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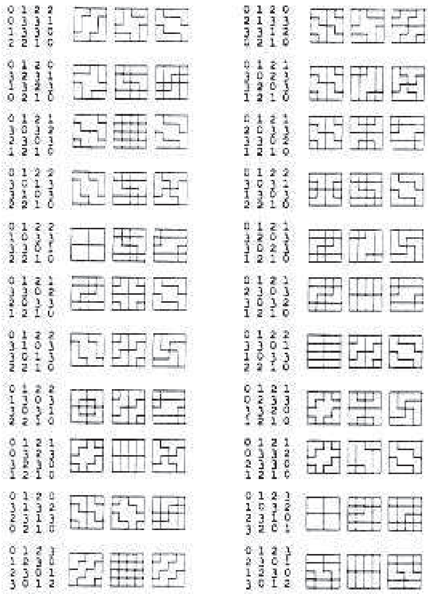
NOTES ON THE COVERS: Illustrations are produced by manipulation on a CRT screen (IBM 2250) from a pattern of two equal squares, programme, "MOLNART 1." They are from a June, 1976 Exhibition by the artist at the Polytechnic of Central London.

DIAMOND THEORY

by Steven H. Cullinane

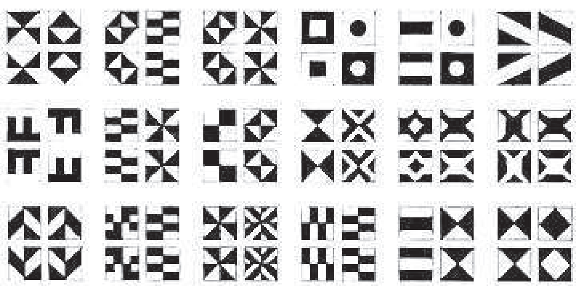
The following illustrations and notes are from the paper, "Diamond Theory," a method of achieving innumerable designs from mathematics. The artist may then choose from the designs to make use of them in paintings and sculpture.

The paper is a technical mathematical work, very heavily illustrated, copyrighted by the author, and available from him for $2.00.

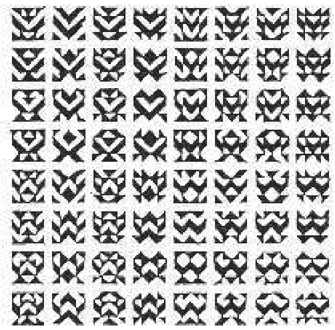


ABOVE: List of foursquares and their block maps. The illustrations shown above are but a few of those generated by the author's system.

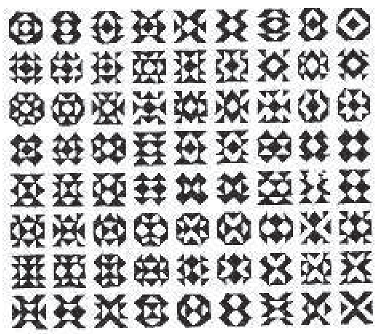
BELOW: "Alternate Designs for Faces of Cubes in a Movable Sculpture" by Steve Cullinane. (These and the designs used in "Design for a Movable Sculpture" are examples of "good sets" of geometric figures.



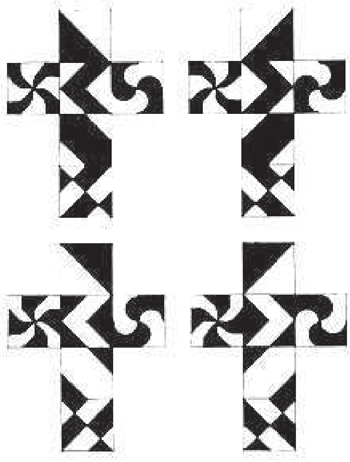
BELOW: Sketch for a painting of the normal diamonds with orbits that are arrows.



BELOW: Sketch for a painting of the normal diamonds with orbits symmetric under H and under V.



