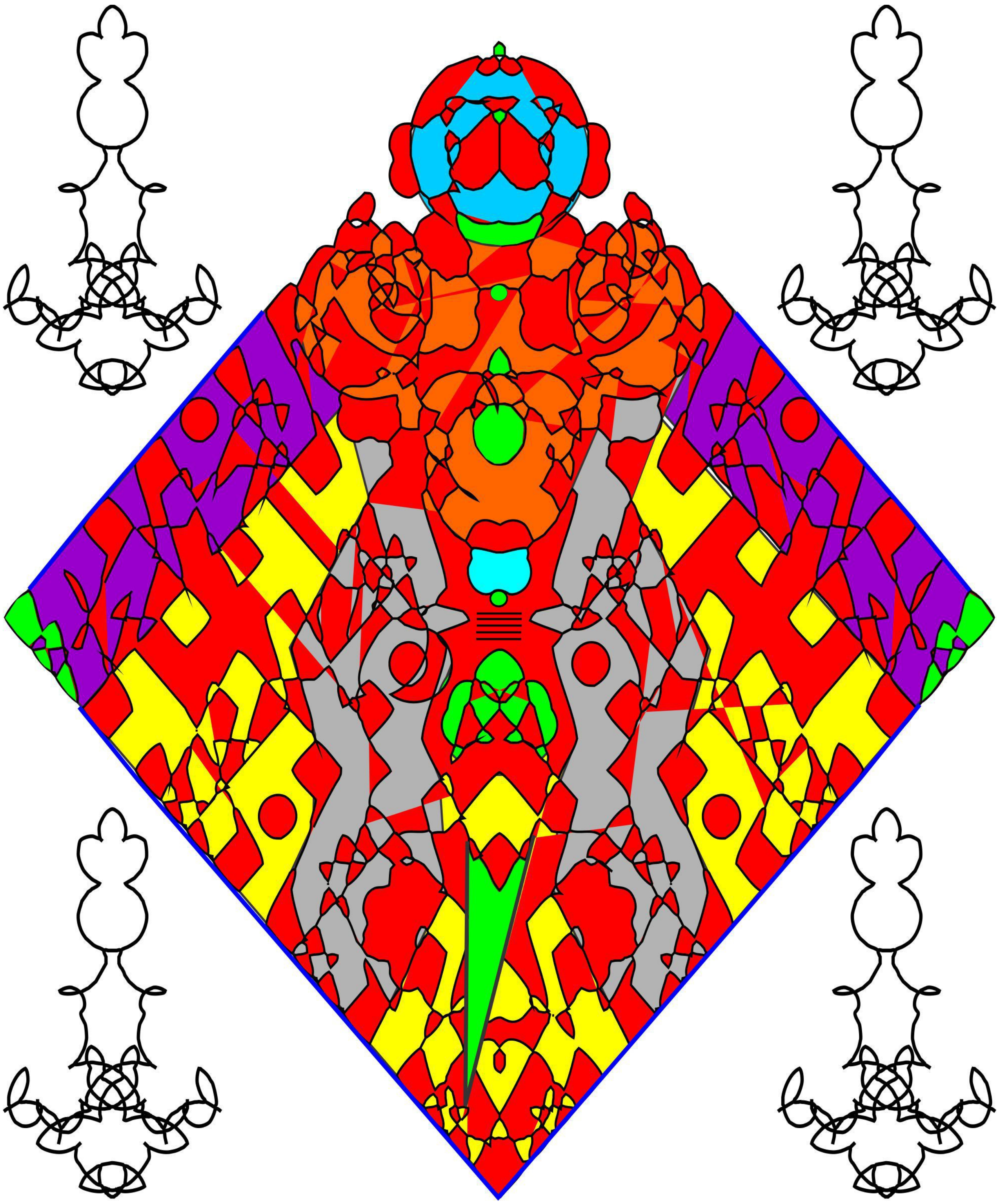
Mathematical Coloring Diversions

(mazes to solve and color included,
developed with Engel's Circuit Curves and
Engel's Celtic Curves)

By Doug Engel



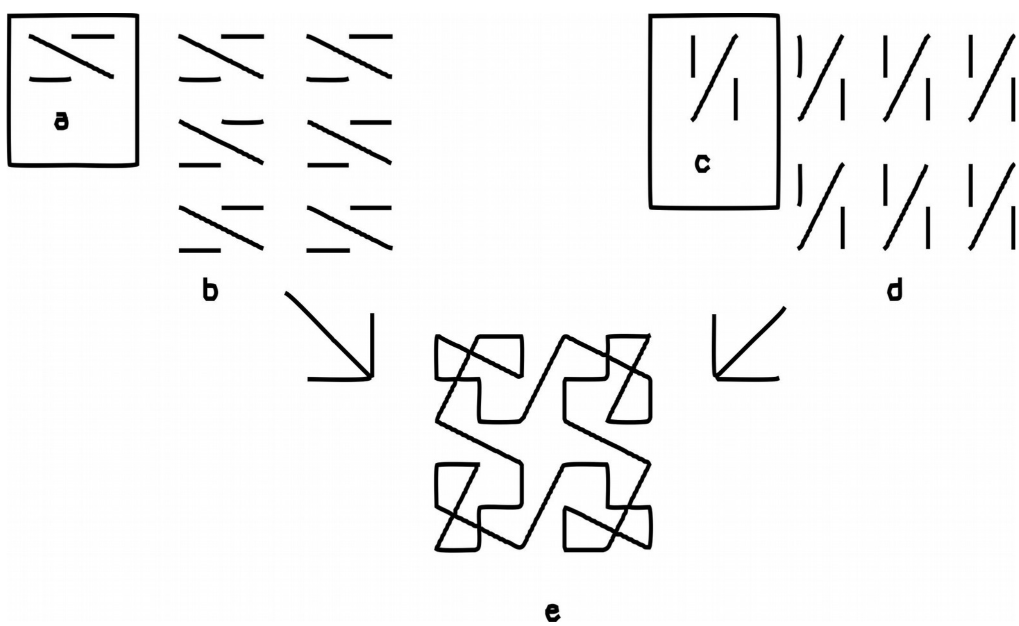
How ECcurves are generated

To create an ECcurve make a rectangular array of points. Connect all the pairs of points in the array with lines, as in a below.. The array should contain an even number of points. The array shown in a is an m by n array where m=3, n=2.

Such a pattern is called is a factor pattern. Repeat the pattern n by m times to create the square pattern as shown in b. Turn the factor pattern 90 degrees as in c and repeat it m by n times to make the pattern shown in d.

Finally to make the product pattern you overlap the square pattern in b with the square pattern in d to create the squared pattern shown in e. This is the product pattern.

The product pattern shown in e is also a Celtic curve, since it forms a single closed circuit. The ancient Celts believed such a closed loop represented life from birth to death. They created amazing and beautiful works of art with such knotted loops, on stones, belts, gold work, books, and on other material.



This idea for product patterns was originally published in the problems section of the American Mathematical Monthly, Feb. 1983 Vol 2. Another publication was in the Journal of Recreational Mathematics V13(1) 1980-81.
Later a small self published book was written called Engel Curves. Since then this EC book is no longer printed but may be edited and published in the future with a different title. This is because the term Engel Curves is terminology used for a different purpose. And would be confusing.
The patterns presented here can be colored as you wish to make your own mathematical art. Of course very few are Celtic and some have been manipulated, using curves instead of lines, for instance, to try to present an interesting pattern. Each pattern was derived with squared products as described here. The ones with bilateral symmetry have one factor reflected in a mirror. It is also possible to use non squares such as m by n times p by q to get rectangular patterns and patterns with quadrilateral and bilateral symmetry. Three dimensional patterns are also possible. With odd patterns, 3 by 3 say, not all the curves will be closed circuits, some will have two ends.

