

5 *Mind-reading with Sums.* Consider the following table of numbers. Look at any four consecutive numbers, horizontal or vertical, compute the sum, and then cover the four numbers. I will then read your mind and tell you the sum. Can you explain it?

5	6	1	6	2	5	6	1	6	2	5	6
1	0	5	5	9	1	0	5	5	9	1	0
7	1	7	2	3	7	1	7	2	3	7	1
2	7	6	1	4	2	7	6	1	4	2	7
5	6	1	6	2	5	6	1	6	2	5	6
5	6	1	6	2	5	6	1	6	2	5	6
1	0	5	5	9	1	0	5	5	9	1	0
7	1	7	2	3	7	1	7	2	3	7	1
2	7	6	1	4	2	7	6	1	4	2	7
5	6	1	6	2	5	6	1	6	2	5	6
5	6	1	6	2	5	6	1	6	2	5	6
1	0	5	5	9	1	0	5	5	9	1	0

Magic Kit - Card 1

fold

1	3	5	7	1
9	11	13	15	
17	19	21	23	
25	27	29	31	

Magic Kit - Card 2

fold

2	3	6	7	2
10	11	14	15	
18	19	22	23	
26	27	30	31	

Magic Kit - Card 4

fold

4	5	6	7	4
12	13	14	15	
20	21	22	23	
28	29	30	31	

Magic Kit - Card 8

fold

8	9	10	11	8
12	13	14	15	
24	25	26	27	
28	29	30	31	

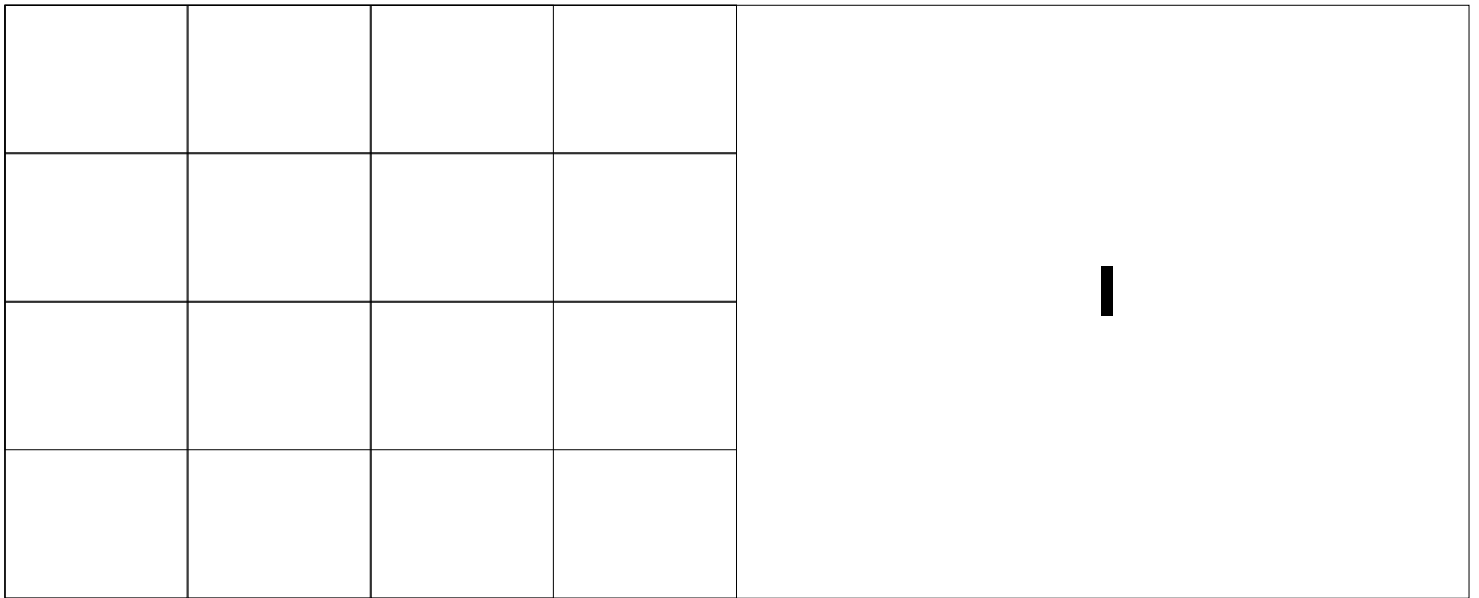
Magic Kit - Card 16

fold

16	17	18	19	16
20	21	22	23	
24	25	26	27	
28	29	30	31	

Magic Kit - Blank Card I

fold



Magic Kit - Blank Card 2

fold

				2

Magic Kit - Blank Card 4

fold

				4

Magic Kit - Blank Card 8

fold

				8

Magic Kit - Blank Card 16

fold

				16

Cat, Dog, and Mouse Magic

A Mind-Reading Number Trick

