On Poetry and Mathematics

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What has mathematics to do with poetry? The question is prompted by a recent anthology of contemporary "mathematical poems", *Against Infinity,* edited by Ernest Robson and Jet Wimp, and published by Primary Press, Parker Ford, Pennsylvania, USA Quotations from this anthology are freely mixed with others in the following attempt to consider the question.

In their introduction, the editors of the anthology note some possible similarities between poetry and mathematics But — disarmingly — they tend to agree with Plato that the aims of the two activities are inherently anti-thetical and they suggest it could be more important to consider the differences.

Certainly it seems to be the differences that have attracted most comment from other poets For many of them, mathematics, like science, represents a reductionist world of analytical thought divorced from feeling and the senses. *Our meddling intellect / Misshapes the beauteous form of things / We murder to dissect* wrote Wordsworth, and Keats claimed that *Philosophy would clip an Angel's wings / Conquer all mysteries by rule and line / unweave a rainbow* Both these poets were at a famous dinner party given by the painter, Benjamin Haydon, on December 28th, 1817 The host recorded in his diary that another guest, Lamb, being "exceedingly merry", had criticised him for putting into one of his pictures the head of Newton, "a fellow who believed nothing unless it was as clear as the three sides of a triangle." Keats had agreed that the mathematician destroyed all the poetry of the rainbow by reducing it to its prismatic colours The company then drank a toast "to Newton's health and confusion to mathematics "

In more sober mood, Wordsworth referred to Newton respectfully as *a mind for ever / voyaging through strange seas of thought alone* Moreover, many eighteenth century poets had begun to invoke scientific ideas. *Even now the setting sun and shifting clouds / Seen, Greenwich, from thy lovely height, declare / How just how beauteous, the refractive law,* wrote James Thomson. But this sort of fashionable padding would not have impressed Blake, who thundered, "God is not a Mathematical Diagram." Nor, for that matter, would it have satisfied men like Thomas Sprat, an early historian of the Royal Society, who claimed that seventeenth century scientists wanted "to separate the Knowledge of Nature from the colours of Rhetorick, the devices of Fancy, or the delightful deceit of Fables." Recognising that in ancient times poetry and science were one, Sprat criticised the ornate diction and classical allusions of some contemporary poets He claimed that scientists would return to "the primitive purity and shortness, when men delivered so many things almost in an equal number of words "

That there was an issue at stake was quite clear to both scientists and poets in the seventeenth century What has been called a "dissociation of sensibility" was felt forcibly by a poet like Donne: *And now Philosophy calls all in doubt / The element of fire is quite put out / 'Tis all in pieces, all coherence gone; / All just supply, and all Relation* Certainly coherence of thought and feeling is now difficult to achieve and we have almost come to think of the dissociation as inevitable, even intrinsic (education often being the worst offender). So much so, that when mathematicians try to explain what it is that draws them to what they do, they emphasise their feelings and so find a "poetry" in their mathematics. According to Mittag/Leffler, the last works of Abel were "truly lyric poems of a subtle beauty whose perfection of form reveal profundity of thought." Russell praised mathematics not only for its truth but also for its "sublime beauty" and, in this anthology, Olga Tausky Todd *claims that number theory is like poetry / they are both of the same kind / they start a fire in your mind* This is all fairly harmless, though it can have a pretentious rhetorical effect. In lighter vein, Naomi Replansky reports that *under that stern government / where the symbols mean just what you are told they mean / I found a land of play,* though later she returns with relief to *the Swamp of Ambiguity / that breeds its own fevers* Conversely, but preserving the same distinctions and invoking a similar tell-tale note of hygiene, Lillian Morrison sees the poet as a mathematician: *having perceived the connexions, he seeks / the proof, the clean revelation in its / simplest form*

The customary — and unfortunate — distinction between precision and passion is amusingly illustrated by Babbage's characteristic letter to Tennyson about a couplet that was originally printed as *Every minute dies a man / Every minute one is born.* "I need hardly point out to you," Babbage wrote, "that this calculation would tend to keep the sum total of the world's population in a state of perpetual equipoise, whereas it is a well-known fact that the said sum total is constantly on the increase I would therefore take the liberty of suggesting that in the next edition of your excellent poem, the erroneous calculation to which I refer should be corrected as follows: Every moment dies a man / And one and a sixteenth is born. I may add that the exact figure is 1.167, but something must, of course, be conceded to the law of metre " In later editions of the poem the word "minute" was replaced by "moment"!

