

PhD from JHU, fall 2022

Supervised by [Emily Riehl](#)

— Work Experience —

- 2024- **Assoc. Director of Research**

SYMBOLICA AI

Initial role: Research Software Engineer

- 2022-2024 **Quantitative Technologist**

RADIX TRADING B.V.

- 2016-2022 **Teaching Assistant**

JOHNS HOPKINS

— Education —

- July 2022 **PhD in Mathematics**

JOHNS HOPKINS

Dissertation: Towards the theory of proof-relevant categories

- Spring 2020 **Programme Associate**

MATHEMATICAL SCIENCES RESEARCH INSTITUTE

Higher Categories and Categorification

- 2018 **Masters Degree**

JOHNS HOPKINS, M.A. MATH.

Completed written qualifying exams and oral speciality exam

- 2016-2018 **Principle Fulbright Scholar**

JOHNS HOPKINS

Selected & funded to pursue PhD in Math., transferred from George Washington University

- 2015-2016 **Principle Fulbright Scholar**

GEORGE WASHINGTON UNIVERSITY

Graduate coursework

- 2015 **Masters Degree**

UNIVERSITY OF CAPE TOWN, M.SC. MATH., WITH DISTINCTION

Dissertation: "On the local and global properties of information manifolds"

- 2014-2015 **Research Group**

UNIVERSITY OF CAPE TOWN, INFORMATION GEOMETRY

Quantum Gravity and Strings Laboratory

- 2014 **Honours Degree**

UNIVERSITY OF CAPE TOWN, PURE MATH., FIRST CLASS

- 2011-2013 **Bachelor of Science**

UNIVERSITY OF CAPE TOWN, DEGREE WITH DISTINCTION

Majors: Pure Math., Applied Math., and Astrophysics, each with distinction

— Computer Science —

Prior to commencing graduate studies in mathematics, i organised, competed in, and taught the following:

- 2011-2014 **Algorithm Circle**

THEORETICAL C.S. ORGANISATION, UNIVERSITY OF CAPE TOWN

Lecturer (2011-2014), Vice Chairman (2012, 2014), Chairman (2013) for an organisation that gave

free & open, weekly lectures on topics in theoretical computer science (data structures, complexity theory, programming language theory, cryptography) and helped attendees prepare for programming contests.

■ Dec. 2012 **Top 10 in Southern Africa**

GOOGLE APP DEVELOPER CHALLENGE

Designed and implemented a website allowing for the easy, intuitive and visual organisation of free-form data into graphs and networks conveying relations and interconnections. Written in Python, Javascript, and using D3.js.

■ 2011 & 2012 **Haskell Course**

UNIVERSITY OF CAPE TOWN

Organised and gave a free & open Haskell programming language course.

In the period 2011-present, i have contributed code to several open-source projects, including:

- [MikeOS](#), a 16bit real-mode operating system written in x86 assembly
- [DoomRetro](#), a modern source port of ID Software's DOOM (II) game engine written in C using SDL2
- [tiny-menu.el](#), an Emacs minor mode to display interactive menus for quick actions written in Emacs Lisp

In the period 2016-present, i have created several medium-to-large projects of my own, including:

- [ctak](#) [C], a line-mode interface for the game of Tak, complete with a computer opponent. This project was designed to learn about neural networks, adversarial tree search, & buildroot for cross-compiling and embedded computing on a Raspberry PI
- [srchr](#) [Rust], a parallelised keyboard layout optimiser. This project exploits symmetries in “pre-layouts” to reduce the search space, which it explores by way of a genetic algorithm in order to optimise layouts given certain n-gram distributions and a customisable loss function as input. Includes schematics for custom keyboard pcbs
- [Art-deco clock](#) [AVR C, OpenSCAD], a 3D-printed art-deco clock using an ATTiny24, RTC chip, and two OLED displays
- [siege-mode.el](#) [elisp], an Emacs minor mode to surround the region with smart delimiters interactively
- [msr](#) [C], a public-key signature verification tool using curve Ed25519, libsodium, GNU argp, and compatible with OpenBSD's signify
- [ZiRC](#) [Zig], a project to learn the Zig programming language and the basics of 3D rendering by building a featureful raycaster engine

— **Papers** —

■ **Regular Calculi I: Graphical Regular Logic** ([arXiv 2109.14123](#))

joint with B. Fong & D. I. Spivak, on the novel structure of regular calculi and their use as an ergonomic & graphical syntax for regular logic.