Instructions

By William Wallace, revised by Nancy Blachman
Images by Freddy Bendekgey
Four Cards with Numbers 0 to 80

Ask someone, whom I'll call Rowan, to choose a secret number between 0 and 80. Display one of the four cards with the numbers 0 - 80 and ask Rowan to tell you the color (blue, green, or red) of or the animal (cat, dog, or mouse) with the secret number. Repeat this procedure with the other three cards. Then tell the audience Rowan's secret number.

January 2, 2012



These cards are licensed under a Creative Commons Attribution 3.0 License. This license lets you distribute, tweak, and build upon these cards, even commercially, as long as you credit MathDelights.org for the original creation.

Method: Calculate the secret number as follows: Start off with the number 0 in your head. If Rowan specifies **blue** (cat), **green** (dog) or **red** (mouse), find the smallest **blue** (cat), **green** (dog), or **red** (mouse) number on the card, and add that number to the sum in your head. Repeat this procedure for the next three cards. After the 4th card, the sum in your mind is the secret number!

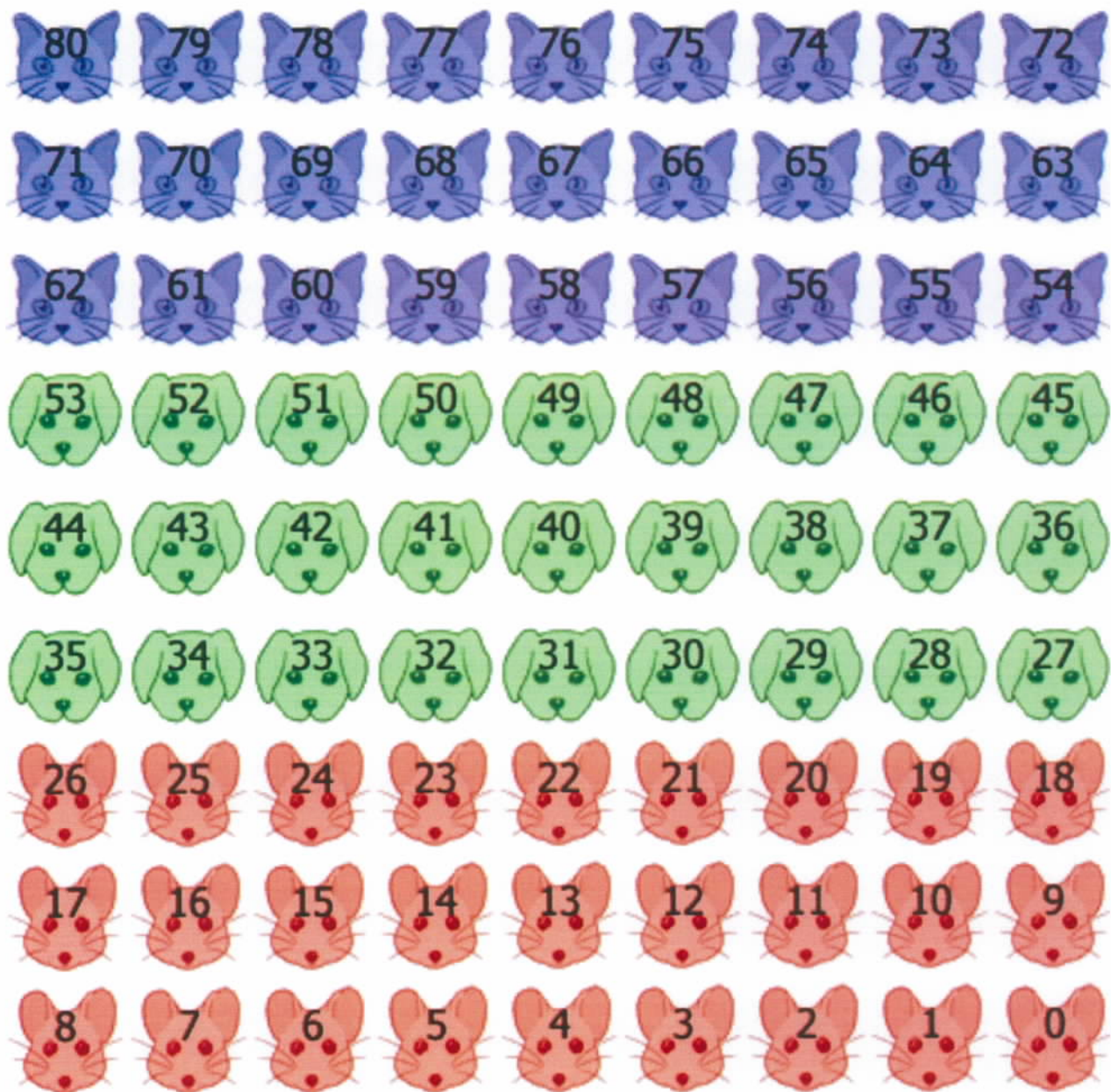
Example: Suppose the player chooses the number 14.

