

## Dr. Vincent A. Knight

**Cardiff University**  
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www.vknight.org  
G+: +Vincent Knight  
twitter: @drvinceknight  
github: drvinceknight  
blog: Un peu de math

- *Topic editor for the Journal of Open Source Software*
- *Local organiser of the SSI Collaborations 2018 Conference*
- *Data Innovation Research Institute Management Board*
- *Editor for the Cardiff Centre for Education Innovation Learning Hub*
- *Member of the PyCon UK organising committee*
- *Sustainable Software Institute Fellow*
- *Deputy director of engagement*
- *Phoenix project advisory board*
- *Cardiff Python User Group Meetup Organiser*
- *Mathematical modelling area editor for Health Systems*
- *Chair of Operational Research in Schools task-force*

### AWARDS

- *2019: School of Mathematics student award for personal tutor of the year*
- *2019: School of Mathematics student award for most influential member of staff in the final year*
- *2019: School of Mathematics student award for best lecturer*
- *2018: Nominated for Cardiff University Enriching Student Life Awards: Most innovative member of staff*
- *2017: John Pinner award for contribution to the Python community*
- *2017: Times higher education award for international collaboration: Phoenix Project.*
- *2016: Shortlisted for Cardiff University Enriching Student Life Awards: Most innovative member of staff*
- *2016: School of Mathematics student award for best lecturer*
- *2015: Times higher education award for modelling unit*
- *2015: Shortlisted for Cardiff University Enriching Student Life Awards: Most innovative member of staff*
- *2014: Cardiff University Recognising Excellence Rising Star Award*
- *2005: Cardiff School of Mathematics - graduated top of my year*

### RESEARCH INTERESTS

- *Game Theory: Strategic behaviour in queues and the Iterated Prisoner's dilemma*
- *Pedagogy: Active learning approaches*
- *Healthcare: Applied modelling of patient flow*
- *Markov modelling: Queueing processes and evolutionary dynamics*

## APPOINTMENTS

Senior Lecturer/Associate Professor Cardiff University	2016 - present
Lecturer/Assistant Professor Cardiff University	2011 - 2016
Post Doctoral Researcher Cardiff University	2009 - 2011

## ACADEMIC QUALIFICATIONS

Postgraduate Certificate in University Teaching and Learning, <b>Obtained with distinction</b> Cardiff University	2013
Ph.D. in Enumerative Combinatorics, <b>Alternating Sign Matrix Polytopes</b> Cardiff University	2009
B.Sc. (Hons) Mathematics, <b>Graduated top of my class</b> Cardiff University	2005
Baccalaureat Scientifique, <b>Fluent in French</b> Lycee du Pre Saint Sauver, St Claude, Jura, France	2002

## PUBLICATIONS

47. 2020: **Matching: A Python library for solving matching games**  
Henry Wilde, Vincent Knight, Jon Gillard  
**Journal of Open Source Software**  
<https://joss.theoj.org/papers/10.21105/joss.02169>
46. 2020: **Using a theory of mind to find best responses to memory-one strategies**  
Nikoleta Glynatsi, Vincent Knight  
**Accepted for publication in Scientific Reports**  
<https://arxiv.org/abs/1911.12112>
45. 2020: **A meta analysis of tournaments and an evaluation of performance in the Iterated Prisoner's Dilemma**  
Nikoleta Glynatsi, Vincent Knight  
<https://arxiv.org/abs/2001.05911>
44. 2020: **Segmentation analysis and the recovery of queuing parameters via the Wasserstein distance: a study of administrative data for patients with chronic obstructive pulmonary disease**  
Henry Wilde, Vincent Knight, Jon Gillard, Kendal Smith

