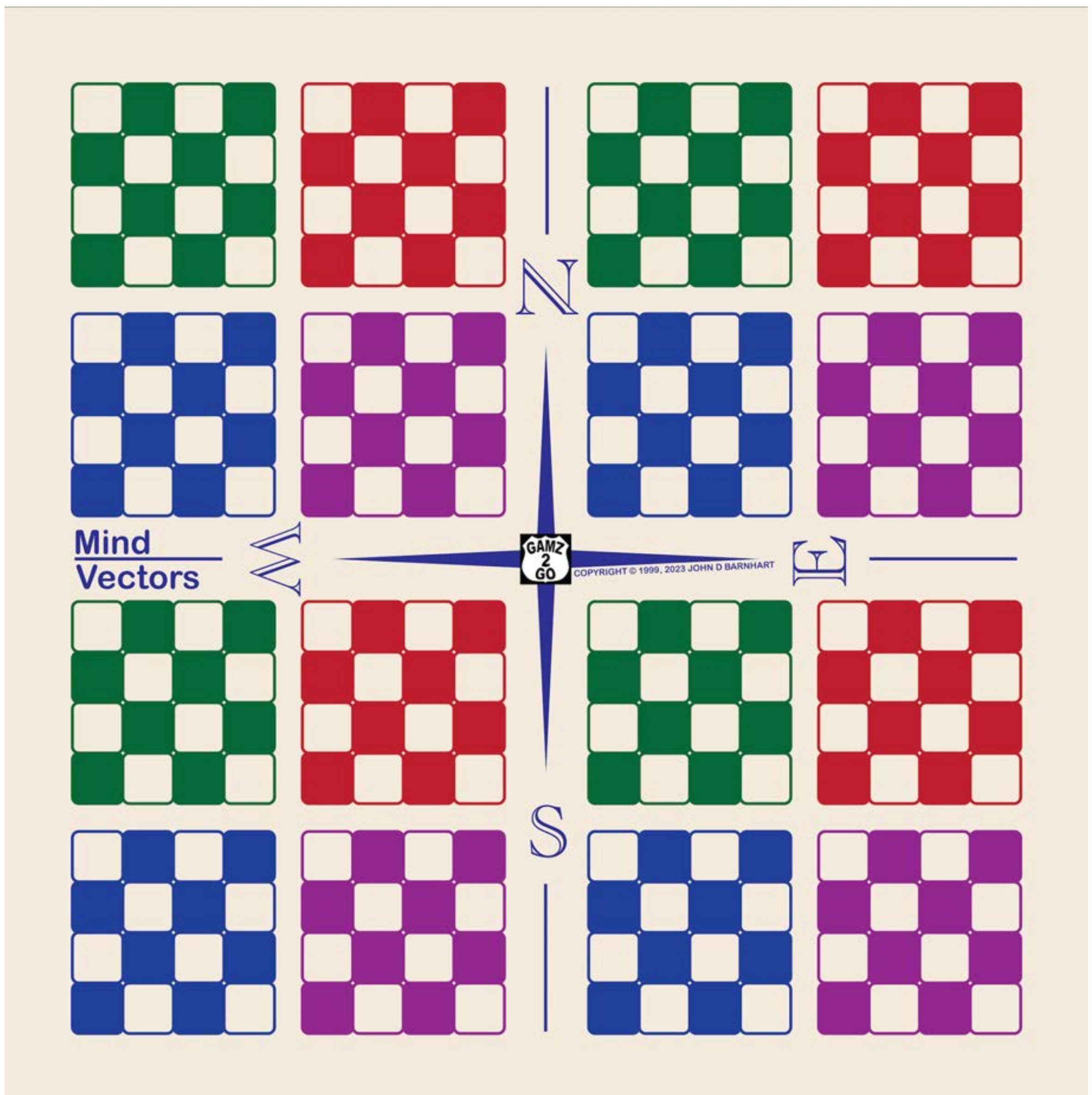
Abstract Strategy Game

Mind Vectors

By John David Barnhart



Included in Your Game

- Four-color game board printed on 22″ bandanna
- Fabric stuff bag
- Bag of game pieces – 25 each of three different colors
- Game instructions

To skip to the first game instructions go here.

WARNING
SMALL PARTS CHOKING HAZARD!
NOT FOR AGES 5 AND UNDER!

Mind Vectors Game Space

The game space is 4x4x4x4 cartesian space. However only the first two dimensions are linear. If you are familiar with JDB games "Time Vectors" and "GRYB," you will see a similarity. Mind Vectors is like a combination of those games.

As a rule of thumb, games which will play on Time Vectors, will also play on Mind Vectors.

Dimensions

The **first two dimensions** in the Mind Vectors game space are shown in **Figure 1**. Each colored grid is a two dimensional playing surface.

The **third dimension** is among different-colored grids. From each grid the next instance is the adjacent grid going clockwise or counter-clockwise. **Figure 2** shows a vector (line) from blue to purple grids. (It could also be viewed as from the purple to the blue grid.)

