The BIG Newsletter

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Business, Industry, and Government Special Interest Group of the Mathematical Association of America

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Message from the Chair

Dear BIG SIGMAA Members,

I'm thrilled to welcome you to this edition of our newsletter. Seeing our community thrive, fueled by your passion and dedication, fills me with pride. As a special interest group within the MAA, BIG SIGMAA is dedicated to connecting mathematicians working in business, industry, and government. We aim to create opportunities for networking, professional growth, and the advancement of our profession. We're looking forward to the events we have planned, including a special session and a guest lecture at MATHFEST 2024, and we encourage your active participation.

We are also calling for your BIG ideas! Your input is invaluable in shaping our activities, from panel discussions to speaker sessions. Please let us know what interests you and how you'd like to get involved.

A special thank you goes to Caroline Maher-Boulis and Aaron B Luttman for their dedicated service as Chair and Secretary/Treasurer, respectively. Their commitment has been pivotal to our success, and we wish them well in their future endeavors.

Thank you for being part of BIG SIGMAA. Your contributions truly make a difference, and I look forward to what we will achieve together.

Sincerely,
Vinodh Chellamuthu,
Chair, BIG SIGMAA

Interview with Jonah Reeger

Jonah Reeger is an Assistant Professor of Mathematics, Department of Mathematics and Statistics, Air Force Institute of Technology (AFIT). He completed a BS in Mathematical Sciences at the United States Air Force Academy, a MA in Computational and Applied Mathematics at Rice University, and a PhD in Applied Mathematics at the University of Colorado at Boulder. Jonah served as an active-duty member of the United States Air Force for eleven years, working on technical solutions to some challenging problems relevant to the Department of Defense. He has held research positions in federal civil service at the Air Force Research Laboratory and served as faculty at both AFIT and the United States Naval Academy. Most of his free time is spent enjoying the outdoors with his wife and two children.

What drove you to focus on mathematics?

I had originally intended to follow in the footsteps of my grandfather and become an electrical engineer, and even began my undergraduate education with that major in mind. It quickly became clear that I enjoyed the math courses I was taking much more, and that much of what interested me about engineering was the mathematics behind it. While completing my education I also realized that I could work across many disciplines through the common language of mathematics. This has certainly been my experience since then!

How did your time serving as an active-duty officer in the United States Air Force impact your career as a mathematician?

I would suggest that every impact was positive. The Air Force does not have a career field specific to mathematicians. This opened opportunities to explore disciplines like Operations Research and various engineering fields. Much of my time was spent managing projects with clear significance to national security. Often this meant learning new subject areas in great detail, and then reviewing and critiquing the work of other scientists and engineers. I learned to manage funding and make difficult decisions about the direction of certain technology areas that fit into much larger defense efforts. This sometimes meant sacrificing efficiency or performance to ensure the piece that I was working on could be integrated into the overall effort. Further, the training I received in leadership has benefited me in the classroom, on project teams, and beyond.

What lessons did you learn while working for a Department of Defense Laboratory?

The lessons I learned at the Air Force Research Laboratory (AFRL) were many and incredibly important for deciding my future. For instance, although I had to learn the details of the subject areas I was working in, I was also forced to focus on the big picture. At the level I was managing projects, I was only considering a small piece of a much larger technological effort, and the goal of integrating this piece into

a larger effort ensured that I was ever aware of what the other project managers were doing with their technologies and how they were intended to fit together.

Do any of the lessons learned at AFRL help you in Academia?

Absolutely, I am now more capable of discerning what is truly important when designing a course. Prior to spending time at AFRL I had difficulty connecting material to application. I can now draw on all my experiences in the labs to create very meaningful connections to applications for students from nearly any discipline taking my classes. My ability to manage research projects and funding has also improved. Working at a government institution requires an understanding of how our federal government obligates and spends its money. The time I spent as a defense acquisition professional was invaluable for gaining a deep understanding of the funding process.

What would you recommend to professors who want to work in the government sector for a while?

I would absolutely recommend the experience. It will expose you to possible funding opportunities that you may not have been aware of, ground both the research and teaching that you do in applications of interest to many, especially taxpayers, and, on top of all that, help you discern if there is an alternative to the job of professor that you might appreciate more.

What would you recommend students do to be competitive for similar jobs?

Develop an appetite for continued learning. It is unlikely that, as a mathematician, you will enter a position at a defense laboratory and perform research on subject areas that you are entirely familiar with. Every position that I held in the labs had a long period of initial learning associated with it, so my informal education never stopped. Also, find ways to demonstrate your qualities as a leader. Even as a scientist, you will be expected to lead others, either directly as a supervisor or indirectly as a manager of a technical area or project. Advancement certainly requires a demonstration of quality contributions and effective leadership.