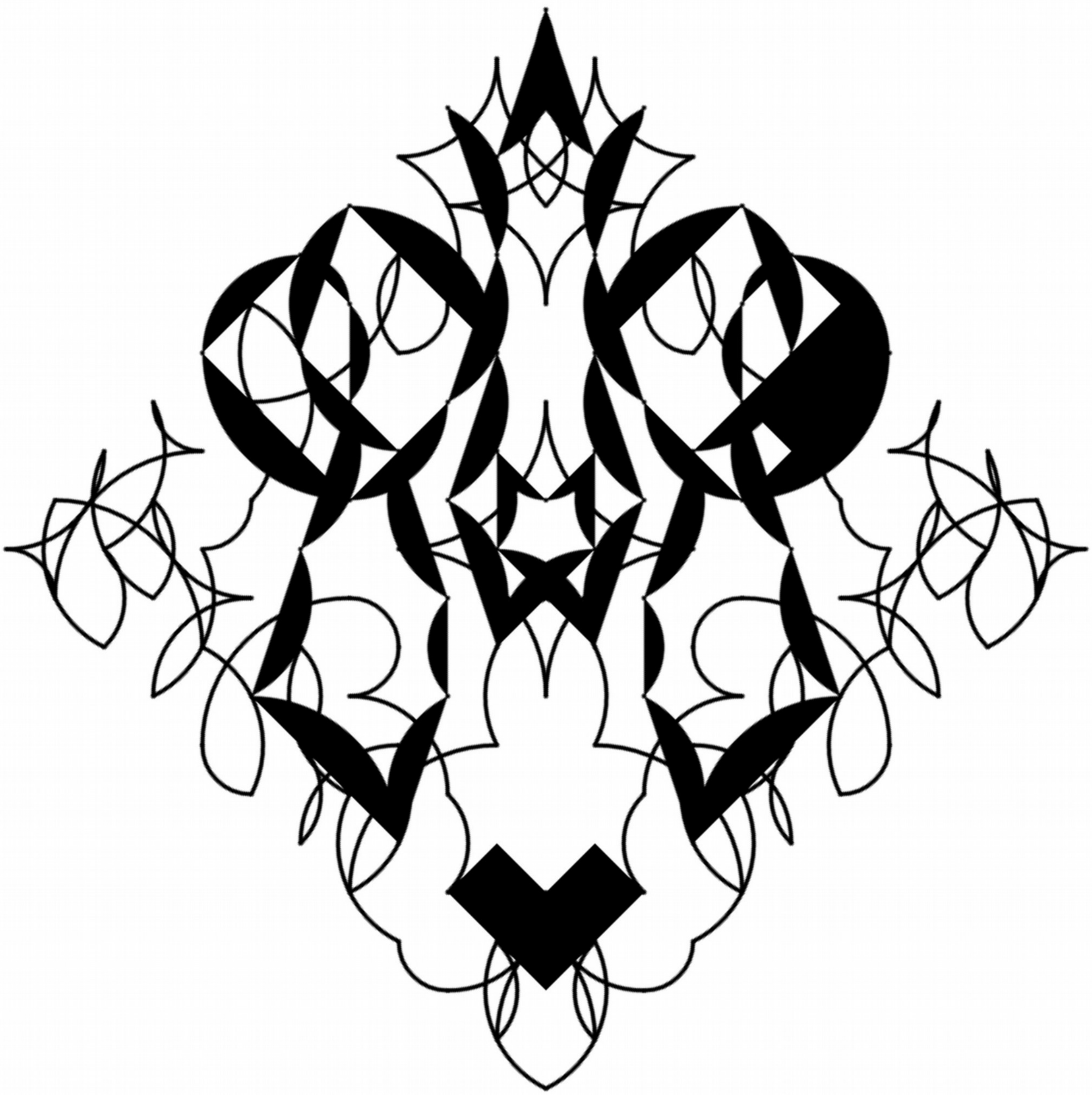


Plate 1 Pirouette

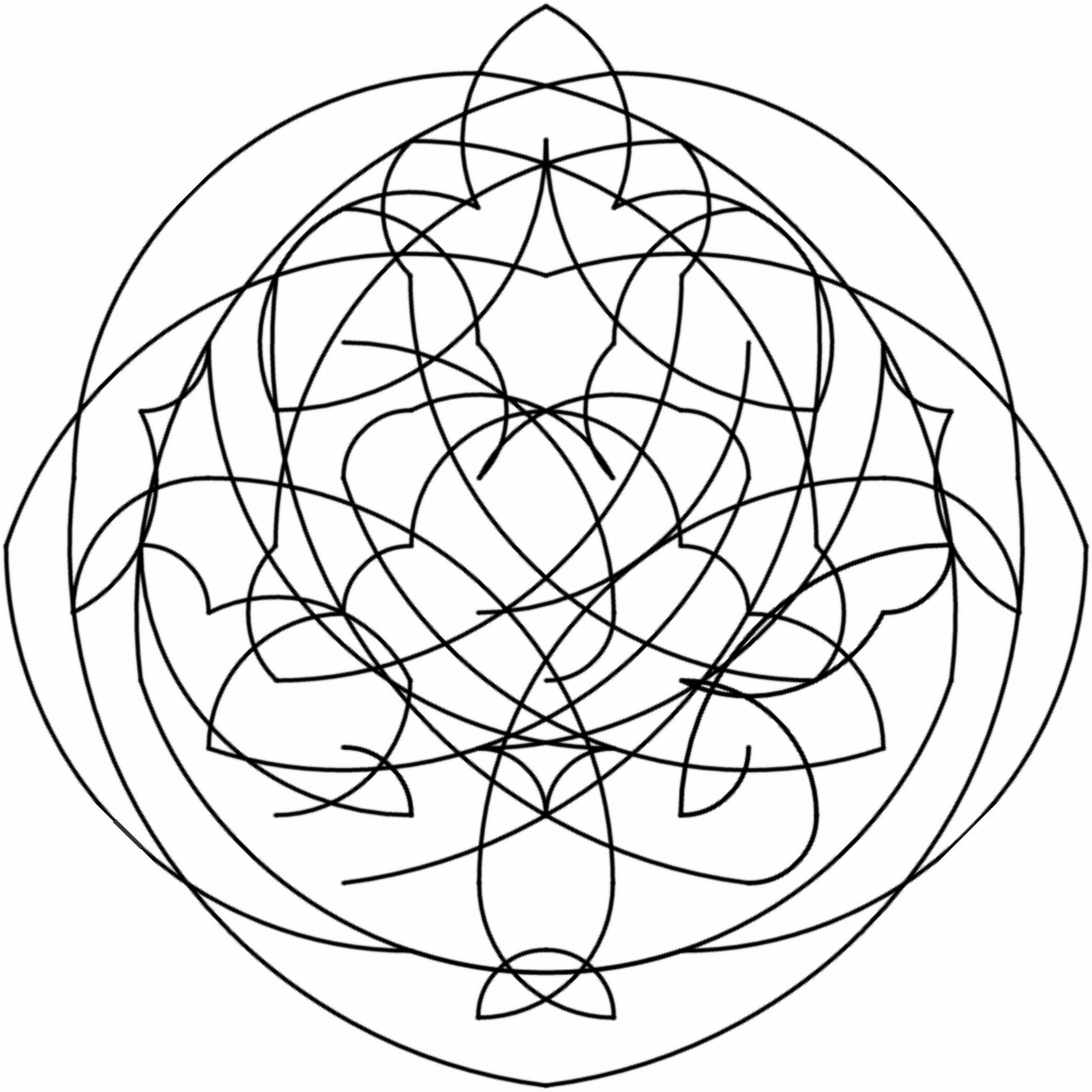


Plate 2 Whirlwind

