Jeff Weeks and Density Experiments

Dr. Sarah's MAT 1010: Introduction to Mathematics

Geometry of the Earth and Universe

How we measure and view the world around us and decide what is the nature of reality.

goals:

- Explore applications of geometry in everyday life.
- Identify the role of probability and chance in real world situations
- Communicate geometric information in written documents.

1. Summarize the $\frac{1}{3000}$ part.

2. Summarize the "plus or minus" $\pm$ (margin of error for confidence interval) parts.

3. Next read the following interview. As you do so, circle or write down at least one or two items that you found interesting, disagreed with, had a question on, or wished had been done as related to the following:

What influences led you to become a mathematician?

Reading Abbot's *Flatland* during senior year in high school was a turning point. After two weeks of intense effort, almost in a flash I could finally "see" it. This glimpse into a new world made a huge impression on me. I think that's what hooked me on mathematics, and on geometry in particular. I love the connections between pure mathematics and the physical world. A real joy.

Why did you become a mathematician?

The combination of beauty and simplicity of exploring new worlds exceeds anything you'll find in everyday life. As part of the current research I've been working on the hypersphere. That's part of the joy of mathematics—you might struggle with something for months, but then when you "get it"...

Are there any local to global issues or diversity issues in your experiences?

In an international sense mathematics is extremely diverse, with people from a broad range of cultures sharing a common mathematical culture. Domestically, though, mathematics seems to be in decline, regardless of race or gender. The US now relies overwhelmingly on foreigners both for mathematically skilled positions in industry and for graduate students in pure math. I did once serve as a "de facto mentor" for a woman's undergraduate thesis. She did a super job, went on to graduate school, and is now a tenured math professor. I don't really see this as a "diversity issue," though. She did the same project a male student would have done. So in that sense mathematics is pretty gender-neutral. It's the social environment where things get messy, but that seems to vary enormously, from departments where gender isn't an issue to other departments that openly discourage women students and faculty.

Did you have support from family and society or face any barriers?

I don't think my parents ever grasped why I wanted to go into math (even when I was applying to graduate school my dad sat down with me and earnestly and kindly suggested that I might want to consider business school as an alternative). On the other hand, my parents fully supported my decisions and encouraged me at every step of the way. Society too has been supportive. However, in graduate school, the pressure took all the joy out of it, and under those circumstances it was hard to make progress. I didn't start enjoying mathematical research until after I got my PhD. I've taken a non-standard path, but there's always been a way to make things work. [After several years of teaching undergraduate mathematics, he resigned to care for his newborn son, and continued his research as a freelance mathematician.] This is a great time to be a mathematician.

Describe the process of doing mathematics?

Everything I do I see as pictures. The mental images are totally convincing. In cosmic topology, the problems arise from anomalies in our observations of the universe. I like to start with the absolutely simplest case that isn't totally trivial. If it's too messy I'll spend a few days trying to understand more deeply what's going on, in hopes of finding a simpler proof or a more enlightening point of view. This is particularly true of calculations—a calculation can prove that something is true without telling you *why* it's true.

How do you get the flashes of insight that you need to do research?

If I could tell you that, I'd be a far more productive mathematician :-) Seriously, for me the key is to be well-rested, unrushed and undistracted. Math is discovered, not invented. For me there is no doubt. As you explore, you work your way through a lot of "false understandings" where things don't quite come together. Then, all of a sudden, things start falling into place. That's the moment you realize you're onto something. It's very much an experience of discovering something that's already there. I find that a lot of progress takes place in my subconscious. That is, I can go to bed totally confused about a question and wake up with an idea. Similarly, I might be, say, out for a bike ride and find an idea just pops into my head, without my having been aware that I was even thinking about the problem. (Your students should understand, though, that they can't expect an idea to literally come from nowhere—they have to immerse themselves in the question first!)

References

Adapted from excerpts taken from:
Jeff Weeks *Exploring the Shape of Space*
my Jeff Weeks Interview