

***Mathematics, Art, Music, Architecture,  
Education, Culture***

**Bridges 2023 Poetry Anthology**

**Halifax,  
Helsinki and Espoo, Linz, Stockholm, Waterloo, Jyväskylä,  
Baltimore, Seoul, Enschede, Towson, Coimbra**



**2011 – 2023**



# Bridges 2023 Poetry Anthology

Halifax,  
Helsinki and Espoo, Linz, Stockholm, Waterloo, Jyväskylä, Baltimore,  
Seoul, Enschede, Towson, Coimbra



A collection of poems with strong links to mathematics  
by the poets featured at Bridges 2011 – 2023 poetry readings

**Sarah Glaz, Editor**



Tessellations Publishing  
Phoenix, Arizona

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# Bridges 2023 Poetry Anthology

Sarah Glaz, Editor

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# Introduction

*Newton's binomial is as beautiful as Venus de Milo.  
What happens is that few people notice it.*

— Fernando Pessoa (as Álvaro de Campos)  
translated from the Portuguese by Francisco José Craveiro de Carvalho

This year's conference marks the 13<sup>th</sup> year anniversary of mathematical poetry readings at Bridges, and the first fully in-person Bridges poetry reading since the start of the pandemic. Both occasions call for a celebration, and what better way to celebrate than to assemble a new collection of poems created by present and past Bridges poets. Welcome to the Bridges 2023 Poetry Anthology!

The Bridges conferences' poetry program started in 2011, when I coordinated the first modest mathematical poetry reading at the conference in Coimbra, Portugal. Through the years the program has flourished and expanded. The number of poetry-related talks and activities increased significantly, and the mathematical poetry readings themselves became richer events attracting larger audiences. It soon became apparent that the poetry offerings deserved exposure beyond the conferences themselves. This prompted me to start editing the print Bridges poetry anthologies. To date, four poetry anthologies have seen print (in years 2013, 2016, 2018, and 2020).

In 2020, at the first virtual Bridges conference, the poetry reading became an online event, appearing as a collection of YouTube videos linked from the Bridges 2020 poetry reading page. The following year, the Bridges conference was offered online with the interactive software, *Gather*. For this occasion, the poets met virtually in “the glade” to read a whimsical and wonderful collection of Fibs. The collection subsequently, appeared in the *Journal of Humanistic Mathematics*. In 2022, the poetry reading took a hybrid form offered to in-person attendees as a one hour and a half YouTube Playlist that was later linked from the Bridges 2022 poetry reading page. In 2023, Bridges (including the poetry reading) returns to a fully in-person format at Dalhousie University, in Halifax, Nova Scotia, continuing the tradition of inspiring math art conferences that have been held under the umbrella of the organization since 1998.

Information about the Bridges Poetry readings and the Bridges poetry anthologies, as well as access to other print and online multi-authored collections of poems by the Bridges poets, can be enjoyed at the *Mathematical Poetry at Bridges* site:

[https://www2.math.uconn.edu/~glaz/Mathematical\\_Poetry\\_at\\_Bridges/index.html](https://www2.math.uconn.edu/~glaz/Mathematical_Poetry_at_Bridges/index.html)

It is a pleasure to be part of the vibrant and creative community of Bridges poets and artists, and to watch it grow and flourish under both favorable and adverse conditions.

The present volume is the fifth print poetry anthology that has grown out of the Bridges poetry readings. Although richer and more diverse than its predecessors, the current volume springs from the same source and shares many of the distinctive characteristics of the Bridges poetry readings. From the beginning, the Bridges poetry readings have featured poems with multi-dimensional links to mathematics and a wide range of styles. The poems' connections to mathematics cover the entire gamut of what is possible. They use mathematical language as metaphor, play with geometric and symbolic imagery, treat mathematical

results or history of mathematics as content for poems, allow mathematical properties to organize poetic structure, and propose mathematics itself as commentary on life, ideas, and emotions. The styles of the poems are equally diverse, ranging from traditional to multimedia, and from lyrical to visual.

As a fortunate consequence of the locations and the participants at Bridges conferences, the poetry readings acquired an international flavor. In addition to many poems originally written in English from Anglophone countries around the world, Bridges poems also include poems translated into English from many other languages. Finally, the exciting diversity extends to the other activities in which the poets are deeply engaged, activities that have left their mark on the poetry. The featured poets are college and universities professors doing research in mathematics, statistics, physics, history, philosophy, comparative literature and education; engineers; higher-education administrators; members and officers of academies; librarians; professional artists, writers, translators, editors, and poets; primary and secondary school teachers; medical doctors, and more.

This volume is organized in two sections. The first section contains poems written by the poets invited to read at Bridges 2023. Twelve prominent poets accepted my invitation to join us at this festive and celebratory reading and contribute their work to the anthology. The Nova Scotia location brings with it the exciting mathematical poetry of Canadian poets: Madhur Anand, Susan Gerofsky, Lisa Lajeunesse, and Alice Major; and from not far away, US poets: Marion Deutsche Cohen, Carol Dorf, E. R. Lutken, Kaz Maslanka, Douglas Norton, Amy Uyematsu, and myself. From further afield and represented on these pages, is the equally exciting work of Tatiana Bonch-Osmolovskaya (coming from Australia), and Marco Lucchesi (Brazil). Also in this section, appears the art of Great Britain's collage artist, Mark Sanders, which accompanies one of my poems. The second section is devoted to work by poets who read at previous Bridges conferences but could not participate this year. They join the celebration in print. In this section of the anthology are samples of the lovely mathematical poetry of past Bridges poets: Robin Chapman, Marian Christie, David Greenslade, Emily Grosholz, JoAnne Growney, Josè Huguenin, Gizem Karaali, Lawrence Lesser, Dan May, Iggy McGovern, Tom Petsinis, Eveline Pye, and Stephanie Strickland. Also in this section appears the art of Julien Clinton Sprott accompanying Robin Chapman's poems, and the art of Robert Fathauer, accompanying a poem by Emily Grosholz.

I am indebted to the poets and artists whose poems and images appear here for their work. In particular, thanks to Gabriele Meyer for the lovely hyperbolic rose appearing on the title pages of this volume. I thank all contributors for patiently going over parts of the anthology and making good suggestions for improvements. In particular, I thank Stephanie Strickland and Larry Lesser for proofreading the entire manuscript and sending valuable comments. Special thanks for great help with multiple aspects of this anthology to Alice Major. Many thanks to Robert Fathauer, at Tessellations Publishing, for help with images and for the work and care he put into producing this book. Last, but not least, I thank my husband, Joe Glaz, for sharing the experience of all the Bridges conferences with me.

Like me, many of the poets came to their first Bridges conference and were captivated: now they come every year. It happens to the best of us! I invite you to the next Bridges poetry reading to see for yourself.

Sarah Glaz  
Storrs, Connecticut

**Poems by  
Bridges Halifax Featured Poets**



**A Mathematical Poetry Reading  
Sunday, July 30, 2023**



# Madhur Anand



Madhur Anand's debut memoir *This Red Line Goes Straight to Your Heart* (Strange Light/Penguin Random House Canada, 2020) won the Governor General's Literary Award for Nonfiction. Her debut collection of poems *A New Index for Predicting Catastrophes* (2015) was a finalist for the Trillium Book Award for Poetry, named one of 10 all-time trailblazing poetry collections by the Canadian Broadcasting Corporation (CBC), and received a starred review in *Publisher's Weekly*. Her second collection of poems *Parasitic Oscillations* (2022) was published to international acclaim and named the top-pick for Spring poetry by the CBC. Both poetry collections were published with McClelland & Stewart/Penguin Random House Canada. She is a professor of ecology and sustainability at the University of Guelph, where she was appointed the inaugural Director of the Guelph Institute for Environmental Research.

Website: <https://49thshelf.com/Blog/2020/08/10/The-Chat-with-GG-s-Literature-Award-Winner-Madhur-Anand>

## Two Part Organ or Returning to Cardinal

Today my consonants are mere control of airflow.  
Only my vowels are sung. When I first write "two-toned"

I mean red or not-red, male or female, but now I  
know more. That the root of "cardinal" is "hinge," that the

square root is of no use, only squared bifurcation  
of bronchi, flips between vibrating columns and noise,

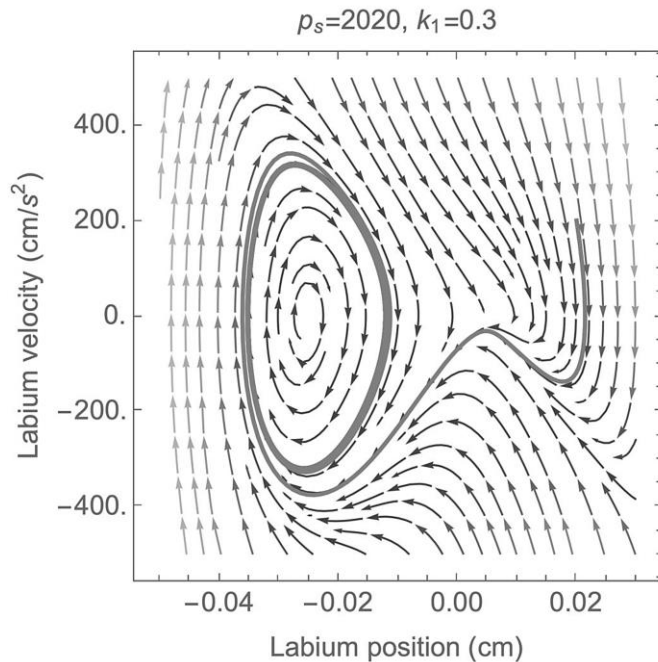
oscillations doubling. Bass and treble, right and  
hope as the probability of synchrony, left.

I see light couple and decouple, beat wings at wrong  
frequencies, fly into a bush, orchestrate landings.

The syrinx and the larynx found at a junction.  
I want those colourless feathers, her colourless lips.

# Madhur Anand

**Portrait 1:** *How might we utilize these oscillations caused by feedback to bring our multiple understandings of the world closer together, to talk to one another while embracing the inevitability of noise?* Phase plane portrait of the mathematical model of birdsong found in: Amador and Mindlin (2008).  $p_s$  is the sublabial pressure in units of Pa.  $k_1$  is the linear restitution coefficient in units of dyn/cm.



## Sensible Parallels

a found poem

Behaviour emerges from interaction between  
a nervous system, a peripheral cusp, and the

environment. Not obvious, but a picture starts  
to emerge. Strong fingerprints on the vocal organ.

Solutions that might not require separate muscles.  
The body uttered/uttering, the field notes inspect/

inspection. One can call this position borderline,  
part controlled, part chaos, the aim of which to unveil

a fundamental relationship, instructions for  
a generation, how to revisit global paths.

How can a single source generate both tonal sounds  
and harmonically rich sounds? Collison, collided

collide. Three roots remain remnant and three roots are born.  
Bird, birds, birdsong, songbirds, songbird, songs, song, syllables.

*Note:* This poem is formed from the article, Amador, A. and Mindlin, G.B. (2008) *Beyond harmonic sounds in a simple model for birdsong production*. Chaos 18, 043123; <https://doi.org/10.1063/1.3041023>

# Madhur Anand

## Summations

He draws a crooked line connecting dime sailboats to  
quarter'd caribou. He erases it. The new line

is straighter, thicker, blacker. It is how he becomes  
a crow, how he is learning to fly. He must first perch,

make obtuse angles with his feet. He must imprint, must  
carry over double digits with what remains of

ambition, his American father. Then he may  
attempt the word problems, other world problems, the small

matter of Benji's length of rope, Cindy's ten apples,  
until all the units match, until he finds fewer apples,

more or less rope. Until he has solved for fibre, for  
the orchard. His teacher writes, *learning how to make change*

*is one of the hardest things we will tackle this year.*  
He brings his summations, his correctable errors.

But ambition is a bitch. Is A.O. Hume's notes on life  
histories of seven hundred bird species which in

1883 at Rothney Castle in Simla  
were stolen by his servant and sold as waste paper.

# Madhur Anand

## Rising Variance as an Early Warning

Today mother transplanted herself to the back deck  
without the walker. It was the sun, her first time out  
since the fall. The verb falling, the fractures curing,  
her eyes closed when I joined her. "Days are becoming long,"

she said. And then in Punjabi: "Two birds. One calling.  
One giving the answer." I know and she knows she has  
never heard these birds before. It took me some forty  
years to learn such songs myself. But today's back and forth

feels like something new. The two-toned cardinals could be  
doing social work, averting warming, or slowing  
down time. Like that Chinese lake I read was flickering—  
alternating between its two states, dead or healthy—

taking twenty years to settle on one. The birds are  
gone but I'm still listening. One grandchild oscillates  
on the rusted swing set with past summers' wasp nests thrice  
removed. Creak, creak. The visual is a sine wave which

becomes near-sighted near the end. I still use that trick  
I discovered in childhood: if I want to be cured  
of hiccups I pretend to badly want the next one.  
I wish some things would just die a little more in spring.



# Tatiana Bonch-Osmolovskaya



Tatiana Bonch-Osmolovskaya was born in former Soviet Union and studied physics at Moscow Institute of Physics and Technology and philology at Moscow State Humanitarian University, where she earned a Ph.D. in Russian experimental poetry. Tatiana is author of eighteen books in Russian, including *Introduction to the Literature of Formal Restrictions* and *Labyrinths of Combinatorial Literature*, and co-editor of the anthology, *Freedom of Restriction*. Her poetry in English appeared in: *Can I tell you a secret?*, *Across the Russian Wor(l)d*, *Bridges*, *London Grip*, *POEM*, *Rochford Street Review*, and *Journal of Humanistic Mathematics*. She is a member of the editorial committee of *Articulation* and the board of PEN Moscow, and was guest-editor of a *Symmetry* literary issue. Tatiana organized the *Mathematics and Arts* seminar, the *GolosA Festival of Combinatorial Poetry*, and the *Symmetry Festival Literary Session*.

Website: <http://antipodes.org.au/en.aboutTatianaBonch.html>

## About the Sator Square



The Sator Square is a 5x5 letter-square containing the Latin palindrome SATOR AREPO TENET OPERA ROTAS. Representations of the Sator Square were found in numerous European archeological sites, the earliest going back to the ruins of Pompeii, which was buried under volcanic ash in 79 CE. A rough translation is: “The farmer Arepo uses his plough as his form of work.” A significant volume of academic research has been published on the square, but after close to two thousand years, there is no consensus on its origin and meaning. Speculations connect it to various letter rearrangements which lend it, at turns, magical properties or Christian religious association.

The poem Sator Square appearing on these pages was constructed by first turning the square’s letters into names of characters . The consonants correspond to male names, the vowels to names of females. The names, all of them palindromes, are: Syzys for S, Alla for A, Tollot for T, Oko for O, Rufur for R, Eve for E, Pillip for P, and Nonon for N.

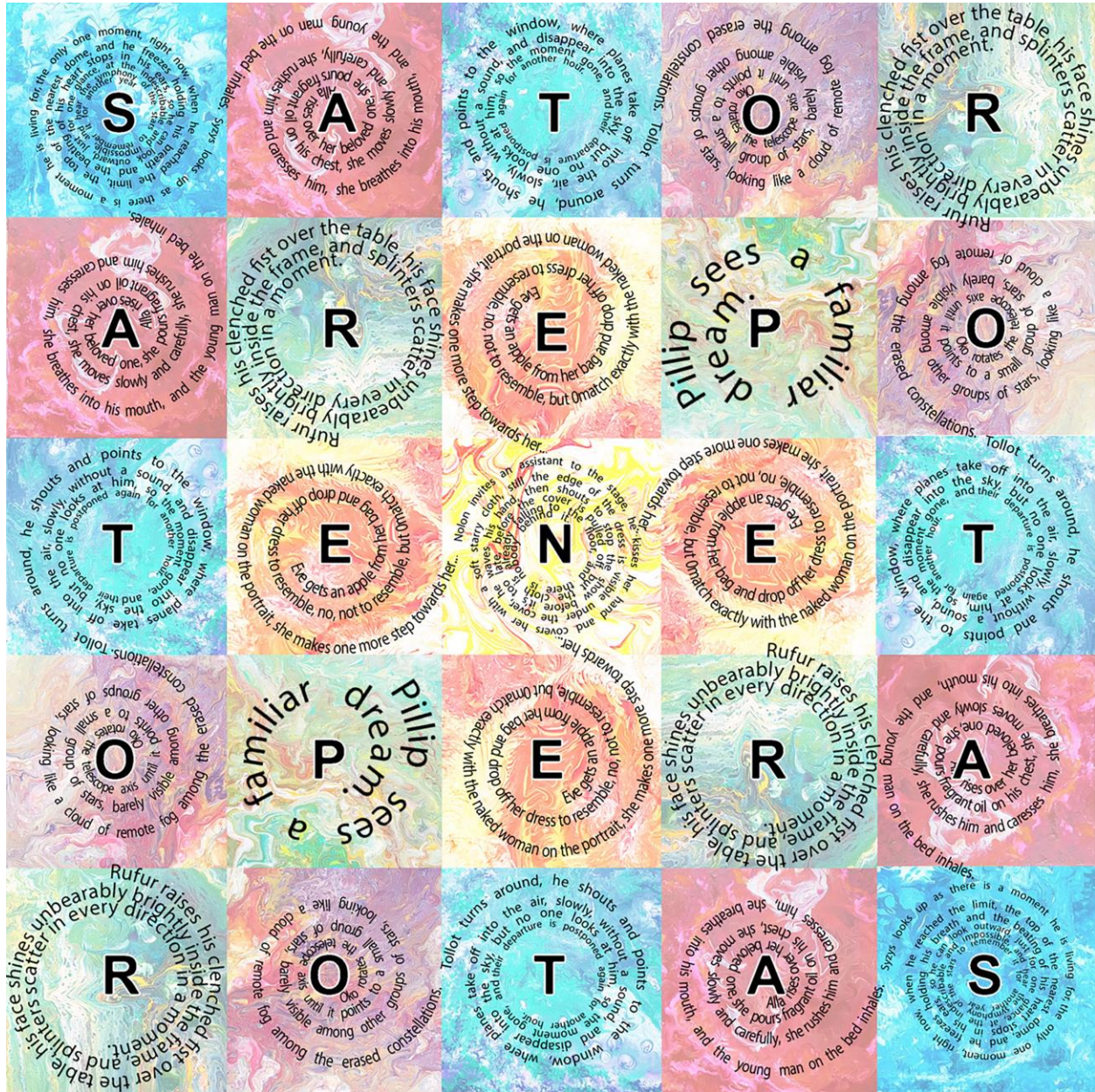
The next step was to write sentences about each of the characters. Those appear in the visual poem exhibited on page 8, as a set of intertwining spirals. Page 9 shows the poem generated by one of the squares’ lines, AREPO, together with its reverse reading OPERA.