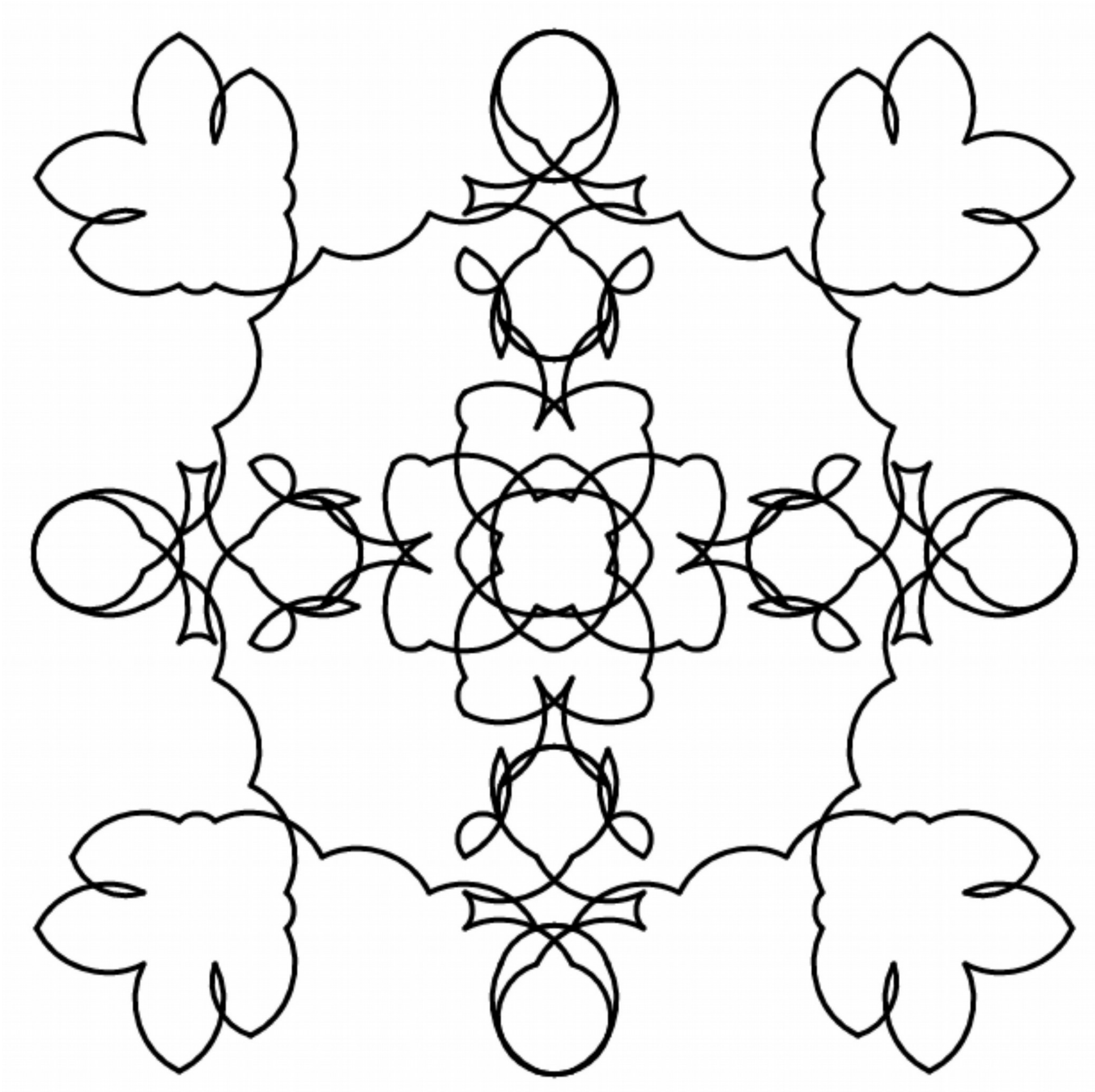


Plate 3 Roundtable

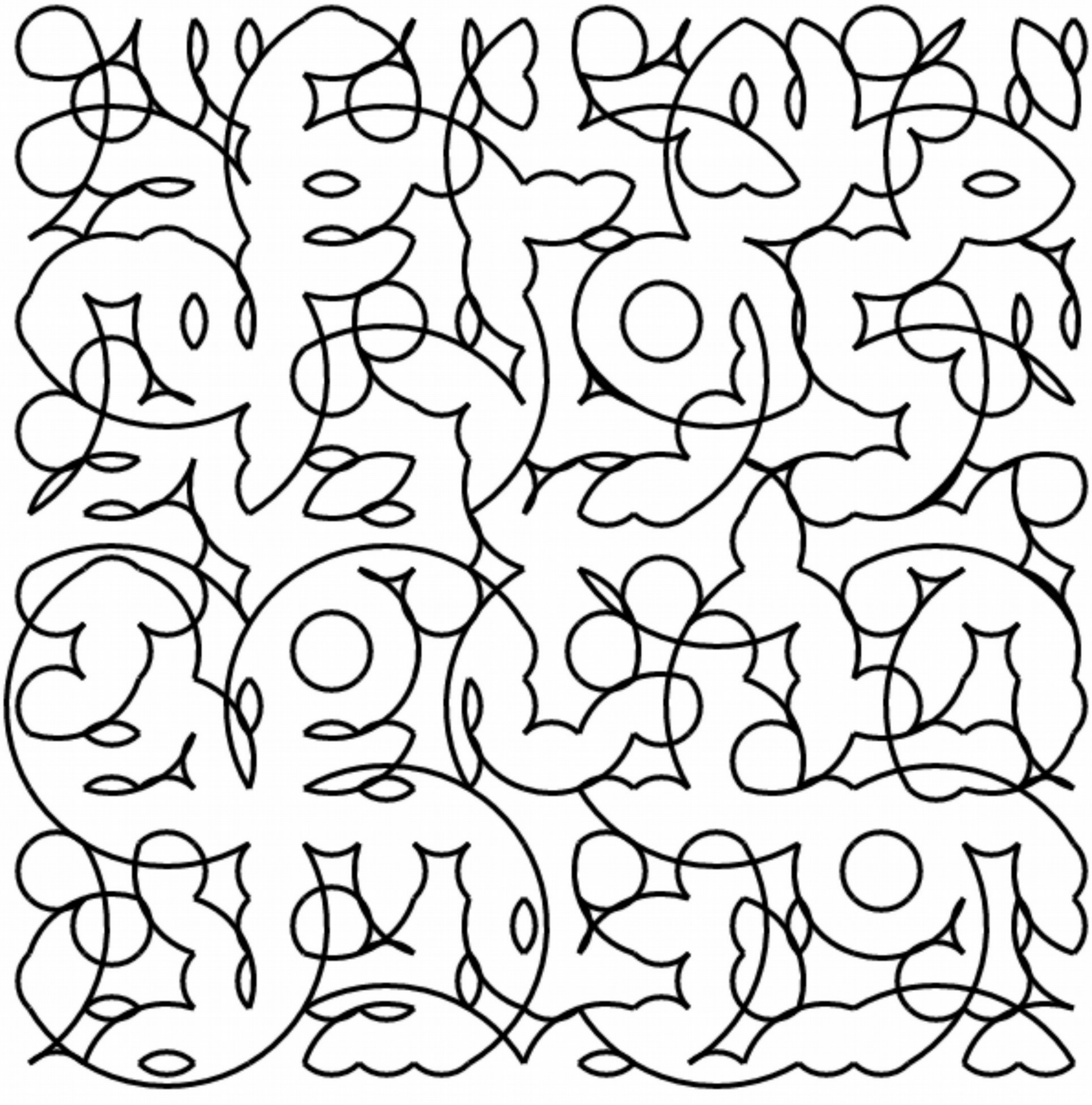


Plate 4 Corals

