



# AGAINST THE ODDS, A GIRL THRIVES IN A WORLD OF NUMB3RS

// WORDS: BLAIRE BRIODY

It's nearly two o'clock on a brisk Saturday afternoon in New Jersey, and snow has started falling lightly outside the classroom. Inside, empty blue and red bags of Doritos and Coca-Cola cans are scattered across the desks. A half-eaten donut lies next to a stack of text books. The fluorescent overhead bulbs cast a bitter light down on the dozen or so students hunched over their bleached 8x10 papers.

Rachel Chasin, a 17-year-old at Bergen County Technical High School and one of the only girls in the room, is looking panicked. Her already pale skin has turned pallid and her hands are shaking as she presses the No. 2 pencil to the page. There are 15 minutes remaining in the American Regions Math League Power competition—which, in the world of high school competitive math, is like the play-offs of the NBA Finals—and she's only just discovered a logical direction for her proof.

Next to her is her teammate, Yoonjoo Lee, the other female senior on the team. And across from her is one of the many boys in the room, Ben Yang, who's considered the MVP. He was originally working with the two girls but suddenly stood up and moved to a different table, looking frustrated.

Rachel, Ben and Yoonjoo are three of the best math students in the country who participate

in high-stress competitions every weekend. Joe Holbrook is their coach and his home room, lined with boxes of shimmering silver and gold trophies, is dubbed the "Math Team Headquarters." The students dress in team T-shirts and their season consists of almost as many competitions—home and away—as the football team's.

The students' ultimate goal is to get to the International Math Olympiad, which takes only the six best high school mathematicians from the country. In the 24-year history of U.S. participation in the International Math Olympiad, three American females have made it: Melanie Matchett Wood was the first, in 1998; Alison Miller in 2004; and last year, Sherry Gong. This year, Rachel Chasin hopes to be that girl. Unfortunately, she still has a long road ahead of her, thousands of years of stereotypes to fight against, dozens of male peers to impress and person after person she'll encounter who will doubt her.

Rachel Chasin lives in Leonia, New Jersey. When she was about four years old, her parents started teaching her basic math; she began learning algebra in elementary school. "My parents encouraged me to do everything. Science, English, they wanted me to experience it all and choose what I wanted," she says. At age 13, she scored

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an 800 on the math section of the PSAT and now studies problems that a graduate student in the Columbia math department couldn't solve.

She sits tall, peering through her black-rimmed glasses and adjusting her straight and manicured dark brown hair. Although nervous and timid at first, she speaks in a serious, mature tone, exuding confidence and at times a hint of arrogance. "My parents say that now I'm ahead of them in math. My mom asked what the 'implied' symbol meant. I thought everyone just knew."

She says she started noticing a significant gender gap in math class during her second year of high school. "Freshman year everyone joins, and even though there aren't as many girls as guys, after freshman year it drops a lot. They realize they don't like it, for whatever reason."

As many math students will note, this is a common occurrence. A low female-to-male ratio becomes most evident in higher levels of math. Although females receive high average grades in math classes at all grade levels, males have dominated on the math part of the SAT, scoring around 40 points higher than females for over 35 years. A study by Camilla P. Benbow and Julian C. Stanley at the John Hopkins University Center for Talented Youth observed precocious 12-to-14-year-olds and found there were twice as many boys as girls with math scores of 500 or higher, four times

as many boys with scores of at least 600, and 13 times as many boys with scores of at least 700. Recently, however, more girls have been joining the 700-score group: In the 1980s, the ratio of boys to girls was 13 to 1 and is now about 3 to 1.

There are countless theories to explain this gap, all falling into two categories of thought: biological and sociological. The biological studies tend to look at hormones (such as testosterone, which some researchers argue causes increased visuospatial ability), brain scans showing a higher percentage of gray matter in the left hemisphere in men, and, more recently, ring-finger length, which is said to determine mathematical ability. The sociological studies look at differences in the games and toys children play with and stereotypes and biases—which never produce as nice, clear-cut stats as the biological tests.

Nevertheless, neither can disprove the other, and the speech by Harvard president Larry Summers in 2005 in which he said males and females may have a "different availability of aptitude" served as a catalyst for more research and academic discussion on the issue. Summers ended up apologizing for the remarks, but the incident proved that even in an astute, academic environment, sexism persists.