What piece of advice would you give a student who is not sure of what they want to do yet?

I think of education in mathematics, especially the applied sort, as a conduit to all sorts of opportunities. This is, again, because mathematics is a language that unites many and varied disciplines. While you are still a student take advantage and learn as much as you can about as many different topics as you can. Try out research and teaching and see if you enjoy either. Seek out internships and other sorts of on-the-job training. Look for opportunities that are outside of your comfort zone to see if you thrive in challenging situations. Hunt for interesting problems that do not have a clear solution, as these are most of the important problems that still need addressed.

What would you recommend math professors to do so that they prepare their students well for a career in industry?

Be aware of internship and research opportunities across disciplines that may expose your students to other fields. Take some time to make meaningful connections to applications that are relevant and significant and, if you can, connect them to your experiences.

Meet Me on the Bridge Between Mathematics and Poetry

By Gregory E. Coxson

I know what you are thinking. An article on Math and poetry is a bit far afield for the BIG community. I get it. I do. I work as an engineering instructor at the Naval Academy. Before that, I worked as a radar analyst in industry for years. But my participation for years in BIG SIGMAA required annual trips to the Joint Math Meeting, and occasionally to MathFest. The latter is where a whole parallel world opened up for me.

A decade or so ago I was at MathFest in Lexington, Kentucky, perusing the offerings at the CRC Press booth at the book exhibits. A red-covered book entitled {\bf Strange Attractors}, by Sarah Glaz and JoAnne Growney, caught my eye. Intrigued, I picked it up and read that it was a book of mathematical love poetry. My reaction -- ``isn't poetry hard enough, without bringing mathematics into it?'' (Not to mention love!). I could not bring myself to buy the book at that moment, but ultimately I had to buy it.

I soon learned that JoAnne Growney lived in the city where I worked, Silver Spring, Maryland. And that she ran (and runs still) a web log called ``Intersections -- Poetry with Mathematics'', exploring the intersection and interaction between Mathematics and Poetry. More on that (I am sure) in later paragraphs.

I have always like complexity in things. No nice, pat, easy worlds for me. And I am sure I am not alone among applied mathematicians in my love of words and etymologies, puns, and puzzles. The ways in which Mathematics and Poetry interact, cooperate, push against each other, is rich and complex and diverse. I was an easy hook.

There are many forms of mathematical poems. Some involve syllable counts (such as one that JoAnne likes a lot, the so-called ``square poems'', or the ``Fibs'' and “Piems”), and forms that permute the ending words of stanzas (such as the sestinas), poems that pose math problems, poems by mathematicians, poems about mathematicians and how they teach and solve problems. I could continue, but do not want to test your patience.

To keep you, BIG mather, engaged, I would like to start out by highlighting a poet I learned about early on, whose poetry ventures into not only mathematics, but applied mathematics. He was Howard Nemerov (1920-1991), brother of the famed photographer of the outsiders and outcasts, Diane Arbus (1923-1971). The appearance of mathematical concepts in some of his poems is due, I expect, to his service as a pilot on United States Army Air Force platforms (in the Royal Canadian unit) during World War II, after which he pursued a PhD in English. My favorite of his poems might be the following, ``Figures of Thought'', which celebrates the logarithmic spiral (something I had encountered in my work in industry). Here is the first stanza of that poem:

Figures of Thought

To lay the logarithmic spiral on
Sea shell and leaf alike, and see it fit,
To watch the same idea work itself out
In the fighter pilot's steepening, tightening turn
Onto his target, setting up the kill,
And in the flight of certain wall-eyed bugs
Who cannot see to fly straight into death
But have to cast their sidelong glance at it
And come but cranking to the candle's flame -- ''

Closer to my particular world of radar and electromagnetic theory, James Clerk Maxwell (1831-1879), Scottish mathematician and unifier of electromagnetic field theory, also wrote poems. As close to a Renaissance Man as anyone, he would use poetry to tease his Cambridge colleague Peter Tait. If you have not seen it already, check out the November 2014 issue of AMS Notices, which has an article by Daniel Silver on how Maxwell employed the style and sense of a Nursery Rhyme to play around with Tait's interest in Knot Theory, using twisty wordplay. Ironically, Maxwell himself found himself drawn to contribute to the field; he is said to have discovered the set of Reidemeister Moves years before Reidemeister. The article is entitled ``Knots in the Nursery: (Cats) Cradle Song of James Clerk Maxwell''.

