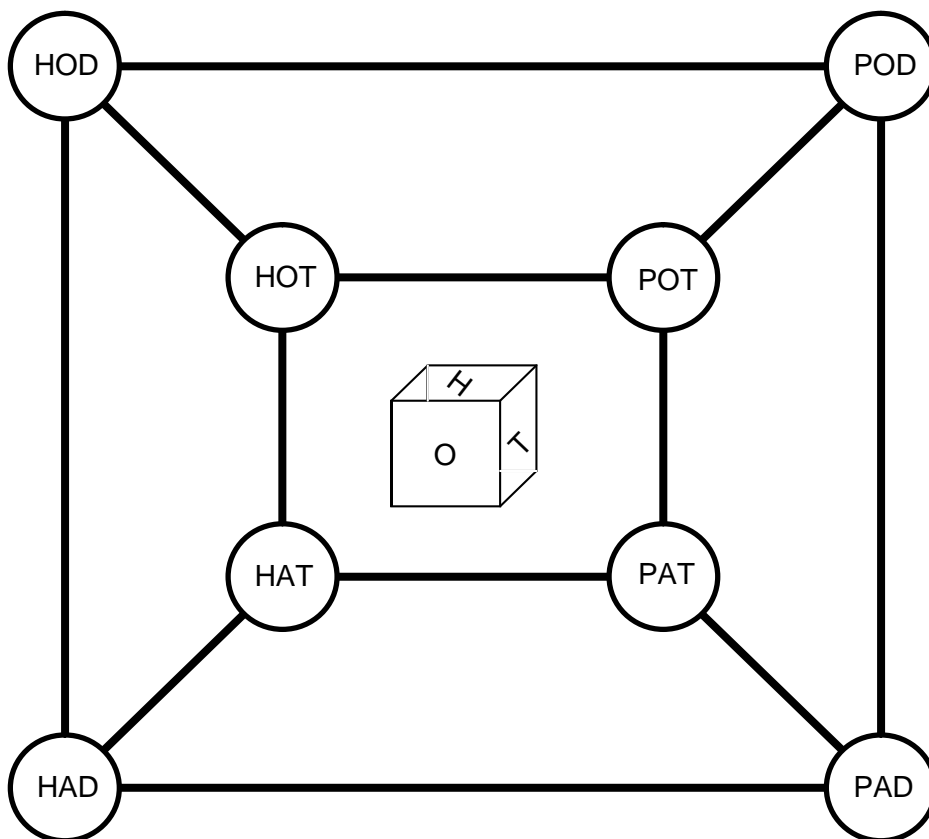


Due to an editorial error caused by abridging this article to fit in the Journal the group action describing the Hot-Pad die was wrong. We correct this error here and enhance the article by adding color to the diagrams. Also included is some additional material.

MAGIC WORD DICE

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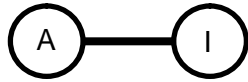
The illustration below is the graph of an ordinary cube with its six faces labeled with the letters H opposite P, O opposite A and T opposite D, thus forming the HOT-PAD die. Each of the eight nodes on the graph represents the eight corners of the die and are marked with the letters of the three faces that that corner abuts. It is possible to perform a mental magic effects on this graph reminiscent of one of the tricks in the Word Ways article “Montey, A Word Game Hustle”, pp. 45-6 in the February, 1998 issue.



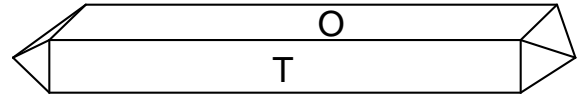
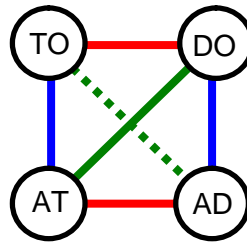
The effect starts with the magician turning his back to the grid and the subject placing a token on any one of the eight nodes. He then moves the token from node to node calling out his moves as “Horizontal”, “Vertical”, or “Diagonal” as the case may be. After a time he announces “I have arrived” and states to the magician either the start or end node (but doesn’t say which). The magician immediately names the other node.

The magician performs the trick by keeping a tally of the letters H, V and D with the proviso that any time a letter is repeated, it disappears. For instance, suppose the subject calls out DHDVHVDVH. The magician resolves this sequence into DH only. Since H changes the first letter, V the second letter and D the third letter, the magician knows that for our DH example he start and end words differ in the first and third letters and is able to quickly name the other terminal node. Mathematically this is called the group theoretic action with 8 elements represented as the direct sum of three copies of C_2 .

Generalizations are certainly possible. HOT-PAD is a 3-dimensional die and it is easy to obtain 1-dimensional and 2-dimensional “dice”. The 1-dimensional AI die has graph: modeled by an ordinary coin which is flipped rather than rolled.



The 2-dimensional TOAD die’s graph is at right along with its model of a lengthy rod with T opposite D, and O opposite A on it.



