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Proof by example Portraits of women in Dutch mathematics

Rosa Schwarz

Rosa Schwarz obtained her PhD in Algebraic Geometry at the University of Leiden in December 2023. For her dissertation titled ‘Logarithmic approach to the double ramification cycle’ she obtained an honorable mention at the Christiaan Huygens Prize 2024. Now Schwarz currently works as a tutor and thesis coach as well as at the Lorentz Center for academic workshops. She shared with us some of her experiences and ideas on research and teaching in mathematics.

Can you start telling us about the beginning of your mathematical journey?

Well, I was very good at mathematics in school so it was a natural option to consider. But still it wasn’t obvious, I doubted for a long time whether I wanted to study Latin and Greek or English or astronomy or mathematics. And then I went to an Open Day at the university where we had the possibility of joining a lecture together with the first-year maths students. It was in February and it was the very first class of Algebra I. During the exercise class, I joined a table and the first-year maths students asked me whether I was already sure I wanted to study maths or whether I was doubting. I told them I really liked those languages and astronomy too and the entire table, without exception, said “Oh but they are also very beautiful subjects!”. That’s when I realized that I was allowed to study mathematics and also like other things at the same time.

And when you started studying maths were you happy with the choice you made?

Were you also able to continue cultivating your other passions on the side?

I did a minor, where I took courses in world mythology, ancient history of Greece and Rome and ancient philosophy. So yes, there was space for other things, but I was, pretty much immediately, happy with my choice. I found a friend



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very early on which was important. It was impossibly hard and some part of me really liked that. During high school I found the maths curriculum not really interesting but at university from day one it was all really new and exciting!

Was there anything you did not expect?

There were only five women in my class in Leiden, out of thirty, and after one year there were only four. People told me that there were few women studying maths but I never fully realized that until I entered the room that day and I looked around at the group.

And did that have an impact on you?

I was actually always encouraged by being different, or by going against the norm or the rules somehow. So at the beginning I was fine. It took me years to realize that it would have been nice to have had an inspiring female professor. I remember when, during my first year of PhD, I went to a winter school in Frankfurt and for the first time there was a female researcher in my area that gave a wonderful series of lectures. That left a deep impression.

But do you think you were still able to find your own community during your studies?

Yes, I found great friends. For me, mathematics is teamwork and apart from the

fun, we were great at doing mathematics together. I would be the one to make weird connections with certain theories or things we had seen before. Then there was a friend that was always able to find counterexamples and gaps in our arguments and a friend that was never afraid to just start and do very long and tedious computations. We were a good team!

And why did you decide to continue with a PhD?

[Rosa laughs]. I actually don't think I have a very inspiring answer to this question.

For many people, including me, it's just a lack of viable alternatives...

Yes, I had a similar experience. My master thesis supervisor was David Holmes and he had the possibility of hiring a PhD student and asked me whether I wanted the position. And I thought "How am I supposed to know what I want?". Then I realized it was easier to continue studying in the direction of my master thesis than figuring out a completely different path. But most of all, I realized I wasn't done learning yet. I liked the working relationship I had with David, I liked the weird abstract thinking. During the master I was a teaching assistant, and I truly enjoyed it very much, so I was happy to have the opportunity to continue doing that also during the PhD. When I started, they were really flexible and there was the possibility of doing a PhD while being enthusiastic about teaching at the same time. So I did a little bit more teaching than what I was expected to because I liked it, even though it took time away from research. But in my second year they introduced more rules and unfortunately the system was not so flexible regarding extra teaching anymore.

Could you explain, in very simple terms, what was your PhD project about?