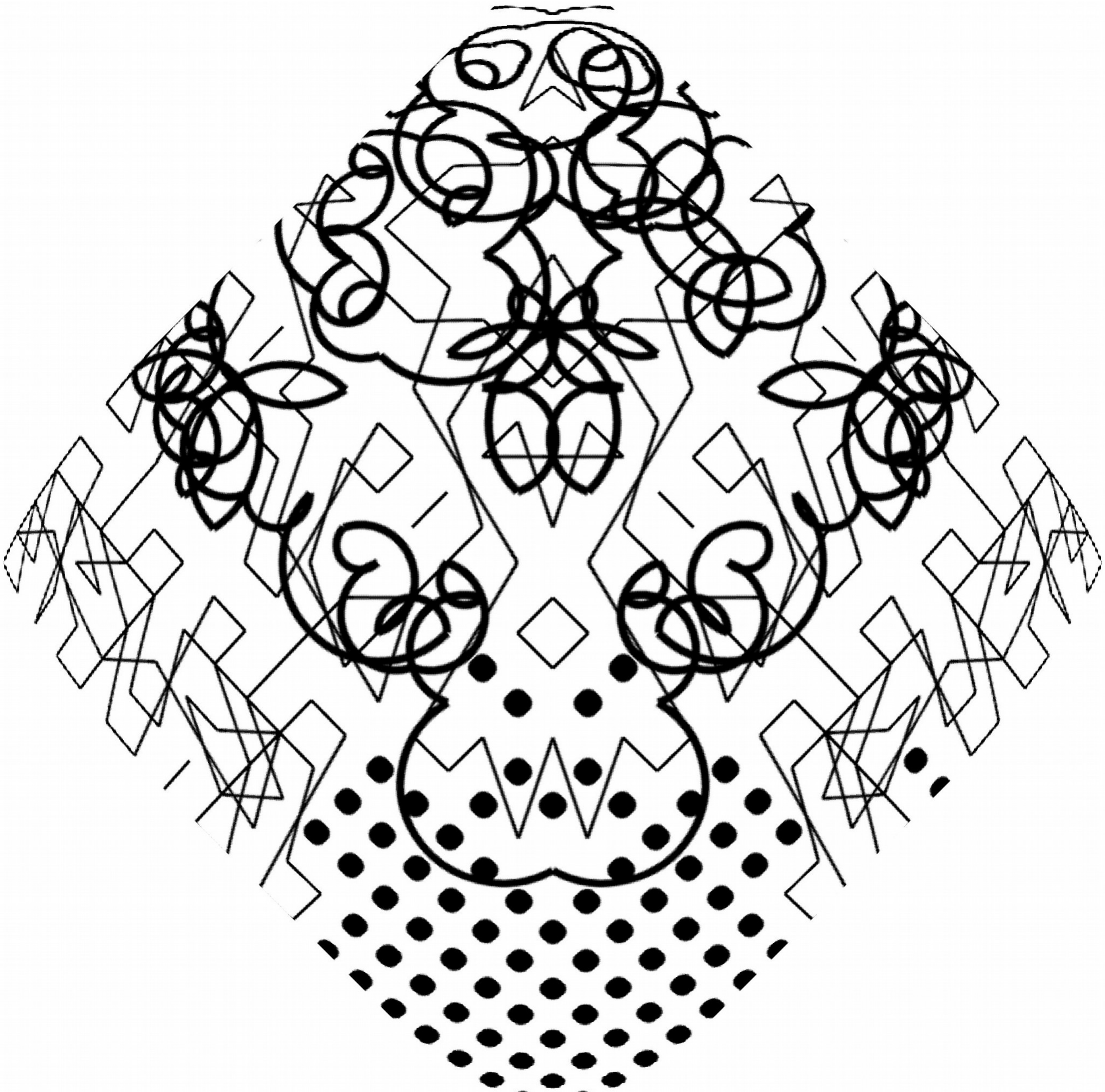


Plate 5 Parallax

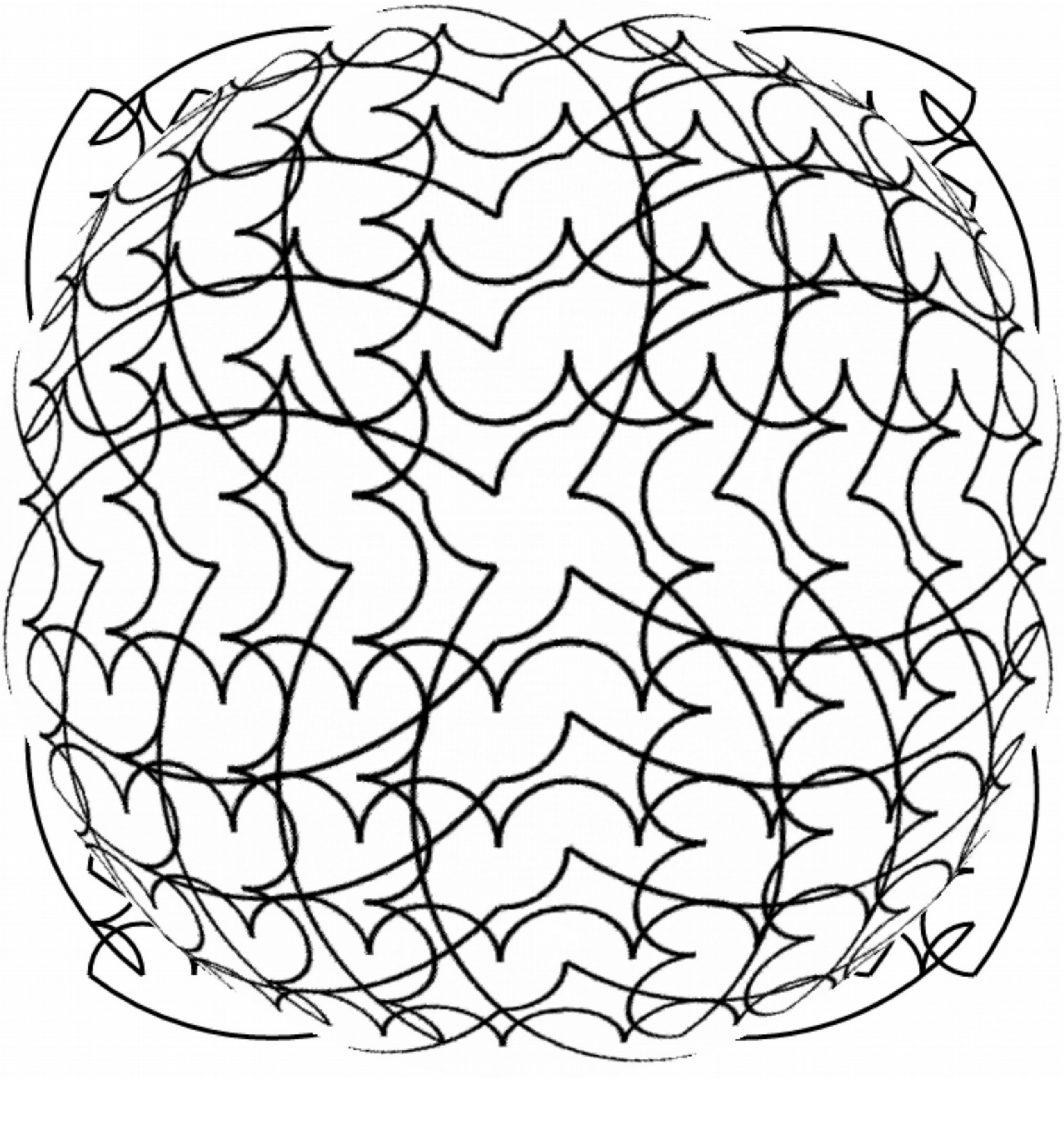


Plate 6 Repitition