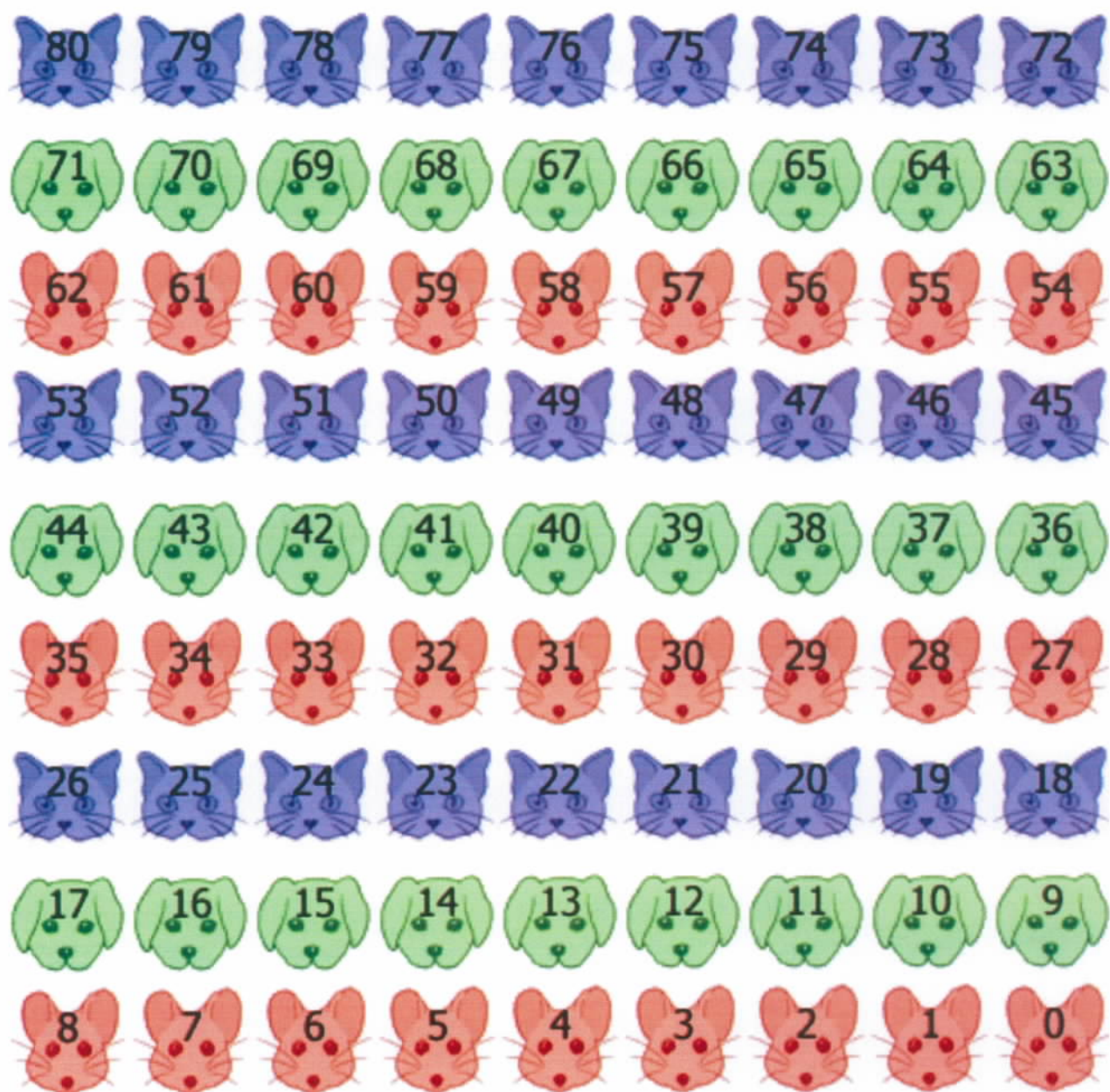
- On card #1, the number 14 is **red** (mouse) and the smallest **red** (mouse) number on card #1 is 0. So the number in your head stays at 0.
- On card #2, the number 14 is **green** (dog) and the smallest **green** (dog) number on card #2 is 9. So add 9 to the sum in your head to get 9.
- On card #3, the number 14 is **green** (dog) and the smallest **green** (dog) number on card #3 is 3. So add 3 to the total in your head, making the total in your head 12.
- The number 14 is **blue** (cat) on card #4 and the smallest **blue** (cat) number on that card is 2. Add 2 to the total in your head, now making the total in your head 14, the secret number!