<https://arxiv.org/abs/2008.04295>

43. 2020: **A novel initialisation based on hospital-resident assignment for the k-modes algorithm**  
Henry Wilde, Vincent Knight, Jon Gillard  
<https://arxiv.org/abs/2002.02701>
42. 2019: **Recognising and evaluating the effectiveness of extortion in the Iterated Prisoner's Dilemma**  
Vincent Knight, Marc Harper, Nikoleta Glynatsi, Jon Gillard  
<https://arxiv.org/abs/1904.00973>
41. 2019: **Memory depth of finite state machine strategies for the iterated prisoner's dilemma**  
T.J. Gaffney, Marc Harper, Vincent Knight  
<https://arxiv.org/abs/1912.04493>
40. 2019: **A conservative index heuristic for routing problems with multiple heterogeneous service facilities**  
Rob Shone, Vincent Knight, Paul Harper  
**Mathematical Methods of Operations Research**  
[https://link.springer.com/article/10.1007/s00186-020-00722-w?wt\\_mc=Internal.Event.1.SEM.ArticleAuthorOnlineFirst](https://link.springer.com/article/10.1007/s00186-020-00722-w?wt_mc=Internal.Event.1.SEM.ArticleAuthorOnlineFirst)
39. 2019: **Evolutionary Dataset Optimisation: Learning algorithm quality through evolution**  
Henry Wilde, Vincent Knight, Jon Gillard  
**Applied Intelligence**  
<https://link.springer.com/article/10.1007/s10489-019-01592-4>  
<https://arxiv.org/abs/1907.13508>
38. 2018: **Evolution Reinforces Cooperation with the Emergence of Self-Recognition Mechanisms: an empirical study of the Moran process for the iterated Prisoner's dilemma**  
Vincent Knight, Marc Harper, Nikoleta Glynatsi, Owen Campbell  
**PLOS One**  
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0204981>  
<https://arxiv.org/abs/1707.06920>
37. 2018: **Determining patient outcomes from patient letters: A comparison of text analysis approaches**  
Jennifer Morgan, Paul Harper, Vincent Knight, Andrew Nelson, Andreas Artemiou, Alex Carney  
**Journal of the Operational Research Society**  
<https://www.tandfonline.com/doi/full/10.1080/01605682.2018.1506559>
36. 2018: **Nashpy: a Python library for the computation of Nash equilibria**  
Vincent Knight, James Campbell  
**Journal of Open Source Software**  
<https://doi.org/10.21105/joss.00904>  
<http://orca.cf.ac.uk/116002/>
35. 2017: **Modelling deadlock in open restricted queueing networks**  
Geraint Palmer, Paul Harper, Vincent Knight  
**European Journal of Operational Research**

<http://www.sciencedirect.com/science/article/pii/S0377221717309529>

34. 2017: **An Evolutionary Game Theoretic Model of Rhino Horn Devaluation**

Nikoleta Glynatsi, Vincent Knight, Tamsin Lee

**Ecological Modelling**

<https://www.sciencedirect.com/science/article/pii/S0304380018303260>

<https://arxiv.org/abs/1712.07640>

33. 2017: **Predicting Adolescent Social Networks to Stop Smoking in Secondary Schools**

Angelico Fetta, Vincent Knight, Paul Harper, Janet Williams

**European Journal of Operational Research**

<http://www.sciencedirect.com/science/article/pii/S0377221717306665?via%3Dihub>

32. 2017: **Reinforcement Learning Produces Dominant Strategies for the Iterated Prisoner's Dilemma**

Marc Harper, Vincent Knight, Martin Jones, Georgios Koutsovoulos, Nikoleta Glynatsi, Owen Campbell

**PLOS One**

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0188046>

<https://arxiv.org/abs/1707.06307>

31. 2017: **Ciw: An open source discrete event simulation library**

Geraint Palmer, Vincent Knight, Paul Harper, Asyl Hawa

**Journal of Simulation**

<https://www.tandfonline.com/doi/abs/10.1080/17477778.2018.1473909>

<https://arxiv.org/abs/1710.03561>

30. 2016: **Measuring the Price of Anarchy in Critical Care Unit Interactions.**

Vincent Knight, Izabela Komenda, Jeff Griffiths

**The journal of the operational research society**

[http://www.readcube.com/articles/10.1057/s41274-016-0100-8?author\\_access\\_token=JAsSHKTcT13NH3k5WULii-5FaAMov8cp-zDTP1PJoVIArpmmPDcS9szSXf4MFhLgmkgDfNf-Es-tfeeFIWjcAd9ghBNqM6EkW%3D%3D](http://www.readcube.com/articles/10.1057/s41274-016-0100-8?author_access_token=JAsSHKTcT13NH3k5WULii-5FaAMov8cp-zDTP1PJoVIArpmmPDcS9szSXf4MFhLgmkgDfNf-Es-tfeeFIWjcAd9ghBNqM6EkW%3D%3D)

3D

29. 2016: **Ambulance Allocations for Maximising Survival within a Heterogeneous Population using a Heterogeneous Fleet.**

Leanne Smith, Paul Harper, Vincent Knight

**Submitted to the journal of the operational research society**

28. 2016: **Editorial: Operations Research for Health Care ESI XXXI — OR applied to Health in a Modern World.**