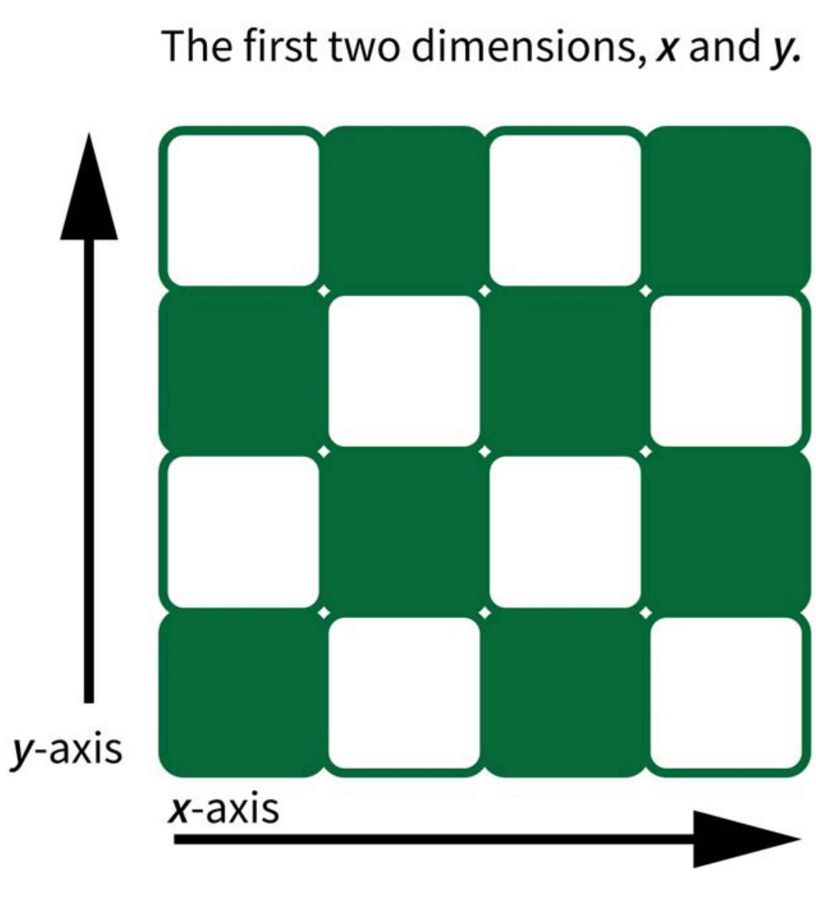


Figure 1.

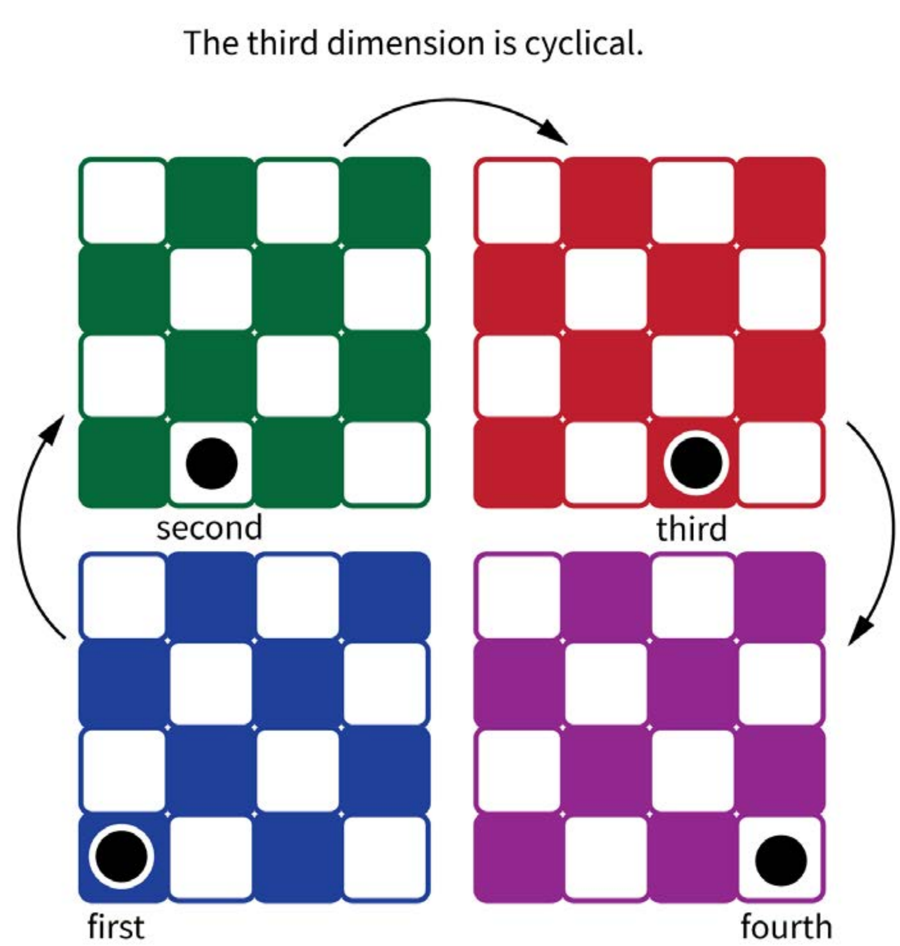


Figure 2.

