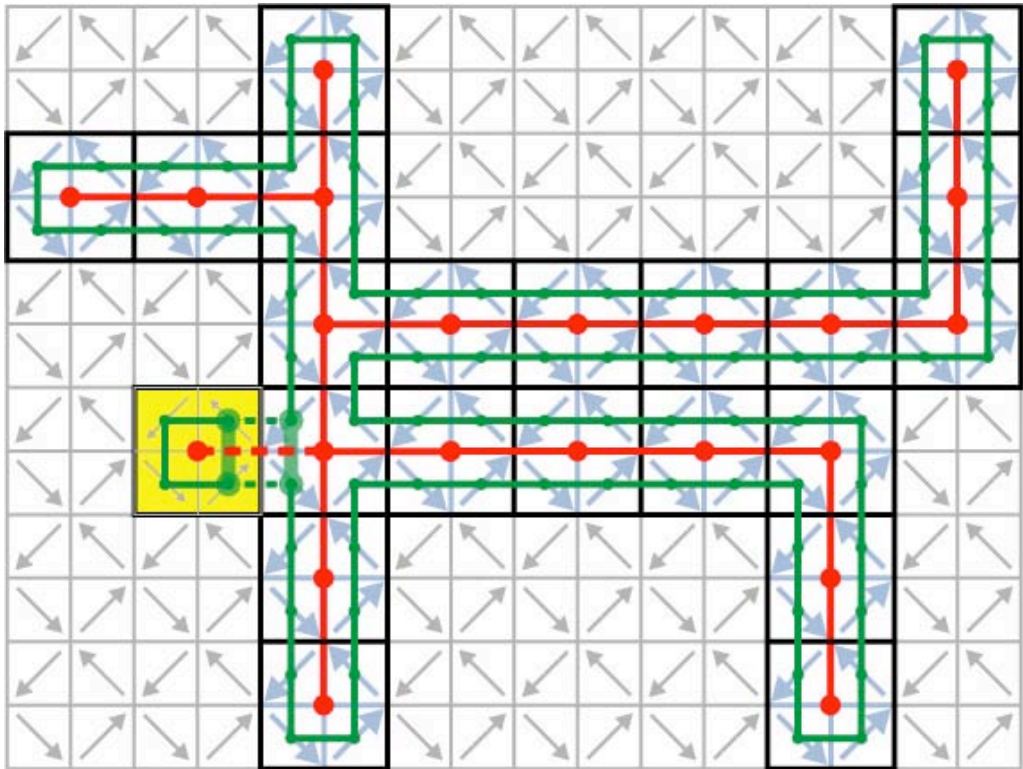
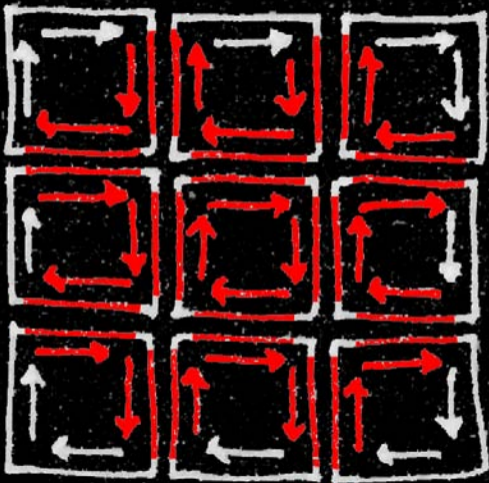
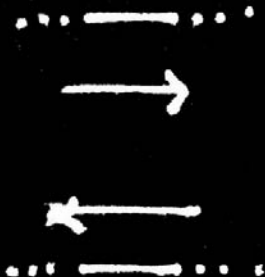
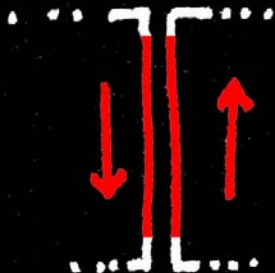
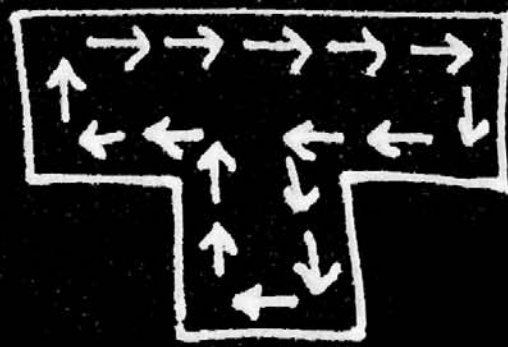
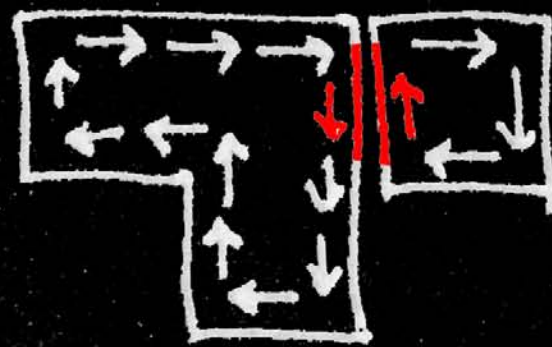
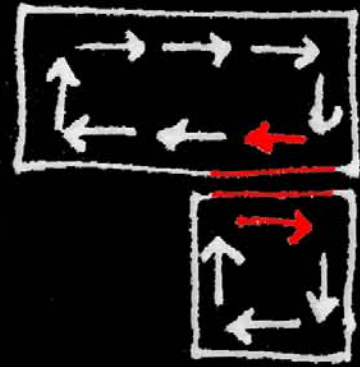


Figure 1c. The same dog where each pixel has been divided into 4 ‘sub-pixels’ enabling a Hamiltonian path or circuit one pixel wide around the perimeter of the spanning tree. The yellow tile shows the construction by addition of new tiles.







Automation of path finding.

Input: Binary image

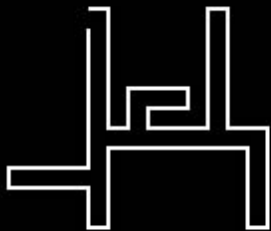
Output: Code string





0301012123032123

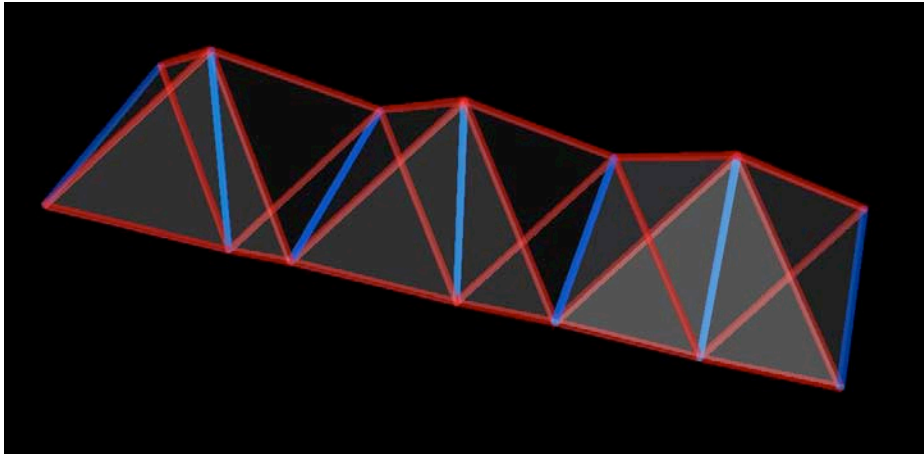




03030323230101030121210101030301212123212121230303232101232303212123

Three Dimensions.

