Chapter 2: Square Poems

My late, beloved brother Martin had a globetrotting habit and a penchant for quirky and impractical gifts. On one occasion he arrived to stay with me bearing a large, heavy stone square, which he had seen on a trip to Italy and decided would make the perfect present for his Classics-loving, mathematically minded sister. It was a replica of the famous SATOR square:

S A T O R
A R E P O
T E N E T
O P E R A
R O T A S

The SATOR square dates back at least to the first century AD – versions were found among the ruins of Pompeii and Herculaneum. Other examples have been found in Cirencester, Dura-Europos in Sicily, Coimbra in Portugal and Luberon in France, as well as a number of locations in Italy. Some versions have the words in reverse order, with ROTAS at the top. The inscriptions have been found embedded in churches and abbeys, indicating strong associations with Christianity.

One possible translation of the inscription is: *The farmer Arepo holds wheels as his work*, presumably for the purpose of ploughing the land.

There has been much scholarly speculation about the origins, meaning and significance of the SATOR square, but viewed as a form of mathematical poetry its elegant ingenuity cannot be disputed. It is square both in geometry and in content, consisting of five words of five letters each. There are lines of symmetry through the diagonals, as well as rotational symmetry through 180°. Furthermore, the square is a palindrome that can be read top to bottom, bottom to top, left to right and right to left.

The SATOR square is a special case of an acrostic, a poetic form where the first letter or word of each line spells out a message. Another remarkable acrostic is the nineteenth-century poem 'I Often Wondered':

I often wondered when I cursed,
Often feared where I would be –
Wondered where she'd yield her love
When I yield, so will she.
I would her will be pitied!
Cursed be love! She pitied me…

This poem is generally attributed to the mathematician Charles Lutwidge Dodgson (who, under the pseudonym Lewis Carroll, wrote *Alice's Adventures in Wonderland*). 'I Often Wondered' is a 6 x 6 array: it has six lines, with six words in each line. Like the SATOR square, it can be read both across and down.

I	often	wondered	when	I	cursed
Often	feared	where	I	would	be –
Wondered	where	she'd	yield	her	love
When	I	yield,	so	will	she.
I	would	her	will	be	pitied!
Cursed	be	love!	She	pitied	me…

The square form features in a poem written in 1597 by Henry Lok, in honour of Queen Elizabeth 1.

God	hath	pour'd	forth	Rare	Grace	on	this	Isle -	And
Makes	crown'd	your	rule	Queene	In	the	same	so	still
Kings	laud	this	saint	Faire	that	with	truth	doth	stand
Rule	so	long	time	milde	Prince	joy	land	it	will
For	proofe	you	showes	wise	of	earth's	race	whom	There
Heavens	have	up	held	Just	choice	whome	God	thus	shields
Your	stocke	of	Kings	worlds	rich	of	spring	and	feare
States	fame	Known	farre	Praise	Isle	which	All	blisse	yields
Hold	God	there	fore	sure	stay	of	all	the	Best
Blest	is	your	raigne	Here	Builds	sweet	Peace	true	Rest

There are 10 lines, each containing 10 single-syllable words. The poem can be read in the conventional way, line by line. However, choosing different starting points and routes through the word square reveals an intricate substructure of shorter poems. For example, reading the shaded region (representing the Cross of St. George) in a certain sequence gives:

Rare Queen, fair, mild, wise
Shows you proof
For heavens have up held
Just world's praise sure.

Here Grace in that Prince
of earth's race, whom
There shields thus God
whom choice (rich Isle, stay!) builds.

Clearly experimental poetry was alive and well in Elizabethan times!

Another renowned example of a square poem with different routes through its structure is the 'Star Gauge', which was composed by Su Hui in northwest China and dates from the fourth century. We will consider this poem in Chapter 5 (Reflection Symmetry).

The square poem lends itself to concrete and visual poetry. Written in 1989, Bob Cobbing's witty concrete take on the square poem consists of 12 lines, each of which is a permutation of the five words 'This is a square poem'. Through Cobbing's artful choice of font, spacing and punctuation, the poem forms a geometric square.

Square Poem

This is a square poem.
This poem is a square.
Is this square a poem?
This square is a poem,
This square is. A poem
Is a poem - this square.
This is a poem-square.
A poem-square is this
Poem. This is a square.
A square poem is this
Square. This is a poem,
This is. A poem-square.