The **fourth dimension** is like the third dimension. It is cyclical as well. Instead of colors, instances are separated by compass points.

Figure 3 shows a **diagonal vector through all four dimensions**. To describe positions on the game board use four-element cartesian coordinates. For instance the vector on the right has the four locations at:

- (4, 4, B, SW)
- (3, 3, P, NW)
- (2, 2, R, NE)
- (1, 1, G, SE)

In the example on the right, starting at (4, 4, B, SW), the third dimension goes counter-clockwise and the fourth dimension goes clockwise.

A vector through all dimensions.

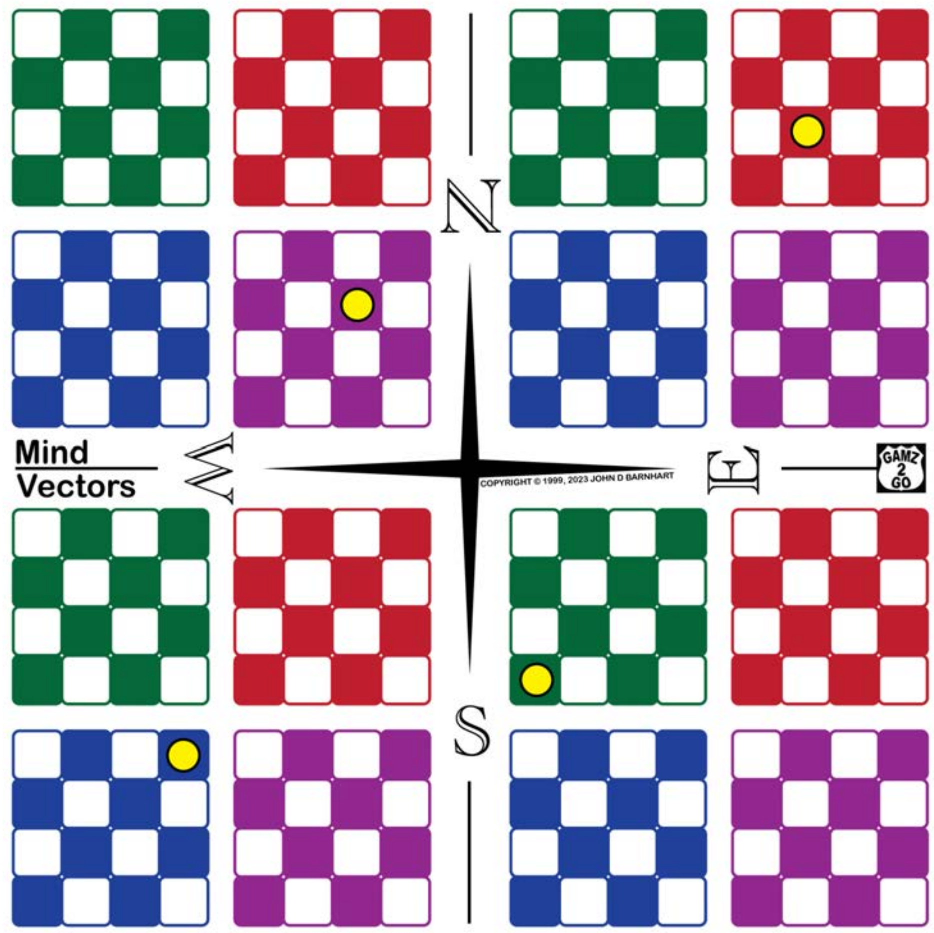


Figure 3.

Notation for Spaces

Shown above is a list of coordinates for the game pieces shown in Figure 3. The way to determine the coordinate is simple. The first two elements refer to a colored grid. Every colored grid has an *x* and *y* axis (see Figure 1). T**he first two exponents of the coordinate are the location of a point on a grid**. For notation purposes, **use the SW corner of each grid as the reference point (1, 1)**.

The **third and fourth exponents are notated differently**. For the **third dimension, the color of the grid is the element**. The dimension is cyclical. The **next and previous instances are adjacent grids**. **Notate these simply with G, R, P, or B**; the first letter of the color names Green, Red, Purple, and Blue. These dimensions **increment clockwise** and **decrement counter-clockwise**. **The fourth dimension uses the Compass Points**. The quadrant any space resides in is **notated SW, NW, NE, or SE**.

