Pattern Puzzles

Edge Matching

Edge-Matching puzzles have many aspects in common with polyform puzzles. In both, the objective is to tile the plane to achieve a specific arrangement (e.g. a square grid), using a set of tiles, each of which has specific features - shape, pattern/symbol/color, sometimes both - that, together with rules about them, govern which tiles can abut others.

Since the tiles can be printed on cardboard, these puzzles can be relatively inexpensive to produce, and in the past have served extensively as advertising promotions and giveaways. Some have been produced in wood, often thin plywood, and must recently in wood or acrylic using laser cutting. There are many modern edgematching puzzles - you may have heard of "Scramble Squares" for example.

Jacques Haubrich has published his definitive "Compendium of Card Matching Puzzles" in three volumes, in which he describes over 1000 puzzles, and a companion volume called "About, Beyond, and Behind Card Matching Puzzles" in which he provides interesting theoretical and historical analyses.

In his book New Mathematical Pastimes, P. MacMahon published some of the first material to treat edgematching puzzles with mathematical rigor. As discussed in my polyforms section, the only regular polygons which can be used to completely tile the plane are the equilateral triangle, the square, and the hexagon. It is evident in Haubrich's Compendium that these shapes comprise the majority of tile shapes used in existing edgematching puzzles. Rectangles have also been used, as have octagons (allowing empty areas). It would be interesting to see other shapes, perhaps non-periodic tiling?

Some puzzles have tiles surfaces other than a plane - e.g. the platonic solids, or a cylinder.

Tile-laying puzzles (in German, "Liegspiele") of both the edge-matching and polyform varieties have been explored and produced by Kate Jones at Kadon, and you can read a lot of interesting material at the Kadon site - see Edgematching Colors and Shapes, and More About Edgematching.

You can see Erich Friedmann's collection here. You can see some original designs by Yukio Hirose here. Take a look at George Hart's article "A Color-Matching Dissection of the Rhombic Ennecontahedron." Also see Peter Fair's page, and Toby Gottfried's site.

At the January 2007 Toy Fair, Tomy launched the Enneacontahedron. You can see some original designs by Yukio Hirose here. Take a look at George Hart's article "A Color-Matching Dissection of the Rhombic Ennecontahedron." Also see Peter Fair's page, and Toby Gottfried's site.

According to Slocum and Botermans' "Puzzles Old & New," the first edge-matching puzzle was patented by E.L. Thurston (in 1892 - see U.S. Patent 487798), and used by Calumet as advertising for their baking powder cans. I solved the Calumet puzzle using a variant of my Drive Ya Nuts technique. The newspaper ran a contest and offered various prizes, and my copy came with a yellowed newspaper clipping showing the winner - one Mr. C. Lewis of Dalston - and the solution. See British Patent No. 1006878.

The Grandpa's Wonder Soap Puzzle was patented (U.S. Patent 331652) in 1931 by A.K. Rankin. It is described on page 38 of Slocum and Botermans' "Puzzles Old & New." The goal is to form a 3x3 grid such that at the points where the quarter-circles on the corners of the tiles meet (either four or two), there are always different colors on each of the meeting quarter-circles. Grandpa's head must always be upright on every card, so the cards cannot be rotated. Jacques says this is the first example of a corner diamatching puzzle. There are different versions.

The Besco Soap Puzzle - from the Beaver Soap Company of Dayton Ohio. Form a 3x3 grid such that there are four different colors in each circle at the corners, and two different colors in each half-circle. There must also be a different color at each of the four corners of the grid. The pieces must all remain oriented with the word "Besco Soap" upright. See U.S. Patent 490689.

The Waddingtons Mindbender Series

More About Edgematching

Compendium of Card Matching Puzzles

About, Beyond, and Behind Card Matching Puzzles

Other Pattern Puzzles

MacMahon Compendium

Pattern Blocks

Pattern Puzzles

Edge Matching: Other Pattern Puzzles

Rob's Puzzle Page - Pattern Puzzles

http://home.comcast.net/~stegmann/pattern.htm#insanity
The OXO Triangle puzzle. This was published in 1922 by the OXO Company for a contest. There are 25 equilateral-triangular cards/tiles, numbered 1 through 25. The tiles must be arranged into a side-5 large triangle such that at each point where the corners of different tiles meet, the colors are different, and such that at each point where three tiles meet they spell "OXO" and where six tiles meet they spell "OXOXOX." There are 104,920 solutions but finding even one by hand is very difficult.

The Nestle’s puzzle, published around 1930-1940, was the first 7-tile hexagonal edgematching puzzle. This one is printed in Spanish. There have been many variants, including the modern "Mére Ya Nuá." JH Vol.4 p510 - 1 soln

Le Berger Malin - The Lazy Shepherd (H. & A. Allen Paris circa 1920). NOTE: "malin" can also be translated as "ingenious." There are nine tiles, each of which is divided into four quadrants by two diagonals. There is a number in each quadrant, and the corresponding number of sheep are depicted. Arrange the tiles in a 3x3 grid such that the total in each square formed where edges meet totals 10. According to Jacques, this is the first known example of a Heads/Tails puzzle (the two numbers which must add to ten comprising the head and tail).

The Nestle’s puzzle, published around 1930-1940, was the first 7-tile hexagonal edgematching puzzle. This one is printed in Spanish. There have been many variants, including the modern "Mére Ya Nuá." JH Vol.4 p510 - 1 soln

Le Fermier Avise - The Wise Farmer
The same principle as the Lazy Shepherd, except with chickens and now it's a wise farmer.

This is L'Arc en Ciel (The Arc in the Sky - i.e. the Rainbow). There are nine discs on pegs, arranged in a 3x3 grid of holes in a baseboard. Each disc has four diamonds arranged pointing north, south, east, and west. Each diamond is one of eight colors: red, green, yellow, orange, gray, white, pink, and blue. The discs must be arranged such that no color appears more than once in each of the three rows and three columns of six diamonds. In this case, not every color appears in every row or column. There is a second constraint - when a pair of colors is placed adjacent horizontally, then that same pair cannot be placed adjacent again in that direction - likewise for the vertical.

