SYMMETRY MODELS THAT LEAD INTO ELEMENTARY LOGIC

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A careful use of the concept of symmetry makes it much easier to present logic to beginners. This becomes especially evident when symmetry is built into a system of educational toys. What follows is a short report that describes how cards, mirrors, and hand-held models can be used to lead into elementary logic.

The example that follows will be limited to the logic of any two things, also called the logic of two propositions, no more than that. Although it may not be evident at first, this example calls on, and draws out, a special set of relations, namely, all of, and not one less than, the sixteen relations between the two things (A,B), such as 'A and B,' 'A or B,' 'if A, then B,' etc. These relations are often called the sixteen binary connectives.

The sixteen DOT-SQUARES in Fig. 1 show all combinations of enlarged corners at the four corners of a front-back square card. There is one dot-square card for each letter-shape (LS) on the FLIPSTICK that appears in the preceding abstract in this volume. These DOTS are coded the same as the STEMS in that abstract.

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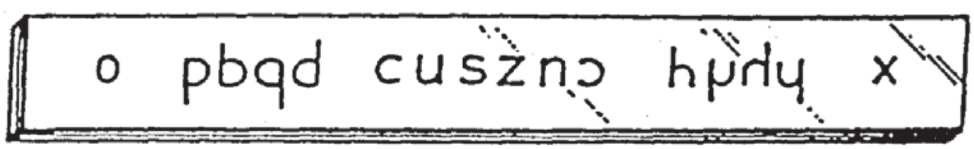

The FLIPSTICK in Fig. 2 also has another set of letter-shapes on its back side, in see-through orientation. The CLOCK-COMPASS in Fig. 3 shows all of the LSs when they have been placed inside of the corresponding dot-squares. The BINOMIAL SUBTOWERS in Fig. 4 have LSs on all four faces: (H)orizonatal flips to the left, (V)ertical flips to the right, and HV-rotates on the back side. The LOGIC BUG in Fig. 5 can also be subjected to the same system of H-flips, V-flips, HV-rotates, and across the center (M)ates.

Fig. 6 shows the EIGHT SYMMETRIES OF A SQUARE: the four flips (horizontal, vertical, two diagonal) and the four rotations (90, 180, 270, and 360 degrees) that are generated when any dot-square is placed between two mirrors at 45 degrees (heavy lines), in this case one darkened in the upper-right quadrant.

The LOGICAL GARNET in Fig. 7 shows what happens when the LSs are placed at the vertices of a rhombic dodecahedron; two vertices (sz) are fused at the co-center. The 8-CELL OF LOGICAL GARNETS in Fig. 8 is generated when three mutually perpendicular mirrors act on an identity garnet (A * B). Three dots in (1) become all combinations of Negation (N,N,N) that act on A, on *, and on B.

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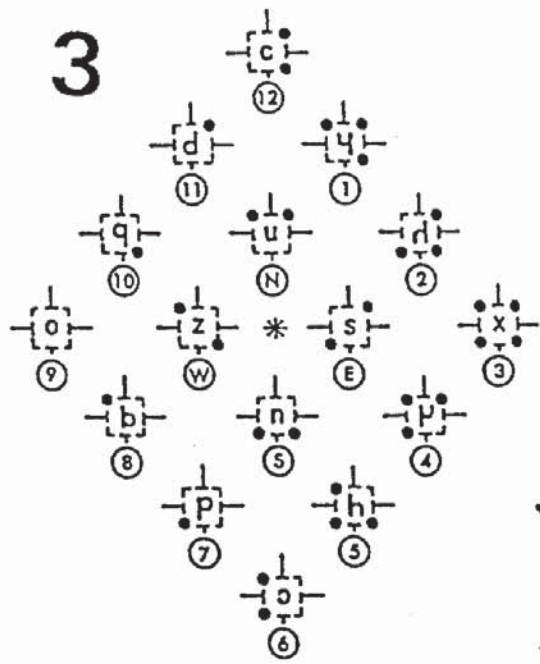

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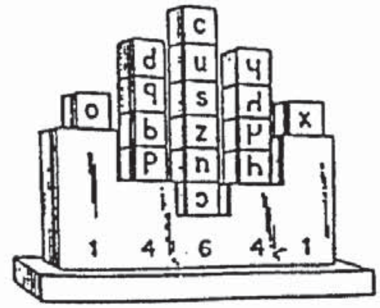

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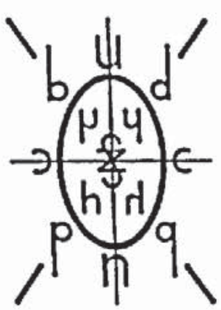

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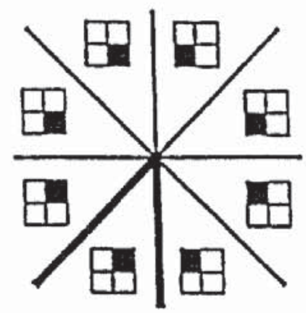

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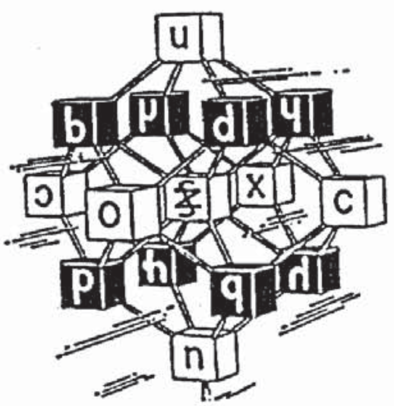

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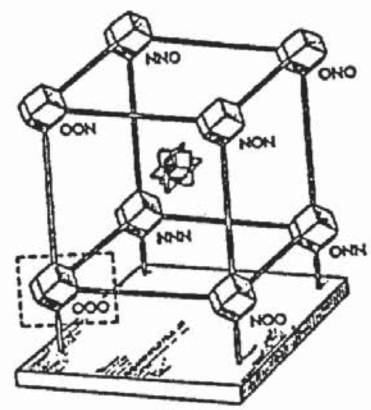

References (See preceding abstract for more details)

Zellweger, Shea (1981). Devices for displaying or performing operations in a two-valued system. Patents in the United States (1981, 1983, 1985), Canada (1983), and Japan (1991).

______________ (1982). Sign-creation and man-sign engineering, Semiotica 38:17-51. Figs. 3, 7, and 8 are from this paper.

______________ (1992). Cards, mirrors, and hand-held models that lead into elementary logic. Displayed at the Sixteenth Meeting of the North American Region of the International Group for the Psychology of Mathematics Education, 6th-11th August, University of New Hampshire (Durham, N.H.).