Vectors

Vectors are lines. But **these lines have four points, and exist in four dimensions** corresponding to *x*, *y*, *z*, and *t*. Any vector can be **described as one point and a function**; The function tells whether to increment, decrement, or leave unchanged each dimension. For example use the vector in **Figure 3**. Start with point **(1, 1, G, SE)**. The function is **ƒ(+, +, +, -)**. Increment *x*, *y*, and *z*, and decrement *t*. If you start at the opposite endpoint **(4, 4, B, SW)** the function is inverted **ƒ(-, -, -, +)**. The vector in **Figure 2** can be described as **ƒ(+, 0, +)→(1, 1, B)**, only three elements are used, Figure 2 could be any quadrant. Starting from the other end, the vector is described as **ƒ(-, 0, -)→(4, 1, P)**.

Moves

Moves are required in some games. Possible moves basically increment or decrement one dimension.

To move in the *x* or *y* dimensions is straightforward. Increment or decrement one space from the start. For instance use a game piece at **(2, 2)**. Increment *x* to **(3, 2)** or decrement *x* to **(1, 2)**. Increment *y* to **(2, 3)**, decrement *y* to **(2, 1)**. **See Figure 5a**.

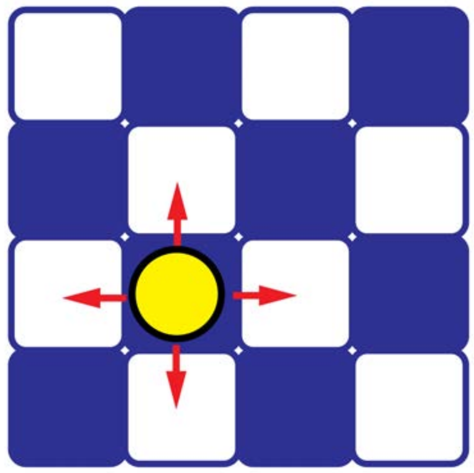


Figure 5a. Moves in *x* and *y* dimensions

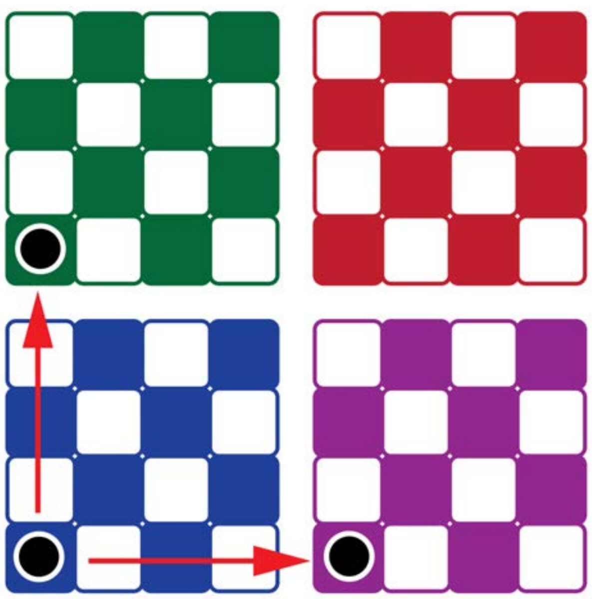


Figure 5b. Moves in the *z* dimension.

To move in the third dimension *z*, **increment clockwise** and **decrement counter-clockwise**. In **Figure 5b** the game piece at **(1, 1, B)** can increment to **(1, 1, G)** or decrement to **(1, 1, P)**.

Moves in the *t* dimension are similar to moves in the *z* dimension. **Figure 5c shows moves in the *t* dimension**. From the game piece at **(3, 3, B, SW)** can increment clockwise to **(3, 3, B, NW)** or decrement counter-clockwise to **(3, 3, B, SE)**.