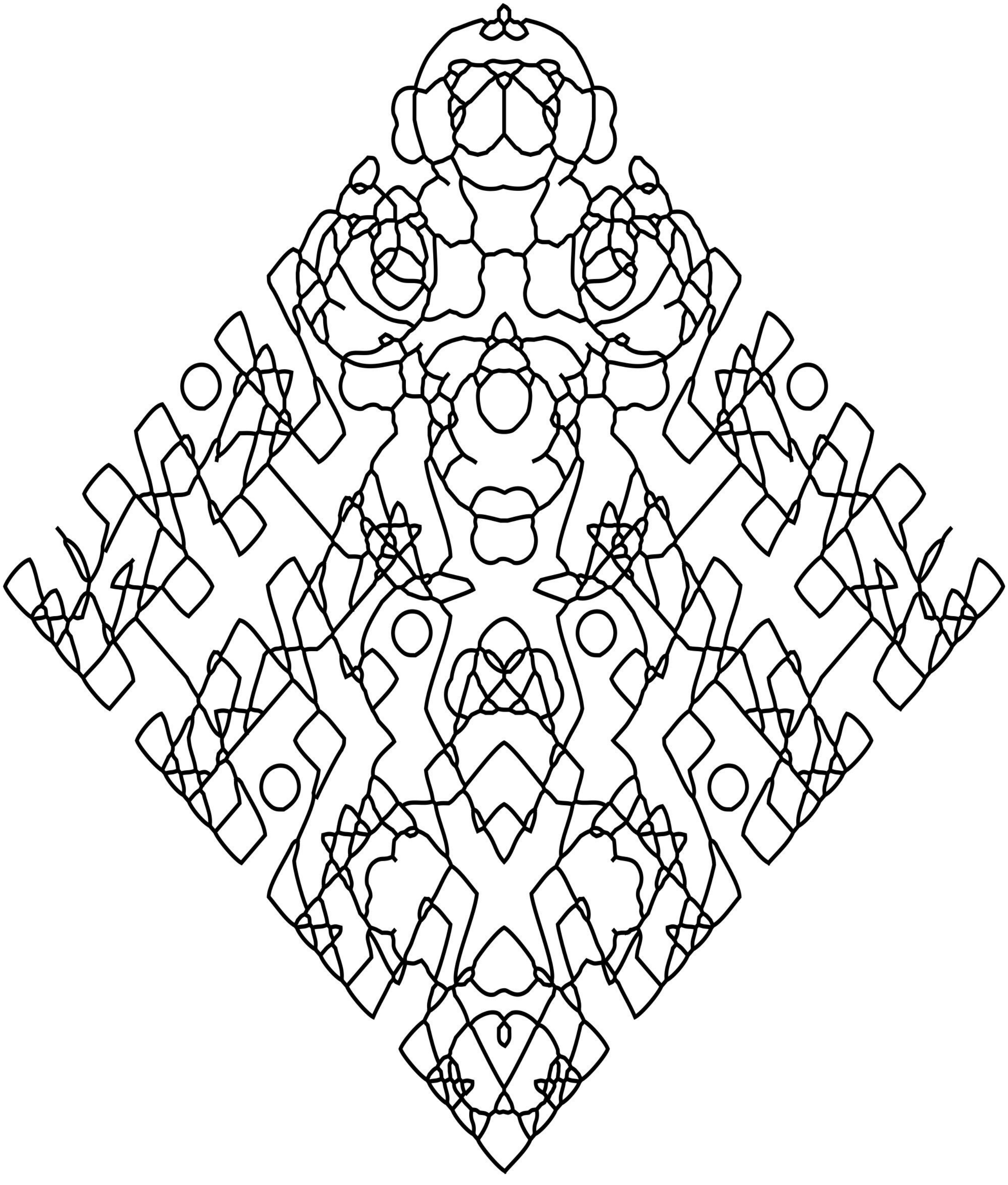


Plate 7 Ninja1

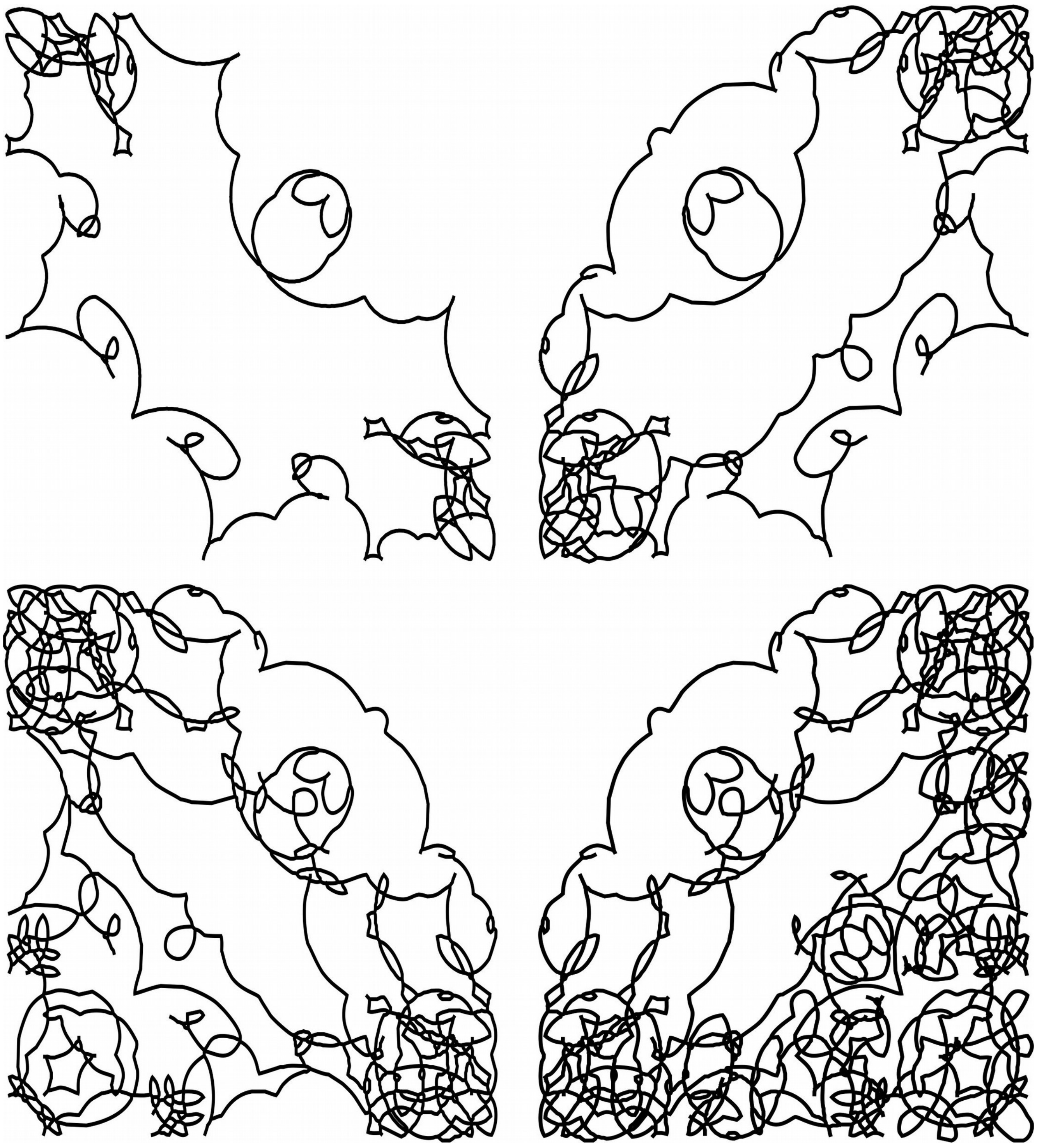


Plate 8 Birdmen

