

Appendix IV: A Selection of Resource Material

As in Appendix III, this list is restricted to material which is still available as far as is known and which has been used in the "SMART" program. More extensive listings and intensive treatments may be found in the publication *World Game Review*.

A. Mathematical Games

Many of the games described here also provide the milieu for countless puzzles, but we will concentrate on their gaming aspects.

Kadon's "Lemma" is the brainchild of Kathy Jones. It can best be described as a meta-game, in which the specific rules change from game to game and evolve gradually within each game in a logically consistent manner. It challenges the creativity of the players.

Avalon Hill's "Sleuth" is a multi-player game in which a deck of special cards is divided among the players, except for one card whose identity is to be deduced. Each player can examine the cards in hand and there are rules which allow for the examination of other players' cards.

Parker Brothers' "Black Box" is a game in which two players assume distinct roles. One player sets up on the playing board a secret configuration of four or five counters, the locations of which the other player tries to discover. The information-gathering mechanism utilizes geometric reflexion in an ingenious way.

In Kadon's "Colormaze," each player has a secret configuration which is to be constructed on the playing board, utilizing counters contributed by all players. The counters can be manipulated in various ways as players inadvertently aid or hinder one another while trying to attain their own objectives.

One of the most popular configuration games is undoubtedly Tic-Tac-Toe. Mag-Nif's "Re" is a non-rectangular, three-dimensional variation in which each stack of counters must be built from the ground up.

The classic game Hex exemplifies another form of configuration game, which requires the building of connected chains linking a pair of opposite edges of the playing board. Here, two players work at cross purposes, since the only way to prevent the opponent from forming a chain is to complete one's own. Avalon Hill's "Twixt" is another game in this category, where the chains are formed along knight moves.

Kadon's "Octiles" has an unusual playing board formed of 17 octagonal tiles that are continually being rotated or replaced by an eighteenth tile. The object of the game is to advance counters from one edge of the board to the opposite one along paths on the tiles, while opposing players get in the way either by blocking the paths with their counters or by altering the board.

The oriental game "Go" utilizes connectivity to enclose and control space on the playing board. Mattel's "Cathedral" is a variation with polyomino-shaped pieces in the form of attractive medieval buildings.

As its name implies, the theme of Lakeside's "Isolation" is the destruction of connectivity. As the game progresses, the squares of the playing board disappear, until one player's counter can make no legal move.

Gabriel's "Point Blank" is another last-move-wins type of game. Each of two players builds a connected path until one player runs out of room. Jeremy Jackson, a Grade 6 student in Garneau Elementary School in Edmonton, discovered a winning strategy for the second player; so a special rule must be added to make that strategy inoperative.

In the game Nim, players take turns removing counters, with the last to move being the winner. Perfect strategies can be formulated from an analysis based on the binary system. Mag-Nif's "Psych Out" is a compact physical version of the game.

Milton Bradley's "Domination" is also a last-move-wins type of game, but here the winning

way consists of preventing the opposing players from moving by dominating their counters or, better still, by capturing them.

Lakeside's "Shogun" is a magnetic version of chess. Each square of the playing board is magnetized, as is each of the counters. The mobility of each counter is determined by a number which depends on both the counter and its location. The objective is to checkmate the opponent's king.

"Quantum," available from Kadon, is a fantastic combination of chess and checkers. The initial set-up is randomized by shaking the specially constructed playing board until the weighted counters fall in place. Each counter begins as a checker but turns into a chess king or queen after its first move. The objective is to occupy the centre of the board.

The "Game of Solomon" is the invention of Martin Gardner. It is a version of checkers on a compact board which forces immediate interaction. It can also be played as a Nim-type game. It is available from Kadon.

B. Two-dimensional Polyforms

The polyominoes, polyiamonds and polyhexes, discussed in Kathy Jones' article, provide an endless number of puzzles, both entertaining and aesthetically pleasing. They are by far the most versatile of all puzzle sets.

Kadon's "Poly-5," "Sextillions" and "Heptominoes" are the finest series of the polyominoes in the market. They are made of high-quality acrylic, are laser-cut for perfect fit and are compatible with one another. The first consists of all polyominoes up to and including the pentominoes. The second consists of the hexominoes together with an instructive booklet. The third series, available by special order only, consists of the 108 heptominoes which are unavailable elsewhere.

Tenyo has put out a series of plastic puzzles under the collective title "Beat the Computer." It includes a double set of the tetrominoes, a set of the pentominoes, a set of the hexominoes, a set of the hexiamonds, a set of the heptiamonds and a set of the pentahexes. They are attractively made but are too small for easy manipulation. The pentominoes are also available from Gabriel in a set named "Hexed."

