



Chelsea Walton Interview

Conducted by Alexander Diaz-Lopez



Chelsea Walton is assistant professor of mathematics at Temple University. Chelsea works in non-commutative algebra, Hopf algebras, and their relations to other areas of mathematics. In 2017 she received a Sloan Research Fellowship. Her email is notlaw@temple.edu.

Diaz-Lopez: *When did you know you wanted to be a mathematician?*

Walton: I've always loved math. It wasn't just because I had a knack for it; I was drawn to it and always wanted to learn more. I liked identifying patterns and symmetries, and I loved puzzles. But when I was young I didn't know that these were mathematical concepts, as some of these "games" did not involve numbers. Once I discovered in high school that I could have a career in playing such games, and even better, making up new math, I was sold—I was determined to be a mathematician.

Diaz-Lopez: *Who encouraged or inspired you?*

Walton: My family has always been encouraging and inspirational. To start, my parents have always trusted my judgment, supported my decisions, and never pushed me into one field or another, although there was that one period when I wanted to be a movie critic, to which my dad replied, "How many Siskels and Eberts do you know?" I couldn't think of any others so I switched back to math,¹ which is ironic because I didn't know any mathematicians when I was growing up! So maybe there was a gentle push there. My paternal grandfather was also very encouraging and liked playing the same games as I did (identify patterns and symmetries, etc.). In fact if circumstances were different back when he was growing up, I reckon that he would have pursued mathematics as a career.

I have also had tons of support from mathematicians throughout my career including undergraduate mentors Jeanne Wald, Joel Shapiro, and Michael Frazier (at Michigan State at the time), grad school mentors at Michigan including Toby Stafford (now at U. Manchester UK) and Karen Smith, and various mentors during my years as a postdoc including James Zhang (U. Washington), Pavel Etingof (MIT), Sarah Witherspoon (Texas A&M), and Ellen Kirkman (Wake Forest).

Diaz-Lopez: *How would you describe your research to a graduate student?*

Walton: I'm a noncommutative algebraist and there are many natural collections of objects in the world that

¹It was actually "mathematical engineering," a term that I made up because I didn't know that "mathematicians" existed.

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algebraic geometry, Poisson geometry, invariant theory, and functional analysis.

More specifically, I'm very much interested in symmetries of noncommutative algebras. Classically, groups suffice as an axiomatization of a given object's symmetries; consider dihedral groups and regular polygons, for instance. But there are many noncommutative algebras that have small automorphism groups. For example, the \mathbb{C} -algebra generated by two noncommuting variables x and y subject to relation $yx = \pi xy$ admits only linear actions given by scaling, whereas the degree-preserving automorphism group of the commutative polynomial ring $\mathbb{C}[x, y]$ is all of $GL_2(\mathbb{C})$. So a better notion of symmetry of noncommutative algebras is needed, and for this, actions of Hopf algebras are widely accepted to be a good fit. Indeed, an example of a Hopf algebra is a group algebra. I study when such actions exist, and when they do, I sometimes do various things with the actions as one would in the classic setting.

I'm also interested in many other aspects of noncommutative algebra...

Diaz-Lopez: *What theorem are you most proud of and what was the most important idea that led to this breakthrough?*

Walton: This is hard to decide and I'll need more time to answer the first question (and the second depends on the first). My honest answer now is "the theorem that's to come!" I think I'm far too young to reflect upon my mathematical journey in the manner that the question suggests. I'll probably give the same reply 10 years from now, maybe even 20 years from now. I like to focus on learning new math, creating new math, and pushing forward.

Diaz-Lopez: *What advice do you have for graduate students?*

Walton: Picking your thesis advisor is the most important decision you can make in grad school. I suggest choosing an advisor based on the following criteria.

(1) What type of mathematics they specialize in broadly-speaking (it's not expected, typically, that you can understand their research statement with ease) — you'll need to think about a problem in their area of research rather obsessively so you better like the mathematics that they're doing.

(2) Whether their style of advising is compatible with the way you need to be mentored. Would you like weekly meetings at first? Would you rather be left alone for lon-

ger period of time? Are your methods of communication compatible? Etc.

(3) They respect your plans after grad school and don't fuss about making you a clone of themselves.

Some would disagree with or would downplay (3). However, you may want to pursue a route in the long term that your advisor hasn't explored. You may want a Research I career, or you may want career at a liberal arts institution, or you may want to leave academia altogether after grad school. You may change your mind a lot. A good advisor will roll with it and the mathematics at hand should be the focus of discussions. Only you know what is best to make you happy.