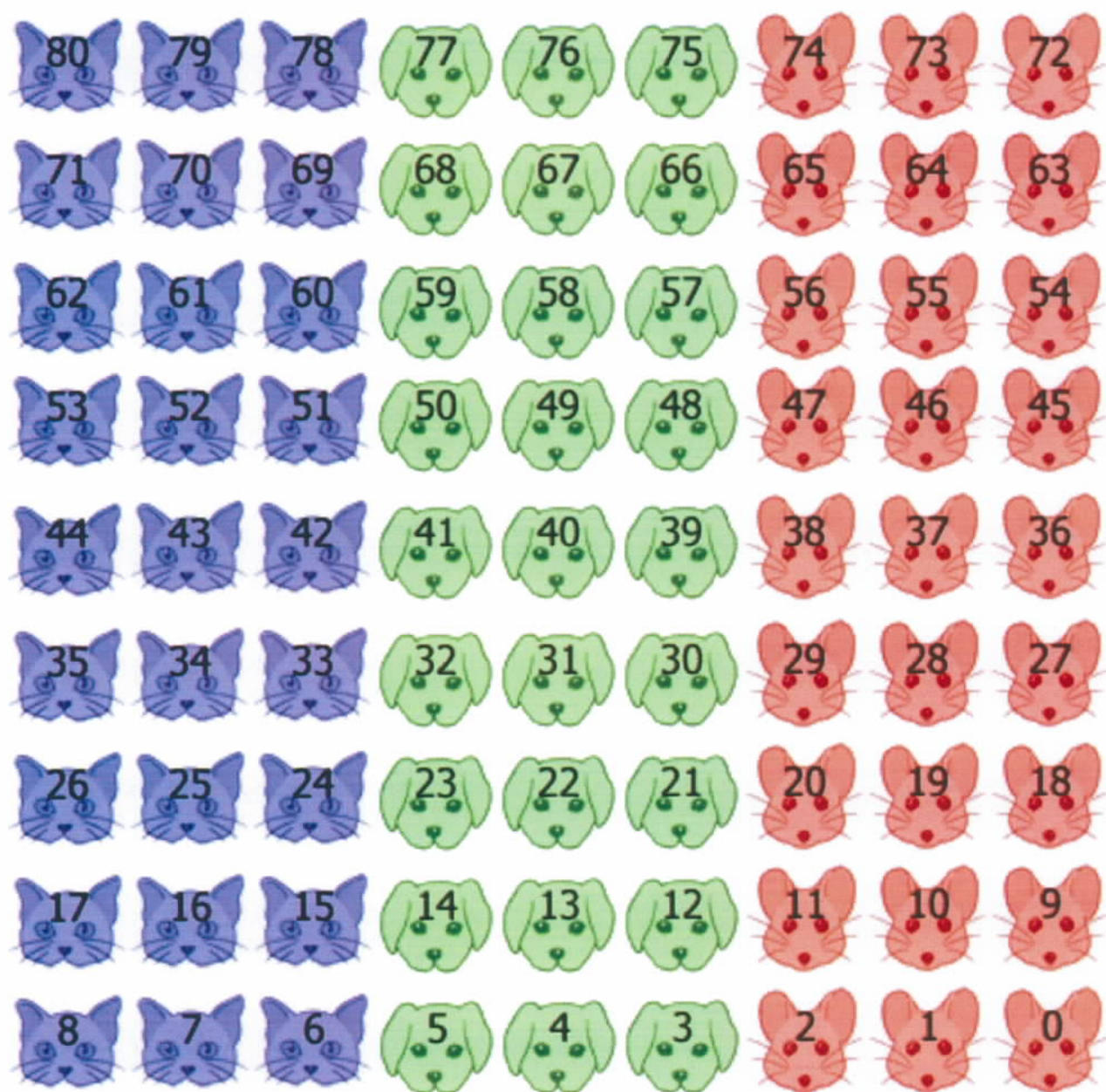
January 2, 2012

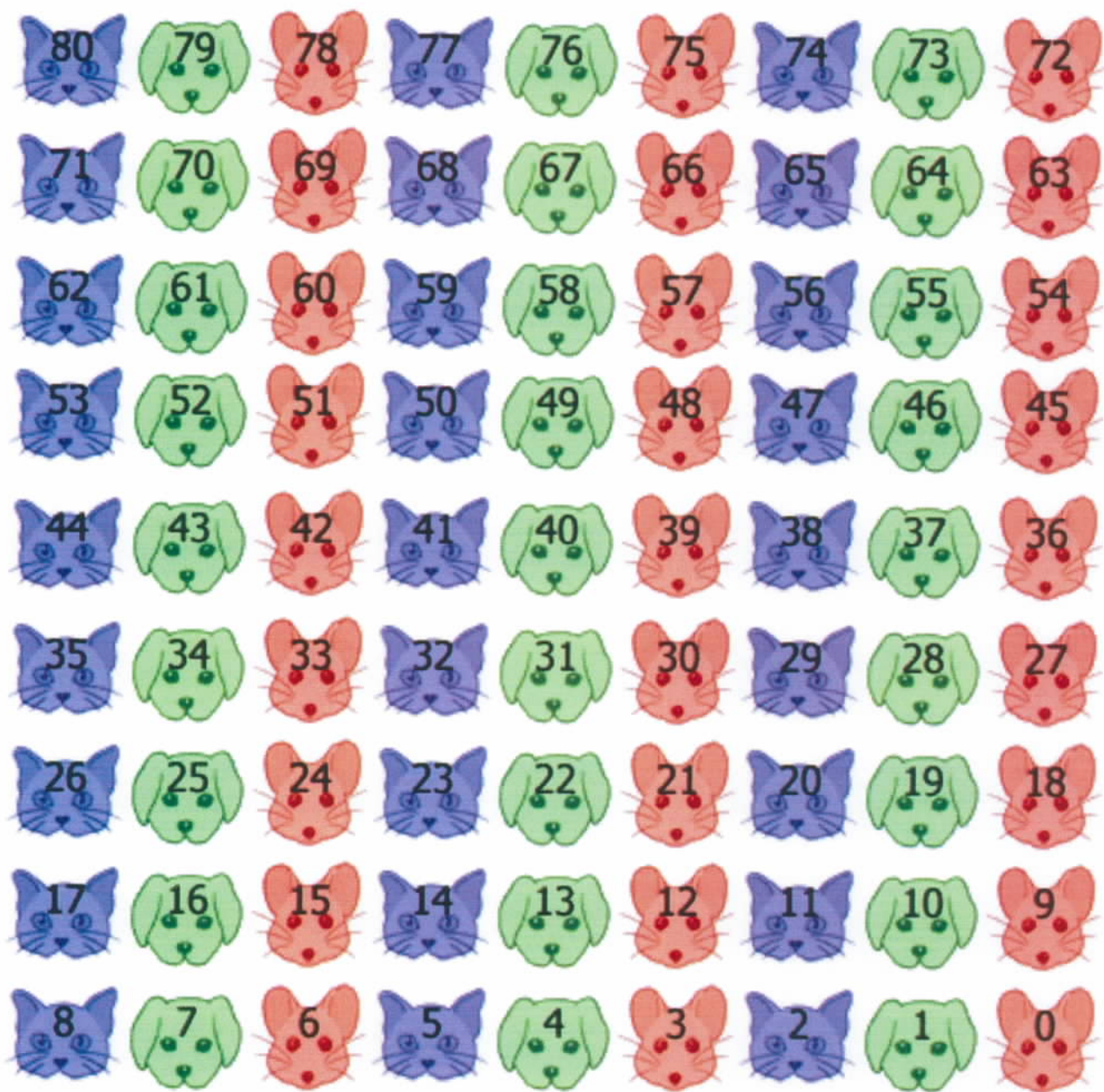


These cards are licensed under a Creative Commons Attribution 3.0 License. This license lets you distribute, tweak, and build upon these cards, even commercially, as long as you credit MathDelights.org for the original creation.









How Cat, Dog, and Mouse Magic Works

By William Wallace, revised by Nancy Blachman

Images by Freddy Bendekgey

Four Cards with Numbers 0 to 80

MathDelights.org

You don't need to understand this trick to perform it. You may find it interesting if you are curious and enjoy playing with numbers.

The cards are color coded in base 3 - a ternary number system, i.e., a number system that only uses the digits 0, 1, and 2. Below is a table with the numbers 1 - 27 in base 3 and in decimal notation.

Numbers One to Twenty-Seven in Standard Ternary

