

# Matt Luckcuck BSc (Hons), MSc, PhD(Ebor)

10 Cavendish Gardens, Devonshire Road, Liverpool, L8 3TH

Tel: 07738423719

Email: m.luckcuck@gmail.com

## Summary

I'm a Research Assistant in the Department of Computer Science at the University of Liverpool. My research interests include formal modelling, model-checking, safety-critical and autonomous systems, and real-time Java. My current project is *Autonomous Robots in Hazardous Environments*, run by Prof. Michael Fisher. I am working with a range of formal verification techniques, including process algebraic models and temporal logic.

I obtained my PhD from the University of York, where I was supervised jointly by Professors Ana Cavalcanti and Andy Wellings. My PhD work involved developing a formal model of a new safety-critical language, Safety-Critical Java, using the state-rich process algebra *Circus*, which combines Z and CSP.

I have teaching experience at a variety of age-ranges and ability-levels, and have found it both enjoyable and rewarding. I have assisted in the teaching of several degree modules, at both undergraduate and postgraduate levels. Also, I have tutored an A-Level Computing student one-to-one, improving her result by two grade boundaries. Finally, I have taught school-age children basic programming skills, often using Scratch.

## Publications

- Marie Farrell, **Matt Luckcuck**, and Michael Fisher ‘*Robotics and Integrated Formal Methods: Necessity meets Opportunity*’ in iFM2018, Accepted
- **Matt Luckcuck**, Andy Wellings, and Ana Cavalcanti ‘*Safety-Critical Java: Level 2 in Practice*’ in Concurrency and Computation: Practice and Experience, 2016
- **Matt Luckcuck**, Ana Cavalcanti, and Andy Wellings ‘*A Formal Model of the Safety-Critical Java Level 2 Paradigm*’ in Proceedings of the International Conference on Integrated Formal Methods, iFM 2016
- **Matt Luckcuck** ‘*A Formal Model for the Safety-Critical Java Level 2 Paradigm*’ in Proceedings of the Doctoral Symposium of Formal Methods 2015, DSFM 2015 [Honourable Mention]
- Andy Wellings, **Matt Luckcuck**, and Ana Cavalcanti ‘*Safety-critical Java level 2: Motivations, Example Applications and Issues*’ in Proceedings of the 11th International Workshop on Java Technologies for Real-time and Embedded Systems, JTRES 2013

## Education

**2012 — 2016** *University of York*

### **PhD in Computer Science**

*Safety-Critical Java Level 2: Applications, Modelling, and Verification*

**Supervisors:** Ana Cavalcanti and Andy Wellings

My PhD work models Safety-Critical Java (SCJ) using the state-rich process algebra *Circus*, which combines elements of Z and CSP. SCJ adopts a new programming paradigm for applications that must be certified. SCJ programs use a particular concurrency model and use region-based memory management (instead of garbage collection); specialised virtual machines are available to execute SCJ programs. It is organised into three compliance levels, of ascending complexity. My PhD focuses on the most complex compliance level, the programs of which are highly concurrent, potentially multi-processor, and make use of suspension and a variety of release patterns. My PhD provides the most complex compliance level of SCJ with its first semantics, enables further integration with other *Circus* semantics for SCJ, and provides automatic translation from SCJ to my model.

**2011 — 2012** *University of York***MSc with Merit in Computing**

Modules:

|                                      |    |                                  |    |
|--------------------------------------|----|----------------------------------|----|
| Formal Specification                 | 97 | Software Measurement and Testing | 70 |
| Concurrent and Real-Time Programming | 93 | Final Project                    | 66 |
| Group Project                        | 72 | Software Engineering             | 66 |
| Java Advanced Programming            | 70 | Database-Driven Web Design       | 63 |
| User Centered Design                 | 70 | Computer Systems Architecture    | 57 |

**2007 — 2011** *University of Wolverhampton***Bsc (Hons) First Class in Computer Science** including Placement Year

Modules Include:

|                   |                       |
|-------------------|-----------------------|
| Java Programming  | Oracle Databases      |
| C/C++ Programming | HTML and CSS Websites |
| PHP Programming   |                       |

**Work Experience****2017 — Current** *University of Liverpool*

**Research Associate** I'm a post-doctoral researcher on the Autonomous Robots in Hazardous Environments project, which focuses on autonomous robotic systems operating in a nuclear, offshore, or aerospace environment. The safety-critical nature of these systems requires verification to ensure that they behave as intended. I am looking at a range of techniques, including process algebraic models and temporal logic.

**2017** *York Learning*

**Adult Education Tutor** I delivered a 6 week adult-education course teaching introductory programming skills using Python. This involved presenting a lecture and then guiding the students through Python programming exercises designed to reinforce the material in the lecture and teach them the basic practical skills of programming. The lectures and resources were designed by me from scratch.

**2017** *York Maker Hub*

**Tutor** I taught children (ranging from 8-14) basic programming skills, in a busy environment that allowed the children some freedom in choosing the platform they used. The day-long sessions provide the opportunity for the children to build and program various projects on a variety of platforms, including Scratch, Makey Makey, and Lego Mindstorms. This role also involved supervising the children during breaks and lunch.