Roberto Aringhieri, Vincent Knight, Honora Smith

**Operations Research for Health Care, 8, 22–23.**

<http://doi.org/10.1016/j.orhc.2016.01.002>

27. 2016: **An Open Framework for the Reproducible Study of the Iterated Prisoner's Dilemma.**

Vincent Knight, Owen Campbell, Marc Harper, Karol Langner, James Campbell, Thomas Campbell, Alex Carney, Martin Chorley, Cameron Davidson-Pilon, Kristian Glass, Nikoleta Glynatsi, Tomáš Ehrlich, Martin Jones, Georgios Koutsovoulos, Holly Tibble, Jochen Müller, Geraint Palmer, Piotr Petunov, Paul Slavin, Timothy Standen, Luis Visintini, Karl Molden.

**Journal of open research software**

<http://openresearchsoftware.metajnl.com/article/10.5334/jors.125/>  
<https://arxiv.org/abs/1604.00896>

26. 2016: **Time-dependent stochastic methods for managing and scheduling Emergency Medical Services**  
Julie Vile, Jon Gillard, Paul Harper, Vincent Knight  
**Operations Research for Health Care.**  
<http://www.sciencedirect.com/science/article/pii/S2211692314200518>
25. 2016: **Editorial: Health Systems ESI XXXI — OR applied to Health in a Modern World.**  
Roberto Aringhieri, Vincent Knight, Honora Smith  
**Operations Research for Health Care, 5, 3.**  
<https://link.springer.com/article/10.1057/s41306-016-0012-5>
24. 2015: **Rostering staff at a mathematics support service using a finite-source queueing model**  
Jon Gillard, Vincent Knight, Julie Vile, Rob Wilson  
**IMA Journal of Management Mathematics. 27 (2)**
23. 2015: **Compliance with National Guidelines for Stroke in Radiology.**  
Izabela Komenda, Hannah Williams, Vincent Knight  
**Operations Research for Health Care.**  
<http://www.sciencedirect.com/science/article/pii/S2211692314200191>
22. 2015: **Containment of socially optimal policies in multiple-facility Markovian queueing systems.**  
Rob Shone, Vincent Knight, Paul Harper, Janet Williams, John Minty  
**Journal of the Operational Research Society.**  
<http://link.springer.com/article/10.1057/jors.2015.98>
21. 2015: **Playing games: a case study in active learning applied to Game Theory.**  
Vincent Knight  
**Connections**  
<https://journals.gre.ac.uk/index.php/msor/article/view/254>
20. 2015: **Modelling of psoriasis patient flows for the reconfiguration of secondary care services and treatments**  
Kayne Putman, Alex Anstey, Paul Harper, Vincent Knight  
**Health Systems.**
19. 2014: **Mathematical modelling of patient flows to predict critical care capacity required following the merger of two district general hospitals into one.**  
James Williams, Steve Dumont, Jack Parry-Jones, Izabela Komenda, Jeff Griffiths, Vincent Knight  
**Anaesthesia. 70 (1)**
18. 2014: **Operational research ambassadors in schools**  
Noel-Ann Bradshaw, Paul Harper, Vincent Knight, Louise Orpin  
**Proceedings of the HEA STEM, Edinburgh 2014**

