

The Geography of a Mathematician
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Interviewee: H el ene Seroussi

The first time I met H el ene Seroussi, I was out of breath. We had both traveled vast distances to arrive here, in her sun-lit office on the third floor of our engineering building, nestled in the Connecticut River Valley. H el ene’s career had taken her from and to many places and geographies: from Paris to across the United States, from laboratories to ships cutting through the Arctic sea. Everywhere she went, she brought with her a love of mathematics. H el ene Seroussi’s career shows the myriad ways math finds its way into your life: from mechanical engineering to numerical modeling to fieldwork to teaching. However, long before she was a Dartmouth professor, H el ene was just a girl who loved to solve puzzles.

In the 11th arrondissement of Paris, H el ene Seroussi’s childhood fascination with puzzles blossomed into a love of science and math. Unsure of what to do after high school, H el ene followed the typical path of attending preparatory school. The idea of building things had called to her, so in 2011, H el ene graduated from * cole Centrale Paris* with a PhD in Mechanical Engineering. H el ene had followed the typical path to pursue her interests in math, physics, and engineering, but now had no idea what she would do with the degree in her hands. With a smile, H el ene remarks that she could have gotten a job building bridges or “something like that”, if not for a fellow student of * cole Centrale Paris* who was studying ice sheet dynamics at NASA’s Jet Propulsion Laboratory (JPL).

H el ene originally planned to be at JPL for just six months. Instead, the banks of the river Seine became the suburbs of Pasadena for thirteen years, and her work as an ice sheet modeler began. She remembers that when she started researching ice sheets, “it was more an opportunity and a coincidence than anything else.” It was also at JPL where she had her first experience with coding. I was amazed that she was able to pick up the diverse skills needed for her work at JPL, and asked if she had any basic knowledge in these skills before starting.

“Oh my gosh, no,” she blushed, “I had a lot of math and physics, but for some reason growing up I always said that I would never do computer science. I didn’t like it... I went to JPL and really didn’t know much about coding.” H el ene smiled. “For the first six months I was just putting random pointers in random places because I had no idea what was going on. Maybe a star there or an ampersand here.”

We both laughed, but I was surprised. In front of me was this remarkable woman who programs daily, telling me that she had sworn off computer science when she was young; this was how I had felt about programming. Only recently had it started to enter my research and my life in a big way, and it was relieving to know a person I looked up to had a similar experience as me.

H el ene claims that her work merely entails solving partial differential equations using numerical methods. Her large-scale models – in which the resolution is at its finest one kilometer – are a long way from capturing the complexity of the margins of an ice sheet

crumbling into small, damaged glaciers that disintegrate into the ocean. While still a work in progress, underneath the mathematics lies an intricate effort to model and understand some of Earth's most inaccessible and most vulnerable regions.

Hélène spent her career investigating glacial systems using remote, coarse-scale data. Only within the past year was Hélène able to participate in her first fieldwork expedition to a fjord in southeast Greenland. She saw ice sheets filling the horizon. "As soon as the ice was discharging into these valleys then into the coasts, it became completely damaged with crumbles and pieces and it was a total mess." It was the *scale* of these pieces which she remembered most of all. "In the background, it was flat, and suddenly the topography changed, it became very steep and the ice became incoherent, almost a different material. I was thinking, in my model the resolution is at best one kilometer. One kilometer is from *here* to *there*" (She makes gestures with her hands, as if to show me *here* and *there*.) "And from here to there we have different valleys and rocks, ice, and so on. My models are simplifications, but *knowing* it and *living* it are completely different. We are a long way away from being able to capture that."

Mathematics and a penchant for seizing opportunities had taken Hélène from Paris to Pasadena to Greenland's fjords. Today, at Dartmouth, she is on a different journey: discovering teaching. Hélène's passion for coding blossoms whenever she teaches her favorite class ENGS 20: Introduction to Scientific Computing. This was the first class she ever taught at Dartmouth, and "the first class you teach is really special." She loves to share the experience of tinkering with models through programming. She understands that coding is daunting to most (I include myself in that "most"), but can enable her students to pursue their own research. As a teacher, Hélène gives her students the tools to ask and answer their own questions just as she did at *École Centrale Paris*.

The great *geography* of her journey is not lost on her. Hélène and I both come from smaller countries: she from France and I from Bulgaria, where family is never far. At the end of the interview, the evening sun setting, I brought it up to see if she felt the same way about being so far from home. Hélène's eyes lit up as she talked about rediscovering music with her children and husband, and their life in the Upper Valley. She pondered for a moment. "With time I had to adjust... The problem is when there are important events or weddings or births." She paused for a moment. "That's when you feel the distance heavily."

About the Author:

I am a senior from Sofia, Bulgaria. I double major in Earth Science and Mathematics. I plan to continue my exploration of the intersection of math and geology in graduate school, where I hope to work on developing analytical and observational tools for Earth's recent-past and current climate. In my free time, I enjoy making jewelry at Dartmouth's Jewelry Studio, hiking, swimming in the Connecticut River, and working at the Organic Farm.