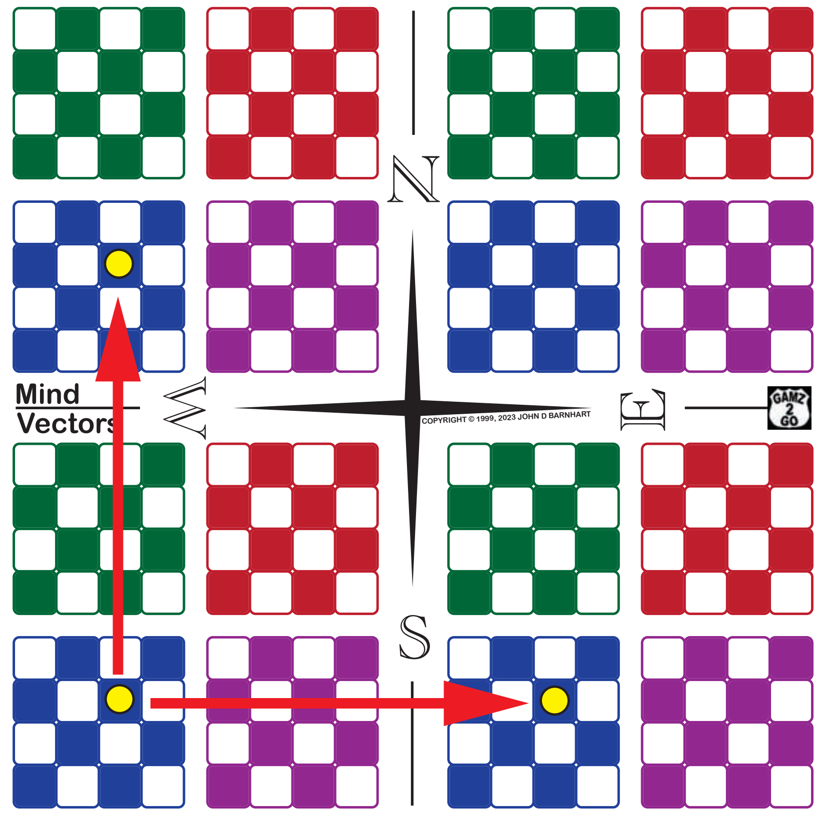


Figure 5c. Moves in the fourth dimension *t*.

Periodic Rules

The third and fourth dimensions are already periodic. You can start at any instance and continue either clockwise or counter-clockwise to the next. You can make **each grid periodic** as well, if you so choose. **Increment 4 to 1**, and **decrement 1 to 4**. Then you can start a vector at any point on a grid and continue according to a two-dimensional function. For example use the point on one grid **(1, 2)** and the function ***ƒ*(+, +)** to get vector **[(1, 2), (2, 3), (3, 4), (4, 1)] in Figure 6a**. **Add 1 to each *y* value** and get vector **[(1, 3), (2, 4), (3, 1), (4, 2)] in Figure 6b**. Add another 1 to each *y* value and get vector **[(1, 4), (2, 1), (3, 2), (4, 3)] in Figure 6c**. Add another 1 to each *y* value and get vector **[(1, 1), (2, 2), (3, 3), (4, 4)] in Figure 6d**, which becomes instantly recognizable as a vector.

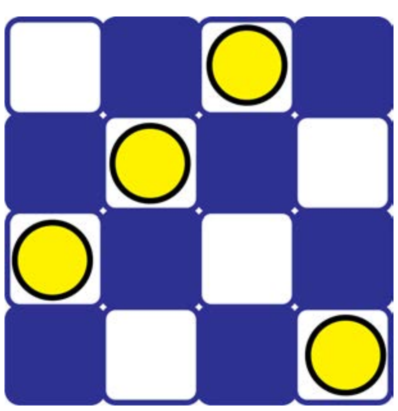


Figure 6a

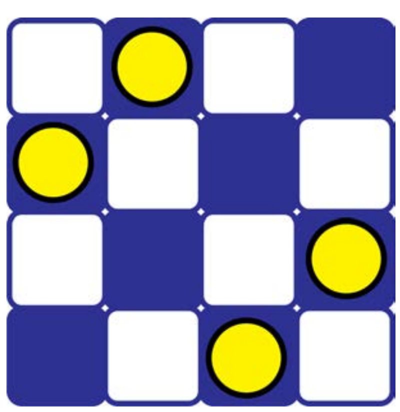


Figure 6b

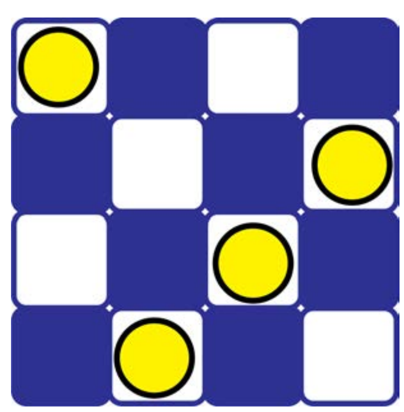


Figure 6c

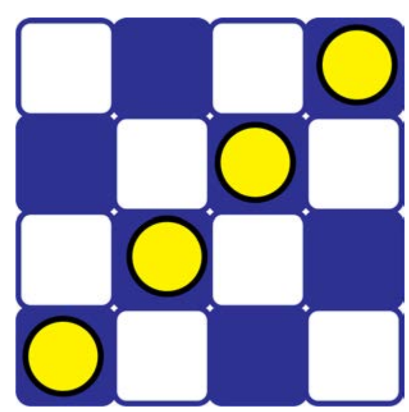


Figure 6d

Integrating this with dimensions *z* and *t* makes the spatial-relational aspect of Mind Vectors cryptic. **Periodic Rules are NOT for beginners**.

Game Rules

This game is for 2 - 3 players ages 8 and above*.

Goal

Get a vector first. **Four pieces in a row in one or any combination of dimensions is a vector.** Pieces **must all be in sequence** (not from first to third to second to last and so forth).