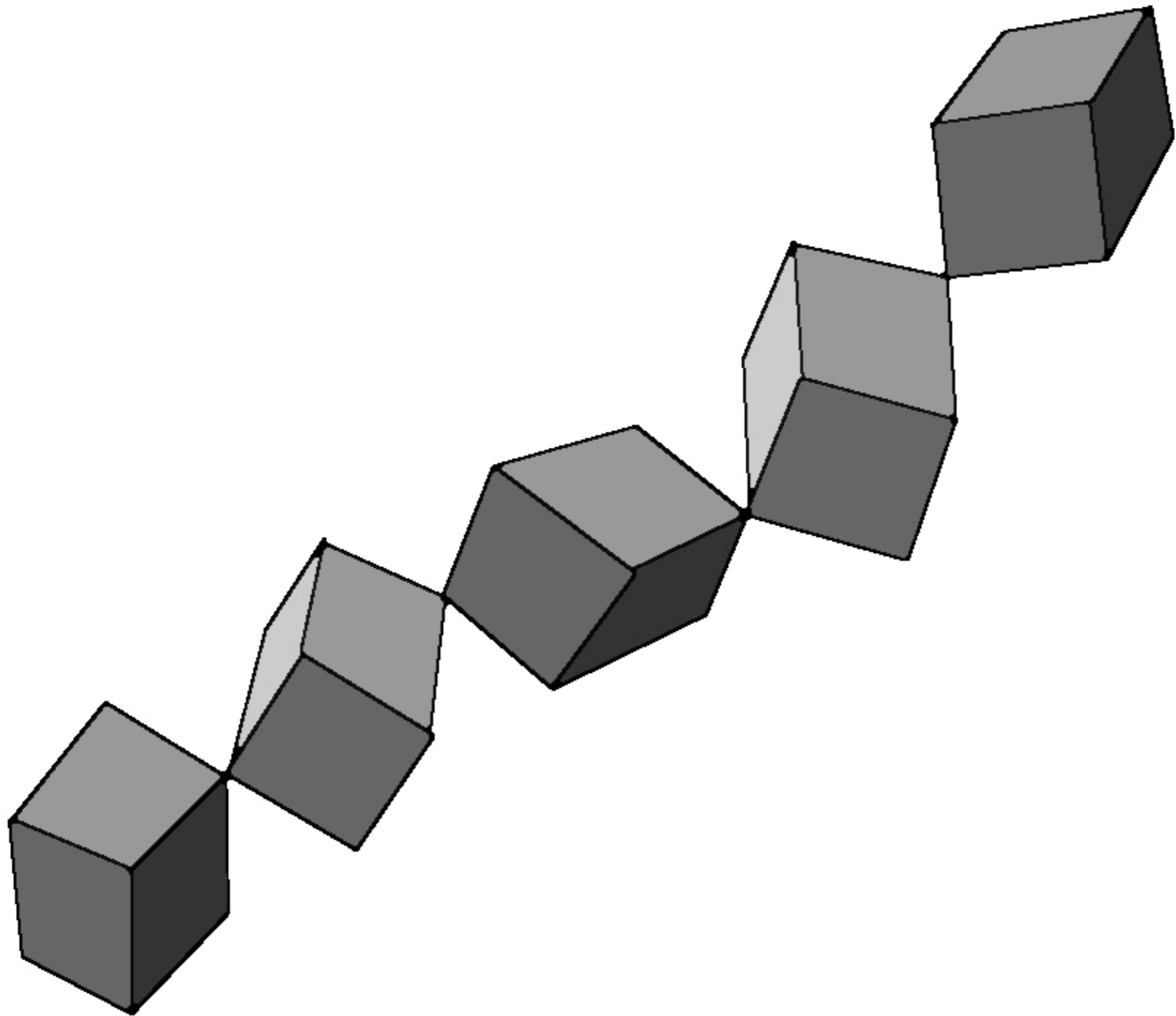
Edge connected tetrahedra (Griffith, 2006)
- considering production means (Rabl, 2006)?



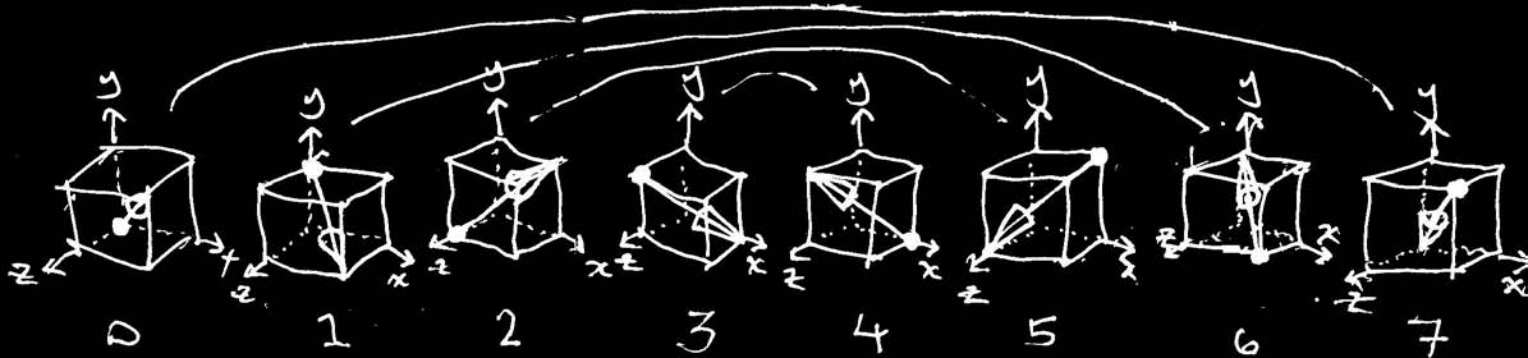
Vertex connected rhombic hexahedra

(eg., cubes)

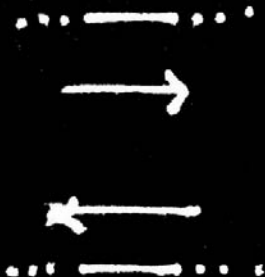
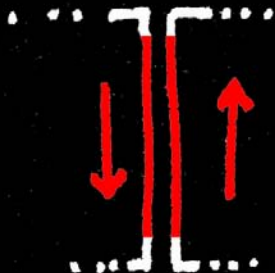
- easier to fabricate (?)**
- satisfies linear production constraint**
- can be made from tetrahedra**



Set of possible states (8).



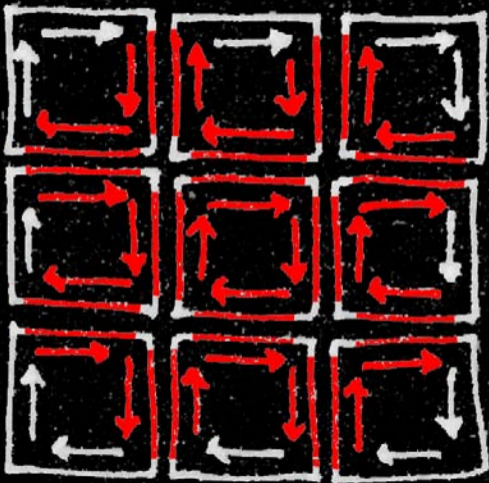
3 turning conditions for each state.