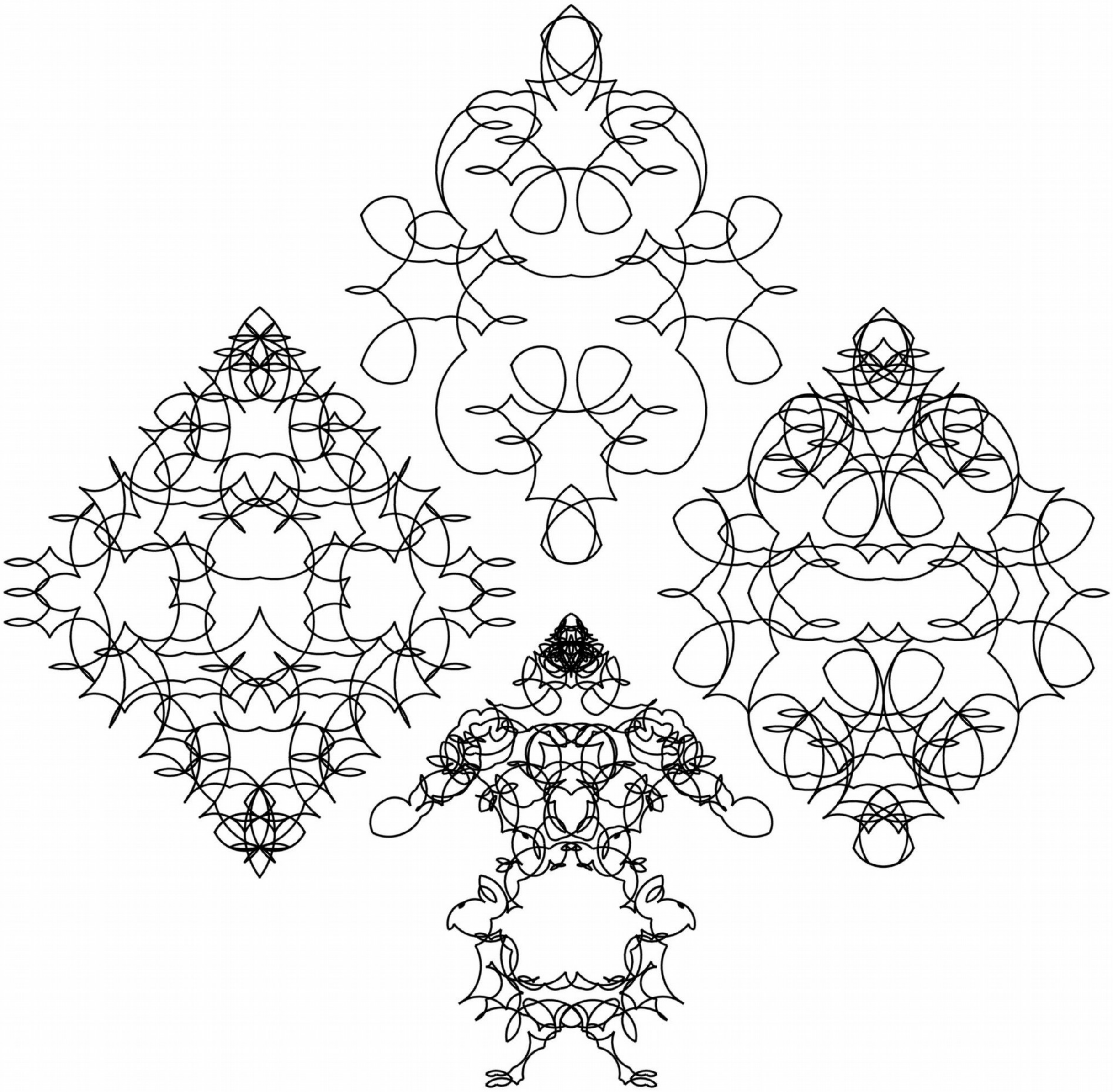


Plate 9 Guards

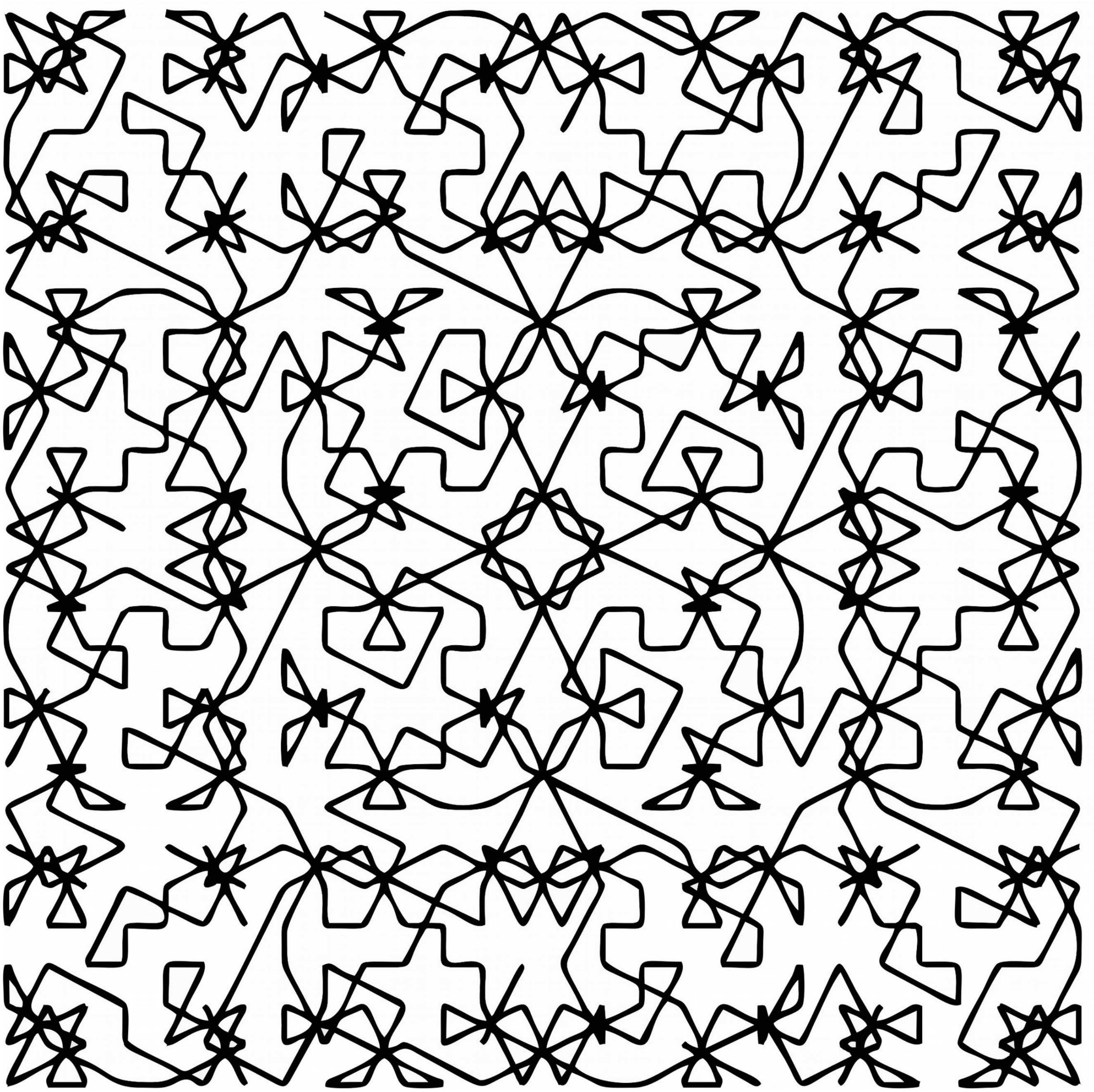


Plate 10 Gate