Next each sentence was developed into a longer poem, whose lines are arranged in the form of a palindrome. Page 10 shows an example of this development, the poem OKO.

This fractal-like construction could in principle be continued....

# Tatiana Bonch-Osmolovskaya

## Sator Square (a visual poem)



Note: To listen to Tatiana Bonch-Osmolovskaya read an excerpt from the Sator Square poem go to:  
<https://www.youtube.com/watch?v=ACSSlt6AU8w>

# Tatiana Bonch-Osmolovskaya

## AREPOPERA

**ALLA** rises over her lover,  
she pours fragrant oil on his chest,  
she moves slowly and carefully,  
she rushes him and caresses him,  
she breathes into his mouth,  
and the young man on the bed inhales for the first time.

**RUFUR** raises his clenched fist over the table,  
his face shines unbearably brightly inside the frame,  
and in a moment splinters scatter in every direction.

**EVE** gets an apple from her bag  
and drops her dress to resemble,  
no, not resemble, but match exactly  
the naked woman in the portrait,  
she makes one more step towards her...

**PILLIP** sees a familiar dream.

**OKO** rotates the telescope axis  
until it points to a small group of stars,  
barely visible among other groups of stars,  
looking like a cloud of remote fog  
among the erased constellations.

**PILLIP** sees a familiar dream.

**EVE** gets an apple from her bag  
and drops her dress to resemble,  
no, not resemble, but match exactly  
the naked woman in the portrait,  
she makes one more step towards her...

**RUFUR** raises his clenched fist over the table,  
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**ALLA** rises over her lover,  
she pours fragrant oil on his chest,  
she moves slowly and carefully,  
she rushes him and caresses him,  
she breathes into his mouth,  
and the young man on the bed inhales for the first time.

# Tatiana Bonch-Osmolovskaya

## OKO

Now listen carefully and answer me after a proper thought.

Oko walks slowly from desk to board asking questions.

What is the name of the galaxy in which our sun is located?

How fast does our sun revolve around the center of the galaxy?

What are the gaseous substances in the layers of a neutron star?

Can a human hear the sound of the solar wind?

Oko stops at an amateur telescope then sighs and continues walking.

What is the speed of a meteor when it enters the Earth's atmosphere?

How can you explain the blueness of the sky high above the horizon?

Oko aims the telescope at the moon and looks through the eyepiece.

Think carefully, and write down all the answers before calling for me.

Oko rotates the telescope axis until it points to a small group of stars, barely visible among other groups of stars, looking like a cloud of remote fog among the erased constellations.

Think carefully, and write down all the answers before calling for me.

Oko aims the telescope at the moon and looks through the eyepiece.

How can you explain the blueness of the sky high above the horizon?

What is the speed of a meteor when it enters the Earth's atmosphere?

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How fast does our sun revolve around the center of the galaxy?

What is the name of the galaxy in which our sun is located?

Oko walks slowly from desk to board asking questions.

Now listen carefully and answer me after a proper thought.

# Marion Deutsche Cohen



Marion Deutsche Cohen is known for writing poetry and memoirs on three topics: spousal chronic illness, late pregnancy loss, and math. She authored 33 books. Her newest poetry collection is *Negative Aspects* (dancing girl press), and her latest prose collection is *Not Erma Bombeck: Diary of a Feminist 70s Mother* (Alien Buddha Press). Forthcoming are: *Disturbing Shapes* and *Reasons and Remedies for Insomnia*. She is also the author of two controversial memoirs about “well-spousery,” a trilogy diary of full-term-pregnancy loss, and *Crossing the Equal Sign*, about the experience of and her passion for math. This year, her work has been included in six anthologies. She teaches a course she developed, *Mathematics in Literature*, at Drexel University’s Honors College. Other poetic inspirations are classical piano, singing, Scrabble, thrift-shopping, grown children and step-children, and six grandchildren.

Website: <https://marioncohen.net/>

## Statement about My Math Poems

They don’t look like math.

A page of 2’s

an ode to infinity in the shape of a sideways eight

that’s not what I’m about.

What I’m about is about.

When something happens to me, I write hundreds of pages about it.

Spousal chronic illness happened to me.

Full term pregnancy loss happened to me.

Chronic un- and under-employment happened to me.

And math happened to me.

I have the math.

So I keep creating things to make me know I have it.

I need an observer.

I need observers.

I need these poems

to help the math

stay put.

# Marion Deutsche Cohen

## So Glad

I'm so glad my passion isn't mountain climbing, hang-gliding, or bank-robbing  
so glad my way of bargaining with the human condition  
of trying to be unique  
trying to be one with the universe  
isn't dangerous or expensive.

Mathematicians haven't really agreed on the definition of math  
but one mathematician said "Math is what, if everything else disappeared, would still be there".  
If everything else disappeared, mountain-climbing and bank-robbing would not still be there.

If everything else disappeared, I would too, math would be there all by itself.  
And sometimes I believe that would be okay.  
If everything but math disappeared, that just might be okay.

# Marion Deutsche Cohen

## **“Which Would You Prefer, To Have Made an Error or Discovered a Paradox?”**

Homework question and class conversation about the story “Division by Zero” in which a mathematician proves without error that  $1 = 2$ , and is very upset

A surprising number of students would rather have discovered a paradox. True, many said, “If I made an error, I could correct it” or “I might feel annoyed with myself, but I could move on.” But many others said, “A paradox would be cool,” “A paradox would open up a whole new world.”

“Paradoxes intrigue my mind,” writes Sara. “They make me realize how complex things are and how special the universe is.”

And Hannah: “I wouldn’t have to blame myself for making the error. I could blame MATH.” Yeah, wouldn’t students with math anxiety just-love to blame math?! *They* weren’t wrong, math was wrong.

*All* math could be wrong. There could be no such thing as math. No more math, no more anxiety. Hurray for paradoxes! In fact, since everything depends on math, a paradox just might get rid of everything. In particular, everything we’re supposed to learn. Everything we might not want to learn. Especially bad things. Like unexpected tragedies. It couldn’t have happened and yet it did, the worst paradox. We could be depressed forever, bargaining forever, denying forever, never reach the acceptance stage, could just keep bargaining, could have both and/or none, could both eat and have our cake, the rest of our lives, forever and ever, once and for all.

# Marion Deutsche Cohen

## “What Do You Think Your Soul Is Shaped Like?”

Homework question inspired by the poem “She Considers the Dimensions of Her Soul” by Young Smith

Isaiah’s is a pyramid. His life path starts out narrow, works towards the point at the top. Yvonne’s is a star. It’s bright and unique and every time her life changes it develops a corner. But the corners are not like a square. Nancy’s is also a star but not always a good star. Her star pokes and prods and its points are sharp and hungry. And Kava thinks about auras and colors rather than shapes. And Ben, his hobby is hunting, his soul is shaped like a shotgun. Forgive his politics, he’s not 21 yet and he loves his girlfriend and baby godson, guns to him represent empowerment and protection.

At first Carol thought her soul might be some complicated interesting shape like a pentagon or crescent moon or snowflake or fractal, but then she decided her soul wasn’t jagged or piercing. Hers is a bioluminescent amorphous thing that lives in a symbiotic relationship with her physical being, it would never injure her or make her sad.

But Lenny’s might. Though it’s a liquid, it’s an opinionated liquid intruding in his life. Just by observing him you can see that soul, beware of it.



## Carol Dorf



Carol Dorf is fascinated with the boundaries between disciplines, particularly mathematics and poetry. She was founding poetry editor of *Talking Writing* where she wrote about issues in contemporary poetry, and edited several issues on mathematical poetry, science poetry, and technology poetry. For many years, she taught high school mathematics, and has led poetry workshops as a California-Poet-in-the-Schools, at Berkeley City College, and other art venues. She brought her loves together by introducing poetry into the mathematics classroom and by teaching poetry writing to mathematics teachers. She has three chapbooks available, *Some Years Ask* (Moria Press), *Theory Headed Dragon* (Finishing Line Press), and *Given* (Origami Poems Project). Her poetry appears in *Yes Poetry*, *Great Weather For Media*, *The Mom Egg*, *Sin Fronteras*, *E-ratio*, *About Place*, *Glint*, *Slipstream*, *The*

*Journal of Humanistic Mathematics*, *Scientific American*, and *Maintenant*.

Website: <https://talkingwriting.com/why-poets-sometimes-think-in-numbers/>

### Psalm for the Numerous on Crossing the Re(e)d Sea

When counting steps on the walk to the sea,  
fragrance of salt, of decay, of the ocean turning

The step from earth to sea feels infinite  
as it must have been for the first plants to gain a foothold on rocky boundaries

The child cries in hunger and the mother plucks  
an apple, a pomegranate; or has a fish been transformed to fruit

How each one feels lost, even though all march  
together to the edge of the waters, awaiting the promised opening

To leave behind shelter, and venture across the opening waters  
And to where, to the desert, with only the sun and the moon to mark time

Hold the astonished moment close at hand

# Carol Dorf

## My Problem with Statistics

*Out of one hundred people . . . living in constant fear  
of someone or something 79. – Wislawa Szymborska*

**In my childhood there were fathers to fear** and nuclear war. Radiation. This was before children were given *Sadako and the Thousand Paper Cranes*, so no wonder we felt hopeless in spite of the cans my grandparents kept in the basement. The footage of the Shoah that appeared in school didn't help. Did they want to scare us into keeping our papers at the ready?

**My friends are out demonstrating** again. I'm proud of them but am in my house grading tests. What use are writers? Math teachers have something to say, but the problem with statistics is that most of the time, approximately 87% of the time, knowing statistics increases uncertainty.

**Actually, I made up that number**, but given the time, could come up with one that most would agree on. The Doomsday clock was just a metaphor, hands creeping closer to midnight. Then in the 90s we stopped worrying so much about nuclear war, despite all the wars with their lists of the dead, and dirty bombs that kept on leaking radiation long after the explosions.

**In an emergency** don't forget to turn off the gas. There are a lot of books to pass out to the children before the end-times. They may need a minimal grounding in mathematics for which I recommend *The Number Devil*, though that story cleaves to number theory, while statistics is the mathematics of our data-burdened lives.

**One in two? One in three?** So many arguments interrupt the quantitative, demand a qualitative explanation. The list of fears grows even though the children deserve the 98% of the hope left in the bottom of the vessel.

# Carol Dorf

## Categorize the Category of Categories (1 of 2)

She's on her way out of the box, despite darkness,  
despite shouts of *rootless cosmopolite*.

Naked, well that could be a problem, but let us assume  
a silk dressing gown, or better yet jeans and a silk shirt.

You have to admit that being perfect is not always  
a gift for the given. Open your eyes already.

...

You would think game theory referred to games  
but the wiki-article refers first to battles.

Give me the problem of crossing Königsberg  
bridges any day, perambulating afternoon.

...

When he asks her for a light in a post-code  
movie, you know what he wants.

Sometimes they show her slap his face  
but the antecedent seems so mild.

How was it that the casting couch  
moved from metaphor to joke to outrage?

In Hollywood your friends stab you in the front.  
Why bother to hang a shmata to dry in the sun?

Retaliation can be shifty –  
Did you know what he could be like, before?

# Carol Dorf

## Categorize the Category of Categories (2 of 2)

This isn't my story, and I wasn't consulted  
which is right in the way of distant friends.

Opinions, and more, like any woman worth her salt  
I have them. Luckily there are recitatives to fill the space.

Do you still drink milk? Cream? Sugar? Something sweet?  
Let me tell you, *Life is Nothing Without a Plan*.

...

The word *substance* when the sun sets in a green flash.  
Imagine the random walk, the encounter.

Say, *He's my type*, and you fracture the world  
separating possibilities into simple code.

Demonstrate *your type* is an abstract concept.  
Sometime you identify *your type* as alien.

...

She printed a board and fashioned pieces out of clay  
for her lover to put into motion.

She opens and closes the doors, not here, not there.  
Once someone said, *What are you looking for?*

Drapery hides darkness or light. Which will it be?  
Beneath drapery lies expectation – cloth on cloth.

*You can see that enough is never enough*, she said.  
Maybe she was right but who carries the measuring cups?

...

Pleasure focuses on the instant and doesn't worry.  
Pleasure does not read the paper or anyone's tweets.

# Susan Gerofsky



Susan Gerofsky is an Associate Professor of Mathematics Education and Environmental Education at the University of British Columbia, Vancouver, BC, Canada. Her interdisciplinary research is in embodied, multisensory, multimodal mathematics education through the arts, movement, gesture and voice. She works in curriculum studies, environmental garden-based education, the language and genres of mathematics education, and media theory. Dr. Gerofsky is academic advisor and co-founder of the UBC Orchard Garden, a student-led campus learning garden. She is active as a poet, playwright, musician and filmmaker, and also works with dance and fiber arts. You'll often find her cycling around town with a baritone horn or an accordion. Susan contributed to the award-winning book *Poetic Inquiry: Enchantment of Place* (Vernon Press, 2017), and has a verse play, *Kepler: A Renaissance Folk Play*, published in *The Mathematical Intelligencer*.

Website: <https://edcp.educ.ubc.ca/susan-gerofsky/>

## Impossible Asymptotes: Three Mathematically Themed and Structured Poems

Asymptote: a line or curve that acts as the limit of another line or curve. Two lines are asymptotic if they approach infinitely close to one another without ever touching or crossing.

### (1) Perfect Pitch

Shimmering notes slip slightly  
Notes shimmering slightly slip  
Notes, slightly shimmering, slip  
Slightly, notes slip, shimmering  
Slightly slip notes, shimmering.  
Slip slightly shimmering notes  
Slip shimmering, slightly, notes  
Shimmering slip notes slightly  
Shimmering notes slip slightly  
From perfection of pitch.

*Note:* This poem is structured in a form called PH4 (Plain Hunt on 4), a braiding pattern based on the Plain Hunt pattern in bellringing, and explored in several Bridges papers, including: Susan Gerofsky, *Two New Combinatoric Poetry Forms: Braided Bellringing PH4 Poems & Anagrammatic, Anglo Saxon-Inspired Poems*, Bridges 2020 Proc., pp 273–280. Four words are braided to form a subgroup of 8 elements of the possible 24 permutations.

# Susan Gerofsky

## (2) Crush

O  
He  
Of the  
Broad shoulders  
Renaissance angel  
Impossibly androgenous  
Dark, melancholy Hamlet's cool ironic humours  
Unreachable untouchable even as I approached nearer, glowing in heat  
Full passion obvious and yet quite invisible  
All roads led only to his house  
Longing for a glimpse  
Some small word  
Or touch  
Not  
Felt

On  
This  
Distant  
Far off coast  
Forty years later  
We plan to meet for a coffee  
I find this sad confused man, never grown to full self  
Whatever was there, if it did exist then, no longer shines in the possible world  
We converse, without touching, from this our vantage place  
In the future of our once youth  
Amplly crushed and juiced  
In fullness  
Lives lived  
Not  
Met

*Note:* This poem is structured as two stanzas of Fibonacci poems, with the number of syllables in each line increasing and then decreasing in Fibonacci sequence: 0, 1, 1, 2, 3, 5, 8, 13, 21, 13, 8, 5, 3, 2, 1, 1, 0.

