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A CONVERSATION WITH

Why Democracy Lives and Dies by Math

A documentary filmmaker and a mathematician discuss our fear of numbers and its civic costs.

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By Siobhan Roberts

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"Math is power" is the tag line of a new documentary, "Counted Out," currently making the rounds at festivals and community screenings. (It will have a limited theatrical release next year.) The film explores the intersection of mathematics, civil rights and democracy. And it delves into how an understanding of math, or lack thereof, affects society's ability to deal with the most pressing challenges and crises — health care, climate, misinformation, elections.

"When we limit access to the power of math to a select few, we limit our progress as a society," said Vicki Abeles, the film's director and a former Wall Street lawyer.

Ms. Abeles was spurred to make the film in part in response to an anxiety about math that she had long observed in students, including her middle-school-age daughter. She was also struck by the math anxiety among friends and colleagues, and by the extent to which they tried to avoid math altogether. She wondered: Why are people so afraid of math? What are the consequences?

One of many mathematicians who share their perspectives in the film is Ismar Volic, a professor at Wellesley College and a founder, in 2019, of the Institute for Mathematics and Democracy. He is also the author of "Making Democracy Count: How Mathematics Improves Voting, Electoral Maps and Representation."

Dr. Volic grew up in Bosnia-Herzegovina, a country that in the early 1990s went through "a horrific war," he said. "I am familiar with what collapse of democracy can lead to." He saw parallels between what happened in Bosnia and what was happening in the United States and around the world. "That has driven me in the last few years, understanding the mechanics of democracy, the infrastructure of democracy, which is very much mathematical," he said.

The following conversation, conducted by videoconference and email, has been condensed and edited for clarity.

The film is dedicated to Bob Moses, a civil rights activist known for his voter-registration work in the 1960s and later for founding the Algebra Project, a math program for students performing in the lowest quartile. How did Mr. Moses inspire you?

Abeles: Bob saw math as access to power in the 21st century. He knew that graduating from high school ready to take math for college credit was key to gaining access to careers and economic opportunity. He observed that students from historically marginalized communities, particularly Black and low-income students, often lack access to quality math education, and he argued that this inequity mirrored the segregation and disenfranchisement of the civil rights era. Bob believed that if society did not address this gap, we were perpetuating a cycle of inequality in which certain groups were systematically denied the tools they needed to thrive.

In civic life, decisions are increasingly driven by data, by algorithms, by statistics. Without the ability to understand or even grapple with the numbers and their implications, people are easily disenfranchised and manipulated. Like Bob, I came to see math literacy as not just a necessary skill but a civil right. You need a certain amount of math to be able to fully participate as a citizen.

From Mr. Moses' vantage point, math literacy is a social justice issue. From another perspective, mathematics underpins the mechanisms of democracy. How so?

Volic: That's the other side of the same coin: the mathematics that's under the hood, the engine of democracy. Many of our electoral and legislative systems are mathematical at the foundation. Collecting and tallying votes, allocating legislative seats, deciding sizes of legislatures, drawing district maps. There are various mathematical ways that these things can be done, and math can also tell us which methods are good or not so good.

Ismar Volic, a professor at Wellesley College and a founder, in 2019, of the Institute for Mathematics and Democracy. Lucy Lu for The New York Times

Your book "Making Democracy Count" encapsulates your course "Math and Politics," which is open to all students and has no math prerequisites. How do students respond to the material?

Volic: They are outraged to learn about how we run our democracy in archaic and deficient ways. They are upset that there is a path to win the presidency with only 23 percent of the popular vote, that gerrymandering is rampant, that the system silences and disenfranchises millions of people. All this is amplified with the current election since we can see the dysfunction unfold in real time.

Many students are apprehensive at the outset about the math part of the course, but very soon they declare themselves to be math people after all. They are excited to learn that our democracy can be mended through a purely quantitative approach — not partisan, ideological or political. Understanding that in a structural way is extremely empowering.

For example, you can explain why, mathematically, plurality voting, which is the method we use to elect all but a handful of our 520,000 officials, is rife with problems. In plurality voting, the voter selects only their top choice. That approach doesn't take in very much information, so math can do very little with it and therefore makes mistakes. The basic problem is that a plurality winner isn't necessarily the majority winner, and that opens the floodgates to mathematical consequences such as vote splitting and the spoiler effect.

Ranked choice voting is one alternative: Voters pick their top choice, and also their second and third choices, and so on. How is that better?

Ranked choice collects more information, so math can do more with it. If nobody has won more than 50 percent of the vote, you eliminate the person with the least number of first-place votes — and the votes for that person are transferred down the ballot to the next candidate. This is like saying to the voter, Look, your top choice didn't make it, but who would you like to give your vote to now, knowing that your person is out? So your ballot still contributes. In this iterative process, math can do a much better job of understanding the collective preferences of the voters.

Showing the improvement with a different method is powerful and disarming precisely because it is steeped in logic and reason.

In your book, you present a plan of action, which includes voting reform and infrastructure reform, and the notion of the citizen mathematician.

Volic: Citizen mathematicians are a subset of citizen scientists. They understand that a functioning democracy relies on mathematical processes, and they advocate changes in the political system based on sound mathematical evidence. So average citizens who are quantitatively literate are key.

Both the film and the book recount the gerrymandering case heard by the Supreme Court in 2017. Chief Justice John G. Roberts Jr. referred to math — specifically to the efficiency gap, a mathematical measure of gerrymandering — as "a bunch of baloney" and "sociological

gobbledygook." Justice Stephen Breyer agreed that it was "pretty good gobbledygook." What should we make of that?

Abeles: Roberts's comment reflects the assumption that people won't accept a Supreme Court decision based on math that they can't follow. We assume and accept that many people don't get math and disengage from it.

Volic: He said that the efficiency gap measure is invalid because a person on the street wouldn't understand it. But the Supreme Court is going to have A.I. cases coming down the pipeline, and crypto and quantum computing. They'd better engage with math.

It was like a frustrated teenager in geometry class, throwing their notebook across the room. I would like to give these people the benefit of the doubt — that they are smart and they are not afraid to tackle new ideas, including mathematical ones.

The personal stories in the film about people revisiting or re-engaging with math are compelling. I've seen viewers moved to tears.

Volic: I cry every time I watch the movie.

Abeles: Do you remember where you cry, Ismar?

Volic: When Rebecca gets her degree.

Abeles: Rebecca Galicia is a mother whose traumatic experience with math derailed her career ambitions. In her case, math served as a gatekeeper. It prevented her from receiving the credentials she needed to get a job to support her family. Rebecca finally faces her math phobia in a community college course.

She's emblematic of the way we've decided to set up our society, the way we have accepted that it's OK to use math to filter most people out. But beyond the way that math affected Rebecca's access to career was the way her experience of school math left her feeling stupid and ashamed. I think audiences relate to that part of her story because so many of us have experienced the same thing.

The story of Glenn Rodriguez, a formerly incarcerated individual, shows the ultimate power that math has. His freedom was on the line when his parole was unjustly denied by an algorithm. He questioned the result because it didn't make sense and he changed the outcome.

That's part of what I want audiences to take away from the film. I want them to feel empowered to do the very thing that Glenn did, to ask questions when things don't make sense, and to start to engage with the math that is all around them.