

# To Look on Beauty Bare: Mathematics as Metaphor in Poetry

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## Abstract

Mathematics is an excellent source of metaphor in poetry. Its capacity to express difficult ideas succinctly can be employed in the structure or language of a poem. In this workshop, participants will be introduced to several examples of mathematics as metaphor in these different capacities. Participants will first explore structure as metaphor, then write poems with two different structural patterns. They will write poems using the constraint of the Fibonacci Sequence, and secondly, poems reflected around a vertical axis. In the third exercise, sample poems with mathematical metaphors within the text will be discussed. Then participants will create poems with metaphors of their own choosing. These exercises can easily be adapted for use in the classroom.

## Introduction

Metaphors have been employed throughout recorded history to stretch the mind and to elucidate phenomena that defy simple explanation. Mathematics with its precision and, perhaps surprisingly, with its subject matter (abstract ideas such as infinity, absence, multiple dimensions, etc.) provides a rich source of metaphors for poets. As referred to in the title, Edna St. Vincent Millay's sonnet "Euclid alone has looked on beauty bare" [10] is an elegant illustration of math as metaphor.

In the first two exercises of this workshop, we will review examples of metaphor in the structure of poems, then write poems involving such structures. In the third exercise, we will describe metaphors in the text of poems. A list of additional possible mathematical metaphors will be provided, and participants will choose a metaphor and write a poem.

## Metaphor in Structure

Metaphor can be conveyed by the appearance of the poem on the page, sometimes referred to as concrete or pattern poetry. In ancient times, spiritual poems were sometimes written in the shape of altars. Perhaps one of the most well-known early modern shape poems is George Herbert's "Easter Wings" [6], its shape suggesting both hourglasses and wings, emphasizing the themes of death and resurrection.

For a mathematical example, the poem "Measured Illusion" [7, p.19] has a form which suggests a (rotated) logarithmic curve for  $\ln(n)$ , but the stepwise lines also echo the graph of the series  $n \rightarrow \infty$ ,  $[1 + 1/2 + 1/3 + \dots + 1/n]$ . The epigraph for the poem is the equation for the Euler-Mascheroni constant:

$$\gamma = \lim_{n \rightarrow \infty} \left( \sum_{k=1}^n \frac{1}{k} - \ln n \right)$$

harmonic series, Etch A Sketch trace along the logarithmic line  
 an endless staircase cascading down the smoothed channel  
 cobbled road of clear-cut stories worn down to history

beads mapped on unspooling strand of mind  
dubstep popping, swan-lake dance apace  
step and thread exactly separated  
by one bare number, carried  
119 billion places so far  
we know it and don't;  
rational, irrational  
transcendental  
algebraic?  
but we  
know  
it is  
real

0.57721566490153286060651209008240243104215933593992...

### *Exercise 1*

For a quick warm up exercise, we will write “Fib” poems which involve a theme of growth. The Fibonacci numbers in mathematics 1;1;2;3;5;8...are based on a sequence of sums, and thus a specific pattern of growth. Poems using this sequence may be made of syllables, words or phrases as units. The syllabic version was first mentioned in a blog by Gregory Pincus [11]. Some examples can be seen in the Bridges Collection of Fib poems which appeared in the Journal of Humanistic Mathematics in 2022 [5], and a thorough explanation can be found in the Journal of Mathematics and the Arts [3]. Poems can use the Fib structure simply as a form, but in our exercise, we’ll write Fib poems specifically with growth as the underlying theme. That could mean any kind of growth: population, knowledge, despair. Here’s a (not very serious) rabbit poem invented for this paper, titled “Rabbit Fib” by E. R Lutken:

It  
takes  
at least  
two rabbits  
to get things going  
then they quickly get out of hand

### *Exercise 2*

In the poem “Reflection” ( by E. R. Lutken, previously unpublished) phrases are reflected over a vertical axis. This does not produce a real mirror image, since each word is considered as an entity, but does function as if each word were given a set of coordinates. The poem can be read straight across, or down the right and left halves, and has completely different, yet somehow similar perspectives with each reading – the phrasing bringing unusual meanings to each reflected line:

staring into mirrors	mirrors into staring
angle of incidence=	= incidence of angle
angle of reflection	reflection of angle
clear silver looking glass	glass looking silver clear
invisible wisps of blinks	blinks of wisps invisible

eyes glittering with mischief	mischief with glittering eyes
hands swapping objects	objects swapping hands
scribbling hieroglyphics	hieroglyphics scribbling
figures traveling opposite paths	paths opposite traveling figures
riddles of empty symmetry	symmetry empty of riddles
mirages in shimmering glory	glory shimmering in mirages
phantom images glistening	glistening images phantom
jumbled isomers of clouds	clouds of isomers jumbled
wild kaleidoscope colors	colors kaleidoscope wild
topsy-turvy dappled gardens	gardens dappled turvy-topsy
flowers nodding their greeting	greeting their nodding flowers
perfectly shuffled rooms	rooms shuffled perfectly
chiaroscuro in candlelight	candlelight in chiaroscuro
patterns mad dancing	dancing mad patterns
play of shadow	shadow of play
light within space	space within light

For this exercise, we will construct reflected poems of a minimum of four lines with at least three or four words in each phrase, and (of course) three or four words in the reflected phrase. In order to write these, we'll take a close look at the individual words, especially the prepositions and participles in the lines of the sample poem. A list of some common prepositions that might be helpful to draw from in constructing phrases is provided here:

aboard, about, across, after, against, along, amid, among, around, as, at, before, behind, below, beneath, beside, between, beyond, by, down, during, except, for, from, in, inside, instead, into, like, near, of, off, on, onto, outside, over, past, round, since, then, through, throughout, to, toward(s), under, underneath, unlike, until, unto, up, upon, with, within, without.