**Tiling in space, so that adjacent paths
can be combined, as in the two
dimensional system.**



Handwritten text in a stylized script, possibly a form of shorthand or a specific dialect, written on a grid background. The text is arranged in several lines, with some characters appearing to be repeated or modified. The script is highly stylized and difficult to decipher without a key.

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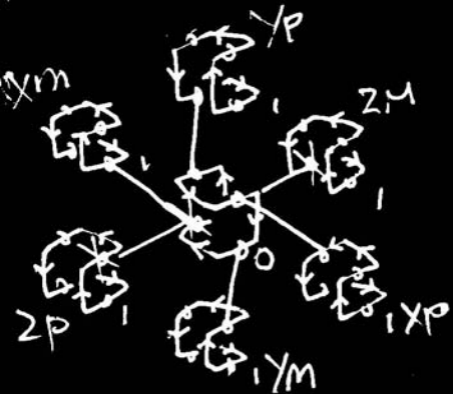
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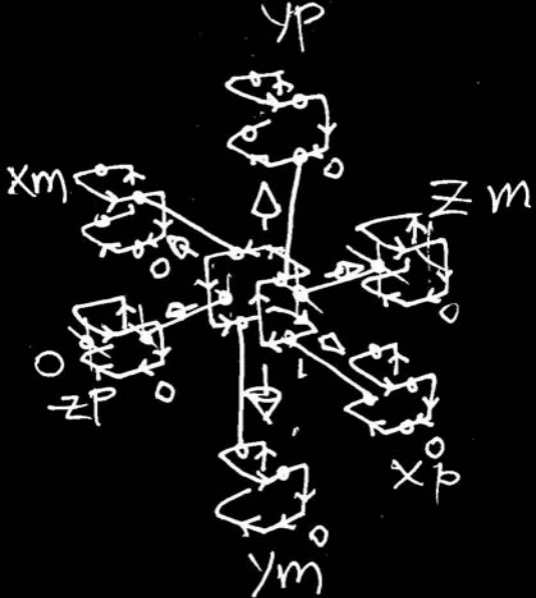
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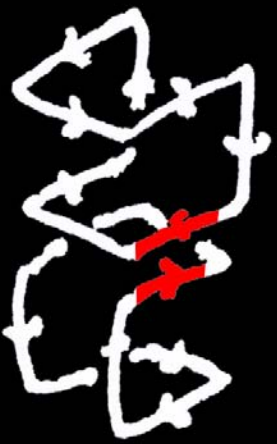
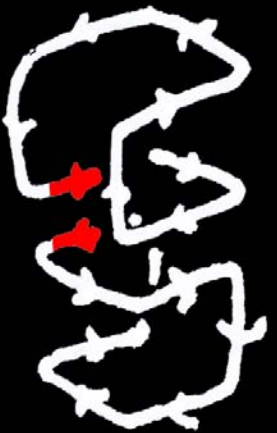
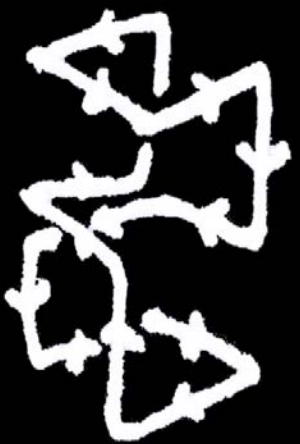
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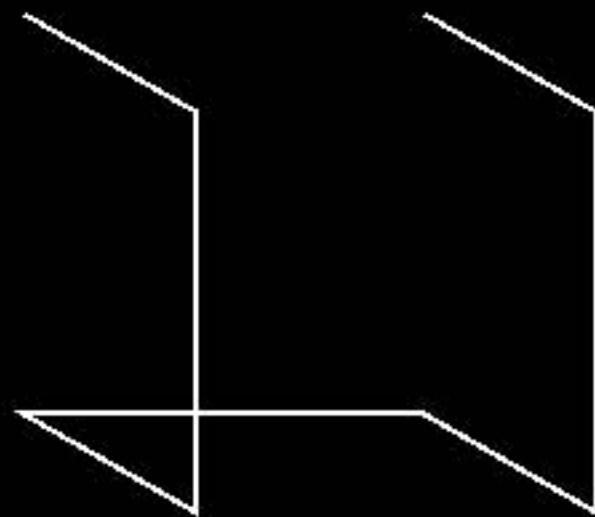








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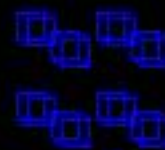
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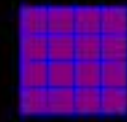
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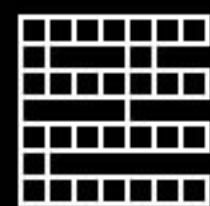
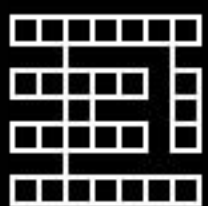
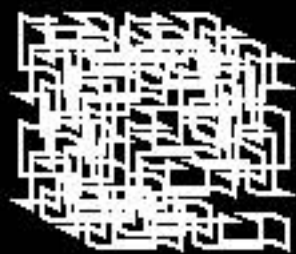
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Input: STL (stereolithography) data