# Susan Gerofsky

## (3) Borders by Bike, 1987

Approaching the border, maps run out  
In the region before the border, signs pointing to the border are nowhere to be seen  
Along the wooded river valley that forms the border, supersonic fighter jets boom below the tranquil bike paths.  
At the border, huge trucks are taken apart and inspected  
At the border control booth, mere bicycles are waved through with disdain  
Just past the border, new tongues are spoken into life  
Beyond the border, all the eggs in the tourist market have double yolks  
Past the border, people do not remember that there is no looking back  
In the new country, the previous country ceases to exist.

Approaching the border, huge trucks do not remember that there is no looking back  
In the region before the border, mere bicycles cease to exist  
Along the wooded river valley that forms the border, new tongues run out  
At the border, all the eggs in the tourist market are nowhere to be seen  
At the border control booth, people boom below the tranquil bike paths.  
Just past the border, the previous country is taken apart and inspected  
Beyond the border, maps are waved through with disdain  
Past the border, signs pointing to the border are spoken into life  
In the new country, supersonic fighter jets have double yolks.

People in the new country are nowhere to be seen  
All the eggs in the tourist market past the border run out  
New tongues beyond the border cease to exist  
Mere bicycles just past the border do not remember that there is no looking back  
Huge trucks at the border control booth have double yolks  
Supersonic fighter jets at the border are spoken into life  
Signs pointing to the border along the wooded river valley that forms the border are waved through with disdain  
Maps in the region before the border are taken apart and inspected.

Maps, signs pointing to the border, supersonic fighter jets  
Boom below the tranquil bike paths, are nowhere to be seen, run out  
Huge trucks, mere bicycles, new tongues  
Are spoken into life, waved through with disdain, taken apart and inspected  
All the eggs in the tourist market, people, the previous country  
Cease to exist, do not remember that there is no looking back, have double yolks  
Approaching the border  
The border that must not exist,  
The border that, in theory, can never be crossed

*Note:* Each of the 9 lines of this poem's 1<sup>st</sup> stanza is of the form (location (L) + noun phrase (NP) + verb phrase (VP)). Stanza 2 recombines these elements, starting from (L1 + NP4 + VP 8) and then cycling through all nine combinations sequentially. Stanza 3 switches the elements' order, starting from (NP8 + L9 + VP2), and cycles through all nine combinations. Stanza 4 collects the NPs and VPs three by three, finishing with three lines that address the theme.

# Susan Gerofsky

## Seven Strands of Alphabetical Braided Crows

All but crows do eat fine grind  
But crows do all eat fine grind  
But crows do grind, all eat fine

Crows do grind, but all eat fine  
Crows do grind fine, but all eat  
Do grind fine, crows, but all eat!

Do grind fine, eat, crows, but all  
Grind fine, eat, do crows, but all  
Grind fine, eat all, do, crows! But...

Fine, eat all grind, do crows but  
Fine, eat all, but grind. Do crows?  
Eat all but fine grind, do, crows!

Eat all but crows. Fine grind, do.  
All but crows eat fine grind, do.  
All but crows do eat find grind.

*Note:* This poem takes a seven-strand braiding pattern and uses it to braid a sequence of seven words. The seven words of the initial line of the poem start with the first seven letters of the alphabet, from A to G, and these also correspond with the seven notes of an A minor musical scale, so that the braid group permutations of the words also creates a melody. The full effect can be experienced through the short film version of the poem: Susan Gerofsky, *Seven Strands of Alphabetical Braided Crows*, Bridges 2021 Mathematical Art Galleries: Short Film Festival. <http://gallery.bridgesmathart.org/exhibitions/2021-bridges-conference-short-film-festival/susan-gerofsky>.



# Sarah Glaz



Sarah Glaz's poetry collection, *Ode to Numbers* (Antrim House, 2017) was a finalist for both Next Generation Indie Book Awards and Book Excellence Awards. Sarah is Emeritus Professor of Mathematics at the University of Connecticut specializing in the mathematical area of Commutative Ring Theory. Her poetry, poetry translations, collaborative work with visual artists, and articles on the connections between mathematics and poetry appeared in a variety of literary and mathematical journals, edited volumes, and anthologies. Sarah

serves as Associate Editor for the *Journal of Mathematics and the Arts*, for which she guest-edited the special issue *Poetry and Mathematics*. She coedited the poetry anthology, *Strange Attractors: Poems of Love and Mathematics* (CRC Press, 2008), and as the coordinator of the poetry readings at the annual Bridges conferences, she edits the *Bridges Poetry Anthologies*.

Website: <https://www2.math.uconn.edu/~glaz/>

## Plimpton 322

I dreamed of being a Babylonian  
clay tablet, brittle with age and broken  
in fragments, the lovely patina of  
time rubbed away by foreign hands in a  
harsh climate. Who will illuminate the  
ancient script imprinted in my core,  
decode the pain ingrained in every atom  
of disintegrating clay, make use of  
my four columns of numbers again?



*Note:* The most famous Babylonian clay tablet, Plimpton 322 (circa 1800 BCE) was decoded by Neugebauer and Sachs in 1945. The text involves a table with four columns of numbers, which after careful scrutiny turned out to yield fifteen Pythagorean triples, the largest being: 12709, 13500, 18541. The original tablet is housed at Columbia University in New York City.

# Sarah Glaz

## Among Practitioners of Cossike Arte

We greet the old mathematicians at the door:  
Good evening! Buona sera! Noswaith dda!

I serve a stew made of poetic equations,  
while Ludovico — reciting his solution  
to the quartic —  
fills their goblets with red wine.

“Shall we commence playing *Primero*  
after dinner,” asks Cardano,  
“or shall we play for money...  
a lively game of chess?”

Put on the spot, Recorde answers,  
“noe 2 thynges are moare equalle” —  
although both know that Robert never gambles  
and Girolamo would prefer to bet on dice.

I glimpse Tartaglia’s scarred face behind a star  
casting an evil spell.



*Note:* During the Renaissance, “algebra”—still in its infancy – was called *Cossike Arte* (“The Art of Things”) and a card game called, *Primero*, became all the rage throughout the European continent. Robert Recorde (1510 -1558), Welsh physician and mathematician, invented the equal sign, =, which he justified in his algebra book, *The Whetstone of Witte*, with the words “because noe 2 thynges are moare equalle.” The other figures are Italian mathematicians who were instrumental in the development of algebra: Girolamo Cardano (1501-1576), physician, mathematician, writer, chess player and gambler, who solved the cubic equation; Ludovico Ferrari (1522-1565), Cardano’s student who solved the quartic equation; and Tartaglia, “the stammerer,” (1500 -1557) who solved an important case of the cubic on which both Cardano’s and Ferrari’s solutions relied.

The accompanying image is a collage, with the same title, by Mark Sanders. The poem-collage pair was part of the project *Imagined Invited*, which was conceived by David Greenslade. More information about the poem, the collage, and the project can be found at *The Bridges 2020 Art Gallery*: <http://gallery.bridgesmathart.org/exhibitions/2020-bridges-conference/sarahglaz>

# Sarah Glaz

## What Can We Do If We Crave Certainty in Mathematics?

*Thus, to salvage traditional mathematics, Hilbert proposed a bold new program. It required first that the whole of existing mathematics should be axiomatized, and second that this axiomatic theory should then be proven consistent.* — David M. Burton, *The History of Mathematics*

Hilbert said, “No one shall expel us from the paradise that Cantor has created.”  
And we believed, like Cantor himself,  
that God had opened the gates  
to the forbidden garden,  
had invited us to enter,  
meet  $\aleph$  (*aleph*) face to face,  
converse in the language of sets,  
admire the ascent of transfinite cardinals  
into an infinitude of infinities.  
No one can possess such knowledge  
and remain unscathed.  
We lost our footing: doubts assaulted us  
from the very first step,  
set roadblocks in our path—  
unanswerable questions, inexplicable paradoxes  
and baffling results.

Before Kurt Gödel, we could still have hoped.  
Attempting to resolve inconsistencies,  
we could have spent our lives trying to grasp  
the tantalizing cloud of certainty  
hanging above our heads—  
just beyond reach.

The naiveté of Frege, Russell, Hilbert,  
and all of us, their followers,  
divided into schools with bombastic titles—  
Axiomatic, Logistic, Formalistic—  
with methods and approaches,

plans for the future,  
a list of problems to last to the end of time.  
Little did we know of logic’s limitations:  
that our system would backfire,  
stating its own incompleteness,  
in its own ink signing the QED—  
that with cymbals and umlauts  
it would prove its inability to prove  
consistency of axioms within the system.  
And what else was there but the system  
we took for granted  
as we did our ability to breathe?

After Gödel proved the Incompleteness Theorems  
a grey cloud descended upon us—  
we could touch the fog.  
Nothing was pure logic.  
Pure logic was nothing.  
We could not even count on knowing what truth  
can be proved.  
Uncertainty permeated everything.

We prayed that this was not the end of the road—  
that there was more of it to travel.

*Note:* Georg Cantor (1845-1918) is responsible for the rigorous mathematical representation of infinity and the development of set theory – the “language” that allowed mathematicians to work with the concept of infinity. Almost immediately after its discovery, a number of paradoxes were found in set theory. Considerable efforts were made to resolve these paradoxes, including the program proposed by the prominent German mathematician, David Hilbert (1862-1943), mentioned in the epigraph to this poem. These efforts were dealt a severe blow by the Incompleteness Theorems proved by Kurt Gödel (1906-1978). Fortunately, it was not the end of the road. Realizing the exact extent of uncertainty inherent in the mathematical system had the beneficial effect of removing vague anxieties and redirecting research focus.

# Sarah Glaz

## Since time is a dense substance impossible to alter

I like to spend time in the past

participate in all events as a bystander  
detached by years  
of action and reaction

I love the care-free travel through time's  
layered complexity  
being of neither here nor there

nowhere and everywhere at once

a bird in flight  
fluttering butterfly  
miraculous apparition as insubstantial as a hologram

The pyramids of Giza witnessed  
my breath on stones blowing away the dust  
from old inscriptions

Worshipers saw me peeking behind  
the temple columns  
as the *cohen* performed the rites

I flowed like a mirage above the bodies piling high  
on Venice' Island of the Dead  
during the plague

Present when Napier discovered his *calculating bones*,  
and there when Newton  
let the sunspots in his vision guide him

towards a theory of color

This flight into the heart of history  
is light  
lighter than here and now

*Note:* John Napier (1550-1617), the Scottish land owner and mathematician who invented logarithms and used them to aid calculations, also constructed a manual calculating device called *Napier's Bones*. British mathematician, astronomer and physicist Isaac Newton (1643-1727), is considered to be one of the most influential scientists of all time. Among his monumental achievements is the development of a theory of color.

# Lisa Lajeunesse



Lisa Lajeunesse is a professor of Mathematics at Capilano University in North Vancouver. As an undergraduate, she studied mathematics and music. Before embarking on graduate studies in mathematics, she worked for ten years with Telesat Canada on the launch and control of Canada's communication satellites. At Capilano University, she has developed and taught courses on the connections between mathematics and the arts to reach out to non-science students, and to express her lifelong passion for creative writing, music and other art forms. During a sabbatical in 2016/2017, she wrote a textbook for these courses, which prompted her to attend Bridges for the first time. Since then, she has adapted popular logic puzzles to encode poetry so that the solving of each puzzle unlocks a poem. A sample of Lisa's poetry may be found at her website.

Website: <https://lisalajeunessepoetry.wordpress.com/>

## Model Theory

*for John Poland*

We met on a Monday  
I'd spent the weekend  
reading first-order logic  
feverishly

our bodies  
question marks curved about  
a proof of the Compactness theorem

the model constructed  
inside the very language of the theory

symbols  
came alive  
writhed then leapt from the page

I looked up and breathed *that's wild*  
he fell back as though a gale had blown past

Ours was never a courtship  
but an exchange of  
rare and precious gifts  
between two royal palaces  
no alliance sought

So I paint him  
as Velasquez might  
with my court as backdrop  
the dignified greeting  
the pretty bows and speeches  
an emissary  
bearing treasures that  
surpassed my need

*Note:* This poem is part of a series called: *If I were a Portrait Painter*, by Lisa Lajeunesse. Each poem in the series describes how the poet would paint a memorable person from her past.

# Lisa Lajeunesse

## A Portrait of My Mother as a Bifurcation Diagram

Launched into life  
from the Great Depression  
the initial soar  
as your universe expands

Shy and introverted  
you were not the daughter  
with the flirty eyes  
(your mother's favourite)  
and your birthday too far from  
payday for spoiling

Education was your consolation  
an equilibrium made stable by  
universal praise on papers and essays  
A dutiful valedictory address  
full of God, King and Country  
penned to a world  
hobbling through Depression and War

Jostling for attention and limited resources  
you wait in hope  
behind five more important brothers  
the air is redolent with potential

It's decided that a year of secretarial training will do

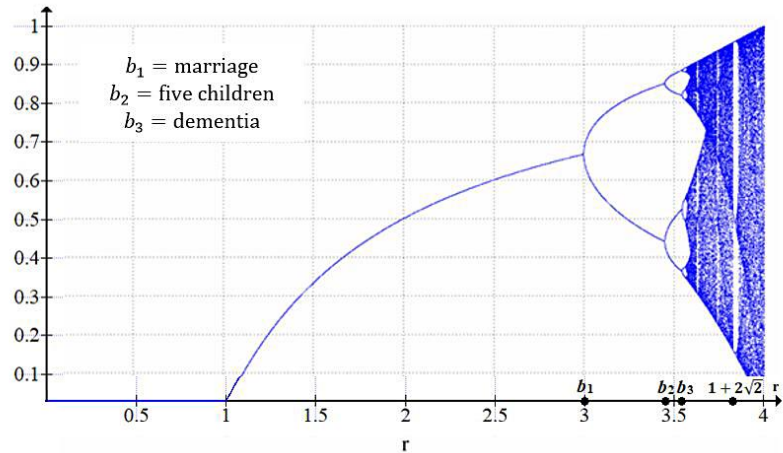
The decay of knowledge acquisition is increasingly marked as  $r \rightarrow b_1^-$

With marriage  
the loving wife persona  
splits from the private essence of you

She executes a courtly dance  
leading her hidden self  
through repeating patterns of afternoon teas and bridge games  
a backdrop of daily drudgery  
is punctuated by five pregnancies

Convergence to a stable 2-cycle for  $b_1 \leq r < b_2$

Pledged to another's dream  
his many fine qualities as husband and father  
notwithstanding



### Bifurcation Diagram of Logistic Map

from: Mahmoud Maqableh (2015) *A Novel Triangular Chaotic Map (TCM) with Full Intensive Chaotic Population Based on Logistic Map*. *Journal of Software Engineering and Applications*, 08,635-659, (Figure 7), modified by adding the points at  $b_1$ ,  $b_2$  and  $b_3$  and at  $1+2\sqrt{2}$ .

## Lisa Lajeunesse

you trade a suburban home  
and all the comfort that entails  
for a hobby farm made shabby  
by the hippie commune that had dwelt there

No kitchen and a family to feed  
LSD-infused drawings on the wall  
plastic milk jug, cut and jiggled to plumbing pipe

Renos inch forward in stolen hours  
the hostess waits lonely years to once more  
usher guests  
across a plush rug to a smart couch  
you always cared what other people thought

I remember you  
explaining why you earned less than  
full-fleshed men  
who didn't mark time by the school bus clock  
who didn't rush home to potatoes  
to peel and boil, the dog to feed  
it seemed to make sense, besides  
I would never throw skepticism in your face  
when you spoke about a number that said  
all there was to say about ambitions  
harboured long ago by a girl  
from a family with nothing

Stunted gifts echoed across a modest life  
sharp number-sense kept tidy finances  
intuition divined when children were lying  
and whether or not it mattered

In an unruly family  
you hummed below radar  
though our craziness could  
seize you in a fit of hilarity  
red in the face and gasping  
and suddenly we'd notice

But none of us noticed time expiring  
for exploring who you might have been

I like to think I glimpsed you in a distant past  
on long afternoons  
in the quiet space between us

Period doubling and increased complexity for  $b_2 \leq r < b_3$

# Lisa Lajeunesse

And the last decade  
    childlike  
        demanding  
sorting through garbage  
clutching fragments of no value  
the legacy of the Great Depression  
when all else was gone

Rude to friends who'd become strangers  
and other odd behaviours  
spilling from unchecked impulses  
I lost you in stages  
never certain how to grieve  
as tiers of elegance and grace fell away

Clarity made a brief and wondrous appearance  
    (see  $r = 1 + 2\sqrt{2}$ )  
*It's hard on your father, I've become quite forgetful*  
before the imp of chaos  
returned

Pointing to a passing stranger  
*Is that your mother?*  
the words a strange shape in your mouth  
as you puzzled over how we fit

Only chaos conveys your personality's disintegration for  $b_3 \leq r$

I suppose I never saw you clearly  
maybe I'm taking you for granted one last time  
seeing only my reflection in you  
maybe it was everything you wanted  
I could have asked  
Instead  
I'm left spinning sad tales  
with half-truths and clichés

When I heard you were gone  
I sobbed and sobbed  
Maybe it was the echo of a door  
closing between us



# Marco Lucchesi



Marco Lucchesi, Professor of Comparative Literature at the Federal University of Rio de Janeiro, is a Brazilian poet, novelist, essayist and translator. Elected to the Brazilian Academy of Letters (ABL) in 2011, Marco served as its president from 2018 to 2021. He is the former editor-in-chief of the ABL journal, *Revista Brasileira*, and the National Library of Brazil poetry magazine, *Poesia Sempre*. His publications include over twenty-five award-winning books and numerous works of translation, among others *Novos Poemas Reunidos* [New Collected Poems], *Hinos Matemáticos* [Mathematical Hymns], and translations of Rumi, Khlebnikov, Rilke, Pasternak and Vico. His work has been widely anthologized and translated into more than ten languages. His literary honors include the Jabuti Prize, the Romanian Latin Prize, the Ministry of Italian Culture Prize, and Alceu Amoroso Lima, a lifetime achievement award in poetry.