My research topic relates to an area of algebraic geometry called enumerative geometry, so it focuses on counting problems regarding geometric objects. Say you were to ask how many lines can you draw passing through two distinct points on a plane, then the answer would be 1. Similarly, if you consider five distinct enough points on a plane, how many pa-

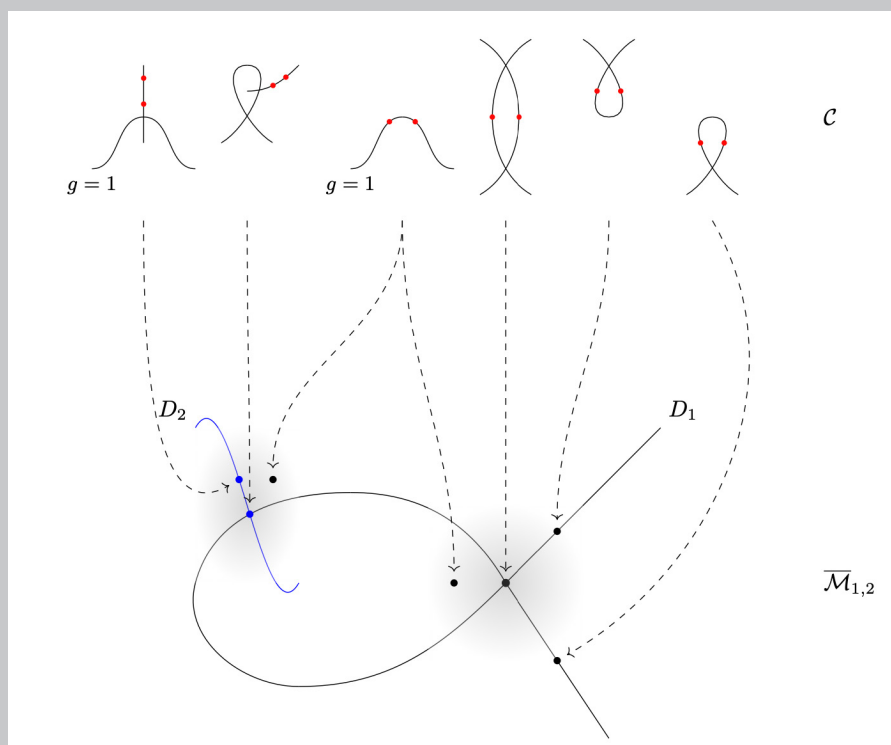


Figure 1 The universal curve $\mathcal{C}$ over $\overline{\mathcal{M}}_{1,2}$ and the boundary divisors D_1 and D_2 .

rabolas, ellipses or hyperbolas - what we call degree two curves - could you draw through these points? The answer is still 1. But if you ask the following question: how many degree three curves pass through eight distinct enough points in the plane then the answer would be 12. The answer to the following question would be 620. And these numbers have an actual structure and a recurrence relation that you can prove through very abstract mathematics, using moduli spaces of curves, that is, spaces that parametrize all possible curves. Structures on these moduli spaces were what my thesis was mainly about.

Did you enjoy working on this specific topic?

I was always fascinated by algebra. And in algebraic geometry you can combine the abstract thinking with a more visual component, for instance you can try to draw examples. I think this is one of the parts that I enjoyed most in my thesis, visualizing examples with drawings and deriving explanations from them. Also, David's enthusiasm for the topic was contagious.

You mentioned you were doing a bit of teaching in your master and in your PhD.

What did you enjoy in particular about teaching?

I like seeing connections or new ideas forming in the mind of the students. But I think it really makes a difference when you work with students that actually want to learn. So, as a teacher, you don't have to work on the motivation, you only have to find the right words or the key to unlock the understanding in their brains. I naturally come up with many different ways to look at a certain thing and this turns out to be very helpful to students.

And what were the aspects of PhD life, or academia in general, that you did not enjoy? Particular challenges that you had to face?

