Imagine

An Essay by Moira Chas

Moira Chas in her office at Stony Brook University.
Photo: Lauren Ruiz

Baird said, “Every woman has a male inside of her. Even you.”

Charlotte answered, “No, not me. I'm really bad at math and I can't change a tire to save my life.”

Sex and The City, Television series, Season 3, Episode 4, June 25, 2000.

Imagine you grew up in a society that constantly repeated things like that; where your teachers believed consciously or not that one of the features defining your kind of people is not being good at math. Imagine you had a Barbie who said: “Math class is tough. Will we ever have enough clothes? I love shopping.” Now expand your vision so you can see daily occurrences of events like those. Imagine those events populating your mind since you were born — slowly, persistently and insidiously. Imagine that the praises to your beauty are many more than those to your mind. Imagine you are rewarded when you are nice, and punished when you are not. Imagine that when you are in college you decide to go for math, despite everything. There, once more, you find no one, or almost no one, that looks like you among the professors. They are not of your kind. They all look alike and unlike you. You are the different one. Imagine you smile after a small academic victory and one of your classmate's whispers in your ear, “That victory is not yours. They let you win because of how you look.”

After college you decide to go for a Math PhD. You have heard that you have to be brilliant to succeed, and you doubt yourself. Images of tortured male geniuses dance in your mind. Maybe you should study a discipline that does not require such brilliance. Nobody tells you that hard work, the hard work you know well how to do, is the main component.

You made it. You are admitted to a great math PhD program. You overhear someone in your class saying that you had not earned that admission. This comment brings more self-doubt. Miraculously, you find one of your kind who is succeeding in this PhD program. This person talks about self-doubt, sounding so much like you, it seems as if you are looking into a mirror. You realize how absurd is your own self-doubt. The mirror helps both of you.

Each new step in the understanding brings you a unique satisfaction. What you may not know is that along the way, you have a disadvantage — tiny and constant. You do know about exponential growth. A tiny disadvantage accumulates, and after some years becomes far from tiny. Unlikely, but you may be an outlier, and climb to the very lonely top where absolutely nobody looks like you. Outliers are very few. Math needs you, even if you are not one of those outliers.

You may read about implicit bias, these unconscious, implicit assumptions that influence people's judgment and perception of themselves or others. There are tools to improve the effects of this bias when selecting candidates, and maybe some of these tools were applied when you were admitted to the PhD program. Maybe the committee managed to make evaluations more anonymous, and developed objective criteria before evaluating. It could have happened, one or two faculty members might have insisted for years, while their colleague mathematicians explained to them how objective they were judging themselves, and how they arrived at this judgment to the certainty of their own absolute objectivity.

Someone may remind you that the group that you belong to is not supposed to be good at math. That reminder has an effect on you, and not a good one. Someone else may remind you that your brain is constantly changing, new connections happen every time you sit and think. You run to your desk and sit and think and can almost feel all these new connections coming to life, and through them, beautiful math images travel your brain.

You ask a question in class. It was a dumb question and the answer you receive makes that crystal clear. You feel utterly and irreparably dumb. Maybe you think that such a question is expected from someone of your kind. The prophesy “people like you are ill-equipped to do math” once more becomes a reality. It is hard to do your homework when you feel utterly incompetent. Then you stumble upon a text that claims that mistakes are inevitable and are positive steps in the process of understanding. Could that be true? You remember when your classmates, those that you hold in such high esteem, asked the dumb questions. You know well that you did not deduce from those questions that they were also dumb persons. You did not merge the person and the question, as you did for yourself.

You go out with other graduate students to a party. Someone asks you about your boyfriend. You realize that this person thinks the only way you could be there, among the math graduate students, is by being the girlfriend of one of them.

Then, the time comes to return midterms to the students of the recitation you are teaching. Among some of the students with average performance you observe two reactions. Those who look like you express the intention of dropping out, they do not think they are good enough to continue to study math. The students who do not look like you are very surprised at receiving an average grade. Even if they were expecting a better grade, they do not express any intention of dropping out.

You realize that it would be good if you became an advocate for yourself. Why diminish your accomplishments? You hear your voice saying “I only did this” and you ask yourself why “only”. There is no need of such an adverb qualifying your actions. ♦

Moira Chas is Associate Professor of Mathematics at Stony Brook University. Born in Argentina, Chas discovered early in life a passion for writing, and later a passion for math. She completed her “Licenciatura” (equivalent to a Masters degree) at the Universidad de Buenos Aires, Argentina, and her PhD at the Universitat de Barcelona, Spain. Soon after completing her PhD she came to the United States for a three-month working visit, and never left.

Chas strongly believes in the benefits of interaction. In her research she strives to find different representations of the concepts she is trying to understand. These representations are created by computer programs, pictures or knitted shapes. In the same vein, she believes in communicating mathematics to an audience larger than her colleagues and students.