Website: [https://pt.wikipedia.org/wiki/Marco\\_Lucchesi](https://pt.wikipedia.org/wiki/Marco_Lucchesi).

## Fractal

We climb  
the ferocious  
moving dunes

Trawlers  
moan  
at dusk

A caravan  
vanishes  
under the sand

How to prevent  
the pregnancy  
of twilight?

*Note:* The mathematics in poetry can appear as a subtle and metaphorical presence driven by degrees of abstraction. The metaphorical fractal of this poem is a constant pregnancy and endless possibility of growing and changing, maintaining nevertheless the fundamental similarities; dune and sand also embody this never-ending process

# Marco Lucchesi

## Set

In cloudy  
waters  
dark and deep

a shaky  
and panting  
Don Giovanni

repeats  
voluptuous  
each day:

"Ma'am,  
this is  
the catalog"

## Undecided



*studio la matematica o lascio le donne?*

*translated from the Portuguese by Renato Rezende*

*Note: The poem Undecided is a slight modification of the Confessions of Rousseau: Zanetto lascia le donne e studia la matematica [Italian for "Zanetto leaves women and studies mathematics"], mentioned by Casanova and analysed by Freud.*

# Marco Lucchesi

## Differential

A dizzying web of numbers  
unsubmissive and unyielding  
to the exacerbated horizon of silence

A spark glittering  
in the eyes of the future

And all it *doesn't* say  
is as if it did

*translated from the Portuguese by Renato Rezende*

## Number / Destiny

Slow down  
the tension  
of our bows:

the small death  
and some few  
thoughts

I'm still searching  
for the body  
I have found

The marigolds  
are gleaming  
in the dark:

a languid requiem

Omen, Nomen  
OM

*Note:* The poem *Differential* speaks on the ambition of the speed of calculation.

# Marco Lucchesi

## Minotaur

The elliptic curve and the rational points

The living solitude in which he finds himself

Feeding only on skirmishes

*translated from the Portuguese by Renato Rezende*

## Canopus

a  
lone  
and wild  
starry night  
still darkens my hope  
which overlooks the hazy dawn

*Note: Minotaur* in the labyrinth of the Birch and Swinnerton-Dyer conjecture.

The poem *Canopus* is a Fib — the syllable count of the poem's lines follow the first six numbers of the Fibonacci sequence: 1, 1, 2, 3, 5, 8

## E. R. Lutken



E. R. Lutken's collection of poems *Manifold: poetry of mathematics* (3: A Taos Press, 2021) won the New Mexico First Book Award 2022. By training, Emily Lutken is a family physician. She graduated from Duke University, and U.T. Southwestern Medical School. After residency, she worked in urban emergency rooms, then with International Medical Corps teaching and caring for refugees, and for the majority of her career on the Navajo Nation. After retiring from medicine, she taught middle and high school science and mathematics in rural Colorado for six more years, and developed an interest in cross-curricular activities with the humanities. Now she spends time writing poetry, and fishing in the swamps of Louisiana and

mountain streams of New Mexico. Her poems often involve science and mathematics, and have appeared in a variety of journals and anthologies.

Website: <https://www.erlutkenpoetry.com/>

### Ars Parabola

*Luc Bat for Horace and MacLeish*

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.

*Note:* *Luc Bat* is a traditional Vietnamese poetic form. The word "luc bat" is Sino-Vietnamese for "six eight," referring to alternating lines of six and eight syllables.

# E. R. Lutken

## Zero

Zip, null, the empty sum.

What is the use of a number  
that cannot be?

Not prime, not composite,  
not positive or negative.

No one can sense it –  
it's nothing.

Can't divide it up –  
all parts of nothing are nothing.

Can't use it to divide things either –  
that would mean cutting something into no pieces.

Multiplying it doesn't do jack –  
if it isn't anything to start with  
why would more of it be something?

So what's the use?  
Place holder? Identity marker?  
Symbol of absence? Point of departure?

0

opens on the page like the dark mouth of infinity,  
hobbit door to a blank symmetry  
where fragile constructs of points, vectors, strings dance,  
arcs, lines, planes stretch to no end  
and all ends.

# E. R. Lutken

## Fourier Transformation

Hollow echoes, furious dissonance in a windowless world; the Unit, where I squandered hours, days, years, dragging from one pained face to another, squirming in the wake of anxious cries, hiss of ventilators, raspy suction pumps, shoes squeaking on linoleum floors, scrambled phone-talk, staccato whistles of alarms. Worm tunes rattle my brain until somehow, Mr. Breitenmeyer emerges from the tangle of cumbrous wires, burbling tubes. I bend towards his ramshackle figure, put stethoscope to chest, my ears tuned for rubs, snaps, gallops, blowing murmurs, crescendo, decrescendo, weighted sum of periodic functions. He smiles, begs pardon for his insurgent body, growling abdomen, lungs mumbling decay. He will die soon and he knows it. But the rhythm of his pulse still sings; seasons, tides in every round of systole, diastole, like lapping waves, a low plainsong in clear translational symmetry. Alongside his even breathing, all pointless noises disappear. The steady pulse, the tide proceeding, not resignation, serenity.

*Note:* Fourier Transform—a mathematical method of decomposing a waveform into its underlying sinusoidal frequencies.

# E. R. Lutken

## Fundamentals of Mathematics

Clothes we put on a shaggy universe  
to make it behave, slick and comb its hair,  
button its collar and send it to church.

Stack of bones extracted at autopsy,  
bleach-soaked, messy bits removed,  
arranged on a pedestal in the classroom,  
shellacked, perfectly articulated,  
clattering, ghoulish display.

Tome of mind-scrambling spells,  
fanciful shapes teased from thin air,  
mazes, knots, rotating matrices,  
meandering Möbius strips,  
rippling surfaces, Klein bottles.

Book, bone, garb, trivial  
intersections with mortal perception.

It is its own rough beast,  
roaming an unknowable territory, staring  
with omnichromatic vision through focal  
depths of countless glittering ommatidia,  
rambling amid tangles of helical strands  
and galactic filaments, wild variables  
crawling over its skin. It feasts on mushy  
stew of particle and wave, gravity, time,  
breathes in the spin of every lepton, laughs  
at notions of elegance, structure, wisdom,  
plays with axioms like toys.  
Secret, savage deity.



## Alice Major



Alice Major's 12th collection of poetry, *Knife on Snow*, is coming out with Turnstone Press in spring, 2023. Her book of essays, *Intersecting Sets: A Poet Looks at Science*, has been awarded the Wilfrid Eggleston Award for non-fiction. Among her writing awards are the 2017 Lieutenant-Governor of Alberta Distinguished Artist Award and an honorary doctorate from the University of Alberta. Her interest in mathematics began at the age of twelve, when she was introduced to non-Euclidean geometry in one of Martin Gardner's books. Ever since, like Percy Bysshe Shelley, she turns to math and science "to replenish my store of metaphor." She has been president of the League of Canadian Poets, first poet laureate for her home city of Edmonton (Canada), and is the founder of the Edmonton Poetry Festival. More information is found on her website.

Website: <https://www.alicemajor.com>

### Moon Exerts Tidal Braking on Earth's Rotation

The moon is pulling away from Earth, just a few centimeters every year, because it is hard work for her to keep the tide's pulse regular. She has kept her cool fingers on the Earth's throbbing wrist so long. Now the planet's early adolescent whirling has slowed to a more stable spin. That lets the moon pick up a little more energy—gives her a chance to drift away.

Earth and moon share the same chemical signature. Their isotopes were donated by two colliding parents—half the material coming from each, like chromosomes. In infancy, the moon had her own giddy birth-spin, but tidal locking set in early. Now she always has to face that sister, keep a calming eye on the sibling that takes up so much space in the adjacent sky with her swirls of tragic pageantry.

Earth's attractive scarves of cloud are admired by other planets circling at their greater distances. Her allure induces slight gyrations in their orbits. But moon will always be the closest, steadiest of the family.

*sometimes you just need  
a tiny bit more distance  
from the drama*

# Alice Major

## Ten Days Past the Equinox

This, the moment when morning sun  
    extends its pointer far enough to touch  
        just that place at the far edge of carpet  
—the point to which it will return  
    twice a year, on its slow sweep back and forth  
        south to north  
along the horizon, then back again

making my small house a sundial,  
    a henge, a stone circle marking  
        light's travelling calendar.

As is the whole of this round globe  
    everywhere an altar, everywhere  
        an opening where light will come to touch  
a surface, waiting.

Tomorrow, sunlight's finger  
    will slide a little sideways.  
        There is always something—  
a chair, a bookcase, a trailing fern—  
    waiting to be noticed, patient,  
        at its accustomed spot  
in the circling geometry of light.  
    Whether I am here to witness it  
        or not.

# Alice Major

## Path Integral

I'm angry about anger—this all-too-easy sheet of flame with its ever-ready pilot light ready to sweep the brain. This coil of neurobiology, the braided lash that rounds us up into obedient legions, to be hectored from lecterns: *They're taking things away from you, those hidden elites, those threatening other-coloured others.* This fetter fastened round our necks, a convenient collar where demagogues can attach the leash.

I want to poke around inside the brain, unroll the wrinkled cortex into a flat, creased sponge and map anger's coordinates. Along the *x* axis: half a billion years of animals trying to survive by fighting back. Along the *y* axis: the logarithmic scale of primate generations, social structures becoming as convoluted as a coral reef, anger rearing up when others break the rules. And *z*, the dimension of the individual life, its traumas and tender spots.

On this stretched-out cortex, I want to locate anger's many domains—bile and choler, ire and indignation, aggression and rage—and trace the paths that chain them. Where is the fury that is close to joy, its luxurious purity? Where do we locate the sullen burn of grudge? Where do I find the domain anger shares with religion, our gods of righteous wrath and war with their foreheads of bronze or steel? Where is that narrow territory where unnecessary rage roars up when I'm hurt by something as minor as a stubbed toe?

Surely knowing this territory would help us negotiate these fragile, fractious times.

But the map bewilders me – the infinite calculation of its tangled functions, its derivatives. I can't compute the area covered by anger, the limits to which it might converge, nor the sum-over-histories of its evolving wave that rolls through brains and time and populations. I can't sum up this cortical compulsion that traps us, this power we hand over to noisy purveyors of conflict.

*The dog flings itself barking  
wildly at the fence  
and its mirror dog beyond.*

*Note:* Enjoy a multimedia performance of *Path Integral*: reading by Alice Major, art by Jean Wolff, music and video editing by John Vogel, in *Talking Writing* at: [http://talkingwriting.com/video-path-integral?fbclid=IwAR1gyNzsy3RFUbKjF0hSB8yxc3HsCbcReNTLpaO1G1OuS\\_DS7TZYfk8Ls4I](http://talkingwriting.com/video-path-integral?fbclid=IwAR1gyNzsy3RFUbKjF0hSB8yxc3HsCbcReNTLpaO1G1OuS_DS7TZYfk8Ls4I)

# Alice Major

## Anger's Arithmetic

one person shouting on the corner is a man  
haunted by some demon

three on the corner become evangelical,  
followers of a hollering God

five on the corner might be an audience,  
puzzled but passive

seven on the corner could include the individual  
who yells back  
at the other six who block the sidewalk

eleven people on the corner  
may bring signs –  
divine-inspired directions

thirteen on the corner might  
begin the straggle of parade  
surge of concerted march

seventeen people leaving the corner  
might begin the brouhaha of righteousness  
pushing unbelievers to the side

nineteen people might become a mob  
primed to lynch

leap on through escalating primes  
until group becomes rabble  
becomes riot

until one thousand and nine people could become  
enough to storm a legislature  
shouting to the god of freedom

all this escalation  
not through addition's simple math  
marching to a necessary sum

but from the math of tipping points,  
the complicated calculus  
of interaction

until the point is reached  
where individuals become  
less free, less individual,

a coordinated wave state  
simplified into  
acting as one

# Kaz Maslanka



Kaz Maslanka received a BFA in Sculpture from Wichita State University, where he also studied music, mathematics and physics. He has been involved in the arts for over 50 years and has been pioneering mathematical visual poetry since the early 1980s. He maintains a strong international presence on his blog “Mathematical Poetry” and with exhibitions of his work. Among Kaz’s awards and recognitions is a nomination for a Pushcart Prize in poetry, and the appearance of a poem in the 2020 ‘Page A Day’ calendar published by the AMS. He lives in San Diego, California, and serves on the board of directors of the San Diego based “Sonic Arts Studio,” a group of composers and musicians devoted to microtonal music. He also served on the advisory board of the Bronowski Art and Science Forum in Del Mar, California.

Website: <http://mathematicalpoetry.blogspot.com/>

## “El Puente Del Corazón” and Its Translation

$$\frac{\text{Emptiness}}{\text{Form}} = \frac{\text{Form}}{\text{Emptiness}}$$

*Multiply Both Sides By Emptiness*

$$(\text{Emptiness}) \frac{\text{Emptiness}}{\text{Form}} = \frac{\text{Form} (\text{Emptiness})}{\text{Emptiness}}$$

*On The Right Side Of The Equation  
Emptiness Divided by Emptiness = One  
Furthermore, One Multiplied by Form = Form*

$$(\text{Emptiness}) \frac{\text{Emptiness}}{\text{Form}} = \frac{\text{Form} (\text{Emptiness})}{\text{Emptiness}}$$

*Multiply Emptiness Times Emptiness*

$$\frac{\text{Emptiness}^2}{\text{Form}} = \text{Form}$$

*Divide Both Sides By Form*

$$\frac{\text{Emptiness}^2}{(\text{Form}) \text{Form}} = \frac{\text{Form}}{(\text{Form})}$$

*On The Left Multiply Form Times Form  
On The Right - Anything Divided By Itself = One*

$$\frac{\text{Emptiness}^2}{\text{Form}^2} = \frac{\text{Form}}{(\text{Form})}$$

$$\frac{\text{Emptiness}^2}{\text{Form}^2} = 1$$

*El Puente Del Corazón* (The Bridge of Heart) involves bridging two traditions from opposite sides of the world, Central America and East Asia. The concept of emptiness is found in the Mayan creation story described in *Popol Vuh*, and emptiness is also a fundamental concept of the *Heart Sutra*, an important tenet of Zen Buddhism. Within the imagery of the work, a circular shaped 'Il won sang' (enso), Zen Buddhist symbol of emptiness, appears as the Mayan creator God reaches for it. The quote from *Popol Vuh* on the top right of the work reads (translation from the Spanish):

Now it still ripples  
Now it still ripples  
Now it still murmurs  
Ripples  
It still sighs  
Still hums  
And it is empty under the sky

On the left is the translation from the Spanish of the poem appearing in the work. In mathematical terms:

Emptiness divided by Form equals Form divided by Emptiness

Algebra is then used to point at the concept of *Oneness*. More details at the site:

<http://mathematicalpoetry.blogspot.com/2022/04/el-puente-del-corazon-bridge-of-heart.html>

# Kaz Maslanka

## El Puente Del Corazón

Vacuidad es a la forma lo que la forma es a vacuidad.

$$\frac{\text{Vacuidad}}{\text{Forma}} = \frac{\text{Forma}}{\text{Vacuidad}}$$

Ahora todavía se ondula  
Ahora todavía se ondula  
Ahora todavía murmura  
Todavía se ondula  
Todavía suspira