Tile-O-Rama
Called the "Wonder Mosaic Puzzle" when it first appeared circa 1925, this was the first design with rectangular tiles. (I have a loose copy but it was also included in the F.A.O. Schwartz Deluxe Puzzle Chest No. 3006.) I also have the Mosaic and Tess Mosaic Square puzzles discussed in Shoomer and Botermans’ "The Book of Ingenious & Diabolical Puzzles" on p.23. According to them, Edwin Thurston patented the first mosaic square puzzle in Dec. 1892.

The Vess Cola Nine Piece Puzzle is an advertising giveaway, promoting Vess Cola; its pieces are equivalent to the Calumet Puzzle. Here is a 3x3 heads/tails that Norman Sandfield found on a visit to the remote Easter Island (Rapa Nui). He bought all he could find, and I got one from him at the 2006 New York Puzzle Party.

The Vess Mystery Puzzle two versions

The "33 to 1" Puzzle, advertising Pabst beer. Copyright 1940.

Pabst 33 - arrange the cards in a 3x3 grid so that the numbers total 33 horizontally, vertically, and along the

Pel-Freeze
The "33 to 1" Puzzle, advertising Pabst beer. Copyright 1940. Numbers total 33 horizontally, vertically, and along the main diagonals.

Jacques' Compendium, Volume 1, pp92-4, indicates that the following 9-square puzzles are isomorphic and have only one solution:
- Le Berger Malin
- Le Fermier Avise
- The Calumet Puzzle
- Pabst 33 to 1 cans
- Pabst 33 to 1 bottles
- The Vess Cola Mystery Puzzle (bottles)
- Vess Cola Mystery Puzzle (caps - violet,brown,green,red)
- Vess Mystery Puzzle (caps - violet,orange,blue,red)
- A-Treat Mystery Puzzle

To me, the edge-matching puzzle is exemplified by the more recent but none-the-less venerable Drive Ya Nuts. I developed a tabular solution, shown below. There was also a version with red nuts in a silver case - it has the same numbering.

Here is a new favorite, an RGB Roundup from Think-Ominos. The basic puzzle is to build a circle in the provided tray, with the adjoining colored dots match. Additional objectives include building various shapes like in Tangrams. The pieces are made of very nice weight plastic material like Mah-Jong tiles.

Pressman's Think-Ominos

Bits and Pieces distributed a similar 2-d puzzle - match the color dots on the squares' edges

The Circus Seven by Masudaya is fairly well-known. In principle it is the same as Drive Ya Nuts, but with tents and colors instead of nuts and numbers. I solved mine easily using my tabular technique.

In Mattel's Mingle Quadrangle one also has to arrange the colored tiles in the tray so that the edge patterns on all adjacent tiles match. One in a series of Brain Drain puzzles.

Ovals - Nob - O-Pico/Color Match

Chelsea Pocket Puzzle - Cats

Chelsea in Greece. Cats, colorful graphics on thin plywood. Novel packaging - an extra backing tile has an attached elastic cord to ensue the stacked tiles. A solution diagram is on the bottom. Available from Padilly.

http://home.comcast.net/~stegmann/pattern.htm#insanity
There are many different versions of Scramble Squares, and most of them are in fact distinct puzzles (not just the same puzzle with different pictures).

IZZI - Binary Arts
Geo Matrix made by Binary Arts for The Museum Company is the same.  
(I don’t have Geomatrix.)  
JH Vol.2 p303

IZZI 2 - Binary Arts
Color Matrix made by Binary Arts for The Museum Company is the same.  
JH Vol.2 p198

DaMert 3D Squares Cars

4D Metapuzzle

Instant Insanity - Hexagon Puzzles 1986
JH Vol.1 p151 - 2 solns

The Invisible Puzzle, designed by Rich Garner, from Loncraine Broxton - Lagoon Trading Co. Ltd. Make a large hexagon from 18 transparent trapezoidal tiles, while matching edge colors.

Setko Match Heads

12 Triangles - Majak

Potterm Upright Spider
JH Vol.2 p149 - 2306 solns

Peek-a-Boo Snakes

Eye-Cue

The Wobbly Web
Create a rectangle from the 15 square tiles such that web strands join (edge matching).
JH Vol.2 p210

The photos show various puzzle puzzles, including Scramble Squares, Zoki, Match the Colors, and others.
3D Edge-Matching Puzzles

This puzzle consists of six plastic pieces each with four color spots on the sides. It is marked "Copyright 1972 Gabriel Ind. Inc." I believe it is a version of Piet Hein's Triple Cross puzzle (that I do not own). I made an xyz-axes center piece from some pipe cleaners. At each intersection, ensure there are three different color spots.

Mental Blocks - Creative Playthings

A 3-dimensional challenge - build a 2x2x2 cube with the pieces, such that the embedded colored rods match where the pieces touch.

This is Aquarium designed by Kohfu Satoh. I bought it at Torito.

Three challenges - no incomplete fish ever allowed to show, but unless otherwise noted fish may span edges/turn corners:
1. Use 3 pieces and build a 1x2x3 showing 7 fish.
2. Use all 4 pieces and build a 2x2x2 showing 9 fish. It is also possible to show only 8 or 7.
3. Use all 4 pieces and build a 2x2x2 showing only 6 fish with none turning any corner.

The Dodeca Nona puzzle comprises a dodecahedral magnetic body, and 12 2-sided pentagonal tiles. The tiles are numbered 1-5 at their vertices in all possible orderings. The objective is to arrange the tiles around the dodecahedron so that the 3 numbers that meet at each vertex add up to nine.

JH Vol.2 p202

This puzzle consists of six plastic pieces each with four color spots on the sides. It is marked "Copyright 1972 Gabriel Ind. Inc." I believe it is a version of Piet Hein's Triple Cross puzzle (that I do not own). I made an xyz-axes center piece from some pipe cleaners. At each intersection, ensure there are three different color spots.

Mental Misery (aka Double Trouble) - Lakeside

A transparent box, a frame which fits inside the box and will hold four cards vertically against the box sides, and five cards each colored with four colors front and back. The four colors are red, yellow, green, and blue. Arrange the cards on five sides of the cube so that edges match inside and outside the cube.