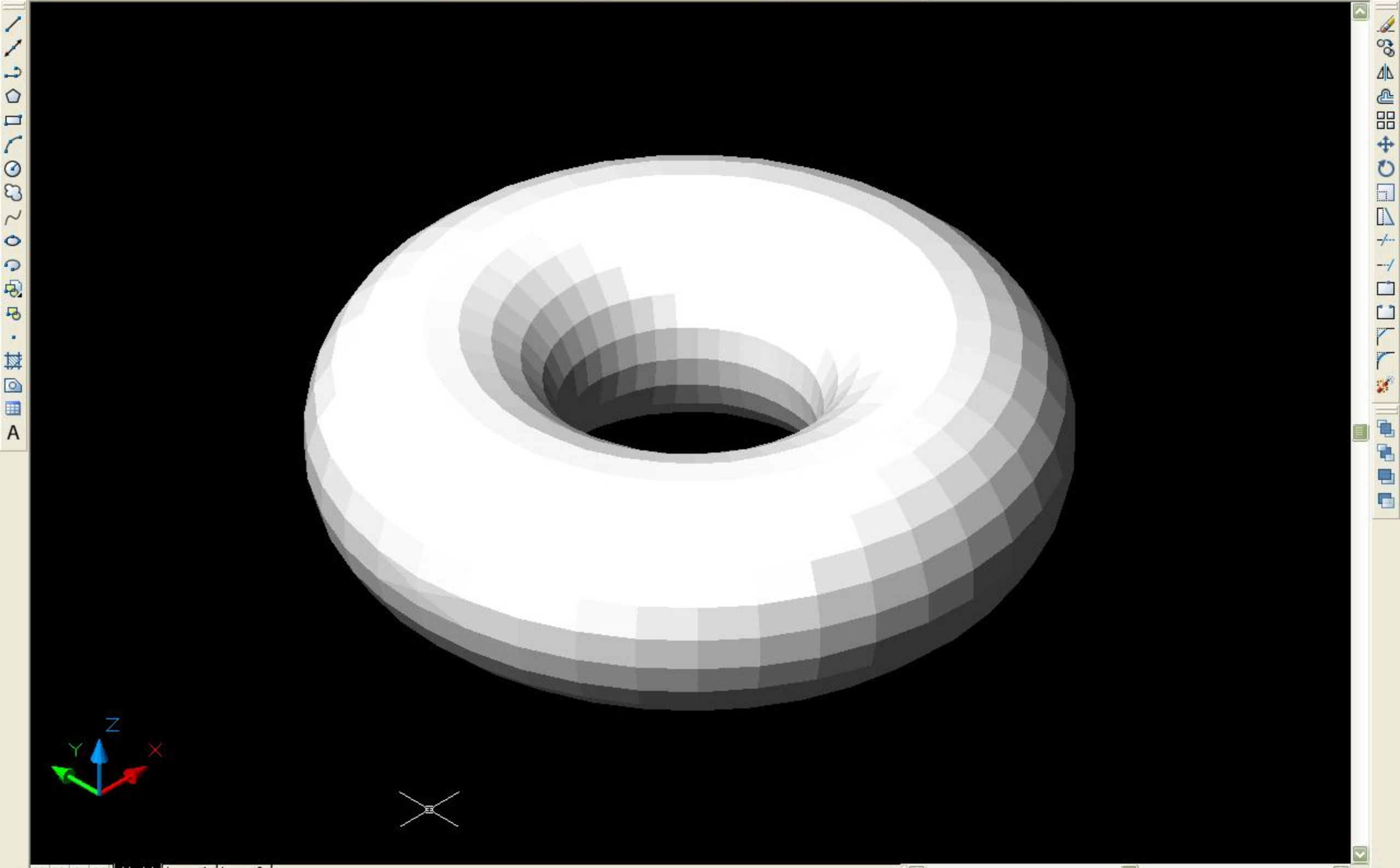
Output: Code string

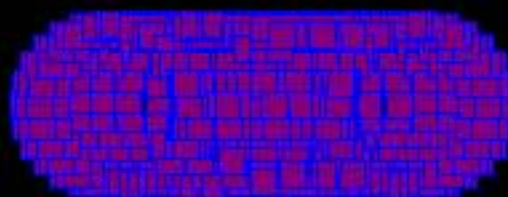
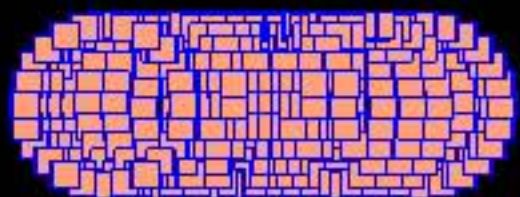
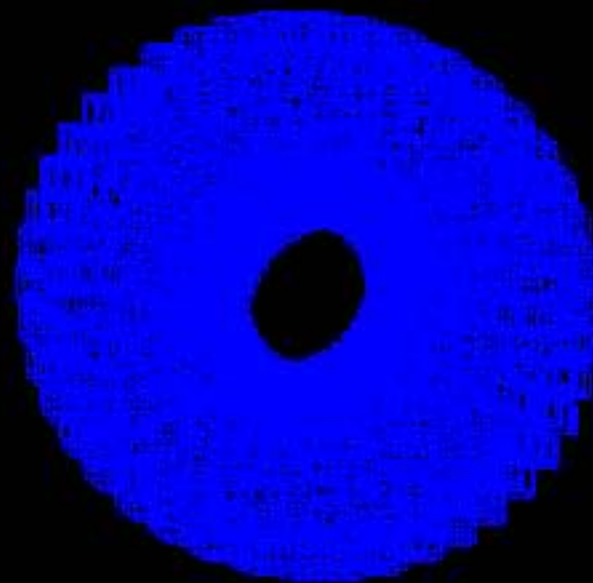
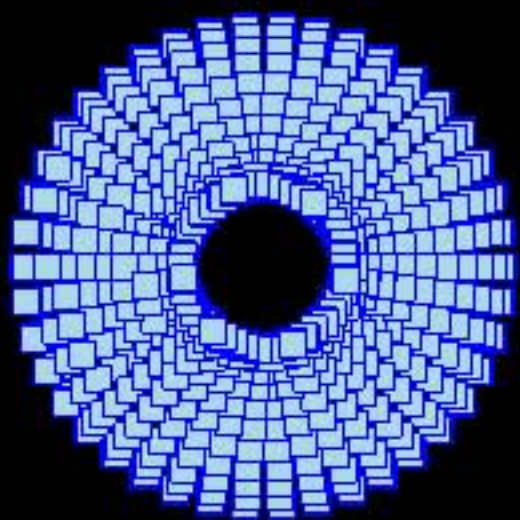


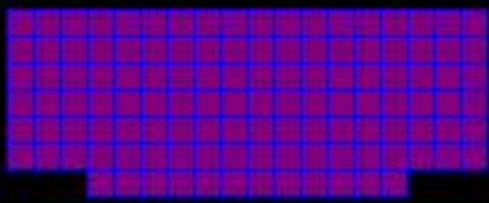
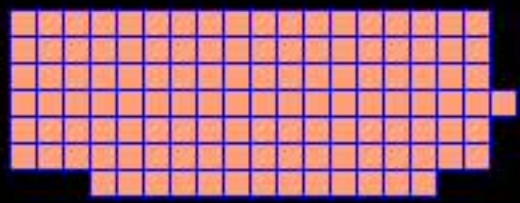
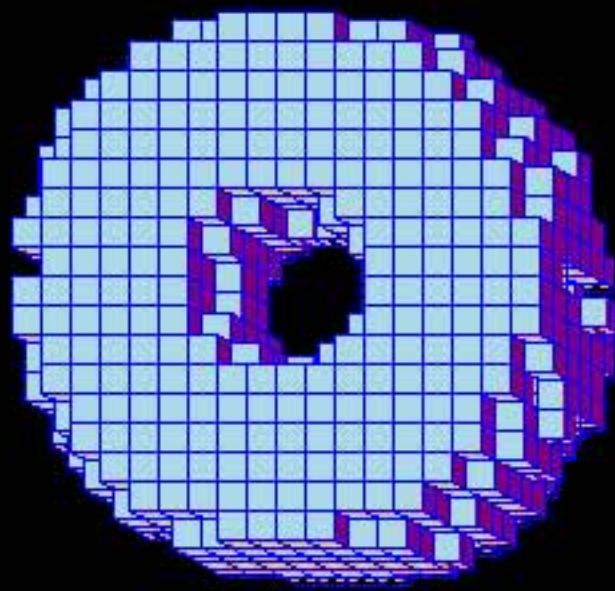
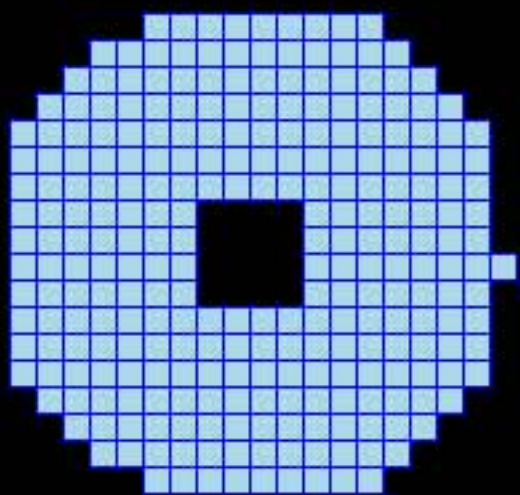