As Auden observed, the "Kingdom of Number is all boundaries / which may be beautiful and must be true." On the other hand, for mathematicians it is clear that within the

boundary of number a "terrible beauty" is always inevitably born — though what this is may not always be agreed. For Jet Wimp, *I, the giver of shapes / scissors of dawn. / I flamingo / I proud bell / is a thumb kneading the / air / the land opens / her legs to / the castaway 2 become- / ing I the shape / of help* This has the stirring quality of myth and recalls similar sexual imagery, for example that found in the ancient Indian epic, the *Rig Veda Between the widespread world halves in / the birthplace the Father laid the / Daughter's germ within it* According to a recent interpretation this refers to the construction of $\sqrt{2}$ as part of tuning an octave This may seem far-fetched when summarily quoted in this way but the musical reference is explicit in *7 steeds draws the 7 wheeled chariot / wherein are placed the 7 sacred notes*. Another extract from the epic supports the view that ancient poets were also the cosmologists of their time: *12 spokes, 1 wheel, 3 navels / Who can comprehend this? On it are placed together 360 like pegs / They shake not in the least*

According to Vico, every piece of knowledge, every law, must once have been "serious poetry" Conversely we may ask what knowledge is enshrined in, say, a fragment from Parmenides *Nor is it divisible since it is all alike. / nor is there more here and less there / which would prevent it cleaving together, / but it is all full of what it is. / so it is all continuous / for what is clings close to what is* The metaphysician says "it" is Being; for Santillana, the fragment is a statement about the continuity and homogeneity of Space. In the latter case, geometry and poetry would have been linked in a powerfully indissoluble way

It is equally speculative to suppose that numbers and gods are inextricably linked. But in cuneiform writing the great god Anu was written with one mark of the wedge, which also stood for the numbers 1 and 60. *One two buckle my shoe* Can we detect in the familiar ordinal count the ghost of some ancient ritual which Seidenberg has claimed was the origin of counting? Certainly numerals can be effectively used in poetry for ordinal effects. *Onery, twoery / ziccery zan / hollow bone crack-a-bone / ninery ten* is just one of many counting-out rhymes that may or may not preserve some echo of the passage of gods. But what is the purpose and origin of the following lines from a famous problem in the Rhind papyrus of c1650 BC? *Houses 7 / cats 49 / mice 343 / spelt 2401 / hekat 16807 / total 19607*. Powers of seven are invoked in a similar way in the riddle, *As I was going to St. Ives / I met a man with 7 wives . .* Apart from nursery rhymes there are obvious relics of ancient number poetry in various Pythagorean fragments as well as in gematria and other forms of esoteric numerology — whether mediaeval or modern

On the other hand, modern poets can use numbers in a completely secular way for certain effects: *What comes first? Can you see? Tell us? It is / 5,800,000 rifles and carbines / 102,000 machine guns / 28,000 french mortars / 53,000 field and heavy guns / I cannot tell how many projectiles, mines and fuses . . .* This is clearly using numbers in poetry, but not the poetry of numbers, and it is perhaps fitting that it is from a poem by T. S. Eliot, who coined the phrase "dissociation of sensibility". The numbers here have some effect; it is difficult to tell what is gained by the proclamation of combinations of the numerals of log π proposed by Larry Wendt in the anthology, as this may depend on the reader. At best the use of numerals and other mathematical symbols in verse can be light and playful, at worst they are boringly trivial Lewis Carroll once asked, *Yet what are all such gaieties to me / whose thoughts are full of indices and surds, / $x^2 + 7x + 53 = 11/3$?* Scott Helmes starts with a fine dash of surreal humour: *random order + perposterous outcry = negative time / negative time^2 = relationship + 3 /* . But this soon loses its interest. Raymond Queneau has done this sort of thing well, but though he is included in the anthology it is not for this vein; here he writes — in sixth-form style — *and the continued fractions (fatally mauled / by a torrent of mute decimals) went to bed*

The editors of *Against Infinity* define mathematical poetry quite modestly as "an association of mathematical concepts, relationships, symbols or forms with interesting verbalisations and/or graphic components." Such a definition will to some extent move away from the *poesia seriosa* of mathematics towards, on the one hand, light verse that invokes mathematical references, or, on the other hand, the faintly obsessive doodlings of various experimental avant-garde forms. As far as random verse is concerned, the editors are mercifully not attracted by the lines that computer enthusiasts like to see their machines churn out. "Dadaist randomness is preferable to machine wisdom," they say, claiming that human unpredictability *sounds* quite different from the machine sort. In the anthology, Emmett William systematically permutes set phrases: *when I loved soft pink nights / and you hated hard blue valleys / and I kissed mellow red potatoes /* Lawrence Kucharz does something similar with the sequence *dark dim, empty entering, lights, man silent, summer street, sounds, walking*