Wood, the first female to make it on the U.S. international team and now a grad student

studying number theory at Princeton (she's also blond and bubbly, with a candid laugh—not your stereotypical mathematician), worries more about the subconscious biases we all suffer from. "I'll try to submit papers with my first initial instead of my first name—not because I think anyone is sexist, but because I know these subconscious thoughts are so powerful. Like sometimes I'll meet a woman who's a scientist and later I'll catch myself being surprised that she turns out to be as smart as she is. You combine that with the stereotypes and the socialization and it's a disaster."

Nationwide math competitions like the Olympiad illustrate the gap all too acutely. Wood says that at the summer camp to prepare for the Olympiad, there were two girls and 23 boys. Not only did she have to deal with immense pressure from all sides, but the social complexities of the situation. "At that age, there are so many things going on with boys and girls. Circles would form around the girls, so it adds this extra thing going on in your life besides this math competition. There are occasional love letters coming under the doorway and guys professing their love for you."

Rachel, with her slim build, quiet beauty and dark hair, has a boyfriend on the math team—a photo of them together is proudly displayed on her Facebook page. She receives her fair amount of attention from her male peers, but a lot of it



Rachel Chasin prepares to journey into no-woman's-land.

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isn't positive. And high school boys are not always respectful. Her teammate Ben rarely lets Rachel make a simple error without correcting her and rolling his eyes.

"We got into MIT early, and people made jokes that we were only accepted because we were female," Rachel says. Yoonjoo agrees: "We had a pack of physics cards with physicians on it, and every time you flipped them over, the queen side had an actual female physicist. And all the guys were like, 'Whoa, there's a female physicist?'"

These types of comments not only affect how well the girls perform, but abate their interest in pursuing math. To use the basketball analogy, it's like being on a team where your teammates never let you shoot the ball, and when they do they assume you'll miss. You would have to make the shot every single time to prove them otherwise. Basketball suddenly wouldn't be so fun anymore.

Earlier in the competition, Rachel and Yoonjoo decided to tackle problem seven, which dealt with devising an equation to represent the movement of billiard balls on a pool table. It stated: "Use  $m$  and  $n$  to create a formula to predict the pocket (A, B or C) the ball will end up in." The girls started drawing

diagrams and possible routes the billiard ball would take. They initially assumed they would only have to find a formula. "Thankfully, it says create a formula, it doesn't say prove," Yoonjoo says. But Ben interrupts her: "Creating a formula means proving it, Yoonjoo." Rachel and Yoonjoo shrug him off and continue to discuss the problem. A few kids join their group. They appear to make some headway when Ben jumps up. "I've got number seven!"

"But they were working on seven," someone says, gesturing to the girls.

"He must have thought they were working too slow," another boy says.

"Well they were."

So without further discussion, looking disappointed but not surprised, Rachel and Yoonjoo start working on number eight.

At first Rachel was uncomfortable about even doing this story. "I doubt I'll even make it," she told her coach. "What's so special about me?" She is anxious about having someone watch her compete and document her struggles as a woman. Because the reality of the situation is, the more you talk about being a woman in math, the more visceral the differences between you and the boy next to you become. You start to identify more with your gender and minority status and thus, the stereotypes that come with them. When a boy understands a problem before you do, doubt begins to settle in.

This experience is often looked at in research studies and referred to as "stereotype threat," first documented in a 1995 study by psychologists Claude Steele and Joshua Aronson, which found that participants who were exposed to a negative stereotype about their gender or race before a test performed worse than those who weren't.

A 2007 study by Dartmouth's Center for Social Brain Sciences examined brain activity during a math exercise, and found that women who were exposed to stereotype threat did not show activation in the brain regions associated with math learning during problem solving, whereas women in the controlled group unexposed to stereotypes did.

Or, as Rachel puts it, "Sometimes you start thinking that as a girl, maybe you won't be able to do as much. But if it weren't mentioned as much... maybe from an early age, girls would think, 'Okay, I can do the same as a guy.' But that would take a major amount of change in a very short time and that's not going to happen."