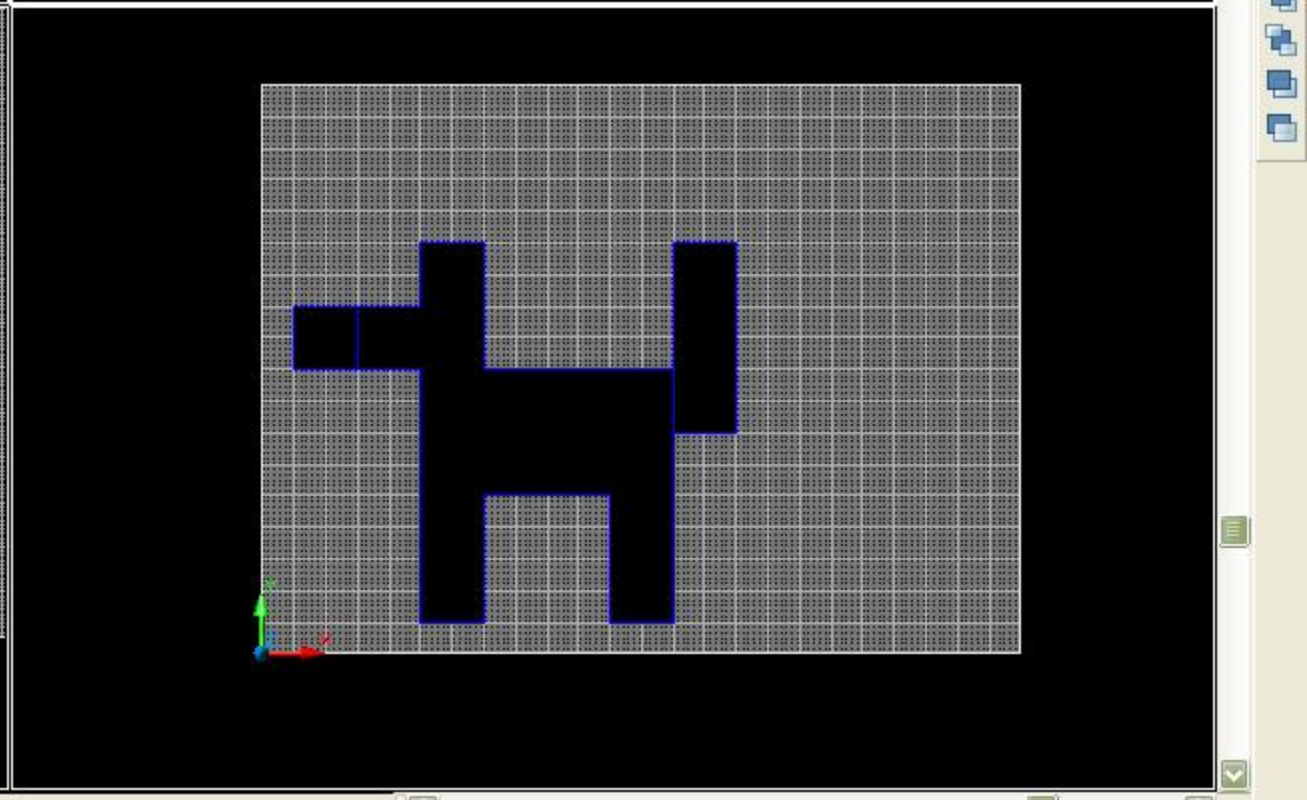
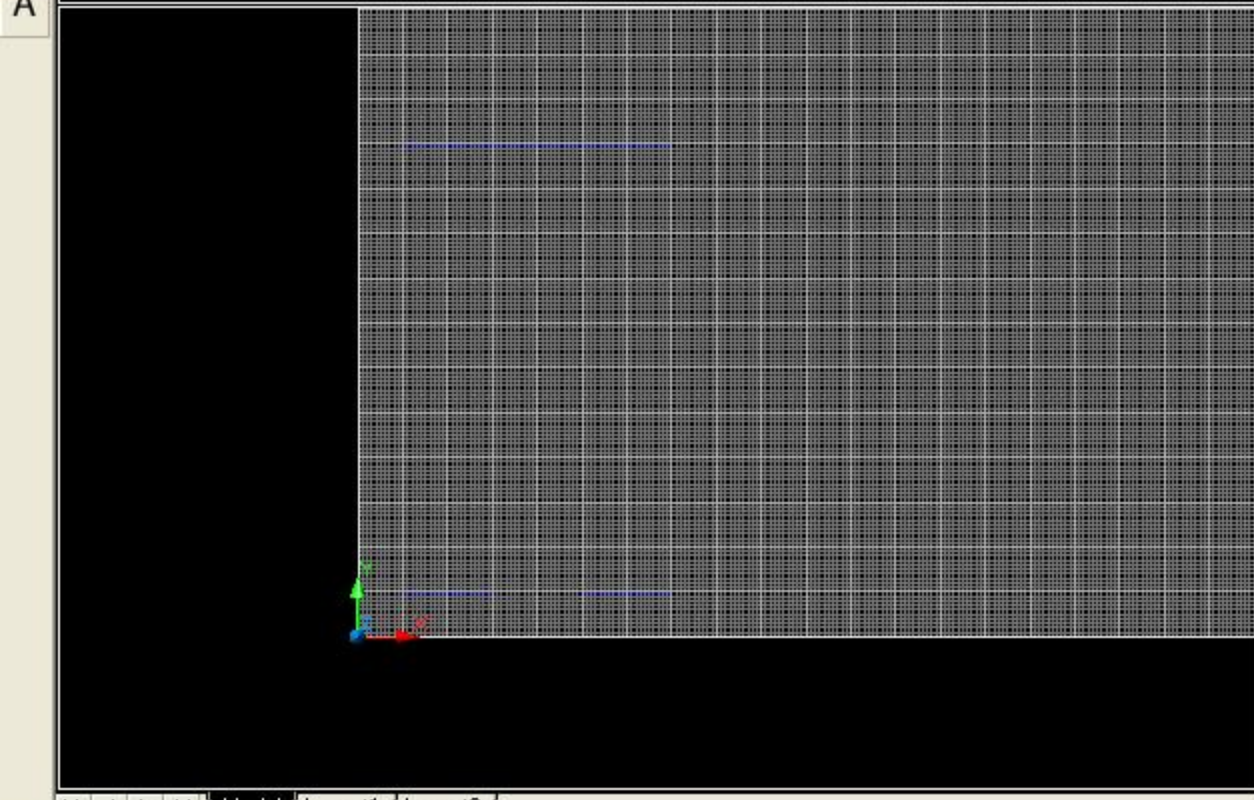