A more amusing experimental form is the found poem and in the anthology there are two examples taken by Elaine Romaine from well-known textbooks by Lang and by Spivak. But this is of course a game that all can play: *A subset T / of a multiplicative group G / is a subgroup of G / if and only if T / is closed under the following 3 / operations of G / identity, inverse and multiplication* this is from MacLane and Birkhoff's *Algebra* and has the lilt that will be familiar to readers of mathematical textbooks, particularly those whose material has become ritualised *A variable x tends to a limit l / if given any positive number epsilon / there is* It is perhaps also worth mentioning that for many people the rhythm of phrases like *a finite-dimensional vector space* is as hypnotic as, say, *the multitudinous seas incarnadine*.

Another experimental form is exemplified by the graphics of Richard Kostelanetz illustrated below This brings out quite neatly the details of the Fibonacci cycle mod 10. There are a number of other experiments with graphics in the anthology: C. M. Lynch's three stanzas to triangular numbers each of which is arranged in triangle form, David Petteys' parabolic indentations, Ernest Robson's letters stretched into golden-ratio forms, and so on These are not always successful; work of this sort with children in classrooms suggests that though it can be fun to

make your own, other people's are rarely very compelling

It seems as if the main strand of so-called mathematical poetry continues to be orthodox verse which invokes mathematical ideas and images to make its point, whatever that may be. It is a continuing feature of our dissociation that a poet can now no more rely on a wide audience which can take his mathematical references any more than he can assume one that can take biblical or classical references. Marvell's readers would have immediately enjoyed his sparkling analogy: *As lines so loves oblique may well / Themselves in every angle greet / But ours so truly parallel / Though infinite can never meet.* But not all Empson's readers could have appreciated *Duality too has its Principal / Those lines you grant me may invert to points,* and he annotated the poem to help the reader understand the imagery of enveloping lines in *Or love what you imply but to exclude / That vacuum has your edge, your attitude*

The reader is certainly expected to know the story of the death of Archimedes invoked by Miroslav Horub in the poem that is quoted in full below. But mathematical references are not always accompanied by a suitable feeling for words and some items in the anthology are very pedestrian, merely producing a slight frisson for the mathematically inclined. Others seem to be quite powerful; Martha Collins, for example, achieves a nice rhythm in her delicate piece about reflective symmetry: *If, when the pond is still / and nothing is moved / and the light is right / you consider the angles / and make the proper approach / you come to a bend / where a small white house / against / the blue water / stair rests on stair / door opens on door / .* Interestingly enough, mathematical references are often most effective in poems that deal with human relationships. For Peter Meinke, *some distances cannot be crossed; like / Zeno's arrows you can only go halfway at a time / there remains a remoteness, a shadow thrown / across an almost infinitesimal line / a separation.* For Jacqueline Lapidus, the third party in an eternal triangle was a hypoteneuse who *knew exactly what he was doing and / cancelled out of the equation just in time / One of these days / we'll intersect again.* Michael Rosen writes a love poem called *There is always a third point between any two* and Linda Pastan claims that *unsolved equations later, and winter now / I know* X *better than I did*

There is also poetry invoking mathematics in order to illuminate it. This might be in the form of good, anonymous, light verse like *Twinkle / little / empty set / have you / any / members yet?* Or it might be like those items in *Against Infinity* that explore aspects of the title. Elizabeth Bartlett, for example, explains: *Because I longed / to comprehend the infinite / I drew a line / between the known and the unknown.* Linda Pastan invokes the continuum in a fine poem quoted in full below. Ilse Bing finds *this infinitesimal instant / lies at the point / where the possible and the impossible / touch each other.* Harriet Zinnes asks *Is a first if z is not final? / Is not the last note in the first implied?,* recalling a favourite seventeenth century "conceit", as in Donne's *Thy firmness draws my circle just, / and makes me end where I begin,* or Mary Stuart's motto, *En ma fin est mon commencement,* used by Eliot.

It seems the right moment to recall the opening question. Various examples from past and present poets have been given and what — if anything — constitutes "mathematical poetry" must be deduced from their work. But there are deeper aspects to the question which could be worth exploring. The similarities between poetry and mathematics are fairly obvious. Both are activities of the mind "imitating action"; both make analogies and abstractions; both are concerned with sequence and rhythm; both *condense* thought and/or feeling into images that, in Thom's pregnant phrase, "reduce to a maximum"; both are, in some sense, *multivalent,* both exemplify Jet Wimp's *diamond held perfectly / will melt.* It may be that at one time the functions of mathematics and poetry came together in the same person at the same time. But certainly since the seventeenth century, differences have been more evident. A fairly widespread present view could be illustrated by a passage from Scott Buchanan's book, *Poetry and Mathematics.* "The mathematician sees and deals with qualities . . the qualities that the poet sees are due to relation, says the mathematician. They need purgation. The relations that the mathematician sees are concrete and tactual, says the poet. They need appreciation and love." This contrast is a significantly puritanical echo of the old dissociation; but we do not have to think in this way, purging need not deny passion.