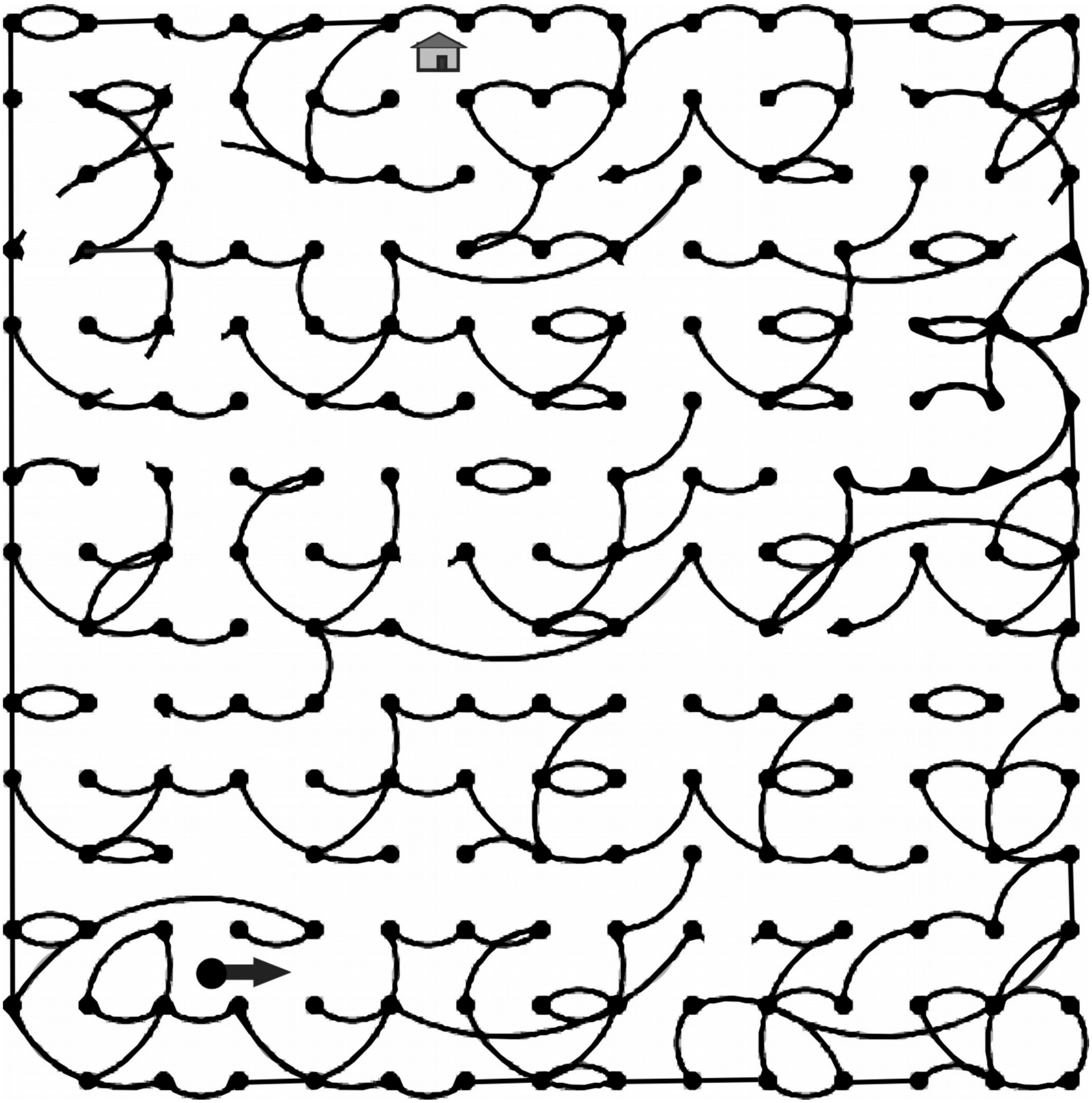


Plate 11 Maze 1

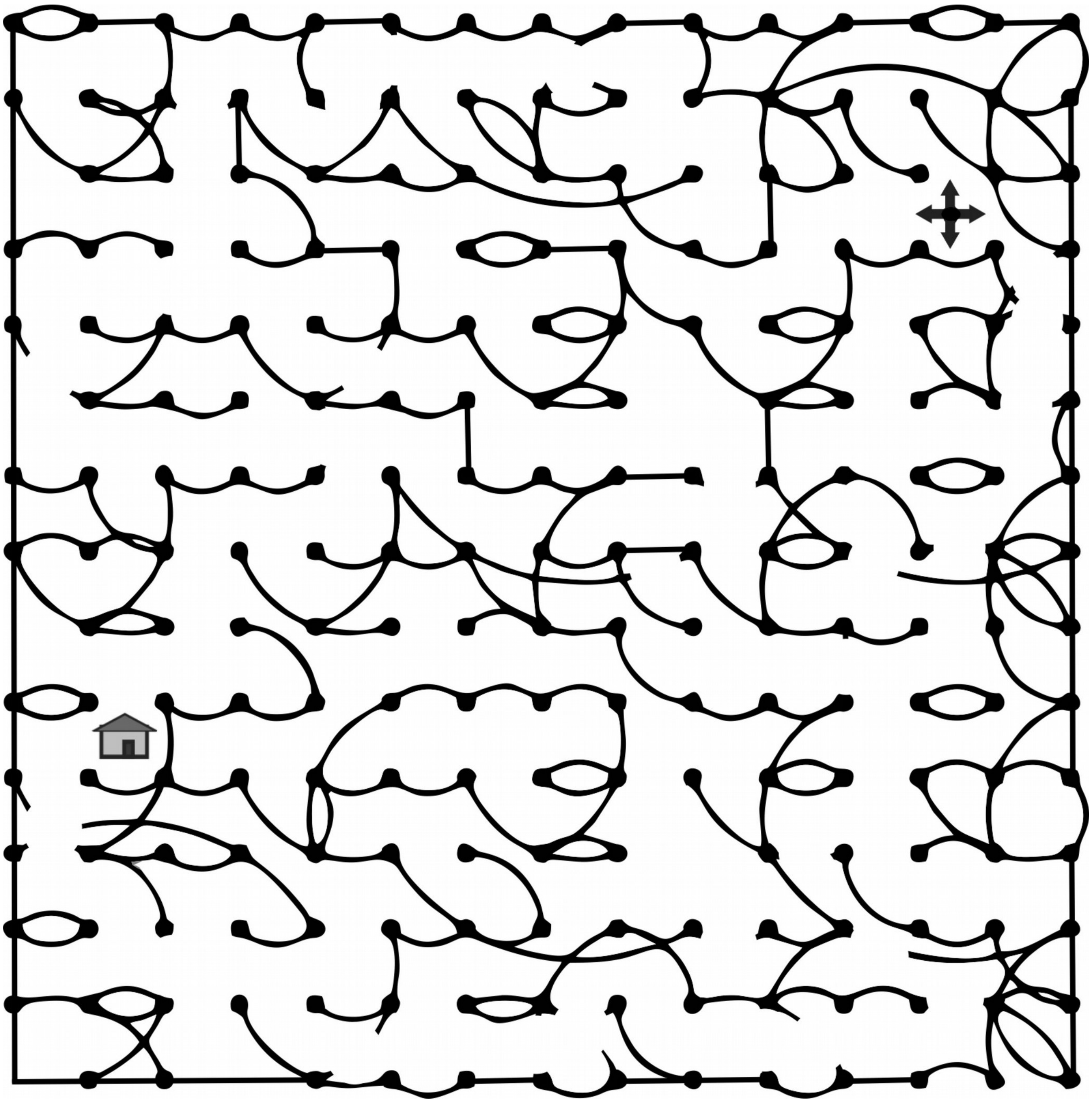


Plate 12 Maze 2