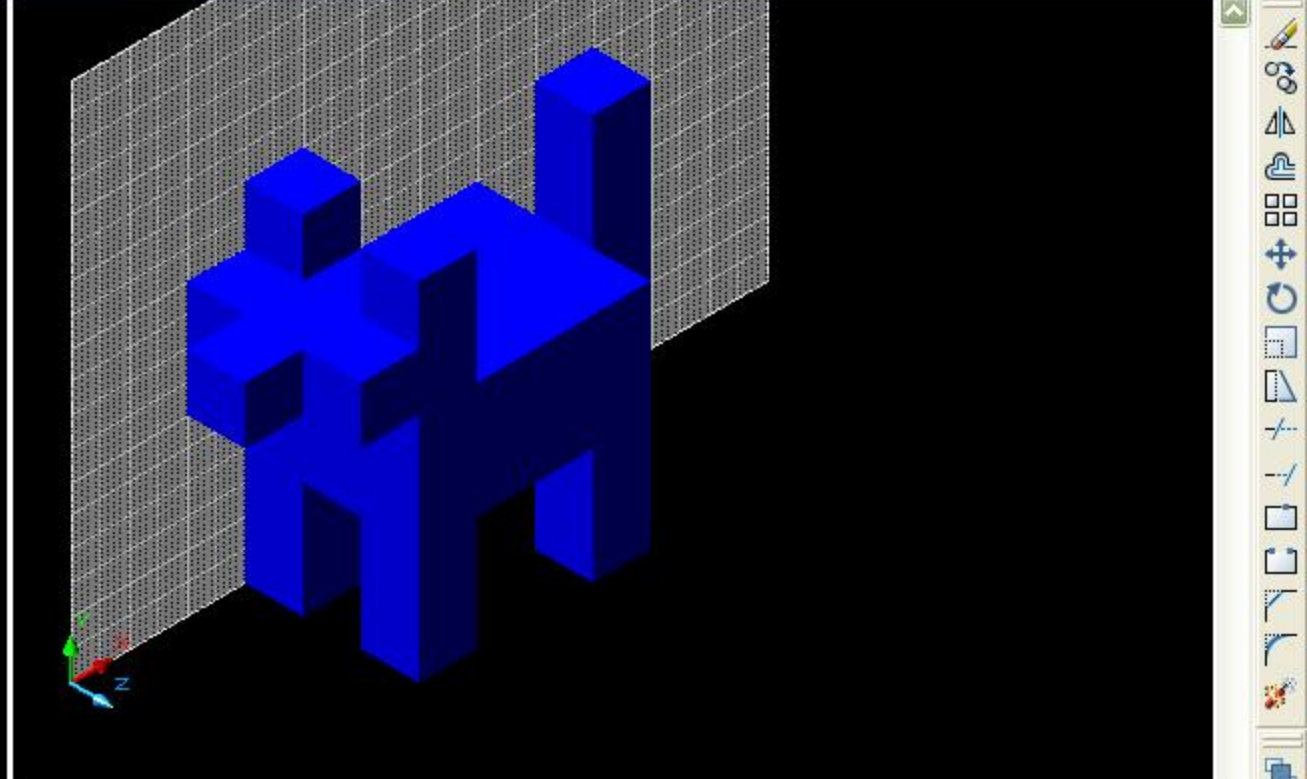
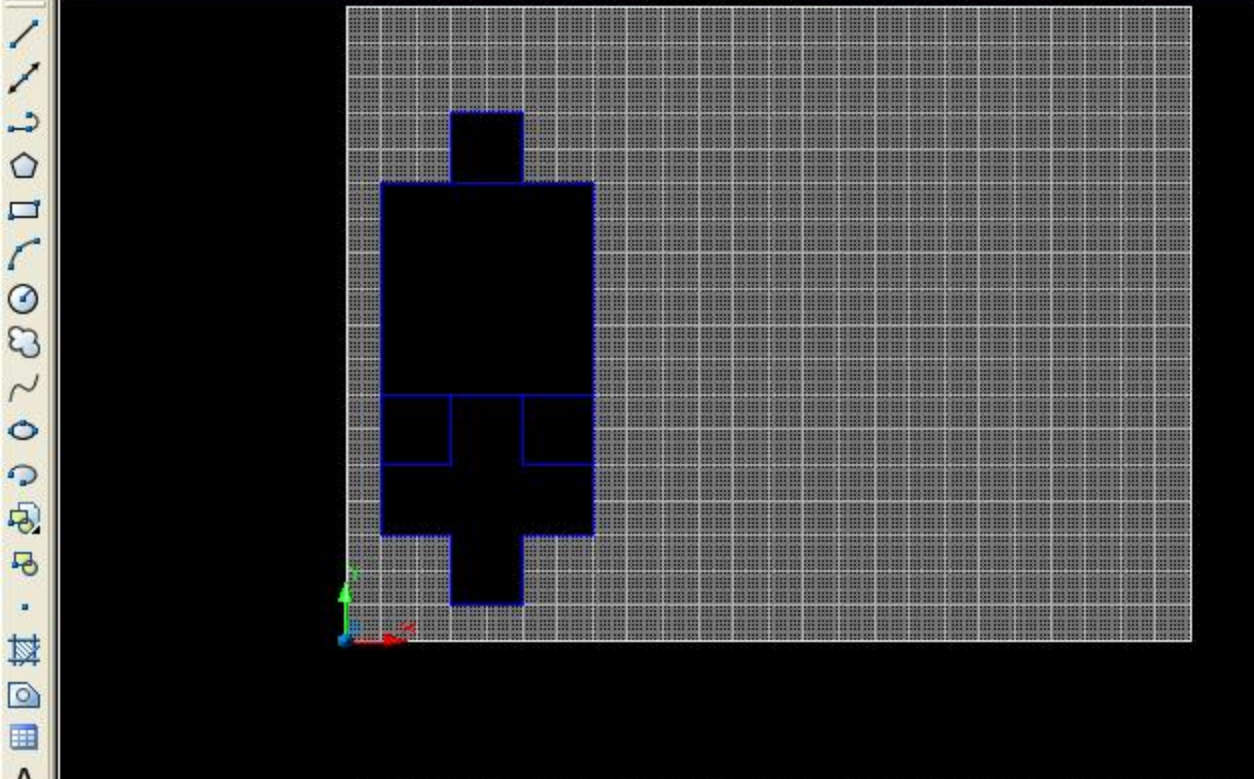