To Play

Separate game pieces into colors, and each player gets all of one color. **Alternate turns placing one game piece on an unoccupied space per turn**. Moves should be to build a vector or block your opponent from building a vector.

**Simplified Version*

For younger players **try playing on just one quadrant** of the game board on just one set of colored grids. It becomes a three dimensional game instead of four, only one cyclical dimension. See **Figure – Simplified Game Board**.

The figure shows vector **[(1, 2, R), (2, 2, G), (3, 2, B), (4, 2, P)]**.

This is a good game for teaching spatial relationships to 3rd and 4th grade students.

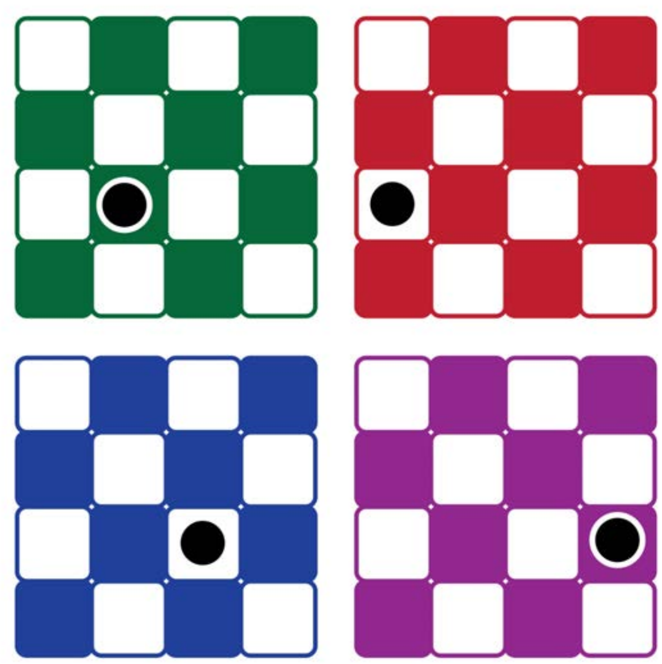


Figure – Simplified Game Board

More Games To Play

Intersection

This is a game for two or three players. Rather than getting a vector, the goal is to **create two three-point lines with only one point common to both lines**. It takes five game pieces to create a winning construct **called an "intersection."**

Goal

Be first to get an intersection. See **Figure 7a**. In two dimensions, the intersection point is obvious at **(1, 2)**. **Figure 7b** shows an intersection in three dimensions. **Figure 7c** shows a three-dimensional line intersecting a four-dimensional line.

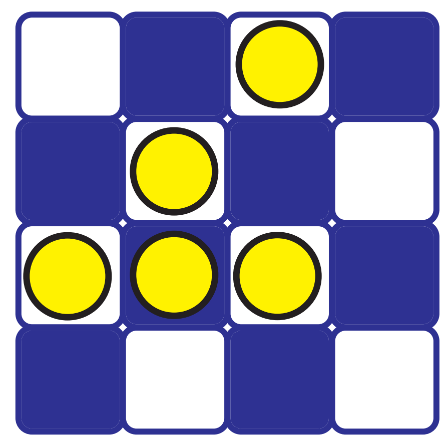


Figure 7a. Two-dimension intersection at (1, 2).

To Play

Each player gets one color of game pieces. Alternate turns placing one game piece on the game board each turn. Moves should be to **create an intersection or block an opponent's efforts to do the same**.

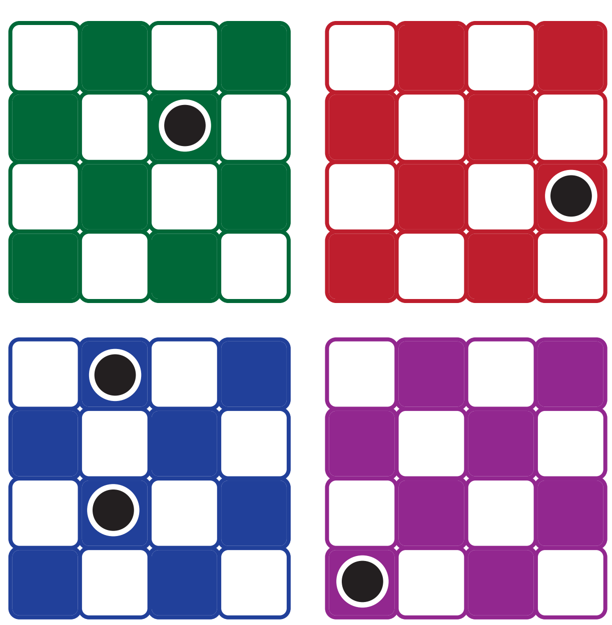


Figure 7b. Three-dimensional intersection at (3, 3, G).