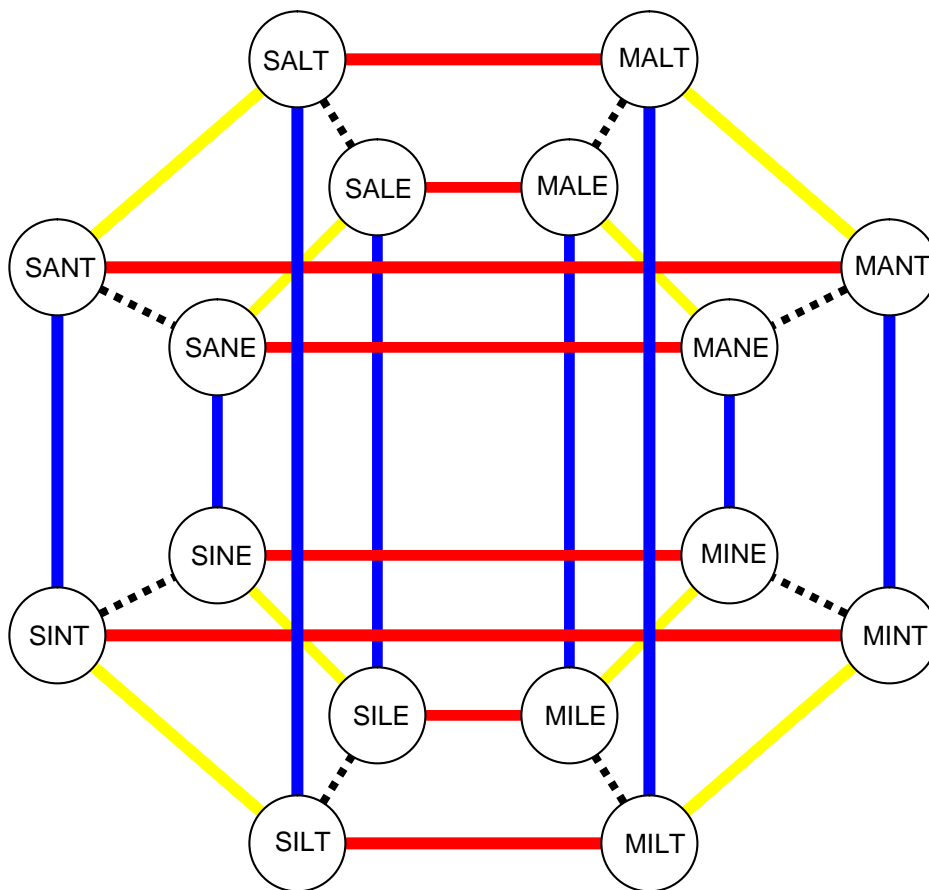
For the TOAD graph the subject can again start by placing a token on any node and moving it Horizontal (H), Vertical (V) or Diagonal (D) as often as he likes, calling out the moves as he does so. The magician can name the omitted terminal instantly, no matter how many moves the subject makes.

The group action here is called the Klein 4-group and its addition table appears below. O stands for no move at all and the table gives the result of a given move (the row heading) followed by another move (the column heading). Note that $X + X$ is always O, and $X + Y = Z$ when X, Y, Z are all different and not O. This allows the magician to quickly “add up” the moves as the subject calls them out.

+	O	H	V	D
O	O	H	V	D
H	H	O	D	V
V	V	D	O	H
D	D	V	H	O

For example, suppose the subject calls the sequence DHDVHVDV. The magician mentally computes $D+H=V$, $+D=H$, $+V=D$, $+H=V$, $+D=H$, $+V=D$. The reader will notice that the move H changes the consonant in the word, the move V changes the vowel in the word, and the move D changes both letters in the word. So, in our example the string of seven moves which summed to D means the start and end nodes are words that differ in both letters. A little practice will enable the reader to easily perform this task.

More interesting is the 4-dimensional SALT-MINE die illustrated in the diagram of a hypercube:



The eight 3-cubes of the graph have their eight nodes marked with a common letter. Trace the S 3-cube on the left of the diagram where the first letter of the eight words is S. This 3-cube is balanced on the right with the M 3-cube. Similarly, the A 3-cube is “opposite” the I 3-cube, the L 3-cube is “opposite” the N 3-cube, and the T 3-cube is “opposite” the E 3-cube.

Each of the 16 words on the nodes are bona fide (SINT and SANT are “Saint” in different European languages and often used in place names). On the back cover of this issue is a convenient toroidal graph of the 16 nodes that can be used for a mental trick similar to the HOT-PAD effect above. The subject again places a token on a node and moves to other nodes calling out his route numbers as he goes. When he reaches an edge node, he is to jump over to the opposite edge’s node. That is as if he were playing on a doughnut shape or torus. When he wants to stop traveling he again gives the magician either his start or end node and the magician immediately can give the other node.

For this effect the magician simply keeps track of the number 1-2-3-4. If any number is repeated it disappears. Thus, for example if the subject calls out “3-4-1-4-2-3-1-4” the magician keeps tally and notes the combination results in 2-4. The start and end word therefore will differ in the second and fourth spots only. Mathematically this is the order 16 group that is the direct sum of four copies of C_2 .

The Word Ways website (www.wordways.com) has another 4-dimensional interactive effect “Oscar Thumpbindle” currently running. We will soon add to the site a puzzle that can be played on the SALT-MINE die. In the August issue Ross Eckler will discuss other word dice effects and it may be possible for some reader to come up with a 5-dimensional die.