17. 2014: **Tweeting the Terror: Modelling the Social Media Reaction to the Woolwich Terrorist Attack**  
Peter Burnap, Matthew Williams, Luke Sloan, Omer Rana, Will Housley, Adam Edwards, Vincent Knight, Rob Procter, Alex Voss  
**Social Network Analysis and Mining**
16. 2013: **Comparisons between observable and unobservable M/M/1 queues with respect to optimal customer behavior**  
Rob Shone, Vincent Knight, Janet Williams  
**European Journal of Operational Research**
15. 2013: **Using Singular Spectrum Analysis to Obtain Staffing Level Requirements in Healthcare.**  
Vincent Knight, Jon Gillard  
**Journal of the Operational Research Society**
14. 2013: **Selfish routing in public services.**  
Vincent Knight, Paul Harper  
**European Journal of Operational Research. 230 (1) 122-132**
13. 2012: **Discrete Conditional Phase-Type Models Utilising Classification Trees: Application to Modelling Health Service Capacities.**  
Paul Harper, Vincent Knight, Adele Marshall  
**European Journal of Operational Research. 219 (3) 522–530**
12. 2012: **Modelling Emergency Medical Services with Phase Type Distributions.**  
Vincent Knight, Paul Harper  
**Health Systems. 1 53-68**
11. 2012: **Ambulance Allocation for Maximal Survival with Heterogeneous Outcome Measures.**  
Vincent Knight, Paul Harper, Leanne Smith  
**OMEGA - The International Journal of Management Science. 40 (6) 918–926**
10. 2012: **How Efficient can an Emergency Unit be? A Perfect World Model.**  
Kesh Baboolal, Jeff Griffiths, Vincent Knight, Andrew Nelson, Cheryl Voake, Janet Williams  
**Emergency Medicine Journal.**
9. 2012: **Simulating Bed Capacity: Evaluating the Impact of Healthcare Service Transfers**  
Robert Bares, Jeff Griffiths, Vincent Knight, Janet Williams, Kesh Baboolal, Andrew Nelson  
**IEEE UKSim 14th International Conference on Computer Modelling and Simulation**
8. 2011: **Forecasting Welsh Ambulance Demand using Singular Spectrum Analysis.**  
Janet Williams, Jon Gillard, Paul Harper, Vincent Knight  
**In Journal of the Operational Research Society**
7. 2011: **On the Peter Principle: An Agent Based Investigation into the Consequential Effects of Social Networks and Behavioural Factors.**  
Angelico Fetta, Paul Harper, Vincent Knight, Janet Williams, Israel Vieira  
**Physica A: Statistical Mechanics and its Applications.**

6. 2011: **Bed Management in a Critical Care Unit.**  
 Jeff Griffiths, Vincent Knight, Izabela Komenda  
**IMA Journal of Management Mathematics.**
  
5. 2011: **Modelling Patient Choice in Healthcare Systems: Development and Application of a Discrete Event Simulation with Agent-Based Functionality.**  
 Vincent Knight, Janet Williams, Iain Reynolds  
**Journal of Simulation.**
  
4. 2011: **Cost-Effective Workforce Planning: Optimising the Dental Team Skill-Mix for England.**  
 Paul Harper, E Kleinman, Jenny Gallagher, Vincent Knight  
**Journal of Enterprise Information Management**
  
3. 2011: **Operational Research Informing National Health Policy**  
 Paul Harper, Vincent Knight, Israel Vieira, Janet Williams  
**Cardiff University. ISBN: 978-0-9569158-0-1**
  
2. 2010: **Forecasting Welsh Ambulance Demand using Singular Spectrum Analysis.**  
 Janet Williams, Jon Gillard, Paul Harper, Vincent Knight  
**In Proceedings of the XXXVI International ORAHS Conference**
  
1. 2008: **Higher Spin Alternating Sign Matrices**  
 Roger Behrend, Vincent Knight  
**Electronic Journal of Combinatorics. 14(1): R83, 38pp.**

#### RESEARCH STUDENTS

- |   |                |
|---|----------------|
| 42. Michalis Panayides (PhD)<br><b>Emergent behaviour in healthcare</b>                                     | 2019 - present |
| 41. Sophie Shapcott (MMath)<br><b>Empirical evidence for Folk like theorems.</b>                            | 2019 - 2020    |
| 40. Tara Hussain (BSc)<br><b>Further game theoretic modelling of Rhino poaching</b>                         | 2018 - 2018    |
| 39. Tara Hussain (BSc)<br><b>Further game theoretic modelling of Rhino poaching</b>                         | 2018 - 2018    |
| 38. Ben Black (MSc)<br><b>Empirical investigation of the Ohtsuki-Nowak approximation</b>                    | 2018 - 2018    |
| 37. Eleanor Owen (BSc)<br><b>Investigating coordinated cooperation games</b>                                | 2018 - 2018    |
| 36. Solomon Keedle-Isack (Summer)<br><b>Further evolutionary game theoretic modelling of Rhino poaching</b> | 2018 - 2018    |