The polyominoes, polyiamonds and polyhexes are based on the regular tilings of the plane using

squares, equilateral triangles and regular hexagons, respectively. If only one kind of regular polygon is used and the polygons meet edge-to-edge, these are the only possible tilings. However, one can relax the conditions in a number of ways.

If two or more kinds of regular polygons are allowed, one can obtain semi-regular tilings. One of them has two octagons and a square meeting at each corner. This forms the basis of Kadon's "Super Roundominoes," a wonderful set in six splendid colors.

On the other hand, we may restore the condition that only one kind of polygon be used, but allow the prototype to be non-regular, such as an isosceles right triangle. The popular Tangram is derived from this tiling. A nice wooden set is available from Pentangle while an inexpensive set is available from Setsco. There are several variations of this puzzle, including Kadon's "Grand Tans" and Milton Bradley's "Boxed In."

C. Three-dimensional Polyforms

There are two broad categories of these puzzles, the polycubes and the polyspheres. Of the former, there is the classic Soma Cube. While this is available in many forms, a nice wooden set may be ordered from Sivy Farhi or from Dale Seymour Publications. Lakeside has put out six variations collectively called the "Impuzzables." Pentangle has one called "Question Mark."

Kadon's flagship is the set "Quintillions" which consists of the pentominoes with the appropriate thickness, so that each piece may be considered as being formed of five unit cubes. This allows for three-dimensional constructions. Pentangle has a colored set called "Super Pentacubes."

Kadon has a companion set, "Super Quintillions," containing all non-planar pentacubes. A set called "Polycube Supplement," which consists of all polycubes up to and including the tetracubes, may be obtained by special order. Finally, there is the magnificent "Hexacubes," all 166 of them, which together with four unit cubes fill a 10 by 10 by 10 box! The Kadon sets are all made of fine hardwood and are laser-cut and compatible with one another.

Mag-Nif's "Tut's Tomb" is a simple but elegantly intriguing pyramid puzzle, consisting of 20 spheres in four pieces. "Perplexing Pyramid," distributed by Kadon, is the same size but more difficult. Even more difficult polysphere puzzles from Kadon are "Big Pyramid," "Giant Pyramid" and the excellent four-in-one puzzle "Warp 30."

D. Mathematical Jigsaw Puzzles

Jigsaw puzzles are characterized by the jagged edges of the pieces which interlock with one another. This may be considered as a physical way of imposing conditions on what pieces may be adjacent and in what combination.

Kadon's "Stockdale Super Square" is a 6 by 6 configuration in the standard mode, but the jagged edges are beautiful, heart-shaped patterns. The set is much more than a jigsaw puzzle. Its instruction booklet is full of suggestions for games and puzzles.

Milton Bradley's "It's Knot Easy" consists of 16 square pieces each containing the picture of part of a piece of rope. They are to be put together in a 4 by 4 configuration so that the pieces link up into a knot.

Pentangle's "Perplexing Python" is the same idea extended to the third dimension. Eight cubes are to be assembled into a 2 by 2 by 2 configuration, showing a python from head to tail.

Heye has put out a series of "Crazy" puzzles. "Crazy Dogs" consists of nine squares each showing four halves of dogs terminating at the edges of the squares. The squares are to be put into a 3 by 3 configuration and two squares may be adjacent if the two halves on either side of the common edge form a complete dog. "Crazy Cats" consists of nine equilateral triangles to be assembled into a larger equilateral triangle. There are a dozen or so puzzles in this series.

Mag-Nif's "On the Level" consists of nine square pillars. The cross-section of each is divided by the diagonals into four quadrants. Each individual quadrant may be at one of three levels. The object is to form a 3 by 3 configuration where adjacent quadrants along a common edge must be on the level with each other.

Kadon's "Hexmozaix" consists of twelve hexagons. Each is subdivided into six sections in three colors, with two sections of each color. They are used for many games and puzzles, all calling for the hexagons to be assembled in such a way that the colors match along common edges.

The same principle applies in Kadon's "Triangoes" which uses tangram-type pieces in five distinctive colors to fill up a beautiful playing board so that the colors on the pieces match those on the board. On the reverse side is an uncolored playing board which is used for many games and puzzles.

E. Rubik-type Puzzles

Rubik's Cube and related puzzles are an outstanding invention of all time in recreational mathematics. Unfortunately, the fad has faded and devotees find it increasingly difficult to obtain these puzzles. Very few new ones are being made.