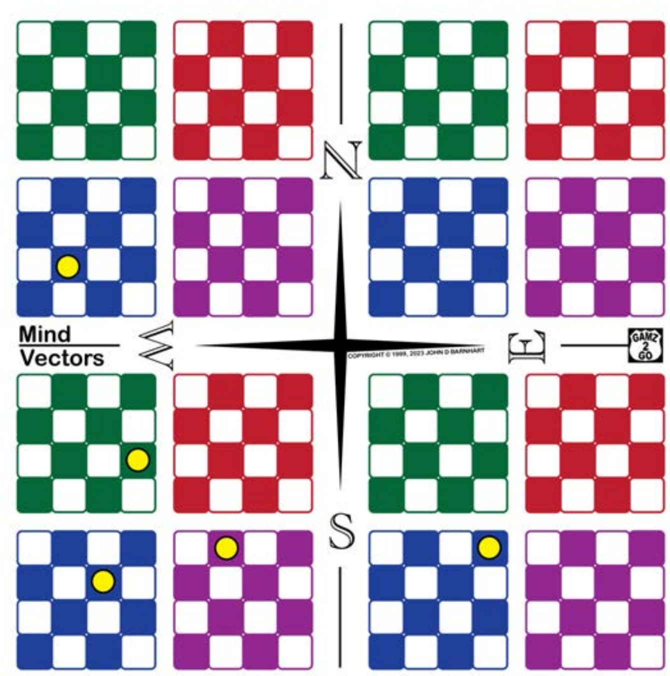


Figure 7c. 4D and 3D intersection at (3, 3, B, SW).

Diez

This game is great for gaining familiarity with the Mind Vectors game space. This game can be played with **2 to 5 players**. This game uses **ten game pieces of one color**.

Goal

Create a vector in the fewest number of moves from a randomly placed group of ten game pieces. Get higher points for fewer moves. Play a series of five games for highest number of points. This can take one to two hours.

To Play

First **use the Mind Vectors Space Selector to select ten spaces**. **Write them down**. Use the system of notation from above. You will want to know how to reconstruct the arrangement. **Place a game piece on each of the selected spaces**.

Give **five to ten minutes for players to analyze the game board**. Then **each player states how many moves it will take them to create a vector** from that arrangement of game pieces. Moves are **along single dimensions *x*, *y*, *z*, or *t***. See she section Moves above.

The player with the **fewest number of declared moves goes first**. This player then demonstrates the moves using the game pieces. If it goes as they say, this player wins points. If not they are out with zero points. The player with the **next fewest number of declared moves goes next**. Reconstruct the ring arrangement between players. If **more than one player declare the same number, play goes to the right of the last player**. Each **vector must be different** from the others shown previously, **unless a different method of arriving at the vector is used**. Each player demonstrates their calculated moves if they can. All who succeed getting a unique vector get points. Calculate points by subtracting the number of moves taken from ten. Calculate **10 – *n* = *p* where *n* is the number of moves and *p* are the points awarded**. Zero moves is ten points, ten moves is zero points.

Siete

This is a game related to the game Diez above, but **for one or two players**. It is a good practice game for the game Diez. This game uses seven game pieces of one color.

Goal

Using a random configuration of game pieces, try to get a vector in the fewest number of moves.

To Play

Use the Mind Vectors Space Selector to **randomly place seven game pieces of one color on the game board**. With two players write down the space locations. Analyze the game board to **find a way to construct a vector in the fewest number of moves**. Make the moves and check it to make sure it's right. The player with fewer moves wins.

Cinco

This game is related to the games **Diez** and **Siete**. (Who would have guessed?) This is a **simplified version** that you **play on just one quadrant of four colored grids**. It can be played with **one to four players**. Play a series of games for highest points.

Goal

Using a random configuration of **five game pieces**, try to get a vector in the fewest number of moves.

To Play

Use the Mind Vectors Space Selector to randomly place **five game pieces of one color on one quadrant** of the game board. Write down the locations. **Disregard the last element *t***, this game uses the **first three elements *x*, *y*, and *z***. Study the configuration of game pieces to calculate the fewest number of moves to create a vector. The player who declares the fewest number of moves goes first. Go around demonstrating your unique ways to get a vector. Success is awarded with **points equaling 5 – number-of-moves**. Play a series of five games for high points. A series of games takes about **30 to 60 minutes**.

Educational Notes

This game has great value as a mathematical teaching aid. Areas of interest to K – 12 educators are shown below.

- Following instructions
- Cooperation
- Plotting points in four-dimensional space
- **Spatial relationships**
- Geometry
- Analytical thinking
- Pre-algebra conceptulization

Appendix

Below are a chart and an illustration diagramming vectors with different dimension integrations. Vectors **F and G are periodic**.