35. Will Guo (Nuffield Research Placement) 2017 - 2017  
**Investigating Axelrod's second tournament**
34. Henry Wilde (PhD) 2017 - present  
**Costs in healthcare**
33. Mansour Hakem (Nuffield Research Placement) 2017 - 2017  
**Investigating Axelrod's second tournament**
32. Thomas Rodwell (PhD) 2017 - present  
**Diary planner for healthcare ward**
31. Toby Devlin (BSc) 2017 - 2017  
**Machine learning for optimisation of move sequence**
30. Lewis Parsons (Summer) 2017 - 2017  
**Building a framework for research excellence framework submission coordination**
29. Cindy Huang (Nuffield Research Placement) 2016 - 2016  
**Investigating deadlock in queues with vacation and baulking**
28. Nikoleta Glynatsi (PhD) 2016 - present  
**Machine learning and the Prisoner's Dilemma**
27. James Campbell (BSc) 2016 - 2016  
**Fingerprinting prisoner's Dilemma strategies**
26. Nikoleta Glynatsi (MSc) 2016 - 2016  
**The effect of graph topology on the Prisoner's Dilemma**
25. Tobenna Peter Igwe (Google Summer of Code) 2015 - 2015  
**Extending Game Theory in Sage**
24. Hannah Lorrimore (Summer) 2015 - 2015  
**Building Game Theoretical Software in a Research Environment**
23. James Campbell (Summer) 2015 - 2015  
**Building Game Theoretical Software in a Research Environment**
22. Ffinian Sullivan (Nuffield Research Placement) 2015 - 2015  
**Understanding mixed behaviour in queue balking threshold policies**
21. Rhys Ward (Summer) 2015 - 2015  
**Building Game Theoretical Software in a Research Environment**
20. Imogen Dunne (BSc.) 2014 - 2015  
**The Effect of Personality Traits on Academic Achievement in Flipped versus Traditional Learning Environments**



19. James Campbell (Summer) 2014 - 2014  
**Building Game Theoretical Software in a Research Environment**
18. Geraint Palmer (PhD) 2014 - 2018  
**Modelling deadlock in queueing systems**
17. Jason Young (MMath) 2013 - 2014  
**Markov Decision Processes for the study a system of two queues in series.**
16. Rhys Jones (BSc.) 2013 - 2014  
**Modelling Rugby Lineout Strategies Using Game Theory**
15. Ceri Morse (BSc.) 2012 - 2013  
**Modelling Lineout Strategies using Game Theory**
14. Jason Young (Summer) 2012 - 2012  
**Understanding the effect of selfish behaviour in a series of 2 queues**
13. Angelico Fetta (PhD) 2011 - 2014  
**Agent Based Simulation for Complex Health Systems Interventions**
12. Rob Shone (PhD) 2011 - 2014  
**Individually and Socially Optimal Policies in Queueing Systems with Multiple Heterogeneous Facilities**
11. Rob Shone (BSc) 2011 - 2011  
**Queueing models of choice in multi facility networks**
10. Iain Reynolds (Summer) 2011 - 2011  
**Modelling patient choice in healthcare systems development and application of a discrete event simulation with agent-based functionality**
9. Chappman Sin (BSc.) 2011 - 2012  
**Mathematical modelling of Risk (the board game)**
8. Catherine Fortune (BSc.) 2010 - 2011  
**Game Theory and the Lemke-Howson algorithm**
7. Tatjana Timofejeva (BSc.) 2010 - 2011  
**Impact of unscheduled care Modelling time varying activities at a Hospital**
6. Stuart MacGregor (BSc.) 2010 - 2011  
**A study into two player hide and seek games verifying results from game theory using monte carlo simulation, with a particular application to anti-submarine warfare**
5. Izabela Komenda (PhD) 2010 - 2013  
**Bed management in a critical care unit**

- |   |             |
|---|-------------|
| 4. Julie Vile (PhD)   | 2009 - 2012 |
| <b>Time-dependent stochastic modelling for predicting demand and scheduling of emergency medical services</b> |             |
| 3. Fern Gould (BSc.)  | 2009 - 2010 |
| <b>Game Theory and the Iterated Prisoner's Dilemma</b>  |             |
| 2. Tamsin Griffiths (BSc.)  | 2009 - 2010 |
| <b>Troops to Task Tool and Refugee Estimation</b>   |             |
| 1. Leanne Smith (PhD)   | 2008 - 2013 |
| <b>Modelling emergency medical vehicle services</b>   |             |

