Damian Marcińczyk – Curriculum Vitae

Education:

2002-2004: Master's Degree, Applied Mathematics, Uniwersytet Szczeciński. Discontinued in third year due to extended illness.
2003-2003: Master's Degree, Applied Physics, Uniwersytet Szczeciński. Discontinued.

My main influences while studying mathematics were dr Franciszek Prus-Wisniowski [1], dr Adam Neugebauer [2], and dr hab. Andrzej Dąbrowski [3].

During employment I have continued my education in pure and applied mathematics to a self-assessed level of master's degree, or above.

2005-2019: Employment as software engineer, during which 2008-2019 were spent entirely working with functional programming languages, predominantly Haskell.

My recent work includes launching Tezos [4], a self-amending nomic-based ledger and system of governance, as well as work on several similar projects afterwards, including [5]. I have recently started looking into theorem provers as well as Homotopy Type Theory as potential avenues for further professional development.

During my professional career I have learned many practical applications of category theory, and supplanted them with a large theoretical base. However, as I am not currently a student, and category theory was not a topic officially offered during my time at the university (except for extracurricular activities which I attended), if there are questions as to my knowledge related to category theory, I would be happy to, for example, solve a set of problems, or take up a preliminary course. In the run up to this application I have perused the currently in-progress lectures by Spivak and Fong available online, and they were not challenging. However, should additional foundational knowledge be required, I can commit to 20 hours/week of directed or undirected study from now until June.

Main skills:
- Well rounded background,
- Seeks out unusual perspectives on problems
- Works well with new people
- Multilingual – fluent in English, German, and Polish; learning Italian and Russian

[1]: http://wmf.usz.edu.pl/en/pracownicy/franciszek-prus-wisniowski-en/
[2]: This mathematician, who declined publishing his work, is nonetheless one of the greatest minds I have met in the field of mathematics and is somewhat well known in the circle of Polish academia.
[3]: http://wmf.usz.edu.pl/en/pracownicy/andrzej-dabrowski-en/
[4]: https://tezos.com/static/papers/white_paper.pdf
[5]: https://kadena.io/whitepapers/

Application for Adjoint School, ACT 2019 – Damian Marcińczyk

Why I am interested in joining the ACT Adjoint School:

My main motivation is to learn new approaches to my main topics of interest, some represented in the projects of ACT 2019.

I am actively interested in self-amending, resilient, and evolving systems, which is strongly related to David Spivak's project. This is the focus of the last several years of my professional career as a programmer.

One of my other interests is a theory of information that I am developing which expresses information processing in a form of generalized electronics. I would like to develop category theoretical foundations for this topic. I believe a deeper understanding of category theory and meeting with people I could work with on topics of category theory in the future could be invaluable as inspiration for this work.

Projects in ACT 2019 represent a cross section of my interests: systems, topics related to building compilers and programming languages, and I see topics that could be influential towards my other great interest, DSP and analog computing.

Last but not least, I am looking to meet people in ACT 2019 and hope that the experience of having worked on a project together could lead to many future joint projects. It was my experience during university that such projects – not for grades, not for a score or money, but just out of pure interest and curiosity of the mind – were the ones that resulted in long lasting and productive professional relationships in academia.

To what extent I can commit to coming to Oxford:

I can fully commit to traveling to and staying in Oxford for the duration of the school as well as the conference, and can also commit to additional visits. I have previously lived in Oxford and have been able to find accommodation within a short brisk walk of University grounds. I know the inner city well. I do not need a visa or a permit to come to the UK.

Projects, listed in order of most to least preferred:

- Toward a mathematical foundation for autopoiesis
- Partial evaluations, the bar construction, and second-order stochastic dominance
- Complexity classes, computation, and Turing categories
- Traversal optics and profunctors
- Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces
- Simplifying quantum circuits using the ZX-calculus

My experience and affinity towards category theory in general:

I have become interested in category theory as initially a practical tool for explicating and understanding my work in the Haskell programming language as well as other areas of functional programming. Upon delving deeper into this topic, it turned out that a large portion of what category theory has to offer has been taught to me during my undergraduate studies, tied into other topics, without explicitly pointing it out. I have since been actively interested in category theory, trying to find interesting papers relating to the subject, and reading up on various topics in books and on websites such as nLab or Lambda the Ultimate.

My experience related to the projects of the Adjoint School:

- *Toward a mathematical foundation for autopoiesis*: I have first encountered the idea of self-amending rule systems as nomics during my time at the university, during a summer camp that the students and some of the lecturers have organized during the second year. Self-amending and resilient systems have persisted as a topic of my study since. I have focused on those topics especially during the last 3-4 years, during which I have studied those – as well as, at work, implemented systems using this knowledge – from the point of view of systems of governance, physical safety systems, as well as programming languages. Some of my main questions of interest are, for example, “what makes a system susceptible to bugs or accidents”, “how does a system ensure it will not deteriorate”, “how can a system be built to ensure a lower incidence of unwanted behavior”, or “how can we predict, minimize, or maximize emergent behavior in a rule based system”. I have worked on Tezos, a self-amending, distributed system of governance, which might be one of the most well known recent industrial applications of this kind of thought. One of my recent interests related to this topic have been papers by Douglas Hofstadter, especially the Copycat system, as well as his work on analogies. I believe I would be able to provide a lot of practical experience to this project. It lies squarely in the center of main research interests.

- *Partial evaluations, the bar construction, and second-order stochastic dominance*: Stochastic dominance and risk are a commonly overlooked yet extremely important factor in decision processes and non-trivial organizations. It is interesting to me to learn methods of analyzing possible outcome classes of certain situations with the technique proposed in the project. On top of this, I hope this work would bring new perspectives on evaluation which I could use in other areas of my work.

- *Complexity classes, computation, and Turing categories*: One of my main interests is designing programming languages, and considering what minimal level of computational power is necessary to express and make possible the solution of problems in a certain area. It is my belief that in the future programmers will increasingly use programming languages of different computational power to express different kinds of problems in their work.

- *Traversal optics and profunctors*: Traversals and profunctors are a commonly encountered topic to a Haskell programmer. My practical experience will make joining this project easier. While not the main topic of interest, I know the style of Bartosz Milewski’s work and am certain that working together will be very inspiring and could result in a lasting professional relationship with other members of the group.

- *Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces*: Building on the previous paragraph, one of my main interests in building programming languages as well as related tooling that will lower the incidence of bugs. A large portion of unexplored approaches have to do with creating a proper dialogue between the programmer and her tools. Jokingly, the compiler is an “Eliza bot” for the programmer. Taking this thought as a serious proposition, one can tease out approaches that will help the programmer express their ideas in a better way. For a simple example, analysis of what sorts of higher-order functions a programmer uses in programs against a corpus can help suggest new approaches by seeing “blind spots” in the programmer’s technical vocabulary.

- *Simplifying quantum circuits using the ZX-calculus*: I have some cursory experience with quantum circuits themselves. I have extensive experience with related topics in digital signal processing, network systems, measurement, and analog computers, which forms a solid practical basis for this project. I am interested in graphical calculus and would greatly enjoy exploring this area. I believe due to my varied experience in peripheral fields, I could provide a unique point of view to the group.