*Multiplique ambos lados por vacuidad.*

$$\frac{(\text{Vacuidad}) \text{ Vacuidad}}{\text{Forma}} = \frac{\text{Forma} (\text{Vacuidad})}{\text{Vacuidad}}$$

*En el lado derecho de la ecuación; Vacuidad dividido entre vacuidad = Uno.*

$$\frac{(\text{Vacuidad}) \text{ Vacuidad}}{\text{Forma}} = \frac{\text{Forma} (\text{Vacuidad})}{\text{Vacuidad}}$$

*En el lado derecho; Uno multiplicado por forma = forma.*

$$\frac{(\text{Vacuidad}) \text{ Vacuidad}}{\text{Forma}} = \text{Forma} (1)$$

*En el lado izquierdo; Vacuidad multiplicado por vacuidad = Vacuidad.<sup>2</sup>*

$$\frac{\text{Vacuidad}^2}{\text{Forma}} = \text{Forma}$$

*Divida ambos lados entre forma.*

$$\frac{\text{Vacuidad}^2}{(\text{Forma}) \text{ Forma}} = \frac{\text{Forma}}{(\text{Forma})}$$

*A la izquierda; Multiplique la forma por la forma para igualar a forma<sup>2</sup>*

$$\frac{\text{Vacuidad}^2}{\text{Forma}^2} = \frac{\text{Forma}}{(\text{Forma})}$$

*Cualquier cosa dividida por si misma es una unidad.*

$$\frac{\text{Vacuidad}^2}{\text{Forma}^2} = 1$$

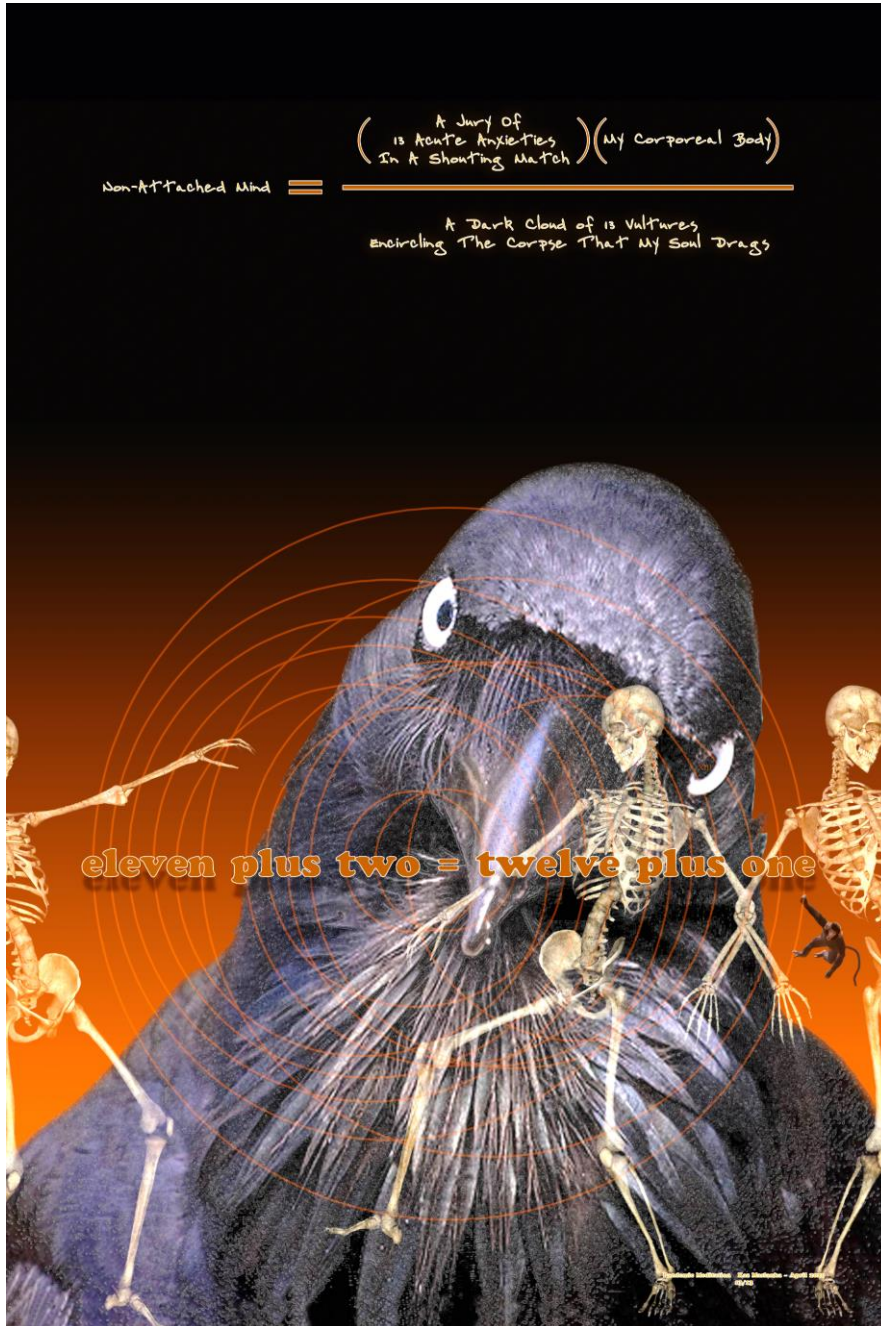
Todavía tararea  
y está vacío  
bajo el cielo



El Puente Del Corazón  
Kazmier Maslanka - 2010

# Kaz Maslanka

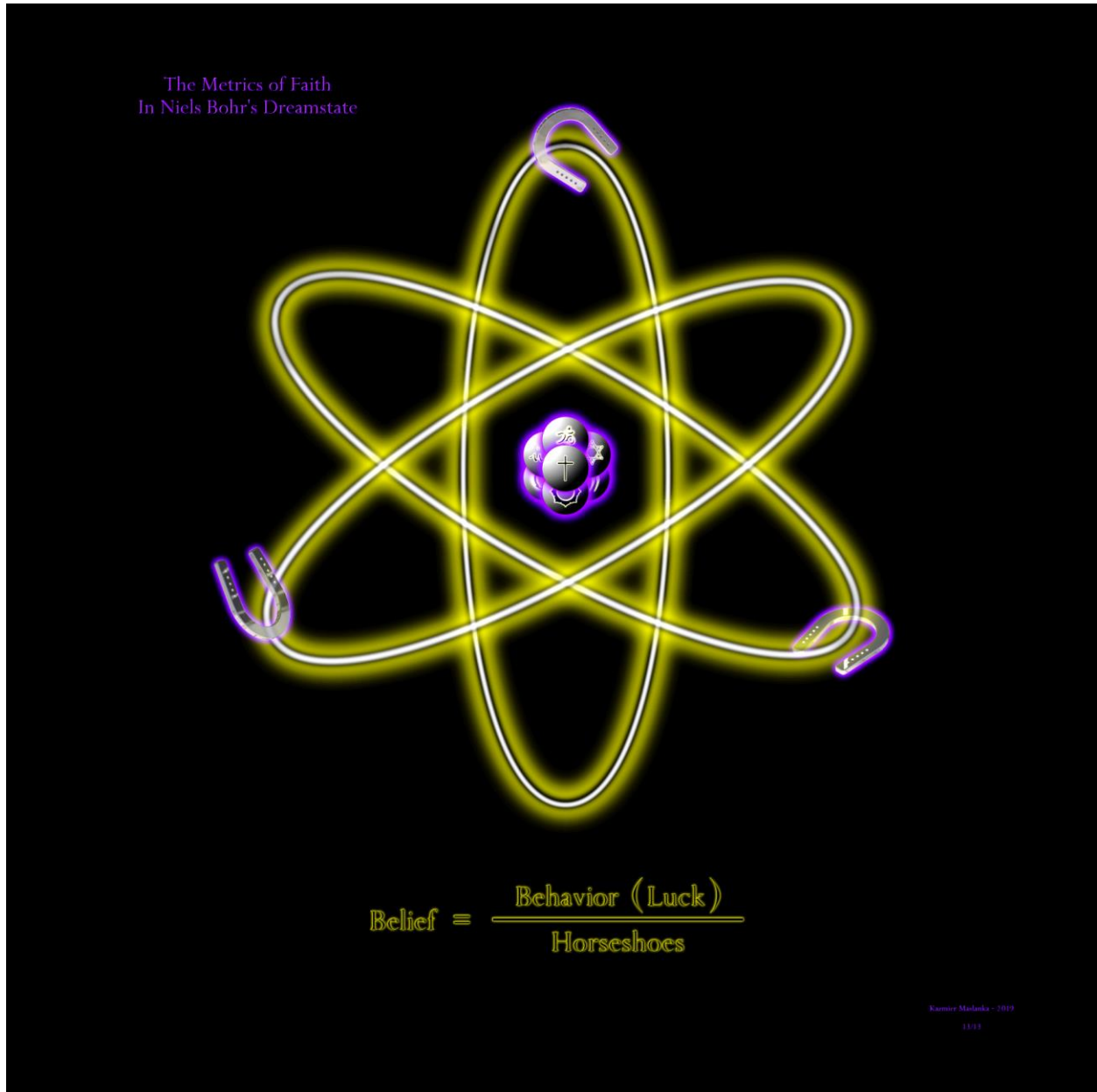
## Pandemic Meditation



*Note: Pandemic meditation is a visual poem inspired by the stress experienced during the pandemic year 2020. It includes two equation poems, the top one is a similar triangles poem whose meaning can be unraveled by algebraic manipulations. More information is found in: Kaz Maslanka (2022), A Cognitive View of Pandemic Meditation, The Journal of Humanistic Mathematics, Vol. 12, Issue 1.*

# Kaz Maslanka

## The Metrics of Faith in Niels Bohr's Dreamstate



*Note: The Metrics of Faith in Niels Bohr's Dreamstate is a visual poem which points to the concept of luck and its relation to language, probability, quantum physics, religious belief, and the nature of reality. The central image is a conflation of the "nuclear genre" icon and Bohr's atomic model, where horseshoes become electrons, and the atom's nucleus carries the symbols of all the main religions. The meaning is enhanced by the equation poem at the bottom.*



## Douglas Norton



Douglas Norton is a professor in the Department of Mathematics and Statistics at Villanova University. Doug's first interaction with the math-art community happened when his proposal for a paper session at the 2003 Joint Mathematics Meetings merged with Reza Sarhangi and John Sullivan's proposal. He was pulled in by the dynamo that was Reza, attended Bridges Alhambra 2003, and has been hooked on Bridges ever since. He pulled his first all-nighter in ages in his motel room at Bridges Towson 2012, completing the lyrics for his first Bridges Informal Music Night presentation. Since 2015, he has attended Bridges and presented a new song each year. Whether contrafactum or parody or something else altogether, whether poetry or lyrics, he tries with each piece to capture some sense of the meeting. The lyrics are available at the Bridges organization website.

Website: <https://www.bridgesmathart.org/norton-lyrics/>

### When, in This Space Proportioned to Metrize

When, in this space proportioned to metrize,  
My monotone decreasing outcast state  
Can double times sev'n absolute demise,  
Mere epsilon myself, and worse: negate;  
Wishing me like to one with pos'tive slope,  
Contoured like him, friend neighborhoods coalesc'd,  
Requiring no bar chart or allotrope,  
With what I want most oriented least.  
Yet with these noughts my null set symbolizing,  
Haply I think on thee, then integrate;  
Like smoothest arc, my true path recognizing,  
To summon forth: a new path bifurcate!  
For thy sweet love brings such sanguinity,  
My null's an aleph null: infinity!

*Note: After Sonnet 29: When, in disgrace with fortune and men's eyes, by William Shakespeare.*

# Douglas Norton

## *from RPM*

Reassuring Ponytailed Mensch.

Ponytail as white as a Minnesota blanket of snow,  
Spread over a land of ten thousand ideas,  
Over a heart of ten thousand moments of kindness,  
Of generosity.  
The night before we drove away from Minnesota  
To a new life in Pennsylvania,  
Sitting atop picnic tables outside our student apartment,  
Dick showed up to wish us well, to send us off.  
We have never forgotten that.

It is the small things that we remember.  
Small like epsilon.  
The seminar, bagel, espresso, cookie sequence.  
The Baltimore Orioles in their house.  
Reciprocity in one-on-one lunch conversations.  
The intermittent catch-up conversations  
At the Joint Math Meetings.  
Dropping by our apartment that final night.  
Lots of epsilons.

There is nothing “pseudo”  
About the epsilon-pseudo orbits of our lives  
As nudged by such epsilon changes.  
They can mold the orbits of our lives.  
Here today we find ourselves epsilon-chain-recurrent:  
The epsilon nudges bringing some of us back  
To within epsilon of where we were before.  
Of course, not periodic:  
You can never step into the same river twice.  
We know such orbits are non-invertible.  
But chain recurrent, maybe.

*Note:* This poem was written for the celebration of the career of Doug Norton’s dissertation advisor, RPM, Richard (Dick) Paul McGehee, held in conjunction with the Midwest Dynamical Systems Conference in November of 2018.

# Douglas Norton

## 2019: Bridges Linz Locus Iste

*“Locus iste” is a sacred motet for four unaccompanied voices, composed by Anton Bruckner in 1869 for the dedication of the Votivkapelle at the New Cathedral in Linz, where he had been a cathedral organist.*

Linz and Bridges are Linzertorte sweet.

Math and Art find the perfect place to meet:

(Johannes) Kepler (U) and Ars Electronica.

GeoGebra, geared jitterbugs, and a discrete gyroid;

A fisheye gyrograph and hyperbolic fish to embroid;

Font and weave and Miura fold,

Math + Fashion stunning and bold;

Quest for egg shape that is pure gold;

Mindful, Max, Matisse, and Mandel-maypole.

Puzzling, walkable, fret, and seductive curves;

Hairy Klein bottle you know you all deserve!

Crop circles, florautomata, Cantor cheese.

Linz Bridges: thanks for all of these.

*Note: Bridges Linz Locus Iste is part of a series of multimedia works celebrating the various Bridges conferences, which Doug Norton composed and performed, either in-person or in a video, during the conferences themselves. A performance of Bridges Linz Locus Iste can be enjoyed at: <https://www.youtube.com/watch?v=xfriEChF1Qs>.*

# Douglas Norton

## 2020: Bridges Nowhere

We've had Bridges Linz, Waterloo,  
Banff, and Alhambra,  
Towson,  
Jyväskylä,  
London, and Coimbra.

But what will Fate decree  
For bizarro year twenty-twenty?

Welcome to Bridges Nowhere!  
There's no need to rent a room.  
No need to book that airfare:  
Sign up for your space in Zoom.

They've wrapped up the Proceedings  
(Though we didn't quite proceed):  
Lots of great math/art reading;  
Entertainment guaranteed!

Knotty knits and trefoil knots,  
Steganography,  
Virtual reality,  
Fractal cohomology,

Fashion-fold origami,  
Labyrinths and spiropoints,  
Lampshade Miura-ori,  
Morton's tritangentless knots.

Orbifolds and gyrations,  
Tiles dendritic and Truchet,  
Girih and pied-de-poule ones,  
Hyperbolic plane crochet.

Coptic bananas, heptagons,  
Perhaps the plaintive numbers flow;  
Hallå STEAM, platonicons,  
Derivision, sgraffito.

*Note: Bridges Nowhere* is to be sung to the tune of "Rudolph the Red-Nosed Reindeer." The Bridges conferences have always been associated with their locations. 2020 was the year of the first online Bridges — the conference held "nowhere." Listing a subset of previous locations brought to mind the Rudolph song, with its intro listing the other reindeer, leading to "but then here is the story of this reindeer who is unlike any of the others." That's where the tune came from. Doug's multimedia rendition of *Bridges Nowhere* can be enjoyed at:  
<https://www.youtube.com/watch?v=nOqfcUzF9Ek>

Aalto, Espoo, Helsinki,  
Otaniemi.  
Plans wrecked by COVID-19;  
Unforeseen, quarantine,  
More hygiene, please, vaccine!  
Very keen to reconvene,  
Back on routine,  
Back to the live math-art scene:

Beauty beyond perfection,  
Augmented reality,  
Math and art intersection,  
Unveiling infinity!

## Amy Uyematsu



Amy Uyematsu, who taught high-school math for 32 years, is a sansei (third-generation Japanese American) from Los Angeles. Amy's poems consider the intersection of politics, mathematics, spirituality, and the natural world. She has published six poetry volumes: *30 Miles from J-Town* and *Nights of Fire, Nights of Rain* (Story Line Press, 1992, 1998), *Stone Bow Prayer* (Copper Canyon Press, 2005), *The Yellow Door* and *Basic Vocabulary* (Red Hen Press, 2015, 2016), and *That Blue Trickster Time* (What Books Press, 2022). Amy is the recipient of the 1992 Nicholas Roerich Poetry Prize. Her work is featured in many venues, including "Poetry Outloud," a national program promoting poetry in American high schools. Prior to teaching mathematics, Amy was active in Asian American Studies at UCLA, and in 1971 she co-edited the anthology *Roots: An Asian American Reader*.