VECTOR	POINTS	DIMENSIONS	FUNCTION
A	(1, 4, B, NW), (1, 4, G, NW), (1, 4, R, NW), (1, 4, P, NW)	3rd	$f(0, 0, +, 0)$
B	(1, 4, G, SW), (2, 3, B, SW), (3, 2, P, SW), (4, 1, R, SW)	1st, 2nd, 3rd	$f(+, -, -, 0)$
C	(3, 4, G, SW), (3, 4, G, NW), (3, 4, G, NE), (3, 4, G, SE)	4th	$f(0, 0, 0, +)$
D	(2, 2, R, SW), (2, 2, P, NW), (2, 2, B, NE), (2, 2, G, SE)	3rd, 4th	$f(0, 0, +, +)$
E	(4, 1, B, SW), (3, 1, G, NW), (2, 1, R, NE), (1, 1, P, SE)	1st, 3rd, 4th	$f(-, 0, +, +)$
F periodic	(1, 1, B, NE), (4, 2, G, NE), (3, 3, R, NE), (2, 4, P, NE)	1st, 2nd, 3rd	$f(-, +, +, 0)$
G periodic	(3, 1, B, SW), (4, 2, P, SE), (1, 3, R, NE), (2, 4, G, NW)	ALL	$f(+, +, -, -)$

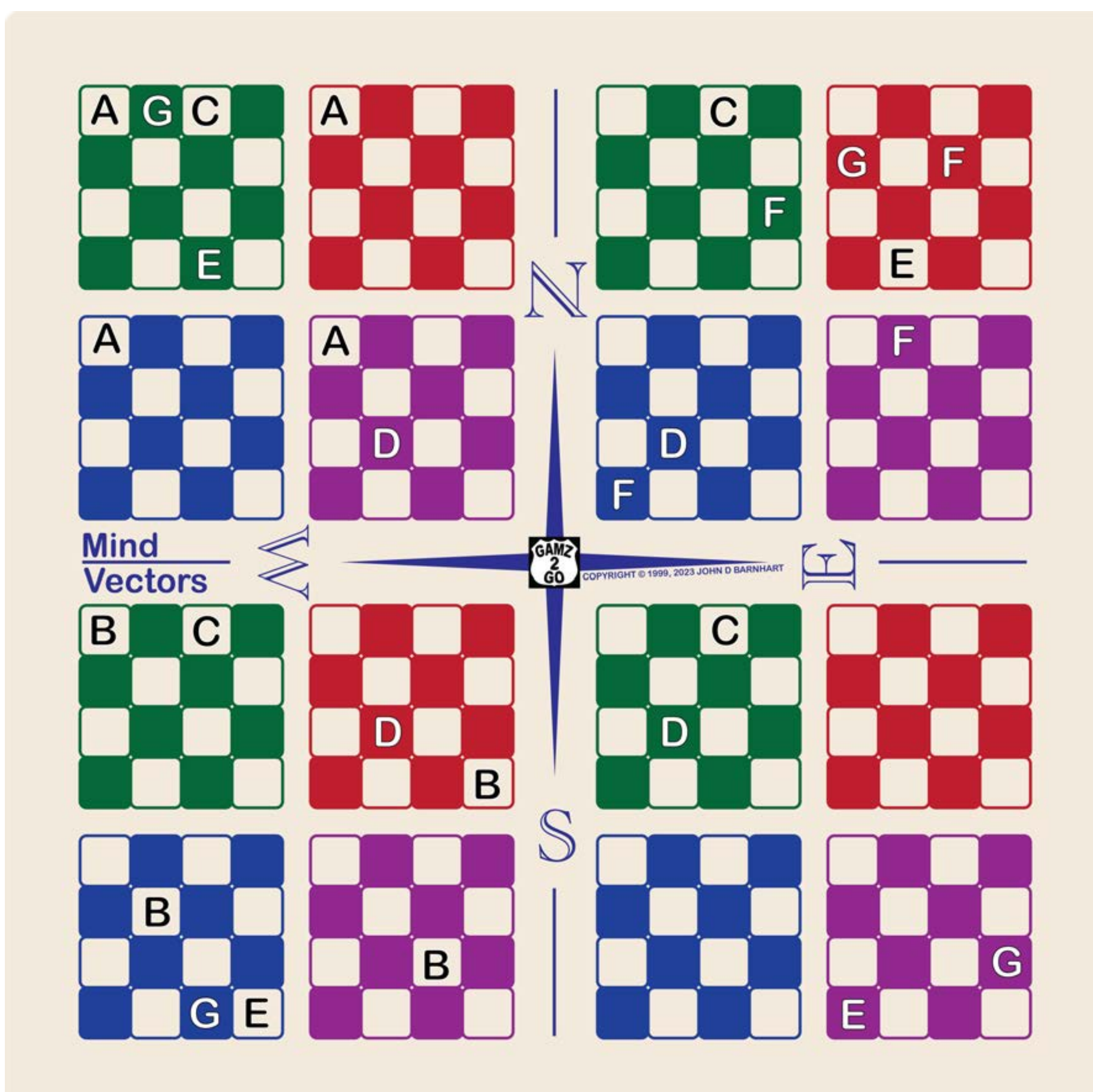


Illustration showing vectors A – G.