The instructions are marked: Made in Hong Kong, Lakeside Industries, a division of Leisure Dynamics, Inc. Minneapolis Minnesota. Copyright 1970 Leisure Dynamics, Inc. The box is marked: Copyright 1969 L.I.I. Made in Hong Kong. The frame is marked: Copyright 1969 Lakeside Toy Division of Lakeside Industries Inc. Made in Hong Kong.

In Reiss' Flat Top, arrange the eight pegs in the four holes so that each stack ends up at the same height.

In Kohner's Even Steven, match pegs to sleeves such that all pegs align at the same height.
U.S. Patent 3375009 - Stubbmann 1968

Here is another version of Even Steven, with blue plastic rod pieces to be inserted into a clear base. Really closer to Flat Top.

Tekozuru Z2 from Hikimi - purchased from Torito

The Great Pyramid Pocket Puzzle, by Elliot Inventions Wales 1981, is a tetrahedron with 4 equilateral triangular tiles pegged to each side. The triangles are printed on one side only with a series of radiating wedges of different widths. The objective is to arrange the triangles so the edge patterns on all adjacent triangles match. The larger version with 9 triangles per side carried a 25,000 GBP prize for the first solver. I have no idea if it was ever awarded. The small case is a mini-puzzle in itself - a 2-piece trick box.

In Contoura, arrange the blocks so that the surface contour is Binary Arts 4 Cubes - ensure patterns match where they adjoin.
solution must be "toroidal" - i.e. opposite outside edges must all also match.

JH Vol.1 p50s

Rob's Puzzle Page - Pattern Puzzles

http://home.comcast.net/~stegmann/pattern.htm#insanity

My Solution to Drive Ya Nuts

The following is my graphical (or tabular) solution to the Drive Ya Nuts puzzle. I have not seen any solution technique like mine applied to this type of puzzle - even from a page says one must try all combinations. My technique is a considerable saving and allows a solution - and negative results - to be derived easily by inspection - the hallmark of a graphical technique. I have worked this entirely "by hand."

Using this technique I can prove fairly easily that this puzzle has only one distinct solution.

There are seven hexagonal "nuts" that I label A thru G. For each nut, the six sides are numbered 1 through 6 in some order. The numbering scheme of each nut, starting with 1 and proceeding CLOCKWISE, along with the letter ID I arbitrarily assign the nut, is shown below:

- A 1 6 5 4 3 2
- B 1 4 3 6 5 2
- C 1 6 4 2 5 3
- D 1 6 2 4 5 3
- E 1 6 5 3 2 4
- F 1 4 6 2 3 5
- G 1 2 3 4 5 6

All nuts must be used, each one and only once. One nut of seven must be placed in the center. In a solution, each nut except for the center must abut 3 other nuts and at each abutment the numbers assigned to the respective abutting sides must match.

I begin by developing a "Primary Table." The table contains one row for each nut A through G, and one column for each number 1 through 6. Each cell contains the 3 consecutive numbers, in a COUNTERCLOCKWISE direction around the nut, that appear on the nut determined by the row, when the number indicated by the column abuts the central nut.

<table>
<thead>
<tr>
<th>Primary</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
<th>-4</th>
<th>-5</th>
<th>-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A 1</td>
<td>A 3</td>
<td>A 2</td>
<td>A 6</td>
<td>A 4</td>
<td>A 5</td>
</tr>
<tr>
<td>B</td>
<td>D 1</td>
<td>D 3</td>
<td>D 4</td>
<td>D 5</td>
<td>D 2</td>
<td>D 6</td>
</tr>
<tr>
<td>C</td>
<td>C 1</td>
<td>C 5</td>
<td>C 6</td>
<td>C 2</td>
<td>C 4</td>
<td>C 3</td>
</tr>
<tr>
<td>D</td>
<td>E 1</td>
<td>E 4</td>
<td>E 3</td>
<td>E 6</td>
<td>E 2</td>
<td>E 5</td>
</tr>
<tr>
<td>E</td>
<td>F 1</td>
<td>F 3</td>
<td>F 5</td>
<td>F 6</td>
<td>F 2</td>
<td>F 4</td>
</tr>
<tr>
<td>F</td>
<td>G 1</td>
<td>G 4</td>
<td>G 5</td>
<td>G 2</td>
<td>G 6</td>
<td>G 3</td>
</tr>
<tr>
<td>G</td>
<td>G 2</td>
<td>G 4</td>
<td>G 3</td>
<td>G 5</td>
<td>G 6</td>
<td>G 1</td>
</tr>
</tbody>
</table>

When a central nut is chosen, the remaining nuts must be arranged around it. For any side of the central nut, the orientation of each remaining nut that can abut this side is given by the cell in the appropriate row and column of the primary table. The row corresponding to the central nut is eliminated from consideration (indicated by the green line through it). If we re-arrange the columns to correspond with the CLOCKWISE side numbering of the central nut (and repeat the "1" column last, for convenience in analysis), we arrive at the 7 diagrams shown below.

Some reflection should convince you that a solution is possible if and only if one can find a set of six cells, such that:

1. each row (i.e. nut) is used once and only once
2. each column (i.e. number on the central nut) is used once and only once
3. the last number of the triple in the selected cell in a given column matches the first number of the triple in the selected cell in the next column - i.e. the numbers on abutting sides match

This is all easier than it sounds - you go about crossing off cells until you arrive at a solution or an impossible situation. In the diagrams below, I have crossed out cells in red and given lower-case letters to the slashes to indicate the order of my logic. I have circled each impossible situation in purple.

When A is in the center there is no solution possible. Consider nut G. Its 1 cannot be used to abut the central 1 on A, since there can be no nut clockwise from it that matches its 6 while also matching the central 6 required at that position. Hence cell G6 crossed out with line a. G cannot be used to abut the central 6 since there can be no nut counterclockwise from it that matches its 1 while also matching the central 1 required at that position. Hence cell G6 crossed out with line b. Similar arguments apply resulting in the cell in every column of row G being crossed out. This means that G cannot be used, violating rule (1) and proving that nut A cannot be in the center.

