Connecting the sciences to the arts: Sarah Hart

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Interviewee: Sarah Hart

1597, Britain. It is the Tudor Age. Elizabeth I is queen, and the Spanish Armada is about to be defeated. And it is also the year when Sir Thomas Gresham creates the position of the Gresham Professor of Geometry: the holder of the title gives public lectures on a mathematical topic of their choice.

Over four hundred and twenty-five years later, the position is still around. It has passed through thirty-four owners. Some of the greatest names in science have held it, including Robert Hooke and Roger Penrose. But until 2020, they were all male.

Sarah Hart, professor of mathematics at the University of Birkbeck became the first woman to hold the title. “I feel that you might say maybe this should have happened sooner,” she says. “It's taken 425 years, or whatever, but I feel very honored to be the first woman.” Dr. Hart works in the area of algebra called group theory. She is interested in the links between math and other subjects, and has written a book about what she calls “the wondrous connections between math and literature”.

I asked her for an interview via Zoom, and she was nice enough to accept and find some time to tell me about herself.

Dr. Hart has always loved patterns. She loved patterns before she knew it was math. In school she enjoyed math and did well in it, and she realized that math is more or less the study of patterns. Gradually she decided she wanted to make a career in the field, but that came with consequences. “I always enjoyed other things, too, especially reading. I would always be reading books,” she says. But unfortunately, in Britain, you have to pick the subject you major in early; furthermore, the ‘science’ and ‘humanities’ streams are separated.

Dr. Hart doesn’t think this is the best approach. “Yes, if you were to let people study eight different subjects up to the age of 18, then they wouldn't know as much about those two or three things [that they end up doing as a profession]. But actually, when you're 16-17, you don't yet know what you want to spend most of your life doing…it's too early to put people down a particular path,” says Dr. Hart.

Sarah Hart chose math, but she continued to cultivate her interest in reading and music. She is interested in the ways that math connects to these arts: “you can see mathematical patterns and structures in the arts and the humanities…” She has written multiple works on these connections, but before we get into that, let’s talk about her career.

Ms. Hart went to college at the University of Oxford where she discovered a field of algebra called group theory and began specializing in it, and after that, she spent three years on her PhD. What *is* group theory? She described it to me as follows during the interview and even used a prop to help me understand: “It’s about structures and patterns and symmetry, really. If you think about, like, any sort of shape,” this was when she got up and took a model of a dodecahedron from the shelf behind her, “...it's very symmetrical, because you can kind of rotate it around, and it's still going to look the same from lots of different angles. There are all sorts of things that you can do with this shape and leave it looking the same. Those things are symmetries and what group theory does is to give us a way to understand symmetry” She explained that the things that you can do to a dodecahedron to leave it looking the same form a group, and if you combine them, you might get something else fitting in the group. Groups are collections of things: “Might be symmetry, might be numbers, where you can combine them to get another thing in that set. So, numbers form groups, because, like, if you take two numbers, you can add them together, you get another number. You know, three plus seven is 10 is another number. So, numbers form groups, symmetries form groups, all kinds of things form groups–functions, loads of stuff. When you think about groups in special kinds of sets and work things out about them and prove theorems about them, it tells you stuff about all these scenarios in mathematics. So, it's a really powerful kind of technique to understand symmetry

and structure, and that's what my own mathematical research has mostly been about."

Back to her story…She started looking around for a job and became a university lecturer (the British equivalent of an assistant professor) at the University of Birkbeck. In 2013, on her daughter Millie's sixth birthday, she got a letter from Birkbeck promoting her to full professor. Lately she has become interested in the connections between math and culture, and as Gresham Professor of Geometry, many of her lectures were directed at these links. As it turns out, there are many mathematical structures, constraints, metaphors, characters, allusions and ideas in many works of classic literature, from *Romeo and Juliet* to *War and Peace.* Dr. Hart wrote a paper on the mathematics of *Moby-Dick* by Herman Melville, called *Ahab's Arithmetic: The Mathematics of Moby-Dick.* "That paper that I wrote was really the seed for, actually, there's a book about literature in my brain," she said. In 2023, she published a book on math and literature, called *Once Upon a Prime.* I highly recommend you try it out. It's amazing, and it also works well as a recommendation for other books.

In her spare time, Dr. Hart likes to read (of course), play the piano, and do puzzles. Her family has a competition every day on who can do the puzzles on the NYT app fastest. They also have treasure hunts that they make for each other.

When I asked her whether she had any advice for students interested in math, she said, "If you enjoy it, then just continue enjoying it. Continue playing. For me, playing in that intellectual way, playing and exploring ideas is the most fun thing ever."

Bio:

My name is Aarik Chakrabarty. I attend Frances C. Richmond Middle School in Hanover, and along with math, I enjoy Quiz Bowl, reading, and cooking.