The Kazimir Effect, by Christian Bök, is a series of minimalist visual poems inspired by Kazimir Malevich's 1918 painting *Suprematist Composition: White on White*. Elegant and austere, they inhabit a space between art, poetry and meditation.

Recent years have seen the emergence of innovative forms of square poetry, including the grid poem, the Latin square puzzle poem and its more challenging variation, the Graeco-Latin square puzzle poem.

The grid poem was conceived by Brian Isett and consists of a 3 x 3 array of cells, each of which contains a word or phrase. The poem can be read in two ways, either horizontally (by row) or vertically (by column), generating shifts in perspective that give rise to different interpretations. As Isett notes, 'Part haiku, part Sudoku, the full poem is only revealed through re-reading and exploration.' Here's his delicately elegiac 'the vacation of a custodian':

the vacation of a custodian

an anxiety of facts	he sits rigidly before a lake	he flickers
free of form	not the hunched shoulders	custodial
and timid	but the man between	straightening a pile of leaves

A Latin square is an *n* x *n* array of cells with *n* distinct characters, each of which occurs exactly once in each row and each column. Two examples of order 3 are shown below.

1	2	3
2	3	1
3	1	2

A	B	C
C	A	B
B	C	A

Canadian mathematician and poet Lisa Lajeunesse has devised a form of puzzle poetry based on the Latin square that has characteristics in common with Sudoku. To illustrate how it works, here's Lajeunesse's 'The Guarded Heart':

The Guarded Heart

4 Life's	Shackled	Fixed	**2** Stone
Eyes	Chambers	**1** by	Alone
Heart	Cup	of	Inwards
2 Cold	Ever	Drunk	Fear

'In this *Sudoku*-like puzzle,' Lajeunesse writes, 'the numbers in some of the cells are provided, and the puzzle is solved by filling in the missing numbers using logical reasoning and the rule of the Latin square. The filled-in square is uniquely determined by the clues given. In the poetic version, each cell also contains a word from a poem. Once the puzzle has been solved, the words of the poem have been unscrambled. The first line is found by reading the words paired with 1 from left to right, the second line by reading the words paired with 2 from left to right and so on.'

Filling in the missing letters according to the Latin square rule, we get

4 Life's	1 Shackled	3 Fixed	**2** Stone
3 Eyes	2 Chambers	**1** by	4 Alone
1 Heart	4 Cup	2 of	3 Inwards
2 Cold	3 Ever	4 Drunk	1 Fear

And now we are able to unscramble the poem!

The Guarded Heart

Heart shackled by fear
Cold chambers of stone
Eyes ever fixed inwards
Life's cup drunk alone

When two Latin squares are combined in such a way that each cell entry is distinct, they form a Graeco-Latin square:

1A	2B	3C
2C	3A	1B
3B	1C	2A

Inspired by Isett's grid poem approach, Lajeunesse has extended the concept of the puzzle poem to Graeco-Latin squares. In this case, the words within the square can be rearranged according to two schemes: one, which reads horizontally from left to right using the number system, gives the first stanza of the poem while the second rearrangement uses the lettering system and reads vertically, from top to bottom.

Here's an example: see if you can work out the poem it contains for yourself (the answer is at the end of the chapter).

1 Time will	Still	Swift
Hours	**3A** Never	**B** Slowly
End	Pass	Wait

As with the grid poem, the constraints make the construction of a coherent poem challenging, but at the same time enormously fun both to create and to solve.

Nkosi Nkululeko, a poet, musician, and chess player/teacher from Harlem, New York, combines his passion for the game of chess with his passion for poetry. He writes:

'Many artistic mediums surrounded me, and I participated in so many forms of expression, but chess was something I absolutely could not live without. My obsession for poetry evolved over the years and during the beginning of the pandemic I started experimenting with an interesting poetic form: the Square Poem. Amazingly, I discovered a way to merge my two passions in both a literary and visual manner, utilizing grids to build a poetic narrative while abiding by such a strict (and therefore freeing) constraint. Lewis Carroll has a square poem that was a great model in the beginning of my journey, but I realized there is a rich history of the form that both precedes and follows his legacy. Inspired by my research on logology, magic squares, matrix theory, and more, I developed more methods to complicate and simplify this incredible form.'

Nkululeko's 'Square Poem: The Bishop', which is laid out in the form of a chess board, can be read both vertically and horizontally, as well as along the two main diagonals.