On to nut B in the center. No nut fits counterclockwise of C6, D5 or E5. No nut fits clockwise of A5, or G4. This leaves only nut F possible to abut the central 5, but nothing remains to fit clockwise of it (only another copy of the F nut would fit). This proves that nut B cannot be in the center.
Here, G6 is eliminated—nothing fits counterclockwise of it. This in turn eliminates D4 and G4. Nothing fits clockwise of A4 or E4, or counterclockwise of F4. This leaves only B possible to abut the central 4, but nothing remains to fit counterclockwise of it (only another copy of the B nut would fit). This proves that nut C cannot be in the center.

If you logically eliminate all impossible cells from the table when D is in the center, you find a single solution indicated by the six cells circled in blue. This is the only solution to the Drive Ya Nuts puzzle.

When E is in the center, only A can abut the central 1. This then requires C4, but no nut fits counterclockwise from it.

Nothing fits clockwise of G1 (except G again). Nothing fits clockwise of A4, B4 or G4. Since G1 is eliminated, now nothing fits clockwise of D4 or E4. This leaves only C4 but nothing fits counterclockwise of it.

Lastly we tackle G in the center. Nothing fits counterclockwise of B2, A3, C3, D3, or E3. Since B2 is eliminated, nothing fits counterclockwise of F3 either. This leaves only B3 but nothing fits clockwise of it.

Route Building

Route Building puzzles are a sub-class of Edge Matching puzzles ("Continuous Path" or CP Edge Matching puzzles according to Jacques Haubrich’s classification scheme). Here, one has to arrange pieces so that connections are made, creating a specific route across the pieces according to some rule.
This puzzle category requires you to arrange the pieces to satisfy some rule or goal relating to a pattern on the pieces or a pattern/silhouette the pieces make. There is no physical mechanism to restrict moves only rules or the goal govern legal combinations. The piece shapes will be fairly abstract but usually it will be easy to abut them and they will interchange positions easily.

**Note:** I have created a separate page for [Tangrams](#).

---

### The Diamond Dilemma

The Diamond Dilemma puzzle was Copyright by Price Stern Sloan Limited in 1989, and offered prizes for solutions of various complexity. The instructions tell you to "arrange the playing pieces on the diamond so that a continuous unbroken line is formed."

---

### Dice Dominos

This is Dice Dominos. The box says: Made in U.K. but there's no other provenance. There are twelve cubes, each side of which shows a correctly linked arrangement of two or three dominos. Paraphrasing from the instructions: Using the box base as the playing area, start with a double-six in the top left corner. (There are six faces among four of the cubes showing a double-six.) The box holds a rectangle of 3x4 cubes. Match dice so a continuous pattern is formed, as in regular dominos. You must use all 28 dominos and cannot use any domino more than once. Each must line up and doubles must be at right angles. A solution sheet (I haven't looked) is enclosed.

---

### Silhouette Puzzles

This category requires you to arrange the pieces to satisfy some rule or goal relating to a pattern on the pieces or a pattern/silhouette the pieces make. There is no physical mechanism to restrict moves only rules or the goal govern legal combinations. The piece shapes will be fairly abstract but usually it will be easy to abut them and they will interchange positions easily.

**Note:** I have created a separate page for Tangrams.

---

This classic three-piece French puzzle is called Bucephale. Arrange the three pieces to form a horse. Described in Slocum and Botermans' New Book of Puzzles on page 23. Sam Loyd called it his "Pony Puzzle."

**The Rabbit Silhouette or "Question du Lapin"** - layer the cutouts to form a rabbit [play the rabbit silhouette on-line](#).

Arrange the 5 layers so the cumulative cutout area forms the shape of a pipe. You will then have "Not A Pipe" - "Ceci n'est pas une pipe" - as from Rene Magritte's "The Treason of Images." A miniature puzzle in a matchbox.

Mattel's Virtual Illusion puzzle contains a base and a series of transparencies each containing a portion of a three-dimensional image. You need to order the transparencies in the base so that the image appears correctly.

---

**http://home.comcast.net/~stegmann/pattern.htm#insanity**
Cliko by Foxmind

Comes with a set of blocks and a booklet of problems. Arrange specific blocks to form different silhouettes.

The Cryptic Classics series from the 1990’s was issued by Crystal Lines and sold by various parties including Binary Arts, and Buffalo Games Inc. (BGI) of Buffalo NY. Each is a modern adaptation based on an old puzzle design. The “Create a Panda” puzzle is based on an old puzzle called “Milk” described in Slocum and Botermans’ 1992 “New Book of Puzzles” on page 15. The Cryptic Classics series includes a 3-part “Seat the Riders” puzzle, and “Find the Escapee” which is similar to the classic vanish “Get Off the Earth.”

Matchstick Puzzles

Using just a set of matchsticks (or sticks without the matchheads), form a figure, then transform the figure into some other figure moving only a specific number of matchsticks.

Puzzle Picks, by Kohner (No. 122) 1967. Includes a set of colorful plastic “matchsticks,” a booklet of 80 puzzles, and a solution sheet.

There are lots of matchstick puzzles on-line...

- zefrank's site
- puzzles.com
- Jim Loy’s site
- iamawiz.com
- quizbox.com

The book “Creative Puzzles of the World” by van Delft and Botermans includes a section on matchstick puzzles on pages 49 through 56.

A set of brightly colored matchsticks, in a matchbox marked “Puzzle” from Japan.

Stacking Pattern Puzzles

Toyo-Glass issued a series of puzzles where you stack clear glass coasters with various patterns:

- Red All Through
- Animal Land
- Starry Skies

Along the same lines as the Toyo-Glass puzzles, combined with the weave concept, Strip Fuse requires you to create a 2x5 weave using 10 clear strips having various arrangements of quarter-squares so that all solid squares result.

Tricky designed by Dorr Green - superpose four cards having transparent and opaque colored sections in order to produce a solid column of each of the four colors.

Trixxy designed by Dror Green - superpose four cards having transparent and opaque colored sections in order to produce a solid column of each of the four colors.

This is the “All 3D Burr” - stack the transparencies so that the image of a 3-piece burr appears.

I bought it at Torito.

The Transposer series of puzzles has been created and developed by Albatross Games Ltd. of London, and distributed by the Toysmith Group. Available from In and Out Gifts. Each puzzle consists of a set of cards with various design fragments and cutouts. Stack the cards to achieve specific patterns, such as uniform color front and back, or unbroken paths of given colors from point to point.