From Wikipedia en.wikipedia.org/wiki/Ternary_numeral_system.

Ternary	1	2	10	11	12	20	21	22	100
Decimal	1	2	3	4	5	6	7	8	9
Ternary	101	102	110	111	112	120	121	122	200
Decimal	10	11	12	13	14	15	16	17	18
Ternary	201	202	210	211	212	220	221	222	1000
Decimal	19	20	21	22	23	24	25	26	27

The pages in the magic trick are color coded. **Blue** represents the numeral 2, **green** 1, and **red** 0. The numerals 2,1, and 0 are sometimes referred to as trits in base 3. A trit is like a digit in base ten or a bit in base two.

Each number between 0 and 80 in decimal can be represented by a 4-trit numeral between 0000 (base 3) and 2222 (base 3). For example, 80 is represented base 2222 (base 3), 79 as 2221 (base 3), 78 as 2220 (base 3), ..., 0 as 0000 (base 3).

Note that $80 = 2 \times 3^3 + 2 \times 3^2 + 2 \times 3^1 + 2 \times 3^0 = 54 + 28 + 6 + 2$.



The four pages represent the 27s place, 9s place, 3s place, and 1s place respectively.

Page	Place	Exponential
1	27s	3^3
2	9s	3^2
3	3s	3^1
4	1s	3^0

Deriving the Ternary Representation of a Number

The following chart show how to represent a decimal number between 1 and 8 in base 3 if you can use at most 2 of any of the following values: 1, 3, 9, 27.

Decimal	27s	9s	3s	1s	Computation
1				1	1×3^0
2				2	2×3^0
3			1		1×3^1
4			1	1	$1 \times 3^1 + 1 \times 3^0$
5			1	2	$1 \times 3^1 + 2 \times 3^0$
6			2		2×3^1
7			2	1	$2 \times 3^1 + 1 \times 3^0$
8			2	2	$2 \times 3^1 + 2 \times 3^0$

Create another chart that shows how to represent decimal numbers between 9 and 80.

Base-4 Mind-Reading Magic Trick

How many different colors or animals and cards would be needed in a base-4 mind-reading magic trick if the cards had numbers 0 - 100?

Design some sample cards for the base-4 version of the mind-reading magic trick.

