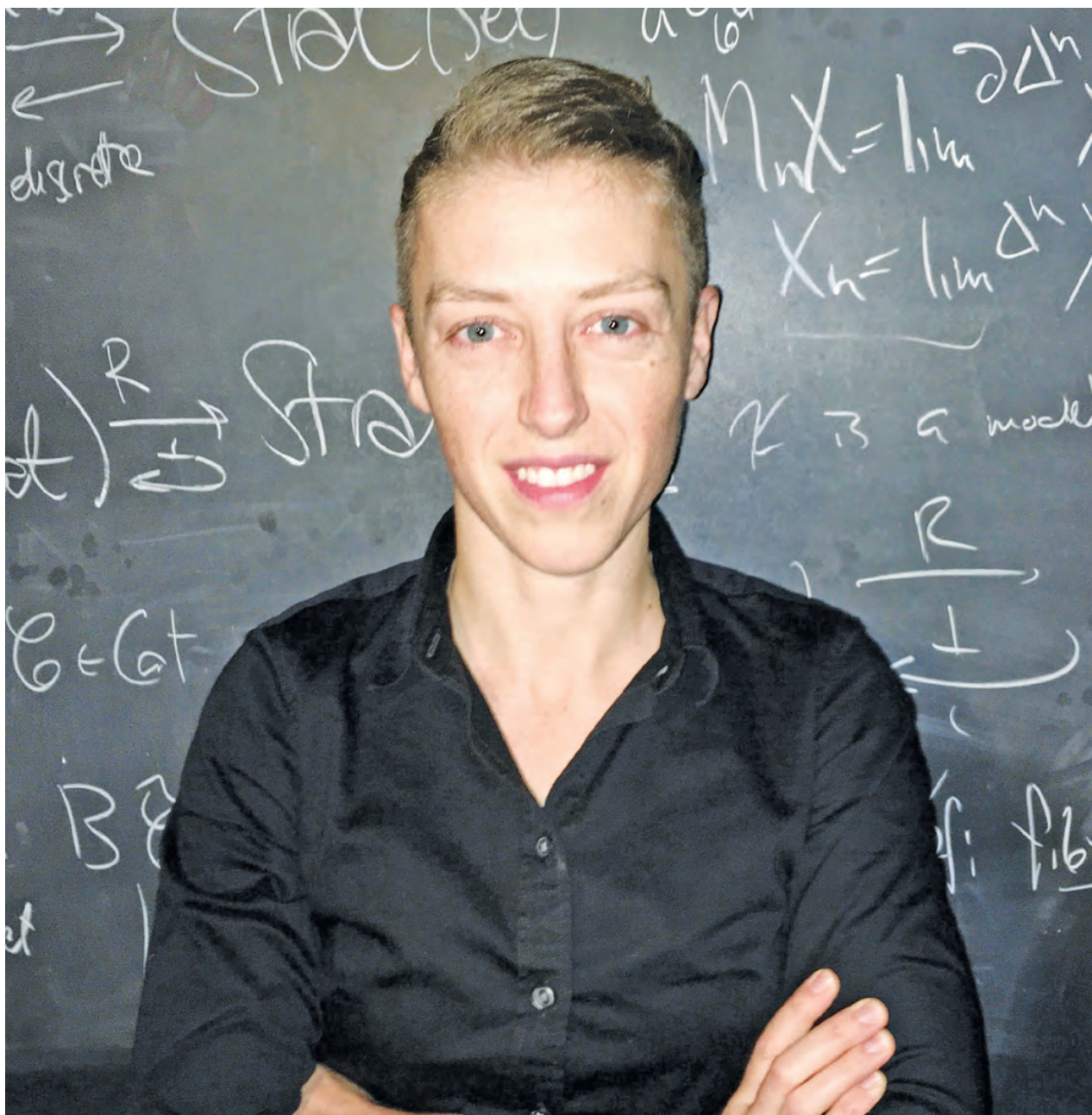# Emily Riehl

Synopsis of Research

A category provides a template for a mathematical theory supplying *nouns*, to represent those mathematical objects, and *verbs*, to represent the transformations between them. But as the objects mathematicians study increase in complexity, a more sophisticated linguistic palate is required, including adjectives, adverbs, conjunctions, and so forth. Such objects live most naturally in weak infinite-dimensional categories, commonly nicknamed ∞-*categories*. Pioneering work of André Joyal and Jacob Lurie to extend ordinary 1-category theory to ∞-categories is "analytic" in the sense that it is developed using the combinatorics of a particularly convenient model of a weak infinite-dimensional category. Emily Riehl's joint project with Dominic Verity redevelops this theory "synthetically," with proofs that hold in any ∞-*cosmos*, their axiomatization of the "universe" in which ∞-categories live as objects. Their ∞-cosmological approach both simplifies definitions and proofs of certain key components from the analytic theory and also generalizes them without change to other well-behaved models of infinite-dimensional categories. In future work, Riehl plans to write a textbook exposing these developments, originally described in a series of seven research papers, and also plans to apply similar techniques to develop the theory of higher-dimensional analogues of ∞-categories.

Biography

I specialize in category theory, particularly as related to homotopy theory, and have been assistant professor of mathematics at Johns Hopkins University since 2015. Prior to this, I was an undergraduate at Harvard University, completed Part III of the Maths Tripos at Cambridge, earned my PhD in 2011 from the University of Chicago, and then spent four years at Harvard as an NSF and Benjamin Peirce Postdoctoral Fellow. I am the author of two books, *Categorical Homotopy Theory* (Cambridge 2014) and *Category Theory in Context* (Dover 2016), both of which are freely available online; a co-author of 20 published research articles; and have written many other expository works with various degrees of polish. I am the founder of the Kan Extension Seminar, an online graduate reading course in category theory with participating students from around the globe, and a co-host of *The n-Category Café*. I serve as an editor for *Journal of Homotopy and Related Structures*; *Homology, Homotopy, and Applications;* and *Cahiers de Topologie et Géométrie Différentielle Catégoriques*. I am a member of the AMS Mathematics Research Community Advisory Board and chair of the AMS Web Editorial Group. I have been awarded an NSF grant and a CAREER award to support my work. I have also been recognized for excellence in teaching at both Johns Hopkins and at Harvard. I am currently advising somewhere between two and four PhD students and mentoring one postdoctoral fellow, and I will be co-organizing an MSRI semester on Higher Categories and Categorification, which will take place in 2020.

Advice to Young Women

Regarding advice, I would have appreciated being reassured that it's ultimately up to me how I want to spend my time. I particularly enjoy giving talks and am unusually enthusiastic about expository writing, so I say yes to most speaking engagements and take on a lot of extracurricular writing projects. This means less time for research and other things, but it also makes me happier, so feels like a win overall. I think the fetishization of research above all else is really damaging to both the self-confidence of members of our community and to the community as a whole, which requires superlative advisors, inspiring teachers, diligent referees, compassionate mentors, efficient organizers, and so on to function in a healthy way.

Photo Credit

Photo of Emily Riehl courtesy of Mona Merling.