

## Inspired by a Problem: Mapping the Butterfly Effect

*“It has been said that something as small as the flutter of a butterfly’s wing can ultimately cause a typhoon halfway around the world.”*

*Square ABCD has a side length of four. A quarter circle is drawn with a center at A, and another at D. The radii of both circles is 4. Compute the value of the region containing both of the quarter circles.* The girl sat at her wooden desk, twirling her pencil slowly around her thumb. “*Hmm . . . How many ways are there to solve this problem?*” she thought. She quickly scribbled down the theorems. *Four squared minus the quantity of one-half pi times four squared.* She finished quickly.

In chaos theory, the Butterfly Effect is based on the notion that sometimes a seemingly small change in one stage can yield large consequences at a distant point in time. That day, a problem placed on a wooden desk during an elementary school math competition in Wuhan, China, captured young Sarah Sellke’s attention. It sparked her lifelong love for mathematics, a love that eventually led her to teach probability and statistics to students at Purdue University, halfway across the globe. As I asked her about her life, Professor Sellke would often preface her responses with “The answers are not that interesting, but...” followed by a series of facts that were, actually, extremely interesting. She humbly describes herself as having a boring life, despite her countless accomplishments. During the course of our conversation, I came to realize that a Butterfly Effect was in motion. And that she may be unaware of her role as the butterfly.

Sarah Sellke was born in Tianjin, the largest coastal city in northern China, where she lived until she was six years old. She spent the next twelve years of her life in Wuhan, attending the Hubei Wuchang Experimental High School, and throughout these years she excelled at math competitions. So it was no surprise that Sellke chose to major in mathematics when attending Tsinghua University in Beijing. Then, she decided to continue her education in the United States, enrolling at Purdue University in West Lafayette, Indiana, where she received not one, but *two* masters’ degrees: one in Mathematics and another in Electrical and Computer Engineering. After completing these two degrees, she went on to pursue a Ph.D. in Electrical and Computer Engineering, studying ways to model security-related issues mathematically. Sellke published papers in prominent journals on topics related to the containment of computer viruses, such as in battlefield or law enforcement settings.

Upon completing these incredibly challenging degrees and publishing several papers, Professor Sellke had to solve another difficult equation: How could she balance her career as an academic with her desire to raise a family? She elected to remain at Purdue as a lecturer of statistics for undergraduate and graduate students. This allowed her to raise an amazing family and also continue to teach mathematics, reaching hundreds of students.

Since that decision in 2010, Sellke has been teaching two classes at Purdue, “Introduction to Statistics” and “Probability.” Her students come from a wide range of programs across the university: engineering, animal science, food science, and consumer science, to name a few. Serving students with a wide range of mathematical backgrounds demands that she have the dexterity to present complex statistical and mathematical topics in ways that every student can

understand. Her students describe her as one of the best professors they have ever had because of this ability and her kind and caring nature. This is likely why Sellke's students have dubbed her "Professor Mom." In addition to teaching, she serves as a Faculty Fellow for a residence hall and is often seen there spending time talking to students and truly getting to know them. Her love of teaching is motivated by her reward in hearing how her teaching helps her students in their lives. Many of them stop by to visit after graduation.

*"It's nice to know that I have a big impact on the students' lives."* She says.

During this time, Sellke spread her love of mathematics not only to her students but also to her children. With whom she began to work when they were in kindergarten. Her daughter, Clara, is currently a computer science major at the prestigious Carnegie Mellon University. Clara once commented on how a particular skill that her mother taught her while preparing for MathCounts in 7th grade helped her earn an "A" in a college computer science course. Sellke also described her son as merely a "fast learner" who was able to pick up mathematical concepts quickly. After a bit of my own research, I discovered that her son, Mark, was the 2010 MathCounts National Champion. In 2013 and 2014, he was a gold medalist and one of the top scorers in the International Math Olympiad. Mark is now a graduate student in Mathematics at Stanford University, and a teacher and coach himself. Mark credits his mother with giving him an early start in math and for her direct involvement throughout his mathematical education.

While some people say that they were inspired by a mentor, Professor Sarah Sellke was not. She was inspired by a problem. That math problem was the first flutter of a wing that rippled halfway around the world. One question, asked at the right time, inspired a young woman; and over the past two decades, this woman has inspired her students, colleagues, her children, and in turn, future generations to come.

**Roxane Park (11)**, is a sixth grader at Crossroads Academy in Lyme, NH. She is currently taking Geometry, although her favorite math subject is Algebra, and she has been competing in local, state, and national math competitions since she was in 3rd grade. She enjoys piano, fencing foil, reading fiction, and occasionally writing a short story. Other than that, Roxane loves to oversleep and eat very copious amounts of salmon sashimi.