Transposer 6
Transposer Bonbons
Transposer Genesis
Transposer Kaboodle
Transposer Tiffany (I don’t have this.)

Positioning Puzzles

The Brain Drain is a form of the Eight Queens puzzle (play the Eight Queens puzzle on-line) - arrange the four squares such that in the resulting 8x8 grid, no two holes appear in the same row, column, or diagonal. The tiles may be flipped over. I have had this puzzle for a long time and it remains one of my favorites despite its simplicity.
Latin, Graeco-Latin, and Magic Squares

According to the Wikipedia entry, a Latin Square is an N×N matrix filled with N different symbols such that no symbol appears more than once in any row or column. Sometimes the additional restriction of having a repeated symbol along either main diagonal is also added. See Terry Ritter’s page, Latin squares: a literature survey, for a nice collection of facts and terminology about Latin Squares. Also see a nice article by Elaine Young.

Leonard Euler (1707-1783) studied Latin Squares in the late eighteenth century, and research into them has continued, not simply because of their use as puzzles, but more for their application to experimental designs and cryptography.

The enumeration of Latin Squares has not been easy — figures up to order 10 are summarised in the table below. A reduced or standard Latin Square is one where the symbols in the first row and the first column are in lexicographical order. Given the number of reduced squares, R_n, the number of distinct squares L_n is:

\[ L_n = n! / 2^{R_n} \]

<table>
<thead>
<tr>
<th>Order</th>
<th>Enumerator(s)</th>
<th>Year</th>
<th># Reduced R_n</th>
<th># Distinct L_n</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Euler</td>
<td>1782</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Euler</td>
<td>1782</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>Euler</td>
<td>1782</td>
<td>4</td>
<td>576</td>
</tr>
<tr>
<td>5</td>
<td>Euler</td>
<td>1782</td>
<td>56</td>
<td>162,860</td>
</tr>
<tr>
<td>6</td>
<td>Fisher and Yates</td>
<td>1938</td>
<td>9,408</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Norton</td>
<td>1939</td>
<td>16,942,080</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Wells</td>
<td>1967</td>
<td>535,381,400,816</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Bammel and Rothstein</td>
<td>1975</td>
<td>379,597,570,064,298,806</td>
<td></td>
</tr>
</tbody>
</table>

In 1992, in Discrete Mathematics, J. Shao and W. Wei published a formula for the number of Latin Squares of any order. (It is non-trivial to specify.)

A Graeco-Latin (or Greco-Latin) Square (also known as an Euler Square) is constructed by superimposing two Latin Squares having the same order but different sets of symbols (usually designated by using Latin letters for one of the squares’ symbols and Greek letters for the other, hence the name Graeco-Latin), such that each combination of symbols (one from each Latin square) occurs only once in the superposition. They are also known as mutually orthogonal Latin squares or MOLS. There are none of order N=2, but N=3,4, and 5 all exist. While searching for (and failing to find) a solution to the Thirty-six Officers Problem, Leonard Euler conjectured that solutions do exist for any order N = 4i+2 (i.e. 2, 6, 10, 14, etc.). Euler demonstrated methods for constructing Graeco-Latin Squares when N is odd or a multiple of 4.

The Thirty-six Officers Problem goes as follows: arrange six regiments of six officers each of six different ranks into a 6x6 grid so that no regiment or rank is repeated in any row or column.

It turns out that there are no Graeco-Latin squares of order N=6 but this was not proven until 2001 by Gaston Tarry who exhausted all possible arrangements by hand. In 1959 Euler’s conjecture was shown to be false for N > 6, by Parker, Ross, and Shelkhande. Rob Beezer shows a nice colorful order 10 square on his web page.

Since in such a superposition, the Latin Squares used cannot both be standard, a Graeco-Latin Square in standard form is one where the first Latin Square is in standard form, and the second has only its first row in lexicographical order.

The maximum number of Latin Squares of order N which can be in a set of MOLS is N-1, but some Latin Squares have no mutually orthogonal mates.

In Graeco-Latin Square puzzles of order N=4, the pieces are an assortment composed of all the combinations of two features each having four possible values. They must be arranged in a 4x4 grid such that no two with the same feature appear in any row, column, or main diagonal. Sometimes it is prohibited to have a repeated symbol among the four corners of the square, or among the four central cells (see "1000 Play Thinks" #400). There is only one order 4 Graeco-Latin Square in reduced form, but it does not meet these additional constraints. But by permuting rows, you can arrive at any solution for an order 4 Graeco-Latin Square that meets all those conditions:

\[
\begin{array}{cccc}
A & B & C & D \\
C & D & A & B \\
D & A & B & C \\
B & C & D & A \\
\end{array}
\]

This is More Madness by Parker - The Fun and Game Name. No Date. It comes as a single 3/4" plastic sheet, scored with grooves along which you are to break apart
the pieces. Each square is one of five colors - yellow, red, blue, green, or white. The unbroken sheet shows the solution - this is a Latin Square puzzle and in the grid, no color occurs more than once in each row or column. There are nine pieces - two are 1x2, seven are 1x3.

This is Bird's Puzzle, by Chad Valley. The Bird's Puzzle is very similar to the More Madness puzzle. There are nine pieces, two 1x2 and seven 1x3, colored with five colors - yellow, red, blue, green, and a Bird's logo - to be arranged into a 5x5 grid such that no color appears more than once in each row and column.

Bali Buttons requires you to place the sixteen tokens - all combinations of four different shapes with four different colors - on the 4x4 board so that no row, column, or main diagonal contains more than one token with a given shape or color. This is a Greco-Latin Square puzzle.

Missionary Puzzle and Four Others - Five (5) Old Time Puzzles - by The Embossing Company of Albany NY. Includes: Missionaries and Cannibals; Staggered Colors; Change About; Double Up; and Sorting Out.

Four Square - Embossing Company, Albany, NY - combines a Greco-Latin Square puzzle with two sliding piece challenges.  

FIRST. Place the blocks in the box so that no two of the same number nor of the same color are in any of the 10 horizontal, vertical, or diagonal lines.

