

Mathematics Through the Matrix of Poetry

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Abstract

This workshop will offer participants a few strategies for expressing aspects of mathematics through the matrix of poetry. We will begin with a group activity whereby members exchange, combine and deconstruct mathematical ideas in order to generate an image or metaphor that ignites their enthusiasm. A short period of free-association will follow, with the intention of new ideas crystallising around the initial image, resulting in a working draft. Members will be encouraged to read their work to the group and, on the basis of constructive feedback, produce a better version. Given time constraints, a finished sonnet is not envisaged in this workshop, however it is hoped that participants will continue refining their work, during and after the conference, eventually sharing their sonnet with group members and the wider public.

Introduction

Over the years I have observed that student engagement with mathematics can be facilitated through the use of fiction, poetry and drama. Students respond more readily to common words than to abstract symbols, they tune in to the narrative of a story or the rhythm of a poem more intuitively than to the unfolding of a mathematical proof. A literary approach to mathematics has the potential to stimulate students by arousing their sense of curiosity and wonder, thereby making them more receptive to both symbol and proof. This workshop will offer participants suggestions for crafting a poem based on mathematics. One measure of the success of such a poem is its appeal to students and the mathematically minded; another, its accessibility to readers from the Humanities. The poems produced in this workshop will endeavour to bridge what C.P. Snow referred to as *The Two Cultures* [1].

This interaction between mathematics and literature has mutual benefits: literature has the appeal to make mathematics accessible to a wider audience, while the concepts of mathematics can enrich literature by providing a new source of metaphors. In this regard, the Italian writer Italo Calvino maintained that the literature of the third millennium must be open to the tributaries of science and mathematics if it is to avoid stagnation [2]. I would add that mathematics must be humanised through literature if it is to avoid hermetic insularity.

The ways of translating mathematical ideas into verse are many and varied, ranging from concrete poetry (the use of digits and symbols in constructing a visual poem) to the pure lyric in which the mathematics dissolves in image, metaphor and music. Being a practitioner of the traditional lyric, I will endeavour to use my experience to encourage and guide participants to produce at least a first draft of a sonnet. This workshop will concentrate on this form because of its history, intrinsic arithmetical structure, use in many languages, and its evolving nature. The sonnet has been used in various ways from the Renaissance to modern times. We have individual sonnets like Shelley's *Ozymandias* [3], cycles such

as Rilke's *Sonnets to Orpheus* [4], even novels written in linked sonnets like Pushkin's *Eugene Onegin* [5] and more recently Vikram Seth's *The Golden Gate* [6]. The sonnet's appeal is partly traditional, partly due to the constraints imposed on poets by its compact form. Poetry, indeed all creative work, arises from working with basic assumptions and constraints. This practice of setting arbitrary constraints on literary production continues to be explored most effectively by the French literary group OuLiPo, whose members have included Calvino and Perec. In the hands of good poets the constraints inherent to the sonnet have produced a remarkably crystalline structure: sharp, vivid, intense, and sparkling with wit, suggestion and meaning.

In modern poetry the stanzaic structure of the sonnet can range from fourteen one-line stanzas, to the single fourteen-line stanza. The metrical composition of lines can vary from hexameters (twelve syllables consisting of six iambs), as in the Alexandrine sonnet, to iambic pentameters found in many English sonnets, down to minimalist verse composed of single syllable lines. Rhyming schemes can follow the Shakespearean model *abab cdcd efef gg*, or the Petrarchan, consisting of an octave with *abbaabba* and a sestet with *cdecde* or *cdcdcd*. Numerous combinations and departures from these traditional schemes are possible, extending to metrical blank verse and even free verse. The following are two examples of my use of the sonnet form.

Pascal's Tooth

Renounce mathematics. I vowed again
To set my faith on paradox, not proof –
Yet spirit could not numb a wisdom tooth
Tormenting me with exponential pain:
I relented, soothed by a circle's roll.
Released from my crucifixion to bone
I embraced the horizon, heaven's dome,
The cycloid of an inviolate soul.
For weeks I flew, forgetful of my sin,
Pursuing figures with ideal curves
To wonderful ends, strengthening my nerves
For the penitential line back to Him.
Renounce mathematics! I found the truth,
Exploring with my tongue the rotting root.

Hypatia

Seventeen and glowing in your prime
From a session in the gymnasium
You're here to exercise your minds.
But are you dispassionate about truth?
Can you circle the semen-coloured sun
Or square the pimple itching at the root?
(Her tunic slips: she stands rigid as law,
Legs apart, arms parallel to the floor.)
Only the pure can serve geometry:
Like the nun faithful to her loving god
I remain a virgin for my deity.
Can you subdue your flesh with intellect?