BELOW: "Design for a Movable Sculpture." The sculpture consists of 16 cubes -- four copies of the four cubes below -- arranged in a 4X4 plaid matrix, so that permutations of rows, columns, and quadrants, along with rotations of the cubes show different sets of faces, yielding a variety of regular geometric matrices.



sculpture © 1976 Steven H. Cullinane

DEFINITIONS: The set F from which the n^2 entries of an nxn matrix M are drawn we will call the set of elements of M. For conciseness, by a permutation p of the elements of M we will mean, according to context, either a permutation on F or the transformation of M to a matrix Mp that it induces. For example, taking F=(0,1,2,3) and M=as shown, p (01) induces the following transformation:

Note that the entries of M occur within a lattice of squares. We will continue to view matrices in this way, whether or not the lattice is shown explicity.

We now substitute for the elements of M the four triangular half-squares (which we will call simply triangles) in this order: (ILLUSTRATIONS AT RIGHT.)

The diamond-like matrix D at right is the result of this substitution.

FACT -- D has the following properties:

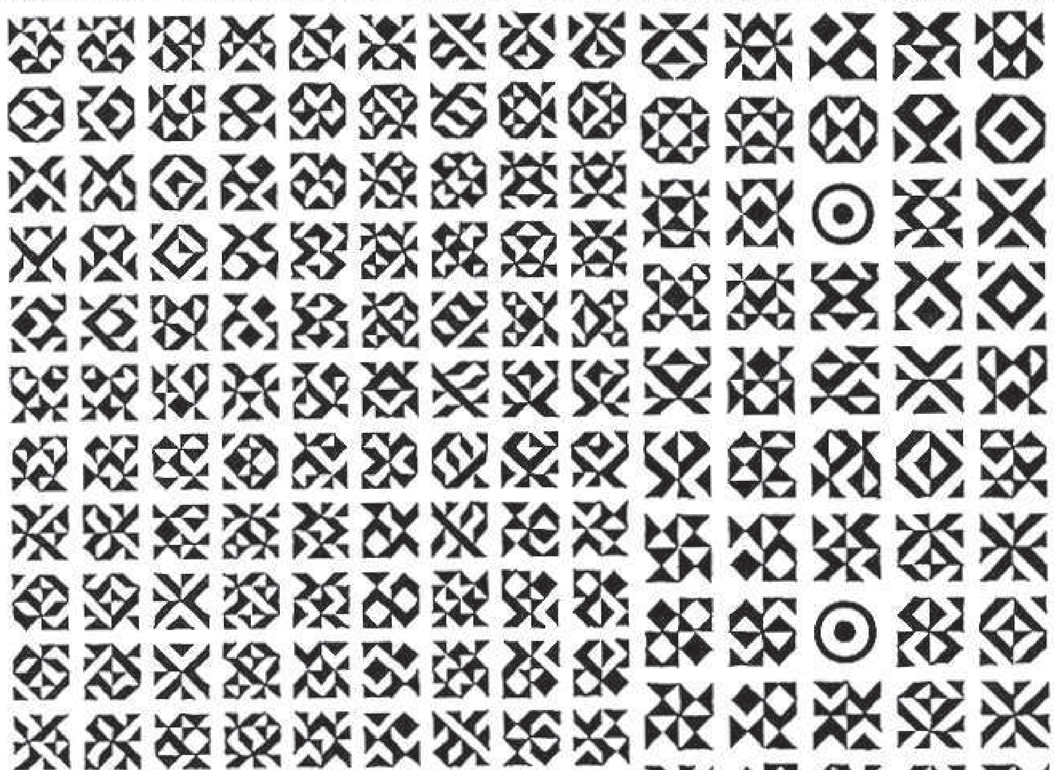
(1) Any matrix (i.e., geometric figure) obtained from D by a permutation of elements is either symmetric or self-complementary (black and white interchanging) under some rigid motion of the square.

(2) Any matrix obtained from D by a row-column permutation (one of rows and of columns) is also symmetric or self-complementary.

(3) The same is true for permutations of quadrants (the subsquares obtained by bisecting a square along each median).

(4) The same is true for any combination of the three sorts of permutations mentioned above.

NOTE: For complete details of this system, see the paper, "Diamond Theory," available from the author.