SECOND. Remove one of the 4's, then, by sliding them about, arrange them in horizontal rows, each of a different color, and in the order of 1,2,3,4. The fourth or bottom row should be 1,2,3.

THIRD. After completing the second, slide them about again to arrange them as in second, but in a vertical position.

This "Brain Strain" advertising puzzle consists of sixteen small playing cards - the Jack, Queen, King, and Ace in each suit. As with any Greco-Latin square puzzle, the objective is to arrange the pieces in a square grid so that neither of the two kinds of feature (in this case, face value and suit) appears more than once in each row, column, or main diagonal. This puzzle was first proposed by Jacques Ozanam.

This is a vintage French boxed puzzle called Les 15. It is a Latin Square of order 5.

A Magic Square is a square arrangement of numbers such that the numbers appearing in each row, column, and main diagonal add up to the same sum, known as the magic constant of the square. If all diagonals (main as well as partial) also sum to the magic constant, the square is a pandiagonal or panmagic square. If replacing each number by its square also results in a magic square, the square is bimagic. If the sequence of numbers used in a square of order n is from 1 to n\(^2\), it's known as a normal magic square. Magic Squares exist for all orders except N=2. There is only one distinct Magic Square of order N=3. There are 880 of order 4, and over 275 million of order 5. Supposedly the order 3 magic square was invented in China between 650 and 400B.C. and known as Lo Shu.

In the order 3 normal square, all rows, columns, and the main diagonals total 15. The magic constant for a normal magic square of order n is given by the formula:

\[ M_n = \frac{n(n^2+1)}{2} \]

An order 4 Magic Square appears in Albrecht Durer's famous engraving called Melencolia I:

```
16  3  2 13
 5 10 11  8
 9  6  7 12
14  4 15  1
```

Each row, column, and main diagonal sum to 34, as do the four corners and the four central cells. Note that this is a solution to Skor Mor's Thinking Man's 34, and Reiss' 34 Skidoo of 1971.

Thinking Man's 34 - Skor Mor. Also 34 Skidoo by Reiss, 1971. Sixteen wooden tiles printed with the numbers one through sixteen. Arrange them in a 4x4 grid such that every row and column and main diagonal totals 34. Also find an arrangement in each of 12 distinct classes/patterns.

There is also a single magic hexagon of side 3, with 19 cells. Its magic constant is 38. It was discovered in 1864 by William Radcliffe. In 1964 Charles Trigg published a proof that this is the only magic hexagon of any size (save the trivial single hexagon). Additional historical anecdotes about this puzzle are given in Bloxam and Botermans 1994 The Book of Ingenious & Diabolical Puzzles on pages 26-27.

```
18 17  3
11  1  7 19
 9  6  5 12
14  8  4 16
15 13 10
```

http://home.comcast.net/~stegmann/pattern.htm#insanity
Rob's Puzzle Page – Pattern Puzzles

Dessi of each of the four cubes. Each block is a different color - orange, pink, green, and yellow. I am missing the fourth block from the top in the illustration in the book, which I believe is the yellow one.

One of the earliest mechanical puzzles I ever had was an Instant Insanity given to me by my mother. Instant Insanity was marketed by Parker Brothers and invented by Franz O. Armbruster, a California computer programmer. I have an original from Parker Brothers, and copies from Winning Moves (found in a shop in Mystic) and Kadon. There are many puzzles in what I call the "Instant Insanity Family."

The first puzzle in this family was designed and patented in 1901 by Frederick A. Schuehle of Detroit. It was marketed as the Katzenjammer Puzzle. I have a copy with one block missing, and another complete copy. The original cardboard container is marked "The Katzenjammer Puzzle -- B. W. Gottechalk Patentee Chicago, Ill. U.S. Patent No. 666463 -- Price 10 Cts." (But also see patent 19024542 – Silham 1932)

"Directions -- Mr. Katzenjammer brought this little box of blocks to his wife, and said to her--'Katerina, you will notice that on the top row of those blocks there is a diamond, a heart, a spade, and a club. Now take the blocks out of the box and place them together so that all four sides will have one of each kind in a row. It comes easy, Katerina,' he said. If you look at the picture on the box, because that has one spot of each kind on two sides already just.'"

The four blocks were marked with the four suits of a deck of playing cards - hearts, clubs, diamonds, and spades. The Katzenjammer puzzle is described on page 38 of Slocum and Botermans' 1986 book "Puzzles Old & New." They show the layout of each of the four cubes. Each block is a different color - orange, pink, green, and yellow. I am missing the fourth block from the top in the illustration in the book, which I believe is in the yellow one.

Other good resources for Domino Puzzles:
- Frans Faase's page
- Domino Logic
- Jurgen Koller's page

The Instant Insanity Family

One of the earliest mechanical puzzles I ever had was an Instant Insanity given to me by my mother. Instant Insanity was marketed by Parker Brothers and invented by Franz O. Armbruster, a California computer programmer. I have an original from Parker Brothers, and copies from Winning Moves (found in a shop in Mystic) and Kadon. There are many puzzles in what I call the "Instant Insanity Family."

The objective for all of them is to find a linear arrangement of the cubes such that all four long sides show each color only once.

You can make and play this type of puzzle with just some paper and a set of dominos. Wonder Workshops had this inexpensive version of a domino puzzle (I don't have it). An arrangement of pips is presented on a card. Using a set of dominos, cover the card by matching pairs.

Other good resources for Domino Puzzles:
- Frans Faase's page
- Domino Logic
- Jurgen Koller's page

Here is another vintage cube matching puzzle called
The Allies Flag Puzzle is another very old example of this family. This puzzle has five cubes, and each cube has some arrangement of five flags on its faces.

This is a vintage advertising premium called Symington’s Puzzle. It contains four cardboard cubes, each with a different arrangement of four Symington’s product ads in their faces: Soup, Custard Powder, Ideal Cream, and Gravy. It is shown in Shafer and Ryser’s “Puzzles Old & New” on page 38.

The FourAce Puzzle. The four wooden cubes are decorated with various arrangements of the four playing card suite symbols: hearts, diamonds, clubs, and spades. The box says “Provisionally Protected” but does not identify the manufacturer or date of manufacture.