Fortunately, some are still available from Cubes International, including the "Cube Ultimate" (5 by 5 by 5) which never made it into the mass market in North America. There are also "Rubik's Revenge" (4 by 4 by 4) and the original classic (3 by 3 by 3), as well as the wonderful "Skewb," a cube with an unusual turning motion. Others include "Impossiball," "Tower of Babylon," "Alexander's Star," "Pyraminx," "Magic Dodecahedron," "Magic Domino" and "Ten Billion Barrels." Some of these are also available from Pentangle.

F. Take-apart Puzzles

There are two broad categories of these puzzles. The first category may also be described as disentanglement puzzles. Outstanding in this field are four puzzles from Binary Arts. As the name of the Corporation suggests, the binary system has a lot to do with the solution of these puzzles.

Both the "Cat" and the "Horse" are fine sculptures of wood and wire and the object is to remove a loop from the wire form. "Spinout" is a splendid variation of the classic Tower of Hanoi puzzle. Here a tray of seven turnable discs is to be disengaged from the base. "Hexadecimal" is a more elaborate sixteen-in-one puzzle. The "Brain" from Mag-Nif is based on the same principle but, unlike the products of Binary Arts, it does not give the solver a full view of the inner structure of the puzzle.

The second group of take-apart puzzles consists of those in which the whole structure decomposes into its component parts. A wide selection is available from Stewart Coffin.

"Mayer's Cube" from Pentangle is a 4 by 4 by 4 cube with a 1 by 1 by 1 interior hole. It is made of six interlocking pieces. It is not easy to take it apart and harder to reassemble it.

Mag-Nif has a series of these puzzles. The simpler ones are the "Magic Box" (two pieces), "Curious Cross" (three pieces), "Four Squares" (four pieces) and "Astrologic" (six pieces).

Kadon's "Icosatriad" is a great dodecahedron composed of twelve wing-shaped pieces with three

in each of four colors. They are held together by six frog-shaped pieces that form a hidden cube. The puzzle comes in a cage consisting of four interlocking hexagonal rings that form the skeleton of a cuboctahedron.

G. Mathematical Models

“Rubik’s Snake” from Ideal is different from the Rubik-type puzzles in that it is less of a puzzle and more of construction set. Jan van de Craats’ “De Slang van Rubik” (in Dutch) is a beautiful picture book of 101 symmetric designs for this puzzle.

Mag-Nif’s “Tri-logic” consists of 24 triangular plates that can be snapped together along their edges to form various polyhedra. Several sets can be combined for larger constructions.

“M. C. Escher Kaleidocycles,” published by Pomegranate Artbooks, is a wonderful collaboration of Doris Schattschneider and Wallace Walker. It consists of a set of cardboard models (glue not supplied) and a book. The models fall into two sets. The first consists of the five Platonic Solids plus one of the Archimedean Solids. They are attractively decorated with colored versions of Escher’s graphic designs. The mathematics of the Escher tilings and their association with both sets of the models are discussed in the book.

The second set of models consists of the mathematical objects in the title role, the kaleidocycles. Each is a loop of tetrahedra linked only along common edges. The loop can be twisted continuously, with different groups of faces coming into view in a forever changing kaleidocycle.

H. Addresses

We have not listed addresses of companies such as Mattel whose products are widely available. We do

not have the addresses of Tenyo or Heye, their products being handled by importers.

Avalon Hill Game Company
4517 Harford Road, Baltimore, MD 21214

Binary Arts Corporation
703 Timber Branch Drive, Alexandria, VA 22302

Cubes International
Haarholzer Strasse 13, D4630, Bochum 1, West Germany

Dale Seymour Publications
P.O. Box 10888, Palo Alto, CA 94303

Kadon Enterprises Inc.
1227 Lorene Drive #16, Pasadena, MD 21122

Mag-Nif Inc.
8820 East Avenue, Mentor, OH 44060

Pentangle
Over Wallop, Hampshire, United Kingdom
SO20 8HT

Pomegranate Artbooks Inc.
P.O. Box 980, Corte Madera, CA 94925

Setsco Educational Ltd.
567 Clarke Road, Coquitlam, BC V3J 3X4

Sivy Farhi
815 South California Avenue #B, Monrovia, CA
91016

Stewart Coffin
79 Old Sudbury Road, Lincoln, MA 01773

World Game Review
3367-I North Chatham Road, Ellicott City, MD
21043