Website: <https://www.poetryfoundation.org/bio/amy-uyematsu>

### ***from* The Invention of Mathematics**

*A man who is not somewhat of a poet can never be a mathematician.*  
Karl Weierstrass, German mathematics teacher

#### ***/ the imaginary number $i$***

my students don't get the joke  
after all, every number is imaginary  
even those we count out  
as beads and stones and miles to the sun

until someone yelled  $i$   
let's make up a new number  
defined as the square root  
of negative one

I tell them about some nameless  
mathematicians who nobody paid  
much attention to  
always gazing at stars

blasting open the infinite  
which no one can see  
able to chart arrow to bull's-eye  
through windstorm and breeze

these early oddballs and nerds  
locked in their rooms  
pondering pages of silly calculations  
as if all life depended on them

# Amy Uyematsu

## The Meaning of Zero: A Love Poem

*Is where space ends called death or infinity?*  
Pablo Neruda, *The Book of Questions*

A mere eyelid's distance between you and me.

It took us a long time to discover the number zero.

John's brother is afraid to go outside.  
He claims he knows  
the meaning of zero.

I want to kiss you.

A mathematician once told me you can add infinity  
to infinity.

There is a zero vector, which starts and ends  
at the same place, its force  
and movement impossible  
to record with  
rays or maps or words.  
It intersects yet runs parallel  
with all others.

A young man I know  
wants me to prove  
the zero vector exists.  
I tell him I can't,  
but nothing in my world  
makes sense without it.

# Amy Uyematsu

## When Geometry Gets Mixed Up with God and the Alphabet

Every time he writes "angel" she puts a big red circle  
around it, not round like a halo but cranky  
and shrill in her thick felt-tip pen,  
just for misspelling "angle" again,  
as she takes a point off here, another point there,  
until he's down to a lousy C-plus.

She's gotta be the pickiest teacher Joey's ever had  
'cuz she makes them spell the words  
like it's some dumb English class  
and a sin to write "slop" for "slope"  
or "rumbas" for "rhombus." She expects  
him to give reasons and claims "just because  
it looks that way" doesn't make it true.  
It's usually Joey who blurts out,  
"What's the point  
if I can figure it out in my head?" –  
but she'll throw him that look  
that makes the whole room quiet  
without saying one word.

Joey will never admit it to his best friend Andrew,  
who sits in the corner and counts  
the number of tiny holes in the ceiling tiles,  
once up to 2,407 when the bell rang,  
that geometry is his favorite class  
even though he hates the homework.  
Sometimes he'll figure out all the problems she assigns  
but will never hold up his hand to answer  
because Andrew and him can't stand  
those show-offs who always wave their arms  
like they want everyone  
to know who's smartest.

Some days she puts on that crazy smile of hers  
and starts asking questions like *How do we know*

## Amy Uyematsu

*a line is straight or Do we believe that  
between any two points there's always one more?*

Joey doesn't doubt that numbers can get bigger  
and never stop, but he's fascinated  
by the idea of infinity shrinking too.

Once she asked if his class ever stops to wonder  
why Egyptians chose triangles for their pyramids,  
even believed these three-sided shapes held  
secret powers. Joey joins in  
as the kids laugh and roll their eyes  
with that oh-no-here-she-goes-again sigh,  
but lately he wishes they'd shut up a minute  
so he can let his mind zoom  
to a space he can't see,  
where ocean meets sky and lines can curve.

Joey might even break his rule  
about homework and answer her question –  
"What geometric shape pleases you most?" –  
because there's no doubt in Joey's mind  
that circles are the best thing ever invented.  
He even wishes he could meet the first genius  
who drew a circle in the sand,  
though the more Joey thinks about it  
circles didn't have to be invented –  
from the moon and the sun  
to eyeballs, round stones, oranges,  
humans have always seen circles -  
from the minute they wake up  
to when they go to sleep, circles.

And Joey can't explain why  
but circles make him feel happy –  
but he's glad she's taught him  
about "concentric" circles,  
pondering one inside another  
inside another without end.



**Poems by  
Past Bridges Conferences' Featured Poets**



**Mathematical Poetry Readings  
2011 — 2022**



## Robin Chapman



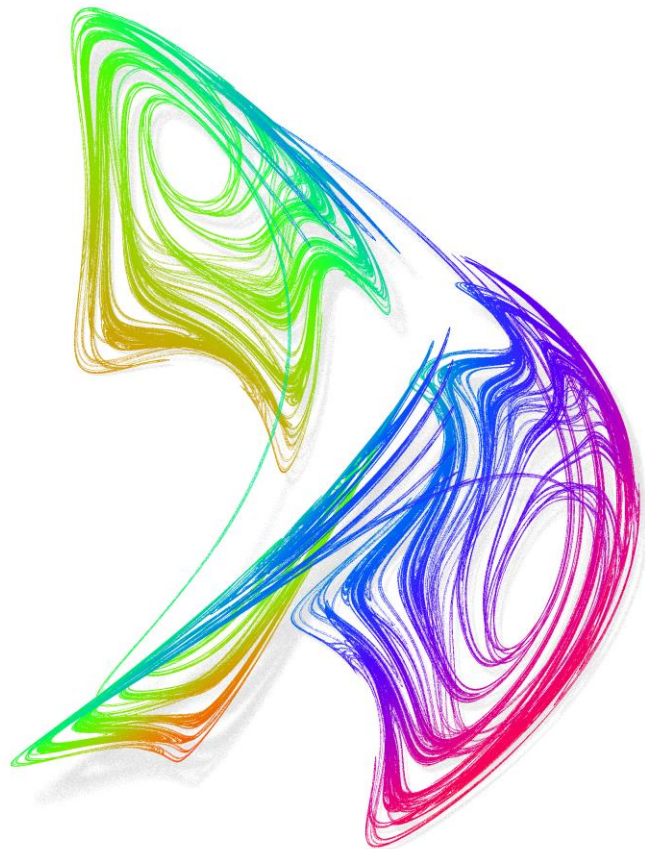
Robin Chapman is a poet, painter and developmental psycholinguist. She is Professor Emerita of Communication Sciences and Disorders at the University of Wisconsin-Madison and emerita Principal Investigator at the Waisman Center, where she studied language development in children. A fellow of the Wisconsin Academy of Sciences, Arts and Letters and co-organizer of the UW Chaos and Complex Systems Seminar, she is author of twelve books of poetry, including, *One Hundred White Pelicans* (poems of science and climate change), *Six True Things* (poems of childhood in the Manhattan Project town of Oak Ridge, TN), *The Only Home We Know*, *Panic Season*, and, with physicist

J.C. Sprott, *Images of a Complex World: The Art and Poetry of Chaos*. Her mathematical poems have appeared in the *Journal of Humanistic Mathematics*, *The Mathematical Intelligencer*, and the anthology *Strange Attractors*.

Website: <http://robinchapmanspoetryandpainting.blogspot.com/>

### Fractal Dimensions

The piano packs up the trees  
into keys and sounding board.  
The player unfurls them as time  
and something more — echo  
Of spring in the forest, the way  
that branches break into leaf;  
Flood, those eddies and whirlpools  
in the turbulent river;  
Voices, those spirits abroad  
in the winter storm.  
Listen, the pianist whispers the name  
of his new wife to the strings  
And they echo back *Rose, Rose*  
in an eighteenth century voice.



# Robin Chapman

## The Trajectory of a Single Particle

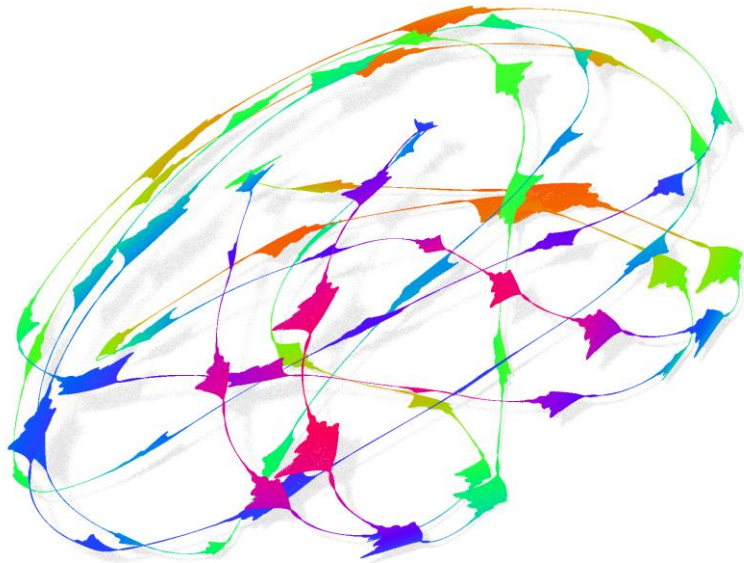
*for Matt Briggs*

It's all there since Newton's time,  
Matt explains, gesturing—  
the equations of motion that say  
how the single particle, bumped,  
will ricochet around the rest:

what every pool player knows,  
leaning over his cue, calculating  
angle and impact, but multiplied

so many times in a gas that  
the smallest uncertainty of path,  
that fraction of spin that sends  
the next molecule left or right,  
becomes, in split-moments,  
doubled path, chaos, the random  
walk of Brownian motion viewed  
through the microscope. And thus,  
Matt concludes, we can explain  
the path of the particle exactly.  
And haven't a clue,  
this blink of time later, of what  
will be the aftermath.

The pool player chalks a cue,  
invites Matt to try his hand.



*Note:* Each of the images “Fractal Dimensions” and “The Trajectory of a Single Particle,” by Julien Clinton Sprott, depicts the orbit of an object moving on a strange attractor that arises from the solution of the same simple 4-dimensional iterated map, but with a different set of coefficients.

# Marian Christie



Marian Christie grew up in what is now Zimbabwe. Drawn to both the arts and the sciences, she wrote poetry from an early age, finding inspiration in the southern African landscape. At university she studied applied mathematics and went on to teach mathematics at schools in the Middle East and Scotland. Throughout her teaching career, she sought creative ways to stimulate students' interest and enjoyment in mathematics, particularly through cross-disciplinary projects incorporating the arts and humanities. Now retired from teaching,

she lives in Southeast England. Marian's published work includes a collection of essays, *From Fibs to Fractals: exploring mathematical forms in poetry* (Beir Bua Press, 2021), and two books of poetry: *Fractal Poems* (2021) and *Triangles* (2023), both published by Penteract Press. In progress, is a new poetry collection, *The Butterfly in all its Jewels*.

Website: <https://marianchristiepoetry.net>

## Crochet

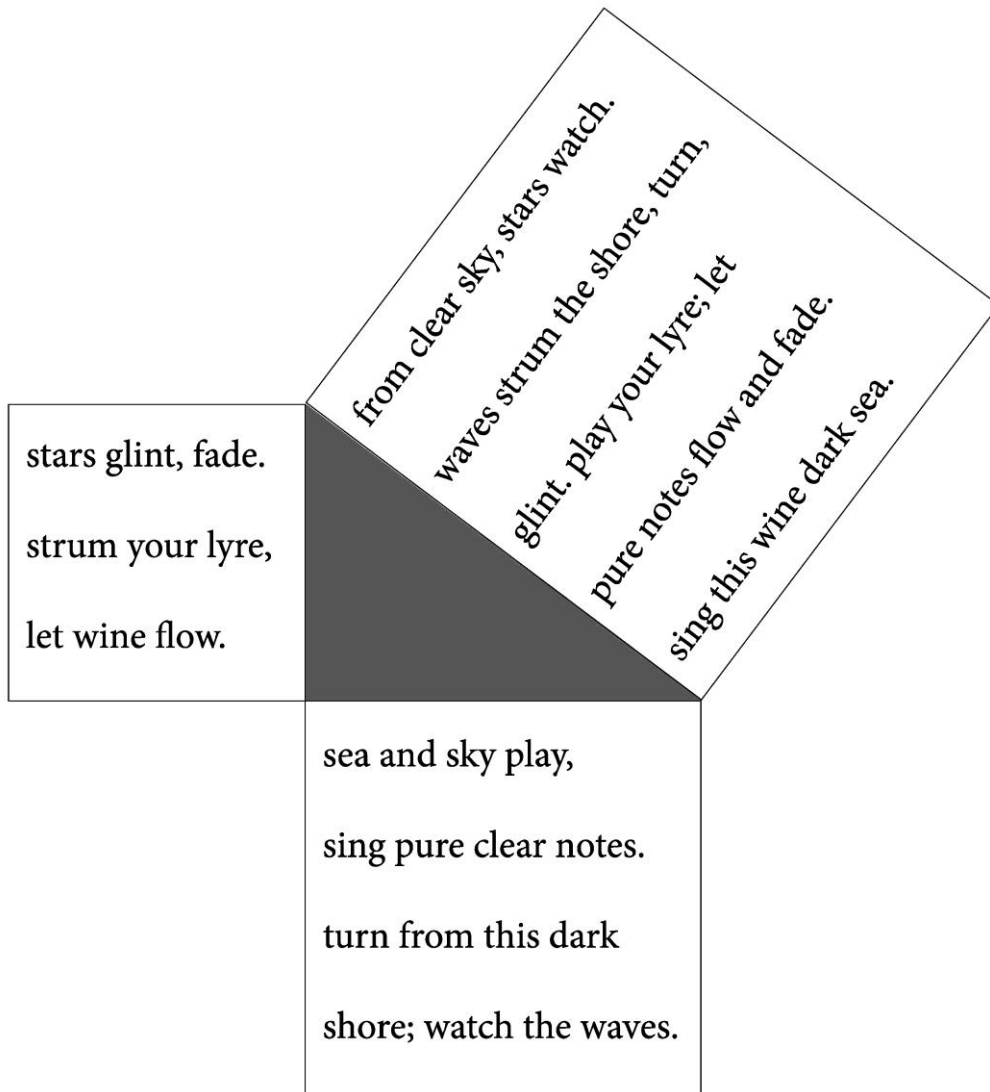
I  
take  
this fine  
spun wool hand  
dyed in shades of blue  
sift its texture balance the hook  
patiently loop stitches and spaces turn sequencing  
intricately patterned rows presences and absences life's imperfect symmetry

*Note: Crochet* is a Fibonacci poem, the syllable count of the poem's lines follow the Fibonacci sequence: 1, 1, 2, 3, 5, 8, 13, 21. The poem was inspired by a crochet pattern for a Sierpinski triangle shawl.

# Marian Christie

## An Illustration of the Theorem of Pythagoras for a 3-4-5 Triangle

*In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.*



*Note:* This poem demonstrates the theorem of Pythagoras for a triangle with sides of lengths 3, 4 and 5 units respectively. The poem consists of monosyllabic words with either 3, 4 or 5 letters. There are three stanzas, corresponding to the sides of the triangle. The first stanza has three lines of three words each ( $3^2 = 9$  words in total), the second stanza has four lines with four words each ( $4^2 = 16$  words in total) and the third stanza has five lines of five words each ( $5^2 = 25$  words in total). Each word in the 3- and 4-line stanzas occurs only once. The 5-line stanza consists of all the words that make up the other two stanzas.

## David Greenslade



David Greenslade has taught Welsh and English at various schools and universities in Europe. He has also led workshops in prisons and other challenging environments. He is a prize-winning essayist and the author of several poetry collections and one novel (*Celtic HotTub*, 2003). Coronavirus lockdowns led to delayed publishing projects appearing close together, notably *Ubiquitext* (Stephen the Great University Editions, Romania, 2021) – a multilingual study of text alongside street lettering; *City of Opal Altars* (Muşatini Press, Romania, 2021) – an illustrated collection of prose-poems and, in 2022, *Full Pareidolia* (CONTRABAND Press, The Netherlands). He shares his time between Wales and Romania where he is active in curating and translating. His co-translations of six Romanian poets from the city of Suceava, Romania will appear in the Italian magazine *Traduzionetradizione* later in 2023.

Website: <https://the-otolith.blogspot.com/2018/05/david-greenslade.html>

### Measuring

The children had found a retractable tape measure  
and were measuring anything that gave them  
a chance to release the thumb lock and marvel  
at inches and centimetres noisily clatter back  
like a chameleon's tongue loaded with rations.  
What if there were no definite quantities  
one child says to the other – oh yeah, cool –  
the other children easily adapt, the way they do  
from space to jungle and into space again  
only this time they measure a dimensionless  
universe and all their paradigms go happily hunting  
hide and seek among rich matter as long as  
it gives them the slightest excuse to reinvent  
this weird toy that changes objects into numbers.