The Great Tantalizer

Tantalizer

Symington’s Puzzle

The four wooden cubes are decorated with various arrangements of the four playing card suite symbols: hearts, diamonds, clubs, and spades. The box says “Provisionally Protected” but does not identify the manufacturer or date of manufacture.

Logi-Queen

Those Blocks

Kraws' version

Tantalizing Ten - Shackman

Daffy Dots - Reiss 1971

I received this set of numbered blocks that I believe are Crazy Cubes. On the web I found a photo of them in packaging. (I don’t own the packaged set.)

“Can you solve those Damblocks?” were offered by the Schaper Manufacturing Company, Minneapolis, Minn. in 1968. I have examples in red, white, and black.

I got Mutando by Logika at Games People Play, and Mutando II from Time Machine Hobby.

Hungarian Tactics

The Buvos Golyok is a clever variant using balls enclosed in a tube.
This is Meffert’s “Drives You Crazy.” It includes six cubes instead of the usual four.

I am not sure what this puzzle is actually called, but on the bottom of the tray it says “Masudaya Made in Hong Kong” so I call them the Masudaya Cubes. This may be the same as Ideal’s Face Four puzzle.

This is the Masudaya Hexagon Mind Exerciser. It has six hexagonal pieces.

Onsworld Ltd. of Stamford UK offers several variants.

Crazy Blocks Color Puzzle
Created by Jak Pak Inc. of Milwaukee
Made in British Crown Colony of Hong Kong

Crazy Blocks Color Puzzle
Created for Jak Pak Inc. of Milwaukee
Made in British Crown Colony of Hong Kong

Onsworld Ltd. of Stamford UK offers several variants.

Coloured Cubes
Peter Pan Series Regd.

Nice Cubes

Color Cubes

Go Crazy
Embree Manufacturing, Co. NJ 1969

Arrange the five disks so that alternate rows have five different colors, then three different colors. The five disks are separate and may be removed from the case and re-ordered.

This type of puzzle can be arranged vertically, too, as in the Steiffel Tower and Totemania.

Ivars Peterson has a page devoted to graphical solution techniques pertaining to this type of puzzle. I used this technique to solve Nice Cubes. Here is my solution using this graphical technique:
Below is my solution to the Masayuya Cubes, using the graphical technique. The connectivity of this graph is similar to that of the Nice Cubes, though its edges seem differently labeled. Are the puzzles in fact isomorphic?
Other Color-Constraint Puzzles

There are several other puzzles, cousins to Instant Insanity rather than siblings - which involve some kind of color constraints.

**Gram's Cube**

Gram's Cube was made by Gram Toys of Birkerod, Denmark. The puzzle consists of 27 Lego-like cubies that mate side-to-side as well as up-and-down. There are 3 cubies each of nine different colors. The objective is to construct a 3x3x3 cube such that each side shows all 9 colors. At first I thought a trick was necessary, but I found a solution using all 27 cubies. I picked this up in a trade with Norman Sandfield, at the January 2005 New York Puzzle Party.

**Oops Again**

The object ofOops Again is to build a pyramid with the 2-sphere pieces so that no two spheres of the same color touch at all. The Golf Smarts Pyramid (a gift from Brett) is similar.

**The Tricky Triangle**

The Tricky Triangle puzzle by Waddingtons is a 2-dimensional analogue of Oops Again - using 10 pieces composed of two linked circles each, and one single circle, build an edge-6 equilateral triangle (of 21 circles) such that "no two circles of the same color are in the same line of the triangle."

**Level Q**

Level Q, by Eng’s IQ Co. Ltd., 1987 Hong Kong. I purchased this quite some time ago. Level Q consists of a hexagonal board and twelve bar-bell shaped pieces. There are three challenges - first, build seven stacks of six disks each. Next, again build seven stacks of equal height, but such that one bar lies on each side of the hexagon and on each of the six spokes. Finally, satisfy the constraints already mentioned, and also ensure that each stack contains only one of each color disk.

**The Trapagon**

Six pieces interlock - arrange them so that there are five different colors on each "face."

**Beat the Elf**

Beat the Elf - by House of Games Corp. Ltd., Don Mills, Ontario 1970
Build a 3x3x3 cube with the 13 blocks so that no face shows three squares in a row of either color, horizontally, vertically, or diagonally. There are 11 1x1x2 blocks of 1 light and 1 dark. There is one 1x1x2 block of two darks. There is one 1x1x3 block of two lights (adjacent) and 1 dark.
MacMahon Colored Cubes and the Mayblox puzzle

Percy Alexander MacMahon was a mathematician who lived from 1854 to 1929. He is noted for, among other accomplishments, his results in the field of combinatorics. In 1915 and 1916 MacMahon published two volumes on Combinatory Analysis which remains a respected work today. MacMahon also produced a two-volume treatise on Combinatory Analysis which remains a respected work today. MacMahon Colored Cubes and the Mayblox puzzle.

Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Also included a brochure on newsprint paper which advertises several games, including Cube Fusion, and puzzles: Beat the El, Kolor Kraze, and 6 Mindbenders - Perfect Square, Tricky Triangle, Perfect Circle, The Path, Rectangle Tangle, and The Coloured Square.

Paid Vol. 3 #927

Create a rectangle from the 12 3x2 L-shaped pieces such that like-colored pieces don’t touch. Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Copyright 1969 No. 305

Create a rectangle using 12 colored square tiles which are each printed at from 1 to 3 of their corners with small circles. There are 4 tiles each of 3 different colors, blue, orange, and pink. All pink must be in the first row, all orange in the second, and all blue in the third. One circle on a pink tile is marked START and must be in the upper left, and one circle on a blue tile is marked FINISH and must be in the lower right. Create a path of circles from START to FINISH such that circles are not adjacent unless they form a path connection.

Colored Cubes.

n!/(2*E)

If each of the Colored Cubes, first introduced in a lecture he gave in 1893 [4]. MacMahon also produced a two-volume treatise on Combinatory Analysis which remains a respected work today. MacMahon Colored Cubes and the Mayblox puzzle.

Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Form a 3x4 rectangle using 12 colored square tiles which are each printed at from 1 to 3 of their corners with small circles. There are 4 tiles each of 3 different colors, blue, orange, and pink. All pink must be in the first row, all orange in the second, and all blue in the third. One circle on a pink tile is marked START and must be in the upper left, and one circle on a blue tile is marked FINISH and must be in the lower right. Create a path of circles from START to FINISH such that circles are not adjacent unless they form a path connection.

Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Form a side-6 triangle from 10 barbell-shaped pieces plus one circle. Each circle is one of 6 colors - in the completed triangle no two circles of the same color can lie in a line. Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Also included a brochure on newsprint paper which advertises several games, including Cube Fusion, and puzzles: Beat the El, Kolor Kraze, and 6 Mindbenders - Perfect Square, Tricky Triangle, Perfect Circle, The Path, Rectangle Tangle, and The Coloured Square.

Form a rectangle using 12 colored square tiles which are each printed at from 1 to 3 of their corners with small circles. There are 4 tiles each of 3 different colors, blue, orange, and pink. All pink must be in the first row, all orange in the second, and all blue in the third. One circle on a pink tile is marked START and must be in the upper left, and one circle on a blue tile is marked FINISH and must be in the lower right. Create a path of circles from START to FINISH such that circles are not adjacent unless they form a path connection.

Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Form a rectangle using 12 colored square tiles which are each printed at from 1 to 3 of their corners with small circles. There are 4 tiles each of 3 different colors, blue, orange, and pink. All pink must be in the first row, all orange in the second, and all blue in the third. One circle on a pink tile is marked START and must be in the upper left, and one circle on a blue tile is marked FINISH and must be in the lower right. Create a path of circles from START to FINISH such that circles are not adjacent unless they form a path connection.

Pamphlet included, which mentions 5 mindbender puzzles but lists 6: Perfect Square, Tricky Triangle, Perfect Circle, Wobbly Web, The Path, and Perplexing Pyramid.

Form a rectangle such that like-colored pieces do not touch. Each piece is one of four colors.

Three challenges:
1. Position or pile the cubes to show only the 6 green spots and no others.
2. Show only the 8 yellow spots.
3. Show only the 4 red spots.

Wobbly Web, The Path, and the Coloured Pyramid.
You can choose any of the 30 cubes to use as a "prototype" and it will be possible to find eight other cubes in the set which can be used to build a 2x2x2 model of the prototype having the same arrangement of solid colors on the six external 2x2 faces as on the prototype's six faces, and also satisfying the additional constraint that internal touching faces are colored alike. MacMahon credited his friend Colonel Julian R. Jocelyn with the discovery that this can always be done regardless of which of the 30 cubes is chosen as the prototype.

For each prototype, there is only one set of eight cubes which will work, and there will always be two ways to build the prototype with those eight cubes. A procedure to transform one solution into the other was devised by L. Vosburgh Lyons and is shown in [2] on page 190. The eight cubes to be selected will not possess any of the same pairs of opposing face colors as the prototype. This means that 13 of the 29 cubes can be eliminated as candidates, leaving 16 from which to choose.

Lyons also discovered that after a 1st prototype is selected along with the eight cubes to model it, it is always possible to select another prototype from the remaining 21 cubes, and find another 8 cubes from the remaining 20 to model this 2nd prototype. The 2nd prototype must be a mirror image of the set, and the eight cubes to model it are the eight not chosen from the 16 eligible for the modeling of the 1st prototype [2].

MacMahon sold an eight-cube puzzle patented in 1892 to the London company R. Journet, which marketed it as the Mayblox puzzle [4]. Its eight cubes are one of the sets which can model a prototype and meet the internal color-matching constraint. However, the Mayblox puzzle does not specify the configuration of the prototype - so it must be deduced, which makes the puzzle more difficult.

I made my own version of a Mayblox puzzle using LiveCube. I chose a prototype arrangement of six colors at random, then colored the 8 sub-cubes as required based on the solution instructions in [1]. I finally found a good use for the LiveCube face plates! Fortunately, they provide enough different colors with the addition of cyan and pink to their previously available black, red, yellow, green, and blue.

References:
1. Mathematical Recreations and Essays, by W.W. Rouse Ball, Macmillan 12th ed. 6th printing 1975, pp.112-113
2. Torsten Sillke provides a good bibliography which led me to other sources, including the Martin Gardner books I already have but hadn't realized contained pertinent information
5. [page missing on internet]
6. [page missing on internet]
7. [page missing on internet]

Pattern Blocks

There have been several issues of sets of "pattern blocks" under various names.

Pattern Pending designed by Fred Horowitz and issued by Parker Brothers (General Mills) in 1971. Fred had the basic idea for these in the 50's, and intended these to be more of an open-ended creative playset than a puzzle.

K-Dron - Janusz Kapustra has it. (I don't have this.)

Other Pattern Puzzles

This is the "Fool’s Spool" (made in Hong Kong). "Mix up the four wheels - rearrange them so that all lines total twelve!" One of my kids found the following solution in minutes: 5115, 1254, 5223, 4341, 2334, 3513, 4422, 3333.

Here are more puzzles with a math theme. One is "Digi-Disc" - arrange the discs so that all equations are true. The discs adhere via magnets and I also show this puzzle in the Magnetic category. Another, from Asia, is a similar stack of discs with the same goal, but it is not magnetic. Yet another is an elongated stack, non-magnetic, called "Magic Numbers."

The Enigma puzzle is a representative of this type, but with letters rather than numbers on the wheels. Form words.

This is the Daily Mail Crossword Disc puzzle by Chad Valley.

There are several "Slivers" puzzles - this is the Anakin Skywalker version.
Tedco Mirage Numbers Up

**That-A-Way by Binary Arts.** Introduced at IPP 20 by its creator Greg Dye. There are 10 tiles/cards each with two arrows in various orientations, and a booklet of problems and solutions. *Play That-A-Way on-line.*

Flower Finder - *William Waite*
Arrange the six pieces in the tray so that every flower has six petals. Also solve so that every flower has three petals.

**Rubik’s Dice**
Flop interior plates around until all pips show red.

Deco Stacker

Binary Arts, now Thinkfun, has supplied many puzzles, including their various “something by something” puzzle/games:

- Brick by Brick
- Square by Square
- Black by Black
- Shape by Shape
- Gridworks

http://home.comcast.net/~stegmann/pattern.htm#insanity