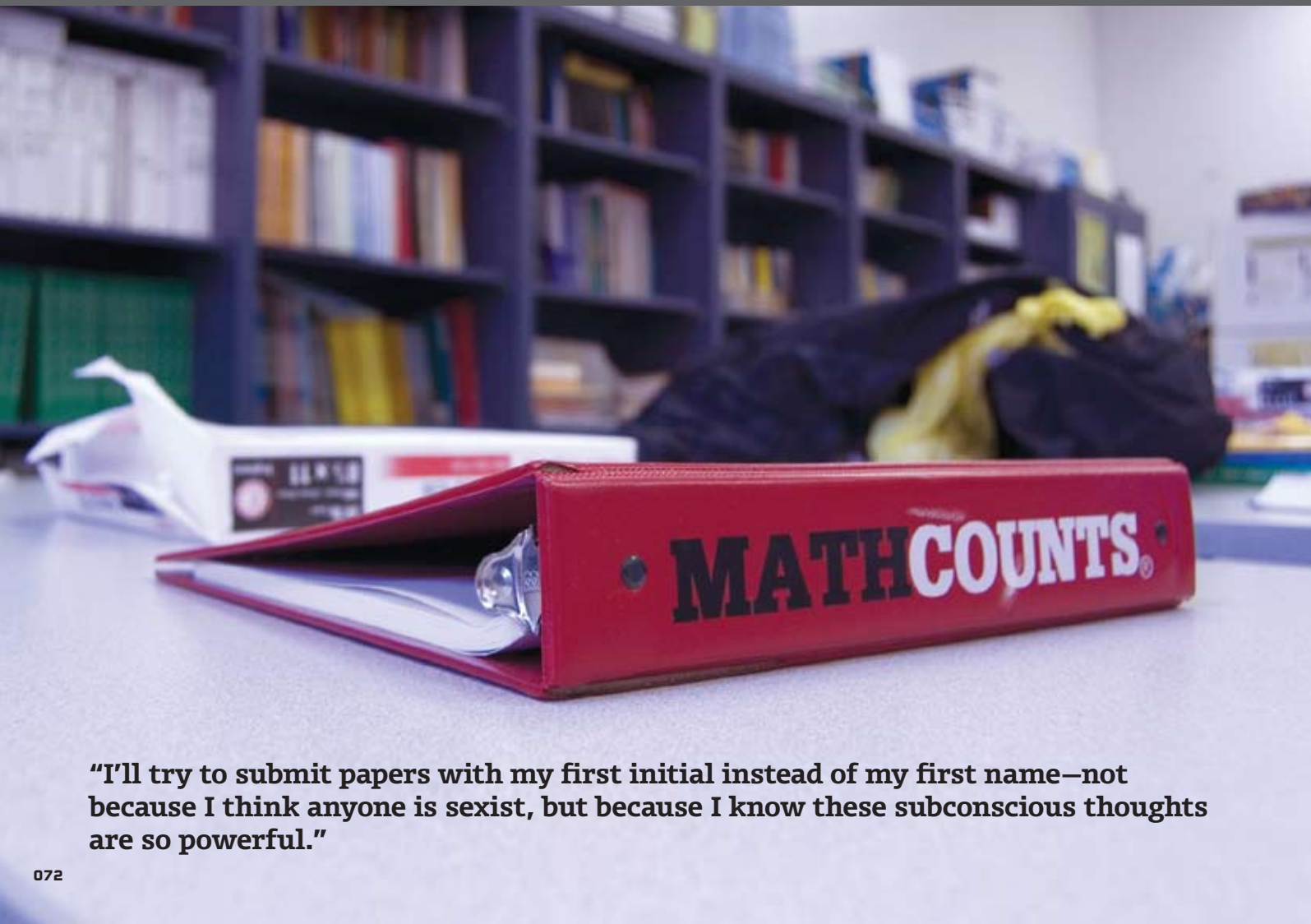
"You have 10 minutes remaining!" Mr. Holbrook announces.

Rachel starts scribbling furiously on her answer sheet, attempting to show the logical progression of her proof. "Leave me alone!" she tells a boy who has walked over to her to ask a question.

Ben stands up abruptly and pushes his chair back, which screeches across the linoleum. He grabs his papers and heads for the door. "I'm going into the hallway to finish!" he declares. "It's too noisy in here!" He slams the door shut with a loud bang that echoes through the hallway.

Finally the contest is over and the students pass in their answer sheets. Rachel asks Ben to explain number seven to her. He quickly starts drawing out his solution, talking fast without explaining the steps to her. But as he gets halfway through, he realizes he's made a mistake. His speech becomes much softer and less confident. "Hold on, I screwed up somewhere," he says.

Rachel rolls her eyes and turns away.



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