■ **A common misinterpretation of Isbell's obstruction to monoidal strictification** ([arXiv 2106.03652](#))

which shows that the widely disseminated obstruction to strictifying the associator is shown to be under-specified as stated, and the truth is more subtle.

■ **Bi-representations and bi-initial objects are not so different** ([link](#))

joint with L. Moser, on 2-categorical and double-categorical theorems characterising when pseudo-functors into Cat are representable, with applications to bi-adjunctions and 2-dimensional limits. Cahiers de Topologie et Géométrie Différentielle Catégoriques, LXIII-3.

- **2-limits and 2-terminal objects are too different** ([link](#))

joint with L. Moser, on the failure of all theorems of the form “a 2-dimensional limit is a 2-dimensional terminal object in a 2-dimensional slice category of cones”. Appl. Categor. Struct. 2022

— Teaching Award —

- **April 2021 William Kelso Morrill Award**

EXCELLENCE IN MATHEMATICS

For love of teaching, love of mathematics, and concern for students, nominated by undergraduates & selected by the department.

— Teaching Experience —

See my [website](#) for details, including my role as sole instructor, my role in administering the online homework system, and my work as a course development assistant and the products thereof.

- **2018-2021 Head T.A. & WeBWork administrator**

JOHNS HOPKINS

Calculus III & ODE (twice & thrice, resp.) and online homework system

- **Spring 2019 Course development**

JOHNS HOPKINS

Introduction to Proofs, assisted Prof. Riehl in course development

- **Fall 2017 Sole Instructor**

JOHNS HOPKINS

Introduction to Calculus

- **Jan. 2017 Primary Instructor**

JOHNS HOPKINS

Intersession Course: Recreational Math. for All

- **2017-‘19, ‘21 DRP Mentor**

JOHNS HOPKINS

Mentored projects in: General Topology, Braid Group Representations, Category Theory, Homotopy Type Theory

- **Oct. 2014 Invited Instructor**

UNIVERSITY OF CAPE TOWN

Introduction to Group Theory

- **2014-2021 Teaching Assistant**

Real Analysis, Introductory Abstract Algebra, Linear Algebra, Differential Equations, Calculus Sequence, String Theory

— Notable Service & Leadership —

- **2019 Primary organiser**

2019 CATEGORY THEORY OCTOBERFEST ([website](#))

hosted at Johns Hopkins

- **2018 Chapter representative**

DIRECTED READING PROGRAM (DRP)

Represented the JHU DRP chapter at the Directed Reading Programme Network & Workshop, MIT

- **2017-2019 Co-organiser**

DIRECTED READING PROGRAM (DRP), JOHNS HOPKINS

Individual pairing of undergraduates with graduates for independent studies ([website](#)). Mentor & co-organiser (2017-2019), primary organiser (2018-2019)

■ 2015 **Organiser**

MATHS POSTGRAD. TEA PARTY, UNIVERSITY OF CAPE TOWN

Founder of a biweekly meeting of graduates, comprising peer lectures and discussions over tea

■ 2011-2015 **Various roles**

ALGORITHM CIRCLE – THEORETICAL COMP. SCI. CLUB, UNIVERSITY OF CAPE TOWN

Free and open lectures, and competition prep. Lecturer (2011-2015), Vice-chairman (2012, 2014), Chairman (2013)

■ 2011 & 2012 **Organiser**

HASKELL PROGRAMMING COURSE, UNIVERSITY OF CAPE TOWN

Organised and gave a free and open Haskell language programming course

— **Competencies** —

- Comfortable in Python (incl. torch) & Haskell, with experience in Agda, C, Common Lisp, Coq, L^AT_EX, Python, Rust, and Zig
- English (fluent), Hebrew (intermediate), Dutch (intermediate)

— **Personal Pursuits** —

- *Electronics & 3D printing*: Various projects leveraging micro-controllers and custom circuitry
- *Cellular automata*: Exploration of rule sets and pattern engineering
- *Esoteric Programming Languages*: Authored and implemented several languages ([url](#))
- *Fractal Art*: Exploration of the media of iterated function systems, chaotic maps and attractors, and epicyclic generators
- *Digital Music*: Leveraged trackers and other platforms to create a variety of compositions