Below is a template with some example reflective words, more rabbits, and more spaces to try a few words for practice:

	Ears	Folded	Back	Back	Folded	Ears	
Brown	Drooping	Eyes	Dazed	Dazed	Eyes	Drooping	Brown

**Figure 1:** *Template for reflected poem with sample words.*

### Metaphor in Language

Metaphors within text can create vivid imagery and enhance creative thinking. In this section, we explore such metaphors in several examples from various areas of mathematics, in order to give some idea of the many possibilities of mathematical metaphors. Reference to the metaphor can be a brief mention as in Millay's poem cited above, or can pervade every line.

*Poems Inspired by Arithmetic Operations*

The first poem below “Arithmetic” [7, p.77] simply uses subtraction as metaphor in the last lines.

One cupcake bite, I’m back in first grade:  
chalkboard dust, spelling apple and you,  
counting by tens, selling lemonade,  
three take-away one, the struggle to tie shoes.  
Mid-east wars have been going solid since,  
a seventeen-year count of money and lives.  
I should know but can’t remember much  
more than black hair, his laugh, piggy-back rides.  
Statisticians seem to agree near six trillion  
dollars, but casualties are another story,  
from one hundred thousand to a million  
depending on who’s taking inventory.  
And every one who died must have left someone  
lost, blank, wondering about the subtraction.

*Poems inspired by Algebra*

The second poem “Ars Parabola” [7, p.52] requires more of a stretch for the mind. The poem uses the graph of a parabola to elucidate the art of poetry. Aspects of the graph as they relate to rhyme, meter, sound, and meaning in this detailed metaphor are woven throughout the poem.

Can’t say what a poem is or not  
but graph it and the plot  
might trace that perfect spot for one  
whose vertex taps the sun:  
abscissa makes a run from rhyme  
to none and metric time  
devolves from frozen symmetry.  
Equal distance of free  
line and focal point defines sure  
sense, logic’s stare obscured  
as symbols play in pure sound’s bright  
flare. White-hot words ignite  
a sharp savor, the bite, the risk,  
an ordinate of bliss.

*Poems Inspired by Topology*

In this third poem, the metaphor is only named in the title, “Borromean Rings”[8]. The mathematical term represents three simple closed curves linked topologically, which cannot be separated, but all come apart when one is cut. This metaphor echoes interpersonal relationships, and is the foundation of the poem.

misty April pall  
masses of craneflies  
attended the service

of her interrupted arc  
even the interred might  
wash away in a record rain  
when the river scours banks  
leaving gray cypress logs  
paddlefish carcasses  
splintered hulls of boats  
strewn across low sandbars

after half a century he and I  
suddenly unable to speak  
nothing alive but separate  
circuits burning in thought  
no defense for watery dissolution

without her interwoven grace  
only the husks of two selves  
remain – tongues and hearts  
just more flotsam sloughed  
into an unforgiving river

*Poems inspired by Category Theory*

The final poem “Diamond” [2] by Shanna Dobson uses concepts from category theory to explore the relation of the self to the external world in contemporary poetry. Specifically, the poem utilizes the powerful categorical concepts of universal property and terminality, and a categorical construction called a diamond [12, 1, 9]. A categorical diamond resembles a mineralogical diamond in a particular way. The categorical diamond has interior points that resemble mineralogical impurities, in that they cannot be observed directly. While mineralogical impurities appear as sparkling reflections on the many sides of the diamond, in the categorical diamond, the impurities appear as profinitely many copies of the interior point. Recall, a profinite set is a compact, totally disconnected Hausdorff space. In the poem, Dobson composes a dialogue in powerful confessional style that shifts perspective from the inside to the outside of her categorical/mineralogical diamond.

If I was your diamond,  
What would profinite see?

I know, sweet Kierkegaard,  
Reflections only to me

Total internal reflection  
Makes aporia sparkle

Great concession  
Categorical Marble

Your diamond is a darkling  
Unhallowed Sparkling

Dark energy must have Diamonds  
Adamantem Lions

I hear total internal reflection  
Red functorial subreption

As Topos Tigers dream of  
Looking-glass ice-cream

Does no one else see the  
Black rainbow?

I dare you to compose anything here  
And hope for anything but what was always  
here.

Clarion Universal  
You could not see 4th Dimensional me  
Profinately.

### **Exercise 3**

The participants will be given time to write a poem with a mathematical metaphor. They may use one from the examples above, or from the listed suggestions below (accompanied by some examples mentioned from various authors for further reading), or from their own imaginations.

Particular numbers, such as 0 as void, 1 as unity

Example poems, “Sine Qua Non” by A. E. Stallings [13, p.11], “The Invention of Mathematics” by Amy Uyematsu [14, pp. 30-33]

Imaginary numbers representing the nebulous or inscrutable

Example poem “imaginary territory” by E. R. Lutken [7, p. 36]

Negative numbers echoing mystery, debt, or absence

Example poem “The First Negative” by Sarah Glaz [4, p.17]

Order of operations: order representing time

Example poem “Antecedents” [7, p.38]

Integral calculus as the summation of small details over time, derivatives as instants in time

Example poem “Sonnets from the Calculus” [ 7, p.84]

Proofs as inspiration

Example poem “Like a Mathematical Proof” by Sarah Glaz [4, p. 47]

Game Theory as conflict

Example Poem “The Truel” [7 p.71]

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