A large part of Chas' research is rooted in finding and probing mathematical conjectures with computers. Many of these computer experiments have been conducted in collaboration with undergraduate students, graduate students and high school students. Jointly with Dennis Sullivan, they discovered and formulated a new structure in the space of closed curves on a manifold called “String Topology.”

Besides a teaching award at Stony Brook, Chas won the Simons Center Science Playwriting Competition with her play, “The Mathematical Visions of Alicia Boole.” This play has been staged in several science venues around the world.

Women in Math

By Moira Chas

The following selection of biographies has been written and contributed by Moira Chas

"All women who have published mathematics hitherto have shown knowledge, and power of getting it, but no one, except perhaps (I speak doubtfully) Maria Agnesi, has wrestled with difficulties and shown a man's strength in getting over them. The reason is obvious: the very great tension of mind which they require is beyond the strength of a woman's physical power of application."from a 1843 letter by Augustus de Morgan, Mathematician

The reason why practically no woman had wrestled with difficulties and shown a man's strength in getting over them was obvious to de Morgan, who attended Trinity College and held a position as math professor in London University. No woman could have been his classmate at Trinity College or his colleague at London University since women were not allowed, regardless of their strength in getting over the difficulties that math may present.

MARIA GAETANA AGNESI, (1718-1799) the Italian mathematician mentioned doubtfully by de Morgan, shined with a bright light since her early years in Milan, where she started by being the hostess of intellectual gatherings at her family house, and making her father burst with pride by showing how she could speak various languages by the age of nine. The wealth and unusual open mindedness of her family allowed her to have excellent tutors with whom she maintained stimulating discussions.

As years went by, Agnesi become more interested in mathematics and religion, and less fond of her social obligations. Her desire of retiring to a convent was met with the opposition of her father, who in exchange accepted a more convent-like way of life for her.

She devoted the third decade of her life to write Foundations of Analysis (Instituzioni analitiche). In these thousand pages she combined her knowledge of math and different languages to give a clear, precise and illuminating discussion of most of the ideas about differential and integral calculus known at the time, including the complementary concepts of the calculus arch-rivals Leibniz and Newton.

Her father died a few years after the publication of her work. Since then, Agnesi submerged herself in religion and charitable work, taking care of the poor and even living among them until end of her life.

SOPHIE GERMAIN (1776-1831) grew up in the turbulent Paris of the end of the eighteen century, not far, in space and time from Agnesi. Germain fell in love with math in an unusual way and never faltered. Her family was far from supportive of this math love story. They tried every method possible to stop Sophie in her pursuit of understanding but her tenacity was stronger.

She was not allowed to attend the school of her desire. Thus she studied from notes. She could not submit work in her own name. She submitted work under the name of a former student, M. LeBlanc. The recipient of this work was the renown mathematician Joseph-Louis Lagrange who became eager to know M. Leblanc after noticing how interesting "his" work was. When he discovered that the admiration should be addressed to a woman, he did not step back. On the contrary, he went to her home to express his admiration and support.

Germain, once more under the pseudonym of M. LeBlanc, maintained extensive correspondence in number theory with Gauss. Like Lagrange, Gauss did not step back when a novelesque incident revealed to him the gender of M. LeBlanc.

Never lacking of self-confidence, Germain submitted an entry for a contest of the French Academy of Sciences. It was an essay about the mathematical theory of elastic surfaces. The rejection of her work did not stop her and two years later she submitted a second entry. This time, she earned the prize.

ALICIA BOOLE (1860-1940). During long centuries women had no access to mathematics. A few excellent fathers, like Agnesi's, did their best to remedy this injustice to their daughters. Everything indicates that the mathematician George Boole would have joined these group of fathers. But death took him before any of his five daughter could benefit from his instruction. He left them however with a remarkable mother: Mary Everest Boole, who raised this all-female family with no money but with an infinitude of interesting ideas. One of these daughters, Alicia Boole (1860-1940) discovered as a teenager the attraction of geometry when a friend of the family showed her a puzzle designed to visualize the tesseract, or cube in four dimensions. From that moment on, she was hooked and spent many hours trying to understand the equivalent to the platonic solids in four dimensions. She married an actuary and had two children. It was her husband who found in a mathematics magazine a picture very similar to the distinctive figures that she was constantly drawing. She wrote to the author of the paper, the Dutch professor Pieter Schoute establishing a collaboration that would last until his death in 1913. Nothing is known about her math activity until 1930 when she met the young geometer Harold Coxeter. Since then, worked with him until her last days. ♦

A NOTE ON THE HISTORY OF THE SIMONS CENTER FOR GEOMETRY AND PHYSICS

In 2007 (check date), Hoberman Associates designed a dynamic installation for the Simons Center for Geometry and Physics. At once functional shading and art, the installation adorns the south-facing primary facade; its kinetic patterns create dynamic, ever-changing views, lighting and shadow-play while providing additional shading for the LEED Gold-status building's lobby.