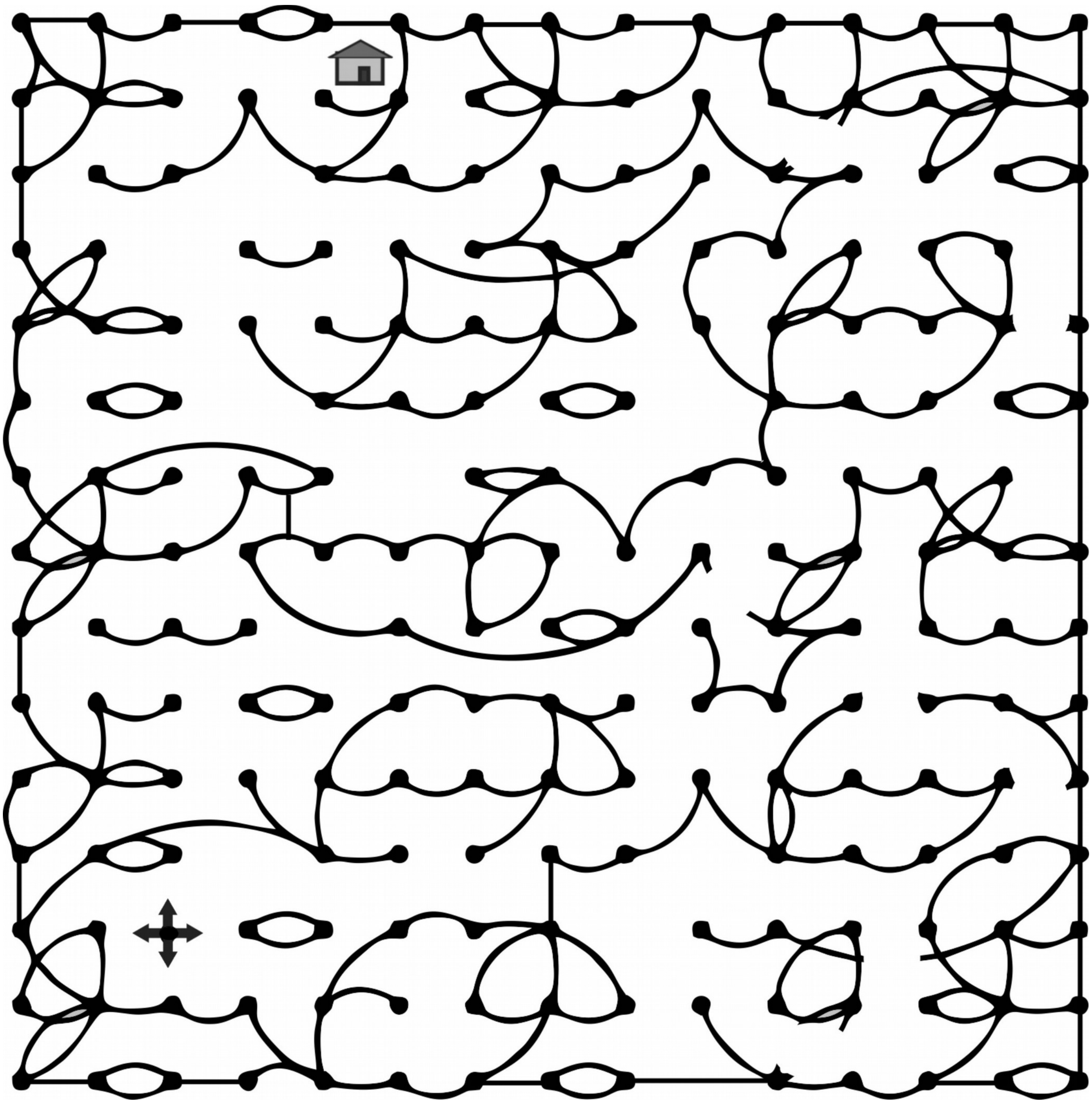


Plate 13 Maze 3

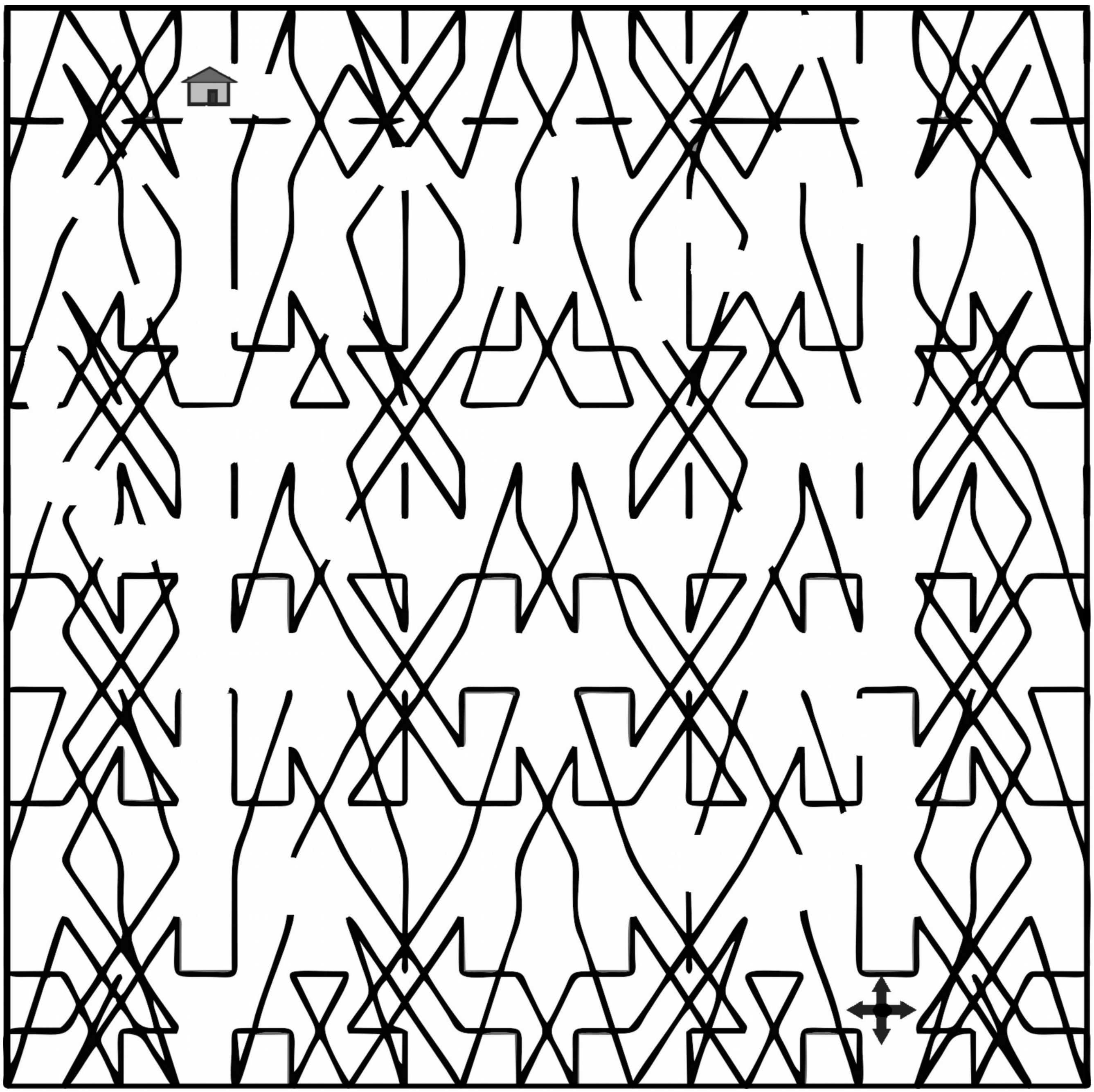


Plate 14 Maze 4