Robson and Wimp, in a stimulating introduction to their anthology, assert that there may be more important differences. They suggest these may be found by considering, on the one hand, the difference between mathematics and natural language and, on the other hand, the difference between poetry and natural language. This seems interesting; but it does presuppose that there is something that could be called natural language, and, moreover, that it is something distinct from poetry. Poetry — and indeed mathematics — is too complex an activity to be categorised in such a linear fashion.

The reader will have to draw his own conclusions. I can only briefly indicate here in which direction my own would lie. The multivalent condensations that are known as images in both poetry and mathematics seem to be important ingredients of the inner life. What role do they play in the development of young children? How and why do people make images and work with them — especially those to do with ordinarily and rhythm? In what way do some images link with external reality? How do condensations become "charged" with some form of energy and how is this evoked, for example, by ancient number myths?

Finally, a more specific exercise for the reader. Recall that in the glass-bead game, from the novel of that name by Hesse, "after each symbol conjured up by the direction of a game, each player was required to perform silent, formal meditation on the content, origin and meaning of this symbol to call to mind intensively and organically its full purport." Carry out such a meditation on the following two "condensations": a) *Coming, going, the waterfowl / leaves not a trace / nor does it need a guide,* and b) *Point nine recurring / equals one*

The four poems from *Against infinity*, edited by Ernest Robson and Jet Wimp, and published by Primary Press, Parker Ford, Pennsylvania, U S A (1980), are reprinted here by permission of the authors and publisher

RICHARD KOSTELANETZ

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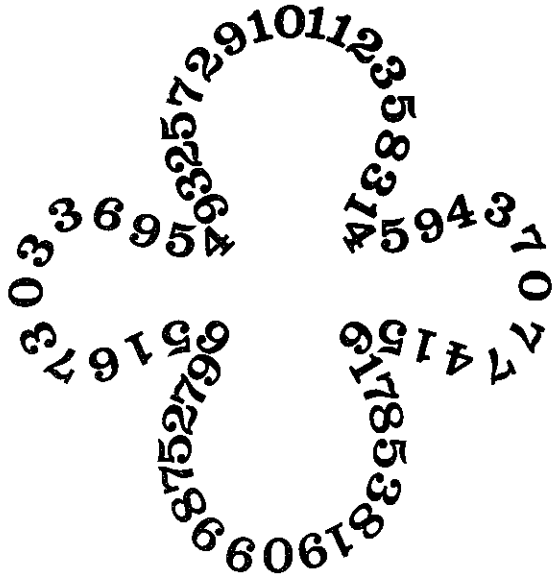

LINDA PASTAN

Arithmetic Lesson: Infinity

"In nature's infinite book of secrecy,
a little I can read."
Wm. Shakespeare
Antony and Cleopatra

Picture a parade of numbers: 1
the sentry, out in front;
dependent monogamous 2;
3 that odd man out, that 1 too many
always trying to break into line
Numbers are subtracted added
numbers fall by the way.
Some are broken into fractions – torn apart
some assigned to stars, to crystals
of salt; to threads of water
on the ocean's dragging hem.
The proper numbers march together
their uniform buttons bright;
the rational numbers walk alone.
Every number on every clock repeats
its psalm over again
as minutes are numbered;
and children; and parcels of earth;
each sparrow as it falls;
each leaf after falling, before burning
The negative numbers squabble
among themselves; imaginary numbers
count the number of kisses
that dance on the head of a pin
And the parade goes on.
Each leaf of grass is numbered
just as it bends beneath
a numbered foot; each newt;
each spider's egg;
each grain of sleep caught
in each waking eye

Pages are numbered as they turn;
dreams as they turn
into facts; the sun
as it rises on its fiery stalk
and as it sets.
But just as the end trembles into sight
the way the sea trembles
beyond the final dune
the steps of the marchers
grow smaller and smaller again –
the steps divide. Each number
hangs back, reluctant as a child
afraid of what he'll find
at the end of a darkened hall
And though the destination
remains always at hand
the parade moves slowly on: 1
the sentry, out in front;
dependent monogamous 2;
3