I have actually never been able to work full time. I knew that since I was 12 years old. At school, my smart brain was enough to compensate so it was less of an issue. I made this clear in my PhD application, so I started with working four days instead of five and in the end it was three days a week. In the academic community this is not something that is always understood. Especially if in those four days you also like to be involved in education because you find that very fulfilling. The fact that you are not 100%

fully focused on research all the time is not always accepted. When I told people I was not working on Tuesday people were confused “But you are a PhD student, you should always be working!”. Of course it is officially allowed to work part time, but the unofficial perception or the comments you get at times made me uncomfortable. It seems that one of the only explanations that is accepted to work less time is parenthood, but there are so many other reasons why a person could not be performing 100% all the time. And often it is not a matter of personal choice but you don’t necessarily have the energy to explain this to everyone. Sometimes this was a bit hurtful.

I struggled also because I genuinely had different interests. As a PhD student you are supposed to do some teaching, but only because you have to and only for the minimum time required. You are not supposed to do it because you actually enjoy it! I also took on several responsibilities, such as organizing the PhD colloquium, as a way to bond with other colleagues. The fact that I did that voluntarily was regarded as unusual.

I think that this only-research focus is a situation that is slowly changing. In the Netherlands there is now this whole conversation about recognition and reward that seems to be a step in the right direction.

So you are optimistic that the conversation about recognition and reward will have a concrete effect with time?

Well, I am an optimist. Not only in respect

to this, but in general. But I accept that change takes time. I think that in the coming years very traditionalist views on what working in academia means will grow less loud and less numerous and that there will be more space for more diverse and inclusive approaches. But there is also concrete research supporting the fact that a more diverse system of recognition and reward will make your employees happier. People might not listen yet but it is good to have it written down.

And what about life after PhD? What are you doing now and what brought you to this direction?

I ended my PhD reporting-in sick, because I entered a trajectory of “revalidatie”, a sort of rehabilitation program for people with an extreme and chronic amount of pain to help them learn to perceive pain again. Amongst other things, it helped me to better understand my boundaries. I realized I don’t want to move abroad for a long time or do a post-doc abroad, since my support system is here. Also, I need to look for work that is not full-time and this limits my options. I am now working at the Lorentz Center, which organises academic workshops, and I do some freelancing as a tutor and thesis coach working with students that are experiencing some difficulties. I still really like mathematics and I would love to keep working in an academic environment as a teacher or study advisor. I especially would like to work with students that have special needs. Since I was never completely healthy, I would love to make the academic environment more welcoming for people that have some functional limitations of some sort or neurodivergent brains. They should receive the help they need.

Did you notice a difference in perception in these kinds of matters after the pandemic?

There was a big progress in terms of facilities for recording lectures, and that is really beneficial for students with special needs. It would have meant the world to me not having to travel for Mastermath classes and being able to watch the re-



Rosa Schwarz en minister Eppo Bruins

ording of the lectures from home. But there are not always easy fixes like that. Some students just need a little bit more than that and getting that assistance takes a lot of energy from those students. It would be nice if there was a system to support them a bit more.

I think it would be really important to have more figures like the one you have in mind, to bridge between lecturers and students.

Yes, especially because in many circumstances students won’t directly approach the lecturers and there are limits to what even a very supportive supervisor can do. I think we need something more and I hope to be able to contribute in this direction.

I really hope so too! To conclude, we wanted to congratulate you again for obtaining an honorable mention at the 2024 edition of the Christiaan Huygens Award. How did the price make you feel?

Well, the first reaction was imposter syndrome, but that’s just my insecurity. During the award ceremony they read the jury report and I was being praised for the chapter of my thesis where I had a lot of illustrations to explain hard algebraic geometry concepts. That actually made me really proud! I also mentioned there that I was no longer active in mathematics and that, given my situation, I would have liked to encourage students with some sort of functional limitation or handicap to be able to study if they want to. There was a lot of positive reaction to that. It wasn’t easy but in the end I learned to be proud of what I have achieved!

We want to thank Rosa again for so honestly sharing her experiences and wish her all the best for her future career!



Figure 2 Schwarz’ thesis cover: artistic interpretation of a moduli space of curves