Moreover, your advisor shouldn't be the only person from whom you seek advice. Building up a network of other faculty and grad students with whom you can discuss mathematics and professional development is essential. Don't isolate yourself.

Diaz-Lopez: *All mathematicians feel discouraged occasionally. How do you deal with discouragement?*

Walton: I have a wonderful support network that I reach out to often—the most immediate one includes my husband and my two pups (see Figure 1). Yes, I include the pups—they couldn't care less if I prove a theorem or not. Although some days I think they have a better shot at this than I do! In general, I depend on people who selflessly have my best interests in mind.

It can be discouraging when I have to deal with people with whom I am not on the same page. Some would call these "difficult people," but it could be the case that I'm the difficult one—who knows? In any case, having another ear, like my husband's, or a friend's, to help me navigate these situations is extremely helpful. Fortunately, on most days, I don't feel discouraged because of such a situation.

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Figure 1. Walton with one of her dogs, Mr. Mischief Maker.

I actually feel the most discouraged when I'm exhausted and feel like I haven't spent enough time or energy doing math, when I've bitten off more than I can chew with other things that grad students shouldn't worry about. Because there's plenty of time later to worry about conference organizing, grant proposals, and wonderful administrative tasks! Again, having family or friends either help me or provide me with the space to re-prioritize my to-do list is key.

I would not say that I do not get discouraged doing math itself, but it pales in comparison to discouragement occurring in life matters.

Diaz-Lopez: *You have won several honors and awards. Which one has been the most meaningful and why?*

Walton: Being awarded a Sloan research fellowship was absolutely fantastic—a feather in the cap of not only me but, in my mind, of all (future) Black female mathematicians. Of course, we're not a monolithic group, but when one of us receives a great honor, like Sylvia Bozeman being appointed to President Obama's Committee on the National Medal of Science, or Talithia Williams hosting *NOVA Wonders* on PBS, or Carla Cotwright-Williams serving as an AMS Congressional Fellow, I'm very proud. It's a great personal boost to me and very motivating professionally.

Diaz-Lopez: *You have co-organized a BIRS workshop for Women in Noncommutative Algebra and Representation Theory (WINART) and manage the website women-in-calg-repthy.org. What motivated you to get involved with this and how has it been received? Are there any future activities?*

Walton: In short, I decided to co-organize the WINART workshop (which was held at BIRS in April 2016, Figure 2) because I needed it for myself.



Figure 2: Women in Noncommutative Algebra and Representation Theory workshop at BIRS in April 2016.

I wanted an experience at a research conference where I was not an outsider gender-wise, and ethnicity-wise (we had a significant number of women of color at the previous WINART workshop). I also thought that other women could benefit from the experience as other participants have in other research collaboration conferences for women at BIRS. Our first event was very successful over-

all and it resulted in several publications, preprints, collaborative works in progress, and even friendships in a short span of time. I learned a great deal of mathematics from being able to work with my collaborators

Adriana Mejía Castaño,

Susan Montgomery, Sonia Natale, and María Vega—techniques that I will be able to incorporate into future projects. It was a super stimulating experience and we are in the process of planning an event for 2019, hopefully to be held at BIRS again if our proposal is accepted.

Diaz-Lopez: *If you could recommend one book to graduate students, what would it be?*

Walton: My advisor, Toby Stafford, raised all of his students on Goodearl and Warfield's *An Introduction to Noncommutative Noetherian Rings*—it's an outstanding text. For graduate students across fields, I would advise reading Terry Tao's article "What Is Good Mathematics?" There's a ton of ways one can be good at math and there isn't a linear hierarchy of X-is-better-than-Y, at least not in my mind. The quicker grad students learn that they are coming in with their own unique bag of tricks, and that there's no point in comparing oneself to others, the better!

Diaz-Lopez: *Any final comments or advice?*

Walton: Actually, the only person that you should compare yourself with is "you yesterday." Keep pushing to be better, and keep re-defining "better" in the context of what makes you happy!

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Figure 1 courtesy of Chelsea Walton.

Figure 2 courtesy of Banff International Research Station.



Alexander Diaz-Lopez

ABOUT THE INTERVIEWER

Alexander Diaz-Lopez, having earned his PhD at the University of Notre Dame, is now assistant professor at Villanova University. Diaz-Lopez was the first graduate student member of the *Notices* Editorial Board.