# David Greenslade

## Infinity Manifold

I took my time machine to the garage for a service.  
after a long wait the mechanic informed me  
there was a problem with the infinity manifold  
what exactly, he wasn't sure. After another wait,  
maybe a century or two, he said the settings were all wrong.  
Manifolds he said were usually set at 'n'  
whereas someone had tampered with mine  
and reset the labyrinth technical gauges to ABC.  
I felt instinctively that this was fault of my mortal twin,  
the one who follows me around from bed to bed,  
slowing my love affairs from bliss to thrill to trust.  
Once back at 'n' I hurled myself to those places  
where day and night, past and future meet  
but with an empty feeling, like a torn-out page.  
I missed a certain smell, a certain pair of lips.

## Number Origami

Some things aren't invented but discovered.  
I didn't invent my love for you but found it  
in a pledge of sand multiplied into a dune  
pleated over here + now where petal  
folded promises proved true,  
not imagined but located at the core  
of unhinged figures multiplied at night.



# Emily Grosholz



Emily Grosholz is Emeritus Edwin Erle Sparks Professor of Philosophy, African American Studies and English at Pennsylvania State University. She was educated at the University of Chicago and Yale University, where she received her PhD in Philosophy. She has published eight books of poetry, most recently *The Stars of Earth: New and Selected Poems* (2017). She has also published six philosophy books (along with six edited collections), including *Starry Reckoning: Reference and Analysis in Mathematics and Cosmology* (2016), which won the 2017 Fernando Gil International Prize for Philosophy of Science. Her book *Great Circles: The Transits of Mathematics and Poetry* (2018) brings both aspects of her creative life together. Her most recent book is a collection of essays *Reflections on Poetry and the World: Walking along the Hudson* (2020), which pays homage to The Hudson Review.

Website: <http://www.emilygrosholz.com/index.html>

## Formal Logic: Farewell to Jules Vuillemin

*...ma Virgilio n'avea lasciati scemi di sè  
(Purgatorio XXX)*

The foothills of the Alps are green. We cross  
A valley downwards, only to reascend  
The other side, and enter the deep woods  
Haunted by fox. Your favorite climbing trail  
Commands the granite peak where guide and pupil  
Gaze toward the crescent blue of Lake Geneva.

So often since, I've dreamed that dip and rise,  
Heard the archaic melody of cowbells  
Distances come to amplify, not dampen.  
Like memory. A landscape scaled for giants,  
As you then seemed to me, striding, explaining  
The modal structures of necessity

In your patrician French, your fine austere  
Logician's dialect, somewhere between  
Our human tongue and music of the spheres.  
Distracted briefly, when I turn again  
You're gone, and all the slopes adrift with snow,  
Night fallen, heaven overwhelmed with stars.

# Emily Grosholz

## The Continuum: Trying to Describe the Reals in Cambridge

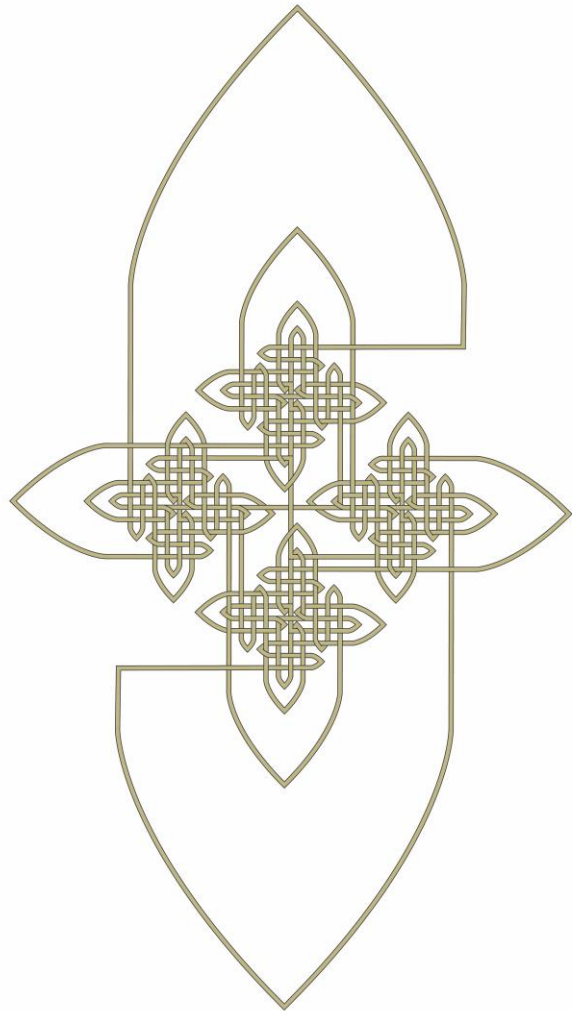
“For there are two labyrinths of the human mind,  
One concerning the composition of the continuum,  
And the other concerning the nature of freedom,  
And they arise from the same source: infinity.”

G. W. Leibniz, *On Freedom*

Draw the curtains! The curtains are always closed  
On roses, rugby field, light variable  
But waning along these tiered northern skies  
Where ten o'clock's the apogee of day,  
A full moon pewtering the cliffs of sunset.  
I write in the wizened glow of my computer.

I write, the reals are really not like numbers  
That we are used to count with, to begin  
And go up stepwise. They are number flooded  
By continuity, the line upbraided  
By differential strands to labyrinth.  
They are the shape and cardinal of freedom.

Abysses along abysses along abysses,  
Yet perfectly defined. As if we charted  
A finest-grained Grand Canyon with passing walls  
Through which a sourceless unplumbed river ran,  
Like moonplate cumulant in tiers above  
The river of waning sunlight. Draw the curtains!



*Note:* “Twice Iterated Knot No. 1,” is a digital print by Robert Fathauer. Information about its construction is found at: <http://www.robertfathauer.com/TwiceliteratedKnot.html>

## JoAnne Growney



JoAnne Simpson Growney has loved poetry since her childhood on a farm, and grew to love mathematics via good teachers and scholarship opportunities. Now Emeritus Professor of Mathematics at Pennsylvania's Bloomsburg University, she lives near Washington, DC, close to children and grandchildren. In addition to publication of poems, poetry collections, and math-poetry articles, Growney participates in judging student essays about math women for AWM and student math poems for AMS. In her own poems and articles, Growney follows the guideline that *everything connects*. These connections are shared in postings in her long-term (since 2010) blog, "Intersections – Poetry with Mathematics" (see link below). Celebrating the elegant languages of mathematics and poetry – and the creative pressures of constraints – Growney's blog postings share mathy poetry and commentary from writers around the world, and occasional poems of her own.

Website: <https://poetrywithmathematics.blogspot.com>

### Expectations

Don't expect two  
to be more than one.

Two can get too near,  
can interfere, can reduce  
each other to less than half.

One  
need not be  
the sum of its parts.

One hour  
is time enough  
to read the news, take a nap,

but sixty minutes  
are times too small  
for anything but frustration.

### Good Fortune

is good numbers—  
the length of a furrow,  
the count of years,  
the depth of a broken heart,  
the volume of tears.

# JoAnne Growney

## Symmetry

After my father died, my mother  
loved God and Esther Williams.  
Nine years old – and oldest – I was  
her right-hand helper; she took me  
to the movies when she went.

*Million Dollar Mermaid,  
Neptune's Daughter,  
Thrill of a Romance.  
Easy to Love,  
Dangerous When Wet.*

Circles of swimmers  
arch outward from centers,  
gently blooming lilies,  
supple bodies matched  
In perfect timing.

Seated in the theater I watched  
my mother dive without a splash,  
go deep to glide, turn, and rise;  
embraced by warm blue water,  
her heavy grief transmogrified.

\* \* \* \* \*

Years later, the synchronized swimmers  
are back in my mind as my daughter and I stroll  
cherry blossom weekend at the National Mall.  
We watch six women draw their angelfish  
up from the lawn. The kites shoot high

In one straight line, then dip and swoop,  
split in pairs to left and right, make loops.  
weave between each other  
like the fingers of two hands,  
pause and hover near the ground.

These kites glide from the women's arms  
like graceful dancing daughters—  
easy in obedience  
to tugging strings.  
And sometimes a kite falters.

# José Huguenin



José Huguenin is a Brazilian scientist and writer. He holds a PhD in Physics and is Professor at the Exact Science Institute of Fluminense Federal University. José's research area is quantum optics and information. He received a fellowship from the Brazilian National Council for Research to study quantum cryptography, gates, and computing protocols by exploring degrees of freedom of light. Literature has been José's great passion since early age. His poetry is intimately linked to science and mathematics. Through concrete poems and free verse, José searches for the meaning of life in its connections to scientific concepts. He is author of four poetry collections: *Vintém* (2013), *Experimentos poéticos* (2015, "Poetic Experiments"), *Koiah* (2019, "Speak" in Brazilian indigenous language), and *Universalidades* (2022, "Universalities"). He also published fiction, short stories, and books on photography and scientific dissemination.

Website: [www.josehuguenin.com](http://www.josehuguenin.com)

## Light

Singularity.  
Nothing is known.  
Photons are released  
From the nebulous sea of infinite energy.

It's hot.  
Within eternal infinitesimals of seconds,  
Particles will gain weight,  
They will collide, they will create,  
They will agglomerate,  
They will illuminate.

And just after a few billion years pass  
Across the blue horizon,  
In certain marshes,  
Children are nourished  
By the primordial soup  
Of light.

*translated from the Portuguese by the author and Sarah Glaz*

# José Huguenin

## Gravity

Makes the apple

fall.

Makes

the planet

turn

around the

sun

and change

seasons

without

our noticing.

Keeps us safe without ropes, hanging

in

nothingness.

Combined with mass, it makes weight.

Holds the arch,

humanity's archetype.

Makes the world lie heavy on our

backs.

But we were born with it. Enveloped in the atmosphere,

we are used to bear the pressure, the weight

of air over our

heads.

More difficult is to bear the weight of words.

*translated from the Portuguese by the author and Sarah Glaz*

# Gizem Karaali



Gizem Karaali is a Professor of Mathematics at Pomona College. She earned a Ph.D. from University of California, Berkeley, in 2004. Her mathematical research lies in the areas of representation theory, super quantum groups, and algebraic combinatorics. Her scholarly interests include humanistic mathematics, quantitative literacy, and social justice implications of mathematics and mathematics education. Gizem is a founding editor of the *Journal of Humanistic Mathematics* and a senior editor of *Numeracy*. She has organized panels, paper sessions, and poetry readings, and presented invited addresses to diverse audiences. She received a National Security Agency Young Investigator Award (2011-2013), served as chair of SIGMAA-QL (2017-2020), and is a Sepia Dot (2006 Project NExT fellow). In her spare time she likes traveling, reading and writing, and hanging out with her two children.

Website: <http://pages.pomona.edu/~gk014747/>

## Continuum Ad Infinitum

In the beginning were counting numbers:  
A baby playing with her toes,  
Her fingers and dominoes.  
Next she toddled after butterflies,  
Touching the berries, the kites,  
The cotton candy clouds in the skies.  
Finally came the stars of cool nights.

She learned to match pairs up,  
Shoe with sock, sock with foot.  
Pair friends and shake hands.  
Then came drums rolling,  
Innocent hearts beating,  
Stability of her happiness  
Founded in love everlasting.

Could there be more?

On the very day she turned fifteen  
She heard a heartbroken violin.  
That day she also saw  
Her very first rainbow.  
Raindrops were melting into the pond,  
Tears down the cheek silently,  
As oranges and greens blended into yellow.

Then she knew  
In her heart and in her mind  
Continuum is always here,  
Has always been,  
Will always be.  
You just have to follow the raindrop  
Into your heart's sorrow to see.

# Gizem Karaali

## To Maryam

I think I don't need gods,  
idols, role models.  
I think I grew out of it.  
"grow up buttercup!"

Soon as you get the medal,  
with no shame I backpedal.

You didn't want to be our face,  
just wanted to do your math in peace.

But then your name is Maryam,  
so it's possible I am  
a little obsessed.

You see,  
you remind me of  
my home, my city.

You see, all of us, who were  
once little girls in  
that part of the world,  
we are so proud.

Yes, they are your theorems,  
and yet they're ours, too.

Thank you.

## Slow Math Haiku

Let the juices mix.  
Simmer, let flavors sink in—  
Slow math is good math.

*Note:* Both poems on this page were inspired by Maryam Mirzakhani (1977-2017), Iranian mathematician and professor of mathematics at Stanford University. Mirzakhani was the first woman to win the Fields Medal in mathematics. *Slow Math Haiku* responds to Mirzakhani's description of herself as a "slow thinker" For more information about her life and contributions to mathematics see: <https://www.ams.org/profession/mirzakhani>.



# Lawrence Mark Lesser



Lawrence (Larry) Lesser is a UTEP Distinguished Teaching Professor at The University of Texas at El Paso. He has co-organized JMM mathematical poetry evenings, judged AMS student poetry contests, and his mathematical poems have appeared in venues such as *The Mathematical Intelligencer*, *Journal of Humanistic Mathematics*, *Amstat News*, *Journal of the Association of Mexican American Educators*, *Talking Writing*, *Teaching for Excellence and Equity in Mathematics*, *Bridges* anthologies, blogs, CAUSEweb.org, GAS video zine, Relatively Prime podcast, gallery exhibits, NPR radio, and a National Endowment for the Arts 'Big Read' event. He gave an invited poetry talk for the National Museum of Mathematics and his STEM poems have won prizes in 4 national organizations' contests. He also has awards for his STEM, Jewish, and secular songwriting. His STEM poems and STEM poetry papers are at his website.

Website: <https://larrylesser.com/poet-larry-ate/>

## Unexpected Expected Value Haiku

### *Deal or No Deal*

The banker offers  
less than expected value,  
as was expected.

### *62% Shooter's 1-and-1*

Expected number  
of points is 1, the outcome  
that is least likely!

### *Exchange Paradox*

Dogs swap bowls and beds,  
sure the other's better like  
Monty's other door.

### *Negative Expected Value*

Lottery tickets,  
extended car warranty,  
or health insurance.

### *Expectation in the Balance*

Where distributions  
balance like a see-saw with  
one's child more distant.

### *Unbiased*

It is hard to speak  
about expected value  
and avoid bias.

### *The Point*

I could reduce a  
distribution to EV,  
but that would be mean.

# Lawrence Mark Lesser

## Permutation

“Hey! You!  
I demand  
you stop  
and give  
me right  
now right  
here a  
permutation!”

“Importunate!”  
he replied.

## Matched Pairs

The ends of lines  
Are grouped by rhymes;

Within each pair,  
Two treatments shared.

If something lurks,  
This plan still works,

But it takes time  
To match the lines

And if one leaves....

## Convergence

Incomprehensibilities  
rationalizing

architectures  
generate

nautilus  
ratio

shell  
may

fit  
in

as  
I

*Note: Matched Pairs* uses end-rhyme couplets to convey tradeoffs of a design with matched pairs. In *Convergence*, each of the 6 couplets consists of words whose number of letters are consecutive Fibonacci numbers. As the words converge down to the one-letter word “I,” the couplet ratios in reverse sequence converge towards the Golden Ratio,  $\Phi$ .

## Dan May



Daniel May is an Associate Professor of Mathematics at Black Hills State University in Spearfish, South Dakota, where he enjoys spending the majority of his time teaching all levels of undergraduate mathematics to primarily math education majors. In the gaps of that teaching load, he explores connections between mathematics and poetry. He is grateful for this community of mathematical poets who engage in similar pursuits. He also thinks about the combinatorics of card games such as SET and *Spot It!*. Dan spends his summers working with Bridge to Enter Advanced Mathematics (BEAM), a mathematics enrichment program for underserved public middle school students in New York City and Los Angeles. Dan also moonlights as a musicologist, and has presented several seminar talks on a variety of musical genres at his university.

Website: <https://talkingwriting.com/daniel-may-poem>

### A Cadae on Waking to a Campfire

Violet  
was  
the sky. But when

you

wake in the purple  
night, may you always find a red flame  
burning.  
A circling of home.

May the pearl moonlight

set aglow  
snow-greened grass below  
your dancing feet at midnight. May your  
violence only be found in  
orange embers and grey ash.

*Note:* A *cadae* is a poem structured by the mathematical constant  $\pi$  in two distinct ways: it possesses five stanzas of 3, 1, 4, 1 and 5 lines (in that order), and the poem's 14 lines consist of 3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5, 8, 9, and 7 syllables (in that order). The name of the form comes from the letters' respective positions in the alphabet.

# Dan May

## One Year of Visiting an Aspen Glade

In the leafless muddy spring,  
the aspen glade feels no shame  
about what is missing.

Which is not a metaphor for me to weigh:  
the trees belong to the trees. I leave them alone.