If you are ready to explore more, you need to seek out JoAnne Growney's Intersections web log. You will find there a rich and long-running exploration into the ways Mathematics and Poetry interact.

Of the many points of interaction between Math and Poetry, one of my favorite comes from the often-told story of the discovery of the general solution to the cubic equation. The story varies depending on the source, but involves Scipione del Ferro (1465-1526), Tartaglia (1499-1557) and Cardano (1501-1576). Most versions agree that somehow after del Ferro's 1526 death, the solution became known by Tartaglia, who tried to conceal it from Cardano, who was eager to learn it. Tartaglia was moved to write the method down as a poem written in Italian. Eventually, through insistent requests (perhaps "badgering" is an apt word), Cardano learned the method and became the first to publish. Here is Tartaglia's poem (has a guide to solving a math problem ever looked so good?):

Quando chel cubo con le cose appresso
Se agguaglia à qualche numero discreto
Trouan dui altri differenti in esso.

Dapoi terrai questo per consueto
Che'llor produtto sempre sia equale
Alterzo cubo delle cose neto,

El residuo poi suo generale
Delli lor lati cubi ben sottratti
Varra la tua cosa principale.

In el secondo de cotestiatti
Quando che'l cubo restasse lui solo
Tu osseruarai quest'altri contratti,

Del numer farai due tal part'à uolo
Che l'una in l'altra si produca schietto
El terzo cubo delle cose in stolo

Delle quai poi, per communprecetto
Torrai li lati cubi insieme gionti
Et cotal somma sara il tuo concetto.

El terzo poi de questi nostri conti
Se solue col secondo se ben guardi
Che per natura son quasi congionti.

Questi trouai, \& non con paßi tardi
Nel mille cinquecentè, quatroe trenta
Con fondamenti ben sald'è gagliardi

Nella citta dai mar'intorno centa.

In a translation by Friedrich Katscher, the last two stanzas translate in the following way. The author was clearly trying to ensure that his work and his priority would be respected:

I found these, & not with slow steps,
In thousand five hundred, four and thirty
With very firm and strong foundations

In the city girded around by the sea.

Over time, I found myself sharing with JoAnne Growney mathematical poems I would find. At times, she would post them on her web log. This led to an invitation to be in a panel discussion of poetry in Bethesda, Maryland. For that event, I tried .. hard .. to write something presentable. I must report that while I did write something, and did bring it to the discussion, I ended up punting when the pressure was on. Still, I have found myself at times needing to put down in poetry memories of experiences I have had while exploring this often difficult, sometimes crazy, always very human, world of Mathematics. Here is one that I wrote, and JoAnne posted:

My PDE Professor

He sometimes wore those marine corps sweaters
The ones in army green, that look the best
On more triangular figures than his.
And then those ridiculous epaulets
How did his wife let him out of the house?

And those high-top Converse sneakers,
Usually in bright reds or yellow,
That were often untied, or laces loose.
One time a shoe came off, and sat up there
Like a proposition he never used.

And then there was his hair, that tangled mat
Of dark curls, a pate cover on a hinge.
One time the lid flipped over, and flapped there,
Distractingly, off the side of his scalp.
We kept on writing, trying not to stare.

It remains a mystery to me, how,
When I opened my transcribed notes each night,
They were all so intricate and precise,
Like movements of a mechanical clock.
In the end, that was the lasting lesson.

Let me just say: poetry is hard, and no matter what a poem's intentions or style, the writer is tempting exposure. ``Respect'', to all the Math poets out there. Those who would like to try writing poems, and are new to it, would have an easier time by following JoAnne Growney's oft-offered suggestion to try one of the syllable-counting forms, mentioned earlier in this piece. A ``Fib'' is a poetic form in which successive lines of the poem obey syllable counts that follow the Fibonacci sequence. Similarly, one might write a ``Piem'', in which the syllable counts follow the digits of the irrational number $\pi$. You might also try a ``square poem'', in which the number of lines in the poem is the same as the number of syllables per line (I certainly could have benefitted by listening to her advice). Here is one of JoAnne's square poems, which also expresses something about the number of women in Mathematics and STEM fields:

Counting the Women

When I look around
the room – if I don't
know in one glance how
many women are
there with me, I smile.

One of the more famous figures to come of my part of suburban Maryland was Benjamin Banneker (1731-1806), an African-British (later, African-American) tobacco farmer from the region around what became Ellicott City. Banneker was the first African-American individual to gain a United States government contract (in 1791), to support Andrew Ellicott (1754-1820) in finishing the realization of the design created by Pierre L'Enfant (1754-1825) for the city of Washington. An amateur astronomer and mathematician, Banneker was also the first to publish an Almanack in the state of Maryland. Some issues of the Almanack include math puzzles he wrote in poetry. These poems exemplify another way in

which Mathematics and Poetry can come together. Read the following, and ask yourself if any word problem you have created matches this one in color and design:

The Puzzle of the Cooper and the Vintner

A cooper and vintner sat down for a talk,
Both being so groggy that neither could walk;
Says cooper to vintner, "I'm the first of my trade,
There's no kind of vessel but what I have made,
And of any shape, sir, just what you will,
And of any size, sir, from a tun to a gill."
"Then," says the vintner, "you're the man for me.
Make me a vessel, if we can agree,
The top and the bottom diameter define,
To bear that proportion as fifteen to nine,
Thirty-five inches are just what I crave,
No more and no less in the depth will I have;
Just thirty-nine gallons this vessel must hold,
Then I will reward you with silver and gold --
Give me your promise, my honest old friend."
"I'll make it tomorrow, that you may depend!"
So, the next day, the cooper, his work to discharge,
Soon made the new vessel, but made it too large;
He took out some staves, which made it too small,
And then cursed the vessel, the vintner, and all.
He beat on his breast, "By the powers" he swore
He never would work at his trade any more.
Now, my worthy friend, find out if you can,
The vessel's dimensions, and comfort the man!"

Iggy McGovern is an Irish physicist-poet I have enjoyed discovering. McGovern wrote an entire book (**A Mystic Dream of Four**) in a series of sonnets, tracing, at times into intimate detail, the life of fellow countryman William Rowan Hamilton (1805-1865). Hamilton was the discoverer of the quaternion, an algebraic entity used in many places today, from computer game design to kinematic models of satellites and missiles. the story of Hamilton's discovery of quaternions while on a walk with his wife, in one of the more famous stories of 19th-century mathematics. A hint at McGovern's puckish wit and use of mathematical subjects is seen in the title of his poem "On the determination of the Golden Ratio ϕ by a series of theatrical approximations" (from his book **Safe House**).

For the statisticians reading this, you are not to be left out. One poet you should seek out is the Scottish statistician Evelyn Pye. Here is one of her poems pointing out the peculiar way the world views numbers:

The Art Of Numbers

We talk of beautiful words, art, buildings
when they're not part of the natural world.
An x in Algebra is no more abstract than
an idea in philosophy, just more useful.

It can't be use that makes the difference.
Keats found beauty in a Grecian urn,
surely practical at some stage of its life:
no one is blind to the beauty of symmetry.

We understand Blake's awe of the tiger's stripes.
Why not awe at Gaussian curves? Of course,
I know 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? It's sublime combinations,
relationships between letters
that create words and sounds we love.

Look. See the numbers shine in my eyes.

Poetry can be about mathematics, and also help build a bigger tent. Jessy Randall, a librarian at Colorado College, has published a small book of poems, each one about a different female mathematician or scientist, some living and some not, and the impossible contributions they have made against the odds. The book is (intentionally) ironically titled **Mathematics for Ladies -- Poems on Women in Science**. Among my favorites is this one:

Charlotte Angas Scott (1858-1931)

When I was at college for Mathematics
I attended Cambridge lectures

From behind a screen, of course.
So the male students couldn't see me.

(I might have distracted them.)

And so I had to picture all the numbers
in my head. I had no view of the board.

Maybe the strain of all that imagining
is why I tied for 8th place on the exam.

Being female, I was not allowed
to attend the ceremony.
Nor could my name be read aloud.

But when the list got to 8th place
the men called out SCOTT
and cheered, and waved their hats.

Or so I'm told.
I wasn't there.

I hope by now you agree that there is interaction between Mathematics and Poetry, and that combining the two can be interesting, inspiring and useful. I will stop here.

But … make sure to check out some of the many other wonderful practitioners, examples, and sources of mathematical poetry. Be sure to check out Rita Dove's short, sublime poem "Geometry". Seek out Martin Gardner, and Lewis Carroll, Sarah Glaz and Wislawa Szymborska. Make time for Miroslav Holub, Carol Dorf, and Emily Grosholz. And when you have run through every such poet and source you can think of, return to JoAnne Growney's Intersections blog https://poetrywithmathematics.blogspot.com/ to pick fresh leads.

To learn more about BIG SIGMAA, please visit http://sigmaa.maa.org/big/BIG_SIGMAA_Home.html

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Interested in contributing to the newsletter? Contact Jan Rychtar at rychtarj@vcu.edu