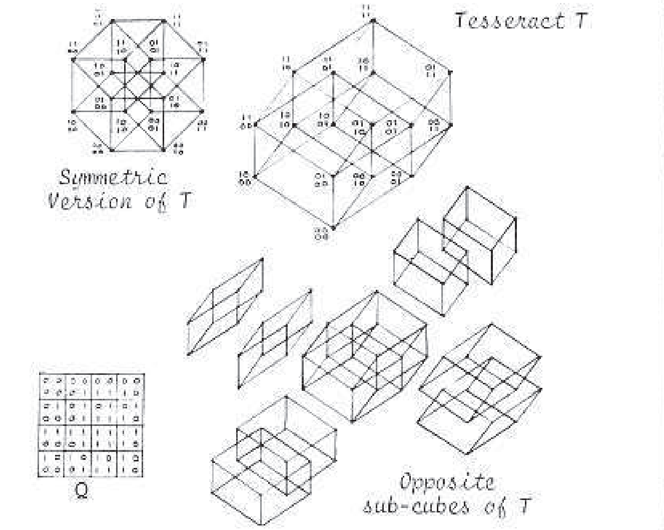


ABOVE: "Canon" by Steve Cullinane shows the subtle interrelationships and symmetries existing among the 156 distinct (in the sense that none can be obtained from another by a rotation in the same plane) figures formed by using the four triangular half-squares as elements of 4X4 Latin squares. At right is an illustration of the half-squares.

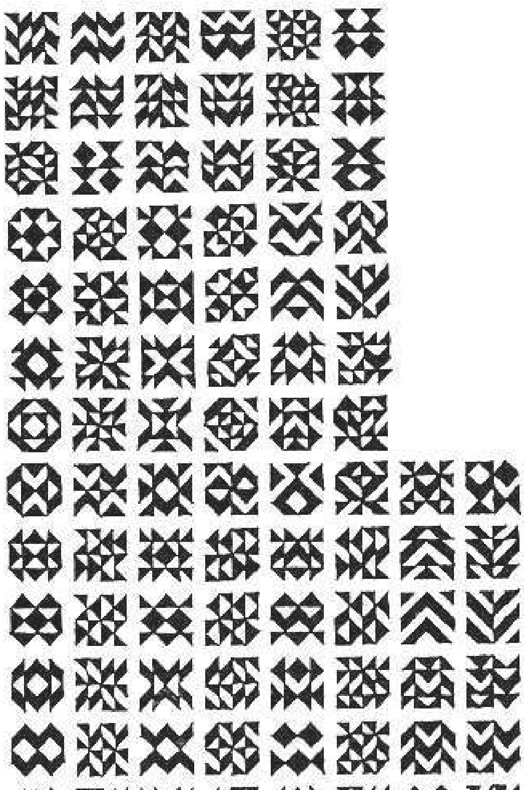
At right, the half-squares: 

A Latin square is an nxn array of n types of elements with each element appearing exactly once in each horizontal row and exactly once in each vertical column. The "eyes are there to fill out the spaces that would otherwise be empty.

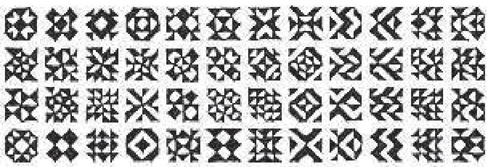
Note: In analyzing the structure of a 4x4 matrix, the tesseract (i.e., hypercube) T at the right below is sometimes useful. Note that T is the diagram showing partial ordering, by inclusion, of the subsets of a four-element set. If the matrix Q at the right is considered as drawn on a torus, then entries of Q are adjacent if and only if the corresponding vertices of T are. The entries in a row, column, or 2x2 submatrix of Q correspond to the vertices in a parallelogram in the drawing of T.



BELOW: Additional illustrations of the half-square diamond manipulations and resultant designs.



BELOW: Sketch for a painting of the diamonds derived from "star" foursquares -- those that yield wholly symmetric diamonds, among others.



BELOW: "Some Geometric Matrices other Than Diamonds." Examples are quadratic matrices, modulo complementation and symmetries of the square, formed from the following good sets of figures: