From *SIAM News*, Volume 37, Number 10, December 2004

Bursts of Poetic Creativity Enliven Two Mathematical Careers

By Sara Robinson

It is true that a mathematician who is not also something of a poet will never be a perfect mathematician.

—Karl Weierstrass

Prologue

A few hours north of Sacramento, the flat plains of the Sacramento valley abruptly give way to the peaks and valleys of the Siskyou mountains. There, skirting Shasta Lake in a second-hand Nissan, two mathematicians—one a young, Oxford-educated British graduate student, the other his Dutch thesis adviser—were translating a mathematical poem into English from the original ancient Greek.

"What do you think of this?" asked Steven Hillion, the student, reciting a translated couplet.

"Oh, but it is just so ugly!" exclaimed Hendrik Lenstra, his adviser, before suggesting an alternative. And so, back and forth it went, as the car crested another mountain pass and dropped down into Ashland, Oregon, home of one of America's best known Shakespeare festivals.

After three days of Elizabethan inspiration and modern perspiration, the result was this:

> Apples in baskets did the Graces bear,
> in like amounts. The Muses nine were there
> and, asking, they gained each an equal share.
> All nine and three now had the same. Declare
> how much was given, how they fared so fair.

—*Anthologia Palatina*, xiv.48
Translated by H.W. Lenstra jr.
& S.J.P. Hillion, 1996

The First Collaboration

For Hillion and Lenstra, what began as a temporary adviser–advisee interaction has become an ongoing collaboration in poetic translation, a process Hillion describes as akin to mathematical research. Their official goal is to translate all the Greek mathematical poems they know and then publish the translations. "But at this rate we will be dead long before that," Lenstra says. Still, the two have plugged away, inserting bursts of poetic creativity into their busy lives whenever the muse takes them.

The collaboration began in 1995, almost by accident, while Hillion was a graduate student in mathematics at Berkeley. He and Lenstra were engaged in a general conversation about poetry when they discovered that they share a "rather conventional" taste, Hillion recalls. Both markedly prefer standard meter, rhyme, and poetic structures over modern, unstructured forms, and both are fans of Alexander Pope and his translations of Homer.

Lenstra, Hillion remembers, launched into a description of Archimedes's cattle problem, expressed in verse in a letter from Archimedes to Eratosthenes of Cyrene during the third century B.C. The problem eloquently and indirectly describes an instance of Pell's equation, given by $x^2 - dy^2 = 1$, where d is an integer.

The 44-line poem describes herds of cattle—bulls and cows—of four colors: black, white, brown, and mottled. The task for the reader is to determine the number of bulls and cows of each color. Lenstra pulled out a volume of Greek mathematical writings from the Loeb Classical Library and showed Hillion the poem in Greek. No English verse translation of the poem was available at the time. That day, the pair agreed to translate the poem together.

To those educated in American public schools, it may seem remarkable that a graduate student in mathematics and his adviser would both be able to read ancient Greek well enough to translate it. But Greek is a standard elective in Dutch secondary schools, available to the intrepid few who wish to learn it, Lenstra explains. Similarly, though classical Greek was not a part of Hillion's English public school education, a course in Latin, with "a tiny bit" of Greek grammar thrown in, was.

Armed with a Greek–English dictionary and a thesaurus, Hillion and Lenstra mapped out their project. They decided that iambic pentameter was the best English equivalent of the Greek elegiac distichs in which the cattle poem was composed. Overall, Hillion says, they were aiming not for modern English, but for something loosely modeled on Pope's Homer translations. "Pope is the inspiration and model for our style of rhyming and our vocabulary," Hillion explains.

The pair took more than a year to complete the full translation.* Occasional bursts of speed and inspiration were interspersed with longer periods when teaching or research took precedence. Some lines fell out immediately, while others were a struggle.

*Available at http://www.ams.org/notices/200202/fea-lenstra.pdf.

Once they'd finished the cattle problem, they moved on to others, soon focusing on Greek epigrams—mathematical puzzles in verse. Epigrams, Hillion says, were a source of entertainment for educated Greeks, the ancient equivalent of a crossword puzzle.

Forty-eight surviving epigrams, including the poem from the Ashland trip, can be found in Loeb's edition of *The Greek Anthology* (Harvard University Press, 1916). Some of the poems had been translated into English before the Lenstra–Hillion project, but the translations were either in prose or too loose in meter or meaning to appeal to the mathematicians.

The Universal Appeal of Structure

Hillion and Lenstra are not alone among mathematicians in their penchant for reading or creating poetry. The type of mind that loves mathematical constraints seems also to thrive under poetic ones. Classical-style poetry, with its formal, rigid structures, seems to have the broadest appeal, and particularly when mathematics is the subject.

Consider, for instance, the following ditty composed by Peter Shalen, a professor of mathematics of the University of Illinois, Chicago, for a poetry contest on the theme of Fermat's last theorem:

> No higher pow'r can ever be,
> The sum of two of like degree.
> That shouldn't be too hard to see . . .

At the same time, some poets describe their creative processes in terms that would not sound unfamiliar to a mathematician. Edgar Allan Poe, beloved of many mathematicians, once said of his poem "The Raven": "It is my design to render it manifest that no one point in its composition is referrible [sic] either to accident or intuition—that the work proceeded step by step, to its completion with the precision and rigid consequence of a mathematical problem."

Some mathematically oriented poets, not sufficiently challenged by the usual constraints, turn to a genre known as "constrained poetry." In one well-known example, a rewrite of "The Raven," Mike Keith closely preserved the meter and story of the original, while introducing the property that each successive word has the same number of letters as the corresponding digit of pi. Another, rather cacophonous poem, written by David Schulman in 1936, describes George Washington's crossing of the Delaware in poetic lines that are all anagrams of one another.

To Hillion, the processes of doing mathematics and translating poetry are similar to those involved in playing chess or composing music. "In all of those activities, you're trying to get several things into place at the same time, and there's a mental dexterity in getting it all arranged just so," he says. "There are lots of possibilities, but only a few make sense and even fewer all work together."

As with other creative endeavors, there is an *x*-factor, too: "You can't do it just applying a handy formula," Hillion says. "You have to go beyond rote work at some point and look for something beautiful or something that feels right. Then you go back and check that it actually works, but somehow your intuition generally gets you there without knowing quite what happened."

The Working Relationship

Like mathematicians collaborating on a research problem, Hillion and Lenstra have developed a working rhythm. When translating a poem, they meet every so often, translate a few lines literally, and then work on them independently, trying to meet the constraints. When one comes up with a translation for a line or two, he e-mails it to the other for critique. If each arrives at a different solution, they decide which one works better and then attempt to improve it.

Over time, the pair has defined a set of working axioms: They try to be as literal as possible with the meaning, striving to translate everything and introduce nothing. Similarly, they work to reproduce the flow of information, keeping everything on its line or in its couplet. At the same time, the translation must be poetic in English, obeying meter and rhyme schemes. They try to be clear, but also to avoid repetition and to use evocative or poetic language.

"Every so often we'd come up with something that particularly pleased us, and then we'd dwell on that phrase for hours or days, sometimes almost meditating on it over dinner at Chez Panisse or La Val's, as if we'd just discovered a profound mathematical truth," Hillion says.

Disputes arise regularly when he and Lenstra are translating, Hillion says, but their shared taste for precision makes it easy to resolve them. "We both have a sense that there is always a 'correct' translation," he explains. "Every poem or couplet or stanza has a metrical structure and rhyming scheme that it settles into most naturally, and it is our job to find it in English."

This "sense of correctness" applies most of all to meter, Hillion says. In translating one of the epigrams, they settled initially on iambic pentameters. Then, after struggling for days, they decided that this choice gave them "too much room," that it would be far easier to fit the Greek into tetrameters.

Lenstra is the Greek expert, but Hillion has his role, too. Lenstra, whose native language is Dutch, occasionally comes up with lines that don't conform to any recognizable English usage at all. Or worse, says Hillion, he unknowingly hits upon a particularly lyric turn of phrase that, while it seems to fit perfectly, has an idiomatic meaning that is subtly obscene. (Hillion declined to provide examples.)

In his criticisms of Hillion's efforts, Lenstra shows his Dutch tendency to be blunt, as in his occasional dismissive cry: "But it is just so ugly." But after suffering years of such abuse as Lenstra's student, Hillion takes it in stride.

Despite their occasional differences of opinion, both mathematicians derive immense pleasure from their project. On occasion, seeking poetic inspiration, they have taken weekend road-trips up or down the West Coast. Ashland has been their most frequent destination, but they happily recall a pilgrimage to Los Angeles, where, after working through a troublesome first line for the whole

of Interstate 5, they carried their thesaurus and dictionary into a bar on the Sunset Strip, and to the Getty Museum the next day, finding inspiration in both places.

The result of that trip was a translation of the poem that, according to tradition, was inscribed on Diophantus's tomb:

This tomb holds Diophantus: wondrous art
that shall the measures of his life impart.
A sixth he lived in boyhood by god's grace,
a twelfth part more, and down showed on his face.
His honey-moon a seventh later shone,
a boy was born unto him five years on.
Alas, the wretched child, begotten late,
lived half the father's life and fell to fate.
Arithmetic diverted his dismay
for four more years, and then he passed away.

—*Anthologia Palatina*, xiv.126
Translated by H.W. Lenstra jr.
& S.J.P. Hillion, 2002

A SIAM Challenge

Finding opportunities to collaborate became a little harder with Lenstra's decision to take early retirement in 2003 and leave Berkeley for his native Holland and a post at the University of Leiden. Still, the duo plans to continue the collaboration, long distance if need be, or during Lenstra's visits to California.

"Perhaps MSRI (the Mathematical Sciences Research Institute in Berkeley) will appoint us poets-in-residence," Lenstra hints.

Meanwhile, Hillion, who works as a software engineer and manager at QRS Corporation in San Francisco, has tried his hand at creating as well as translating poetry.

At the Lenstra Treurfeest, a conference held in March 2003 to honor Lenstra on his retirement from Berkeley, Hillion gave a well-received talk on his long-time collaboration with his adviser. Afterward, he abandoned his audience to torment with the following rhymed puzzle, to which he has added a prologue for the benefit of SIAM readers:

A problem that Steven Hillion conceived in verse
And posed to the readers of SIAM in an article by Sara Robinson. Compute the measures of our scholar's
Academic career, and you shall be ranked among the wise.

This room was Hendrik Lenstra's: it declares
the measures of a scholar's life, in squares.
In Groningen the young boy had his start
at Kohnstamm's School, beguiled by Euclid's art.
In one year less, his knowledge multiplied:
Praedinius his school, Newton his guide.
At Vossius he studied half as long,
but learned from Gauss the notes of nature's song.
His research was at Amsterdam begun
in lattices, and curves of genus one.
At Berkeley he turned numbers into primes
and filled the hole in Escher for *The Times*.
Two measures more stand out from his career,
one longer than the other by a year.
These split his time at Berkeley into two,
with honours from the old world and the new.
The first ends when, as teacher, back he's brought
to Groningen, where young Bernoulli taught.
The next starts when he joins mathematics' giants,
elected to th'Academy of Science,
and closes with a gathering of his peers
to celebrate four dozen glorious years.

Responses, anyone? Send them to sara@msri.org and I will forward them to Steven Hillion.

Sara Robinson is a freelance writer based in Los Angeles, California.