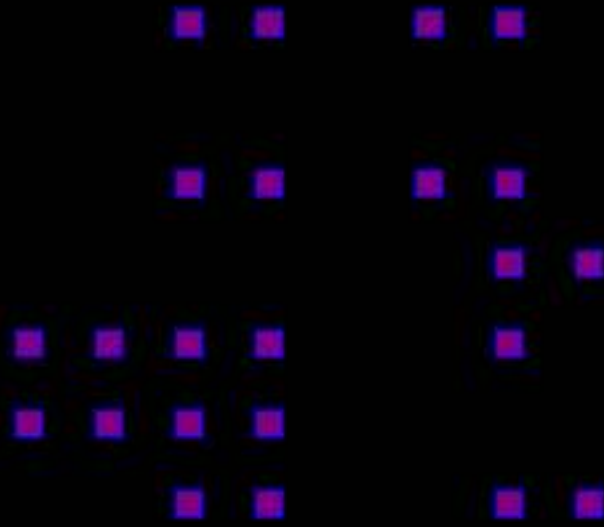
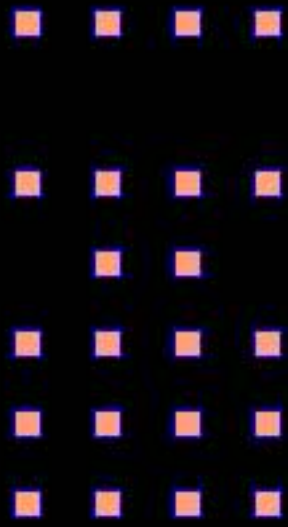
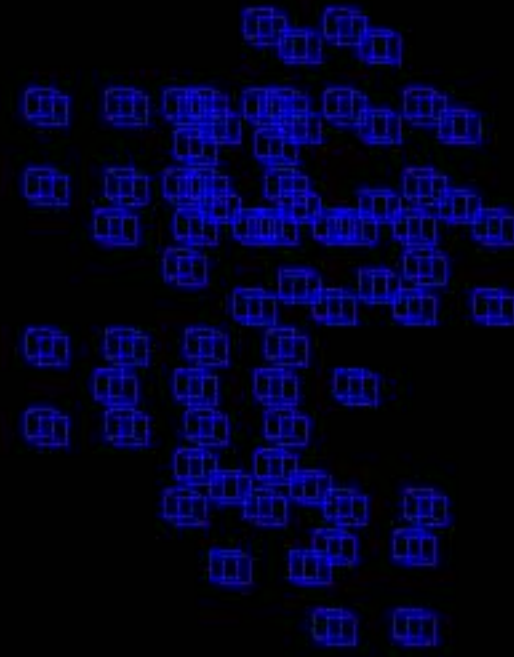
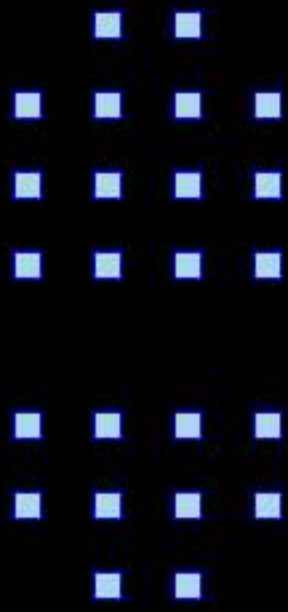
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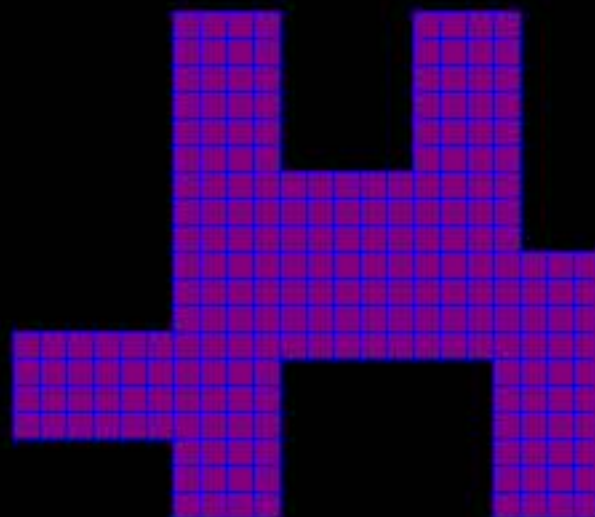
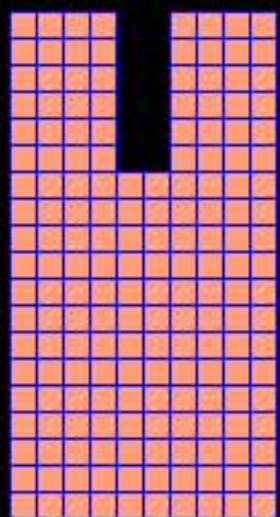
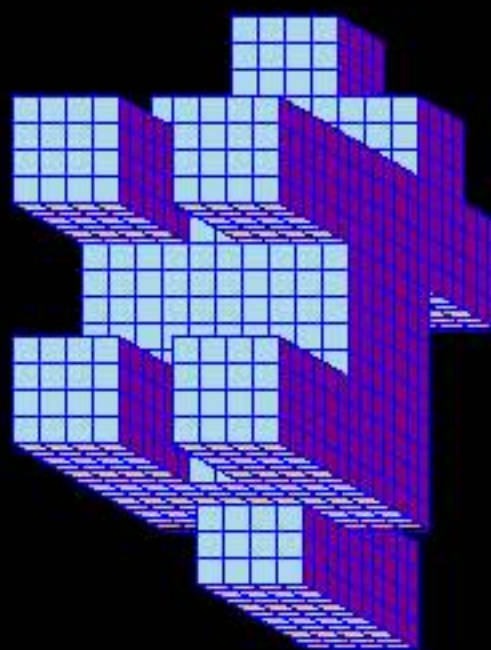
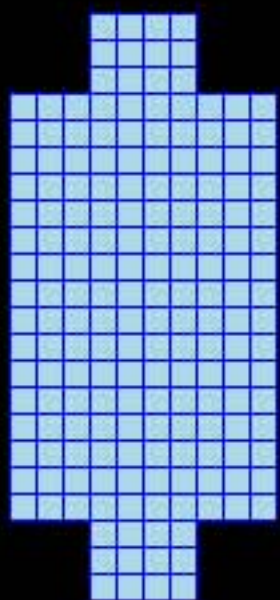