Even more remarkable is his 'Square Poem: The Knight', shown below. In addition to horizontal and vertical readings, the numbers in each square guide us through a 'Knight's Tour' that covers each of the 64 squares on the board just once. Exploring the poem's multiple pathways and meanings is contemplative and rewarding.

Square Poem: The Knight

"Soft songs, like birds, die in poison air"
— Etheridge Knight

1 Soft	48 Songs,	31 Like	50 Birds,	33 Die	16 In	63 Poison	18 Air—
30 Voices	51 In	46 Knights	3 Spark	62 While	19 Our	14 Burning	35 Dread
47 Resemble	2 Beasts'	49 Imitating	32 Choruses—	15 Humans	34 "Saving"	17 Daylight,	64 Feeds
52 The	29 Harmonious	4 Fire—	45 The	20 Unearthed	61 Emerges	36 Dante's	13 Infernos;
5 Flames	44 Ruin;	25 Like	56 (K)Nights	9 Snow-	40 Filled	21 Mourning—	60 Deserts
28 In	53 Primal	8 Embers:	41 That	24 Speckled	57 Emptiness—	12 Fear	37 Most
43 Our	6 Ruin	55 Within	26 Blundered	39 Wounds—	10 And	59 Our	22 Drowned
54 Bodies'	27 Cries	42 *Hollow*	7 Breaths	58 Because	23 We're	38 Hunted	11 Flesh

Note: this is a Square Poem that not only reads horizontally →and vertically↓ but is numerically arranged to create additional meanings. These numbers are positioned in the way a Knight moves; ↲, ↱, etc., in L-shapes. This is a Knight's Tour; where the Knight visits all 64 squares only once.

Another way of defining square poems is by syllable count, where the number of syllables per line is equal to the number of lines. Mathematician and poet JoAnne Growney often chooses to work with syllable-counting constraints of this type, commenting that they 'limit word choices so that, when I write in support of women's rights or with grave concern about climate change, I am pushed to think carefully and not simply to rant.'

Her poem 'The Bear Cave', set in the Carpathian Mountains of Romania, has nine lines of nine syllables each. Note how Growney's choice of constraint conveys a crushing sense of entrapment that is aptly suited to the subject.

The Bear Cave

Twenty-five years ago at Chiscau,
marble quarry workers discovered,
trapped by an earthquake in a wondrous,
enormous cave, bones of one hundred
and ninety bears, *Ursus spelaeus*
(now extinct). Cold rooms of cathedral
splendor now render tourists breathless
while the insistent drip of water
counts the minutes. There is no safe place.

The concept of the square poem by syllable count can be extended to longer poems and sequences. John Hollander's *Power of Thirteen*, published in 1983, consists of 169 poems, each of which is 13 lines long with 13 syllables per line. The extended poem 'Orders of Magnitude' by H. L. Hix comprises 100 'decimals' of 10 lines and 10 syllables per line.

The square and its three-dimensional companion the cube have a particular significance in ancient theories of the fundamental elements (Earth, Water, Fire, Air and Space/Ether) that were thought to constitute all matter. Plato assigned the cube to the element Earth, on the grounds that the cube was inherently the most stable of the five Platonic solids. In the tantric theory of subtle energy, Earth is represented by the yellow square contained in the symbol for the Muladhara chakra. My poem 'Earth Geometry' invokes these geometric objects in its structure: the poem has $2^2 = 4$ stanzas, $4^2 = 16$ lines and $4^3 = 64$ syllables.

Earth Geometry

Let us assign the cube to earth. (Plato)
In this Muladhara Lotus is the square region of Prthivi. (Purnananda)

Solid stacking.
Four triangles
per plane; six planes.
Cube. Immobile.

Beautiful as
lightning, a square
surrounded by
eight shining spears.

Shifting plates on
a spinning sphere;
magnetized, with
a molten core.

My mother, toes
dew-sensuous,
at dawn among
her fuchsias.

Rather delightfully, recent research by geophysicists supports the Platonic belief that the basic structure of earth is the cube. The farmer Arepo, working the soil with his wheeled plough, may well have had his own thoughts on the matter.

Solution to Lisa Lajeunesse's Graeco-Latin square puzzle:

Time will pass slowly,
Hours still wait,
End never swift

Time will never wait
Still slowly end
Swift hours pass

Further reading

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