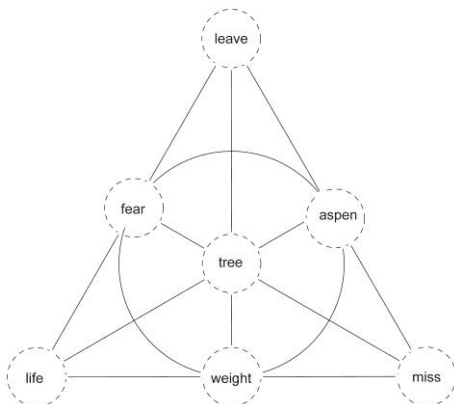
Summer comes verdant, leafy green  
shade for mushrooms and shrews and fearless  
short ones. New life is not proud.

Lived accomplishment was my birthright.  
Aspis means shield, but the trees are not here  
to protect me.

Yellows browning and falling,  
trees have no fear of what they are about to lose.  
Preparation yes but not missing  
the longer days.

In my year of coming here  
I have learned nothing.  
Only misunderstanding.  
The cycle of life is a spiraling down. A weightlessness.

Frozen branches thin and waiting, but  
not weighty. Not afraid.  
The aspen have no breath to billow out into the subzero air.



*Note: One Year of Visiting an Aspen Glade is structured by the Fano plane, which is represented by the figure to the left. Each of the poem's seven repeated words corresponds to one of the seven points of the Fano plane. The seven stanzas correspond to the seven lines of the Fano plane: the three sides of the triangle, the three altitudes, and the inscribed circle. According to the geometry of the Fano plane, any two of the repeated words appear together in exactly one stanza, and any two stanzas share exactly one of the words between them. More information may be found in: *Galaxies Containing Infinite Worlds: Poetry from Finite Projective Planes*, by D. May & C. H. Wika, Proceedings of Bridges Baltimore, 2015. <http://archive.bridgesmathart.org/2015/bridges2015-259.html>*

# Iggy McGovern



Iggy McGovern is Fellow Emeritus in Physics at Trinity College, Dublin. He is also a poet, blending formal structure, humor and science. Iggy has published with Dedalus Press three poetry collections: *The King of Suburbia* (2005), *Safe House* (2010) and *The Eyes of Isaac Newton* (2017), and an anthology *20/12: Twenty Irish Poets Respond to Science in Twelve Lines* (2012). *A Mystic Dream of 4* (Quaternia Press, 2013) is his verse biography of the 19<sup>th</sup> century Irish mathematician and poet, William Rowan Hamilton. His most recent publication *Making Waves* (Quaternia Press, 2019) is a verse biography of the Austrian physicist Erwin Schrödinger who was a refugee in Ireland 1939-56. Among his awards are: the Glen Dimplex New Writers Award for Poetry, the Hennessy Award for Poetry, and The Ireland Chair of Poetry Bursary.

Website: <http://iggymcgovern.com>

## Two Sonnets from *Making Waves*: A Verse Biography of the Physicist Erwin Schrödinger

### Ludwig Boltzmann

Perhaps I hear his name when I resume  
My former chair, with Mach out of the way,  
(Ironic that I'm also to exhume  
That old fool's classes in Philosophy)

It could have been somebody from his school,  
A teacher bragging of his rising fame?  
Herr Neumann maybe, waving his slide rule  
To put a second Boltzmann in the frame.

Just one more name to add to that long list  
Of those I disappointed, children, wife...  
No one can say why I could not resist  
The darkness that closed in upon my life.

I hope he will exhibit more backbone;  
Perhaps a new equation carved in stone.

# Iggy McGovern

## Herman Weyl

Great thinkers always value isolation,  
Alpine resorts are known to work the best.  
But few would want to share that destination  
With some 'old girlfriend' cosy in the nest.

It does not do to dwell upon her role  
Perhaps those were her pearls lodged in each ear?  
How would it differ if he'd been the sole  
Foot-soldier - just another mountaineer?

When Moses-like he came down from The Mount  
His tablets were in need of some repair  
To square the mathematical account,  
Send relativity into thin air.

We both learned to distrust causality  
And shared an Eastern mystic empathy.

### *Notes on both sonnets:*

Erwin Schrödinger had been looking forward to attending the lectures of the mathematical physicist Ludwig Boltzmann at the university, but the latter had resigned (subsequently taking his own life) while Erwin was in his final school year. The physicist and philosopher, Ernst Mach, and Boltzmann argued over the existence of atoms. Boltzmann's statistics remained a key reference point in Schrödinger's research; Boltzmann's seminal relation for entropy [  $S = k \cdot \log W$  ] is carved on his headstone.

Schrödinger's 'old girlfriend' mentioned in the second sonnet has not been identified and it is fanciful to suggest that the pearls he habitually used as noise suppressors belonged to her. His time in the Alpine resort of Arosa was certainly fruitful, but his original relativistic wave equation did not provide the correct solution of the hydrogen spectra; the exact cancellation of relativity and then unknown electron spin effects meant that the non-relativistic equation gave the correct solution. The mathematician, Herman Weyl, helped Schrödinger with the mathematics that underlies his eponymous wave equation.

## Tom Petsinis



Tom Petsinis was born in Macedonia and immigrated to Australia as a child. He is a novelist, playwright, poet, and mathematics adviser at Deakin University, Melbourne. Tom has published nine books of poetry, including *Naming the Number*, *Four Quarters*, and *isolation* (2021) — poems based on the COVID experience. His plays include *The Drought*, *Salonika Bound* and *Hypatia's Circle*. Among his works of fiction are the novels *The Twelfth Dialogue*, *The French Mathematician*, *Quaternia* and *Fitzroy Raw*. Forthcoming works include the novels *Fog* and *Plato's Number*, the play *Zorba's Last Dance*, and the narrative prose-poem *Shinoko and the Silkworm*. Tom's work has been translated into a number of languages. His literary honours include the Wesley Michel Wright Poetry Prize, the Wal Cherry Playscript of the Year Award, and a nomination for South Australian Premier's Award.

Website: <http://tompetsinis.com/>

### Beatitudes of Chance

Blessed are the blind dice —  
They're above temptation.  
Blessed is the unseen card —  
It's in a state of innocence  
Until the croupier's touch.  
Blessed, the two-up coins —  
The wisdom of their spin  
Marries heaven and hell.  
Blessed, the mad marble  
Riding the roulette wheel —  
It's ecstatic in uncertainty.  
Blessed, the wild numbers  
Before the Sabbath's draw —  
They tutor God in equality.

# Tom Petsinis

## Father's Advice

Farkas Bolyai to his son János

Avoid the fifth postulate like the plague:  
You're intelligent, virile, in your prime,  
Pursue figures with curved bust and hip  
Not this pair of lines intersecting a third.  
I've seen its effects on idealists like you,  
Estranging them from family and friend,  
Their health consumed and minds spent –  
A compulsion ruinous as cards and drink.  
Say, by some chance, you were to prove  
It's really independent of the other four,  
Be assured it wouldn't extend geometry.  
Go, stroll the boulevard lined with trees  
Reflected in spheres covering the lamps  
And in flared ends of brass instruments.

## Son's Reply

János Bolyai replies to his father Farkas

The thirteen duels I'd fought before noon,  
Playing Liszt on the violin between shots,  
Were a preparation for my final challenge:  
The thirteen gospels of Euclid's *Elements*.  
I studied the parallel as if a mortal enemy,  
When, out of nothing, the vanishing point,  
(Perhaps death's proximity enlightens us)  
I negated in a blink the devilish postulate  
And a new Book of Revelation appeared,  
(Which will lead to another Reformation)  
With images of heaven's hyperbolic space  
Grasped not in penance but intellect's pride,  
Where a far more liberating Trinity exists,  
Whose angels render two right-angles less.

*Note:* János Bolyai (1802- 1860), following in his father's footsteps, attempted to prove or disprove Euclid's fifth axiom, *The Parallel Postulate*. In the process, he discovered the non-Euclidean geometry called *hyperbolic geometry*. *Hyperbolic geometry* was also discovered, independently and almost simultaneously, by both Carl Friedrich Gauss (1777-1855) and Nikolai Lobachevski (1793-1856).



# Eveline Pye



Eveline Pye worked as an Operational Research Analyst for Nchanga Consolidated Copper Mines, in Zambia, for almost ten years, and was a Statistics Lecturer at Glasgow Caledonian University, in Scotland, for over twenty years. Her mathematical and statistical poetry has been published in a wide range of literary magazines, newspapers and anthologies. In 2011, *Significance Magazine*, the joint publication of the Royal Statistical Society and the American Statistical Association featured her work in education and published a selection of her poems as part of their *Life in Statistics* series. She served as a director of the Scottish Writers' Centre. A collection of her poems about Zambia, *Smoke that Thunders*, was published by Mariscat Press in 2015. Her second collection, *STEAM*, containing poems of science, technology, engineering and mathematics, was published by Red Squirrel in 2022.

Website: <https://onlinelibrary.wiley.com/enhanced/doi/10.1111/j.1740-9713.2011.00510.x>

## The Shapes We Walk In

At the lights, four people form the vertices  
of a two metre square, stand waiting  
for green, then snake downhill, curving  
away from another serpent coming up.

A straight-line queue outside the mall,  
each person, equidistant in a mask,  
bows their head over cupped hands  
receives a blessing of anti-viral gel.

Inside, shoppers deviate to avoid collisions,  
each trajectory irregular, straight lines  
followed by semi-circular deviations  
magnetic repulsion, contact could kill.

Our conversations, muffled like children  
talking behind hands in church. Bluetooth  
measures the social distance between us  
– parallel lines can never touch.

# Eveline Pye

## Coastline Paradox

Look at Great Britain from the sky,  
see its coast curve inwards, outwards,  
zigzag along craggy rocks, discontinue  
at inlets, extrude into ocean and sea.  
Closer, bays, coves, nooks, crannies,  
zoom down to the microscopic world,  
see increasing complexity in nature's fractals  
like the iterations of a Koch snowflake.

We tried to measure the coastline with maps  
but the bigger the scale, the longer it became.  
In the end, we had to accept the paradox  
– this island has finite area, infinite perimeter.  
And still, the length of the coast changes:  
we were once a peninsula attached to Europe.

## The Art of Numbers

*Beauty is truth, truth beauty.*

Keats

We understand Blake's awe of tigers' stripes  
so why not awe at Gaussian curves?

There is no great beauty in a single number,  
in a four or a seven or an eight, but it's the same

with the alphabet. Where is the wonder in a *b*  
or a *k* or a *t*? However, sublime combinations,

equations with letters *and* numbers, explain  
the fundamental truths of our universe.

## Stephanie Strickland



Stephanie Strickland's eleven books of poetry include *How the Universe Is Made: Poems New & Selected* (Ahsahta Press, 2019) and *Ringling the Changes* (Counterpath, 2020), a code-generated project for print based on tower-bell ringing. Her twelve collaborative works of digital literature include *Liberty Ring!*; *slippingglimpse*, which maps text to Atlantic wave patterns; the *Vniverse* app for iPad; a poem generator, *Sea and Spar Between*, accompanied by *Duels—Duets*, a poem reflecting on collaborative composition and *cut to fit the toolspun course*, a glossed code version; *House of Trust*, an homage to free public libraries; and *Hours of the Night*, an MP4 PowerPoint poem probing age and sleep. Strickland has been granted NEA, NEH, and NYFA Arts fellowships. Her digital poems have been featured at the Library of Congress and Bibliothèque Nationale de France.

Website: <http://stephaniestrickland.com>

∞ INFINITE ways to change continuously lapping licking staying  
at ( near ) equilibrium

7 but    seven stable ways to change abruptly                    *jump*  
Hell's kitchen smoke plume fire cat  
something's got to give it *duh*  
does . . . spectacular  
collapse  
    . . . or the baby's nap . . . unfolding

stably disappearing stability a  
ha downdraft snowflake oh also snow  
ball rolling into mind soot chippiness ice

utter irrelevance  
    scale | laws | causes | radiation  
to the form to  
    the gliding shape the wind the word the ( class 4 )  
computation

# Stephanie Strickland

## The Infinite Stops Between Our Fingers

in a down-

slanting shaft through the laundry room window  
rectangle of mud-splashed glass near a stone basement ceiling

motes in the beam

seen

so differently Democritus      Brown      Brownian motion  
*mathematized—*

in 1905

who made the connection

to photoelectrics

to blackbody radiation?

( that would be Einstein )

mote

seen

*& unseen*      so differently—a quantum  
entanglement      field      dot      foam  
at last

perhaps

gravity's quantum?

heard ( for real ) in 2015

gravity      waves      *sing*

ringing      ( *hringan!* )      between our fingers

“that simple chirp,

which rose to the note of middle C before abruptly

stopping”

## About the Artists



After beginning his working life as an experimental physicist, Robert Fathauer currently runs the small business *Tessellations*, which includes *The Dice Lab* and the publication of the Bridges organization books. His interests include recreational mathematics, designing and producing math-related products, writing books on tessellations and related topics, and creating and curating exhibitions of mathematical art. While he created two-dimensional art for many years, in recent years his artworks have mostly been abstract ceramic sculptures.

Website: <http://robertfathauer.com/>



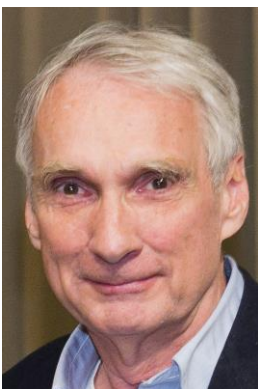
Gabriele Meyer was born in Germany, and received a master's degree in computer science and a Ph.D. in mathematics from Cornell University. She taught computer science at the University of Buffalo, before settling in 2000 at the University of Wisconsin, Madison, teaching mathematics. In 2021, Gabriele became Lecturer Emerita at the University of Wisconsin. She is passionate about crocheting hyperbolic surfaces and lino printing, and exhibits her art every year at JMM and Bridges conferences.

Website: <https://people.math.wisc.edu/~gemeyer/>



Mark Sanders has been creating Surrealist-influenced collages since 2008. His work has been included in a number of international publications and exhibitions, as well as mail-art projects. Since 2016, Mark has also been producing collaborative work, developing visual responses to texts provided by poets from around the world. In 2017, he added ceramics to his creative portfolio. Mark Sanders lives in Northamptonshire (styled "the Rose of the Shires") in England.

Website: <https://www.instagram.com/peaceandoutrage/>



Julien Clinton Sprott, born in Memphis, Tennessee, received his B.S. in physics from the Massachusetts Institute of Technology and his Ph.D. in physics from the University of Wisconsin. He worked at the Oak Ridge National Laboratory for several years before returning to the University of Wisconsin as faculty member in the physics department. In 2008, he became an Emeritus Professor of Physics. His research is in chaos and complex systems.

Website: <http://sprott.physics.wisc.edu/sprott.htm>

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## For interested readers, additional collections of poems with strong links to mathematics

- Bridges 2022 Virtual Poetry Anthology*, Sarah Glaz (coordinator), Susan Gerofsky (guest host).  
<https://www.youtube.com/playlist?list=PLBMMY3UMNbPIUz-2WS7AwvtmOiLTsRecY>
- Poetry in the Glade: Bridges 2021 Fib Collection*, Sarah Glaz (curator), Journal of Humanistic Mathematics Poetry Folder, January 2022. <https://scholarship.claremont.edu/jhm/vol12/iss1/35/>
- Bridges 2020 Poetry Anthology*, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2020.
- Bridges 2018 Poetry Anthology*, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2018.
- Bridges 2016 Poetry Anthology*, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2016.
- Bridges 2014 Virtual Poetry Reading*, Sarah Glaz (editor), Mike Naylor (guest host), Steve Stamps (video editor), <https://www.youtube.com/watch?v=fcaL2PXuy7U>
- Bridges 2013 Poetry Anthology*, Sarah Glaz (editor), Tessellations Publishing, Phoenix, AZ, 2013.
- Intersections – Poetry with Mathematics*, 2010 – present, an online blog maintained by JoAnne Growney, with more than 1500 postings. <https://poetrywithmathematics.blogspot.com>.
- Strange Attractors: Poems of Love and Mathematics*, Sarah Glaz & JoAnne Growney (editors), CRC Press /A K Peters, Wellesley, MA, 2008.
- Numbers and Faces: A Collection of Poems with Mathematical Imagery*, JoAnne Growney (editor), Humanistic Mathematics Network, Claremont, CA, 2001.
- Verse & Universe: Poems About Science and Mathematics*, Kurt Brown (editor), Milkweed Editions, Minneapolis, MN, 1998.
- Songs from Unsung Worlds: Science in Poetry*, Bonnie Bilyeu Gordon (editor), Birkhäuser, Boston, MA, 1985.
- Against Infinity: An Anthology of Contemporary Mathematical Poetry*, Ernest Robson and Jet Wimp (editors), Primary Press, Parker Ford, PA, 1979.
- Imagination's Other Place: Poems of Science and Mathematics*, Helen Plotz (editor), Thomas Y. Crowell, New York, NY, 1955.
- Songs of Science: An Anthology*, Virginia Shortridge (editor), Marshall Jones Co., Boston, MA, 1930.