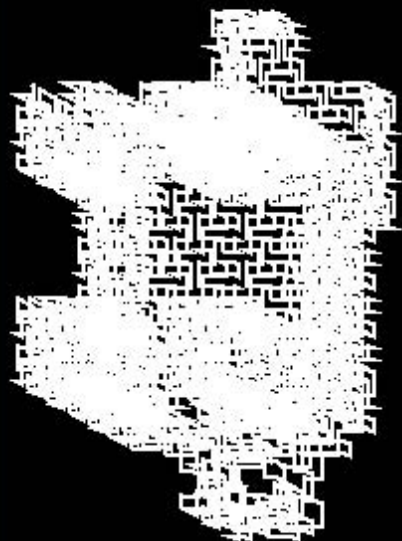


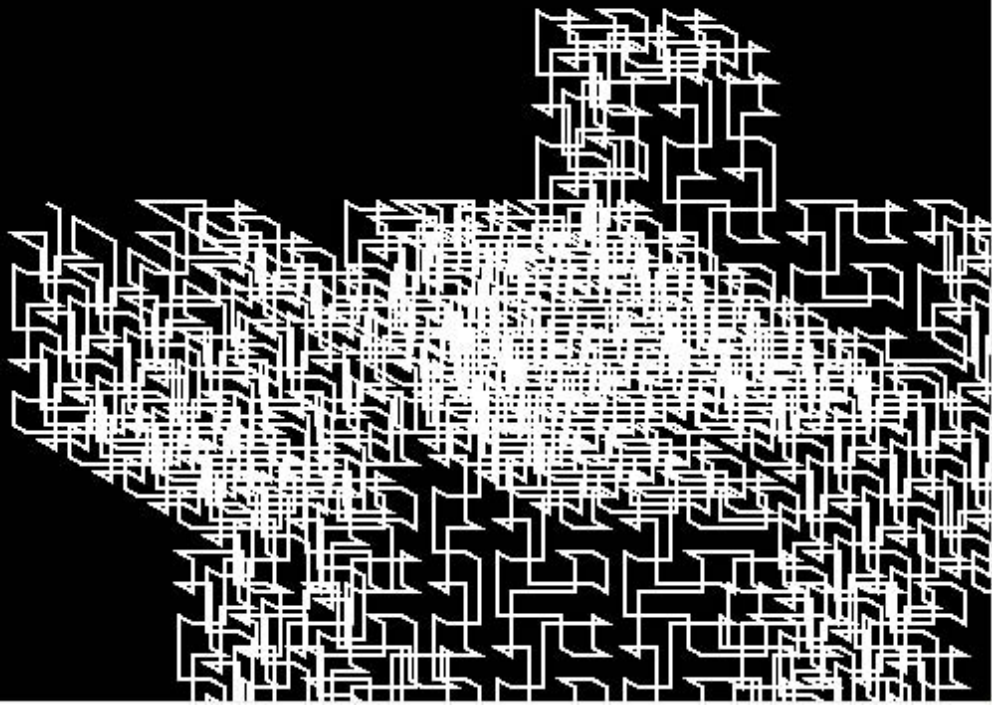










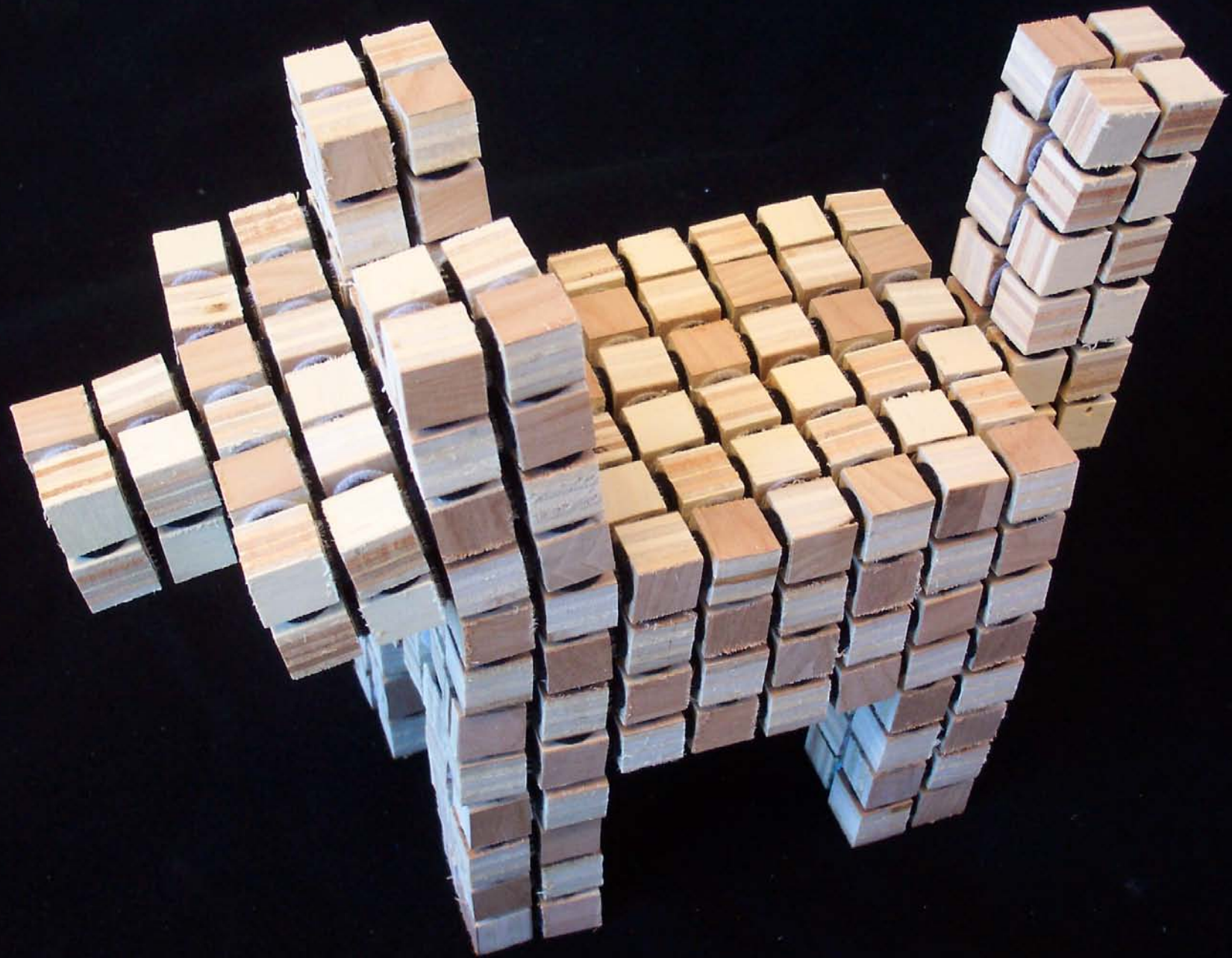


What next?...

Use the code.

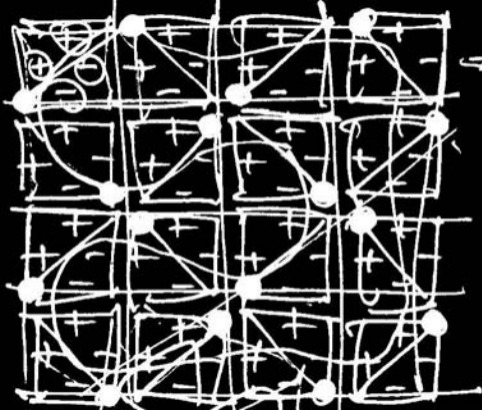
**How can this do something more than
create solids?**

- Open connections**
- Re-Programmable Turning Properties**
- In-unit Actuation**



A modification of the strong-bonding system that requires only 1 primitive (in terms of arrangement of edge properties), with four primitive ways that it can be strung...

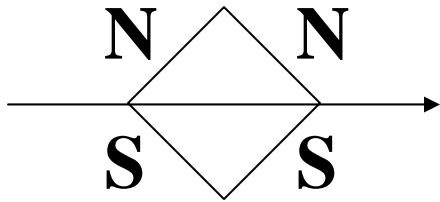




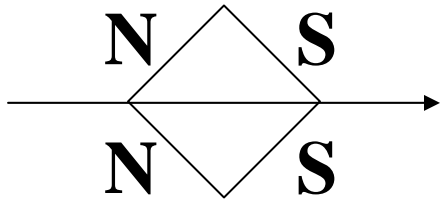
↑ int.
macro
state

↓ IDEAC?

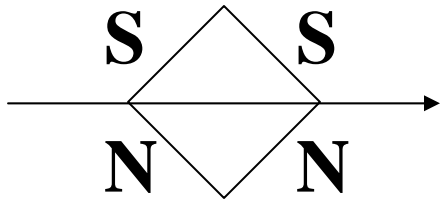
0:



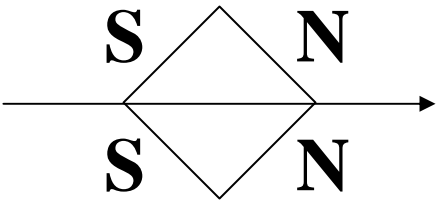
1:



2:

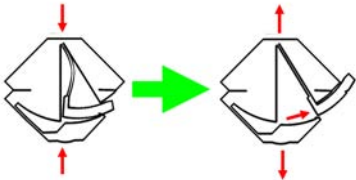


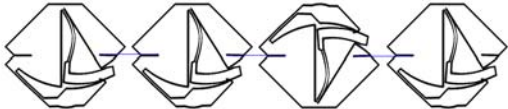
3:

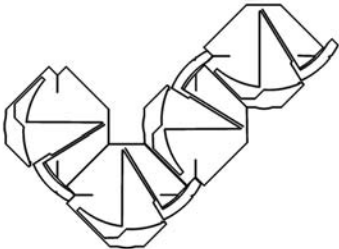


The modified system also has enough information on each of the two sides of the string, in order to create an exact duplicate...

The system may also be modified to be purely mechanical and printable from a single substrate...







**CA with conservation of mass,
connections, and 1d order...**

