ACT SCHOOL 2019 - APPLICATION

BRYCE CLARKE

Background

I have a strong technical knowledge of category theory, having recently completed a Master of Research at Macquarie University, and have a large exposure to higher categorical methods as a member of the Centre of Australian Category Theory. I have experience in applying category-theoretic methods in the study lenses and bidirectional transformations, which arise in areas of Computer Science such as functional programming and database synchronisation, that is particularly relevant to the project "Traversal optics and profunctors". I have familiarity with the concepts of monoidal and enriched categories, and a strong interest in diagrammatic methods, which would be beneficial to several of the projects listed.

Research Summary

I expect to complete my PhD in early 2022. The project aims to utilise internal category theory to unify the theory of asymmetric and symmetric lenses.

Project Preferences

(1) *Traversal optics and profunctors* - Bartosz Milewski

(2) *Simplifying quantum circuits using the ZX-calculus* - Miriam Backens

(3) *Toward a mathematical foundation for autopoiesis* - David Spivak

(4) *Complexity classes, computation, and Turing categories* - Pieter Hofstra

(5) *Partial evaluations, the bar construction, and second-order stochastic dominance* - Tobias Fritz

(6) *Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces* - Mehrnoosh Sadrzadeh

Commitment

As much as possible I am committed to coming to Oxford. While the financial commitment of arranging travel and accommodation from Australia is challenging, I intend to apply for sponsorship from my home university, and I have also set aside additional personal funds. Any funding that the ACT 2019 School may be able to provide would ease the financial burden significantly.

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Bryce Clarke

Contact Information

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Research Interests

Lenses, bidirectional transformations, profunctor optics, internal categories, restriction categories, higher category theory

Education

Macquarie University, Sydney, Australia

Ph.D. Candidate, Mathematics (expected early 2022)

- Dissertation Topic: A Unified Theory of Lenses
- Advisor: Professor Michael Johnson

Master of Research, Mathematics, October 2018

- Thesis Title: Characterising Asymmetric Lenses using Internal Categories
- Advisor: Professor Michael Johnson

University of New England, Armidale, Australia

Bachelor of Science (Hons), First Class, December 2016

- Thesis Title: Representations of Finite Groups
- Advisor: Professor Gerd Schmalz
- Awarded the Edgar H. Booth Memorial Prize and Medal

Bachelor of Science, Mathematics, October 2015

- Grade Point Average: 6.92 / 7.00

Talks and Seminars

Internal Lenses, Australian Category Seminar, Macquarie University. (21 November 2018)

Characterising Asymmetric Lenses using Internal Categories, Visiting Seminar, University of New England. (12 November 2018)

Teaching Experience

T1, 2017	Teaching Assistant, Introduction to Quantitative Skills (MTHS100)
	Teaching Assistant, Quantitative Skills with Applications (MTHS110)
T2, 2016	Teaching Assistant, Quantitative Skills with Applications
T1, 2016	Teaching Assistant, Introduction to Quantitative Skills

Honors and Awards

2017	University Medal, University of New England, Armidale
2014–2016	Dux of Mary White College, University of New England, Armidale
2013–2016	University of New England Country Scholarship
2013–2015	Vice Chancellor's Scholar, University of New England, Armidale

Professional Experience

Summer 2016	AMSI Summer School in the Mathematical Sciences - Completed a course on Projective Geometry with John Bamberg at RMIT
Summer 2014	VC Scholar's Research Traineeship - Completed a research project on Geometry of Differential Equations with Gerd Schmalz at UNE

Reference

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ACT SCHOOL 2019 - EXPRESSION OF INTEREST

BRYCE CLARKE

The Applied Category Theory School 2019 offers a unique opportunity in my development as a category theorist with a growing enthusiasm in applications.

One of my primary research goals is to advance the understanding of lenses from a category-theoretic perspective. Throughout my Masters project, under the supervision of Professor Michael Johnson, I discovered first-hand the clarity which can be achieved through applying novel categorical techniques to problems arising in Computer Science. This culminated in the submission of my thesis, titled "Characterising Asymmetric Lenses using Internal Categories", and initiated a passion for understanding other kinds of optics through this framework. In particular, I feel the project "Transversals and Profunctor Optics" would not only offer a rare opportunity to advance my personal research goals, but provide a forum to share my own expertise gathered through previous work in the area.

Professionally, the ACT School would present my first opportunity to interact with other like-minded mathematicians abroad. While I am fortunate to be positioned in a rich community of category theorists at Macquarie University, there are too few occasions in Australia for a graduate student to interact with the wider international community given our geographical remoteness. I am excited by the chance to connect with applied category theorists from a wide range of backgrounds, and be exposed to an environment with a focus on the cross-fertilisation of theory and applications. This would also be immensely beneficial as I strive for a career in research mathematics, where collaboration could lead to a new idea, a new paper, or a post-doctorate position.

I am passionate about utilising category-theoretic methods produce novel solutions to interesting applied problems, and collaborating with a diverse group of people to achieve new insights. I hope participating in the Applied Category Theory School 2019 will allow me to achieve these goals, and lead to future opportunities to inspire research in the growing area of applied category theory.

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