## GRANT FUNDING

- |   |                |
|---|----------------|
| Cardiff University CUROP Award<br>Further game theoretic dynamics of Rhino poaching<br>£2,100   | 2018 - 2018    |
| ESRC<br>Hate speech? Understanding the modelling of social media identity formation and behaviour through the Cardiff Online Social Media Observatory (COSMOS)<br>£7,015  | 2013 - 2016    |
| Health Foundation and Cardiff and Vale University Health Board<br>Estimating quality improvement and cost reduction for the patient and local health economy of transferring ENT/audiology services into a community setting<br>£61,237 | 2013 - 2014    |
| Aneurin Bevan Health Board<br>Creation of a Mathematical/OR Modelling Unit to Support the Aneurin Bevan Health Board<br>£319,944  | 2013 - 2015    |
| EPSRC<br>Identifying and modelling victim, business regulatory and malware behaviours in a changing cyberthreat landscape<br>£101,659   | 2013 - 2016    |
| Sustainable software institute<br>Fellowship<br>£3,000  | 2013 - ongoing |
| Cardiff and Vale University Health Board<br>Operational Research Modelling to Support Cardiff and Vale UHB<br>£371,427  | 2013 - 2018    |
| Cardiff University CUROP Award<br>Developing and Evaluating Mathematical Teaching Resources through Open Source Software<br>£2,200  | 2012 - 2012    |
| LANCS (EPSRC)<br>Post-Doctoral Training Scheme Grant: Investigating the Effects of Individual Behaviour on Hierarchical   |                |

queueing Systems £5,000	2012 - 2012
Cardiff University CUROP Award Patient Choice: A Discrete Event Simulation £2,500	2010 - 2012
LANCS (EPSRC) Post-Doctoral Training Scheme Grant: Choice and Healthcare Investigation Project £2,500	2010 - 2011

## TEACHING

Courses I am currently teaching:

5. Writing with LaTeX: A brief introduction to LaTeX
4. Introduction to Object Oriented Programming: A hackathon introduces students to fundamental aspects of object oriented programming
3. Game Theory: A final year mathematics course covering introductory game theory
2. Research Software Development: A course introducing best practice for software development
1. Computing for Mathematics: A course introducing programming to mathematics students

Courses I have taught in the past:

3. MSc. Week 0: An overview of fundamental mathematics concepts for new MSc students
2. Advanced Statistical Packages: A course teaching the SAS and R software packages
1. OR Methods: A course covering: queueing theory, game theory and Markov processes

## MEDIA

12. 2018-10-18: Pythagoras' trousers - Discussing the recent claims of a proof of the Riemann Hypothesis.
11. 2018-06-07: Pythagoras' trousers - Mathematics behind modelling jet stream as a traffic jam
10. 2017-03-23: Talk Python to Me Podcast - Game Theory and the Axelrod library
9. 2017-03-17: Cardiff University YouTube Channel - PyCon Namibia and the Phoenix project
8. 2017-01-09: Pythagoras' trousers - Mathematics in animation
7. 2017-01-02: Pythagoras' trousers - Alpha Go
6. 2016-09-26: Pythagoras' trousers - Election polling
5. 2016-01-27: Namibia broadcasting company - Discussing PyCon Namibia
4. 2015-06-16: BBC Radio Wales - Game Theory and Nash Equilibrium
3. 2015-04-16: Sci screen screening - The Imitation Game
2. 2014-05-05: 2014 Pythagoras Lecture - Mathematics and Healthcare Management
1. 2014-03-19: BBC Parliament - Voice of the Future 2014

## OUTREACH

*I participate in a variety of mathematics outreach activities.*

- *Regular workshops at the School of Mathematics.*
- *STEM live: a university wide event.*
- *Monmouth Science initiative.*
- *Speaking at the British Science festival 2015.*

## SOFTWARE PROJECTS

- *Axelrod: A Python library/github project that replicates Axelrod's tournament.*
- *Ciw: A Python library for simulating queueing networks*
- *Conference Scheduler: A Python library to schedule conferences using integer linear programming*
- *Game Theory in Sage: A collection of code to continue the integration of Game Theoretic capabilities in to Sage.*
- *Nashpy: A Python library to find equilibria in 2 player normal form games*
- *Virtual Microscope: A web application to display and annotate scanned slides.*
- *blackbook: A python library to format Jupyter notebooks with black*
- *ghtalks: Organise and share talks with gh-pages*
- *sklDj: A Django web app interface to machine learning algorithms*

## SOFTWARE COMMUNITY

- *DjangoCon Europe 2015: I was on the organising committee for DjangoCon Europe 2015.*
- *PyCon UK: I am on the organising committee for PyCon UK (I took a sabbatical in 2018)*
- *PyDiff: I help organise the Cardiff Python user group meetup.*
- *Python Namibia: I help run the PyCon Namibia conference.*
- *sklDj: A Django web app interface to machine learning algorithms*