**Curriculum Design** I also helped to develop a new pathway for older or more advanced children who wanted to learn programming. This involved reviewing the currently available projects, collaboratively designing new Python projects, and then writing up the project instructions sheets and resources.

**2015** *University of York*

**Research Associate** During my PhD I was employed, part-time, to produce a tool that automatically translated program code for Safety-Critical Java into a formal model written in the state-rich process algebra *Circus*. This role was closely related to my thesis, so I managed the work alongside my PhD.

**2011** *University of Wolverhampton*

**Support Desk Technician** I provided front-line support to students using the university's computer systems. This involved polite and timely responses to requests regarding printing and WiFi access, for example. Emphasis was on following standard operating procedures and escalating more serious problems to the relevant teams within the university.

**2010** *National Institute for Health Research*

**Information Services Placement Student** During the placement year of my BSc I worked in the Service Desk, Testing, and Infrastructure departments. Each department presented its own set of tasks and challenges. Most of my time was spent in the Service Desk where I supported several hundred clinicians using a health research data collection system. I also spent several days leading the Service Desk team due to staff illness.

## Teaching

- 2017: Delivering an 11 week adult-education course in basic programming skills, using Python. This involved designing the course and resources, delivering lectures, then guiding students through Python programming exercises.
- 2017: Teaching 8-15 year olds basic programming skills using a range of platforms including Scratch and Lego Mindstorms. These were day-long sessions with a large, mixed age and ability group.
- 2017: Volunteering at a local Code Club, teaching 9-11 year olds basic programming skills using Scratch. The small group was of mixed ages and abilities. Each week we worked on a small game, each introducing increasingly complex techniques.
- 2016: Tutoring an A-Level Computing student, one-on-one. We focussed on covering key topics, and improved the student's exam grade by two grade boundaries. My contact time was 20 hours (1 hour per week).
- 2015—2016: assisting in the workshop sessions for two terms of a first year undergraduate module, introducing programming concepts, in the Computer Science degree at the University of York.
  - In the first term, the module focused on basic programming using Python. My contact time for the term was 20 hours.
  - In the second term, the module focused on objects and inheritance, and used both Python and Java. My contact time was 28 hours.
  - Each group contained around 65 students of very mixed ability.
- 2015: assisting in the workshop sessions for a  $\text{\LaTeX}$  module for PhD students at the University of York. The group contained around 12 PhD students and my contact time was 5 hours. I also assisted in a workshop session on  $\text{\LaTeX}$  for an MSc module, also with around 12 students.

## Administration

- During 2014 I was the Programme Committee chair for the York Doctoral Symposium on Computer Science and Electronics (YDS2014), a student conference organised at the University of York. I was responsible for recruiting programme-committee members and ensuring that submissions were reviewed fairly. I also co-lead an interdepartmental team of PhD students in the planning and organisation of YDS2014.
- In 2014 I marked the two exams for a first-year undergraduate programming module. There were 108 scripts in one exam and 130 in the other. This involved working to the mark scheme and keeping to the marking deadline.
- In 2013 I marked the group projects for an MSc module. There were eight groups of six students. This involved reading each group's project report and grading it, along with supplementary material, against the module mark scheme. Again, there was a strict marking deadline.
- Throughout my PhD I have gained experience in academic writing, for both external publication and internal PhD progression.

## Reviewing

- Theoretical Aspects of Computing (ICTAC) 2013
- International Workshop on Java Technologies for Real-time and Embedded Systems (JTRES) 2014
- York Doctoral Symposium 2014, 2015, 2016, 2017
- Journal of Software Testing, Verification & Reliability

## Conference and Workshop Presentations

- 2016: International Conference on Integrated Formal Methods (iFM 2016)
- 2015: Doctoral Symposium at the International Symposium on Formal Methods (DSFM 2015)
- 2014: Certifiable Java for Embedded Systems (CJ4ES)
- 2013: Workshop on Java Technologies for Real-time and Embedded Systems (JTRES 2013)

## Referees

Professor Michael Fisher — Current Employer  
Department of Computer Science,  
University of Liverpool, Liverpool L69 3BX

Tel: +44 (0)151 795 4262  
Email: Mfisher@liverpool.ac.uk

Professor Ana Cavalcanti — PhD Supervisor  
Department of Computer Science,  
University of York, YO10 5GH

Tel: +44 (0)1904 325478  
Email: Ana.Cavalcanti@york.ac.uk

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Doctor Helen Treharne — PhD Examiner  
Department of Computer Science,  
University of Surrey, Guildford, GU2 7XH

Tel: +44 (0)1483 684380  
Email: h.treharne@surrey.ac.uk

Professor Andy Wellings — PhD Supervisor  
Department of Computer Science,  
University of York, YO10 5GH

Tel: +44 (0)1904 325539  
Email: andy.wellings@york.ac.uk