See the point where my breasts rise to a pod,
The triangle that redefines my sex? [7]

The spark for these sonnets was a ‘dramatic moment’ in the lives of these mathematicians. Pascal numbs his toothache through mathematics, while Hypatia proposes a kind of Platonic purity as a precondition for mathematics. The first sonnet uses the rhyming scheme *abbacddceffegg*, which is a mixture of Petrarchan and Shakespearean. The second weaves a slightly more intricate pattern: *ababcdddefegfg*. A sonnet’s stanzaic structure, prosody and rhyming pattern allow for a great deal of variety. Some poets will compose a sonnet by adhering to a strict set of preconceived constraints, while others will trust the writing process, and the possibilities of language itself, to determine the constraints.

The Workshop

In using literature to convey a mathematical idea, we are effectively making the latter less abstract by investing it with colour, sensuousness, recognisability. The anthropomorphism of mathematical ideas has been carried out since the time of the ancient Greeks, who classified numbers as good and bad, male and female. In more recent times Edwin A. Abbot has done this very playfully with Euclidean geometry in *Flatland* [8]. Taking this transformation further, I have endowed numbers with a kind of animism in my recent novel *Quaternia* [9], in which the protagonist ventures through the forest of feral numbers and into the graveyard of dead numbers. From the point of view of poetry this process could be thought of as a translation of the mathematical idea from the range of the head to the domain of the heart. Indeed, this is what poets have been doing for millennia: rendering the abstraction of a memory or an emotion or a subtle thought into heart-felt words. This translation occurs through the matrix of literary devices such as image and symbol, simile and metaphor, personification and pathetic fallacy, synecdoche and synaesthesia. But before this process can begin we need a starting point, a mathematical idea – the spark.

Generating and Catching a Spark

Many poets keep notebooks and journals in which they record, often in no more than a few words, fleeting thoughts and impressions. These jottings provide a ready source of material for development as poems when circumstances permit. This is a very useful practice because the very fact of noting something implies curiosity, wonder, interest, excitement – the spark. Although the spark often flashes unbidden, out of the blue, in this workshop we will explore ways of generating it, such as playing with numbers and letters, seeing something animate in a symbol, giving a voice to geometric shapes, capturing a dramatic moment in the history of mathematics, first encounters with mathematical ideas, experiences from the classroom. Some of the following may prompt a spark in participants: the house of the number twenty-nine, an asymptote is like, in the beginning was the number, a dialogue between the letter O and the digit 0, i = an imaginary being, life under a square-root sign, multiplication by zero = annihilation, division by zero = transcendence. Participants will be encouraged to share their sparks with others in a free exchange of ideas. An interesting outcome of this sharing would be the case where two or more people develop the same spark.

Developing the Spark

Having caught a spark, participants will be given a little time to free-associate and come up with words, images, metaphors, phrases, lines that might find a place in their poem. Given time constraints, a finished sonnet is not expected in this workshop. Participants will be encouraged to produce a draft they would feel confident in reading to, and discussing with, other members of the workshop. At this early stage the sonnet might be anything from fourteen unconnected lines, to chopped up prose, to something approaching the finished form.

Workshopping the First Draft

If we compare the process of writing a poem to that of finding the approximate root of an equation using the Newton-Raphson iteration formula, then the first draft is analogous to the first approximation. Like the iteration formula, each new draft is based on a preceding draft, and so on, until we arrive at a poem that is aesthetically satisfactory. The iteration process does not produce an exact root, likewise the drafting process does not produce a perfect poem. In fact, just as the iteration process can be carried out ad infinitum, producing ever better approximations, so the drafting process is theoretically endless, implying a poem can never be completed, only terminated in order to begin a new poem. Workshopping the first draft will entail participants reading their poem to the group, receiving constructive criticism and feedback, and using this input to produce a second draft. Perhaps something that might be explored at this stage is shaping a traditional, single stanza sonnet into rectangular dimensions that mirror the golden section, with proportion of length to width approximately 1.6.

The n^{th} Draft

Participants will be encouraged to carry out a few more iterations in their own time, until they have extracted the poem to a degree of satisfaction determined by their aesthetic sensibility. They will be invited to email their n^{th} draft to other members of the workshop, thereby continuing friendships and the building of bridges between mathematics and poetry, and between countries and cultures.

References

- [1] C.P. Snow. *The Two Cultures and the Scientific Revolution*. New York: Cambridge Press, 1961.
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- [3] Shelley, P.B. *The Selected Poetry and Prose*. New York: Signet Classics, 1966.
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- [5] Pushkin, Alexander. *Eugene Onegin*. Harmondsworth: Penguin, 1964.
- [6] Seth, Vikram. *The Golden Gate*. New York: Vintage, 1991.
- [7] Petsinis, Tom. *Naming the Number*. Melbourne: Penguin, 1999.
- [8] Abbott, Edwin A. *Flatland*. London: Signet Classics, 2005.
- [9] Petsinis, Tom. *Quaternia*. Melbourne: Arcadia, 2015.