# Dr. Vincent A. Knight

Cardiff University School of Mathematics Senghennydd Road Cardiff, CF24 4AG (+44) 29 2087 5548 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 commit-

#### tee

- 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 taskforce

#### **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

Lecturer/Assistant Professor
Cardiff University

Post Doctoral Researcher
Cardiff University

ACADEMIC QUALIFICATIONS

Postgraduate Certificate in University Teaching and Learning,
Obtained with distinction

 $Ph.D.\ in\ Enumerative\ Combinatorics,$ 

Alternating Sign Matrix Polytopes

Cardiff University 2009

2013

B.Sc. (Hons) Mathematics, Graduated top of my class

Cardiff University 2005

Baccalaureat Scientifique,

Fluent in French

Cardiff University

Lycee du Pre Saint Sauver, St Claude, Jura, France 2002

#### **PUBLICATIONS**

46. 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

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: 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

43. 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

42. 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

41. 2019: A conservative index heuristic for routing problems with multiple heterogeneous service facilities

Rob Shone, Vincent Knight, Paul Harper

Submitted to Operations Research

40. 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

39. 2019: Stability of defection, optimisation of strategies and the limits of memory in the Prisoner's Dilemma

Nikoleta Glynatsi, Vincent Knight

https://arxiv.org/abs/1911.12112

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=JAsSHKTcT13NH3k5swULIi-5FaAMov8cp-zDTP1PJoVIArpmmPDcS9szSXf4MFhLgmkgDfNf-Es-tfeeFIWjcAd9ghBNqM6Ekw%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

 $\verb|http://openresearchsoftware.metajnl.com/article/10.5334/jors.125/|$ 

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) Emergent behaviour in healthcare	2019 - present
41.	Sophie Shapcott (MMath) Empirical evidence for Folk like theorems.	2019 - 2020
40.	Tara Hussain (BSc) Further game theoretic modelling of Rhino poaching	2018 - 2018
39.	Tara Hussain (BSc) Further game theoretic modelling of Rhino poaching	2018 - 2018
38.	Ben Black (MSc) Empirical investigation of the Ohtsuki-Nowak approximation	2018 - 2018
37.	Eleanor Owen (BSc) Investigating coordinated cooperation games	2018 - 2018
36.	Solomon Keedle-Isack (Summer) Further evolutionary game theoretic modelling of Rhino poaching	2018 - 2018
35.	Will Guo (Nuffield Research Placement) Investigating Axelrod's second tournament	2017 - 2017
34.	Henry Wilde (PhD) Costs in healthcare	2017 - present
33.	Mansour Hakem (Nuffield Research Placement) Investigating Axelrod's second tournament	2017 - 2017

32.	Thomas Rodwell (PhD)  Diary planner for healthcare ward	2017 - present
31.	Toby Devlin (BSc)  Machine learning for optimisation of move sequence	2017 - 2017
30.	Lewis Parsons (Summer) Building a framework for research excellence framework submission coordin	2017 - 2017 nation
29.	Cindy Huang (Nuffield Research Placement) Investigating deadlock in queues with vacation and baulking	2016 - 2016
28.	Nikoleta Glynatsi (PhD) Machine learning and the Prisoner's Dilemma	2016 - present
27.	James Campbell (BSc) Fingerprinting prisoner's Dilemma strategies	2016 - 2016
26.	Nikoleta Glynatsi (MSc) The effect of graph topology on the Prisoner's Dilemma	2016 - 2016
25.	Tobenna Peter Igwe (Google Summer of Code) Extending Game Theory in Sage	2015 - 2015
24.	Hannah Lorrimore (Summer) Building Game Theoretical Software in a Research Environment	2015 - 2015
23.	James Campbell (Summer) Building Game Theoretical Software in a Research Environment	2015 - 2015
22.	Ffinian Sullivan (Nuffield Research Placement) Understanding mixed behaviour in queue balking threshold policies	2015 - 2015
21.	Rhys Ward (Summer) Building Game Theoretical Software in a Research Environment	2015 - 2015
20.	Imogen Dunne (BSc.) The Effect of Personality Traits on Academic Achievement in Flipped versus Learning Environments	2014 - 2015 s Traditional
19.	James Campbell (Summer) Building Game Theoretical Software in a Research Environment	2014 - 2014
18.	Geraint Palmer (PhD)  Modelling deadlock in queueing systems	2014 - 2018
17.	Jason Young (MMath) Markov Decision Processes for the study a system of two queues in series.	2013 - 2014

16.	Rhys Jones (BSc.)  Modelling Rugby Lineout Strategies Using Game Theory	2013 - 2014
15.	Ceri Morse (BSc.)  Modelling Lineout Strategies using Game Theory	2012 - 2013
14.	Jason Young (Summer) Understanding the effect of selfish behaviour in a series of 2 queues	2012 - 2012
13.	Angelico Fetta (PhD)  Agent Based Simulation for Complex Health Systems Interventions	2011 - 2014
12.	$Rob\ Shone\ (PhD)$ Individually and Socially Optimal Policies in Queueing Systems with Multiple neous Facilities	2011 - 2014 Heteroge-
11.	Rob Shone (BSc) Queueing models of choice in multi facility networks	2011 - 2011
10.	Iain Reynolds (Summer) Modelling patient choice in healthcare systems development and application of event simulation with agent-based functionality	2011 - 2011 <b>f a discrete</b>
9.	Chappman Sin (BSc.) Mathematical modelling of Risk (the board game)	2011 - 2012
8.	Catherine Fortune (BSc.)  Game Theory and the Lemke-Howson algorithm	2010 - 2011
7.	Tatjana Timofejeva (BSc.) Impact of unscheduled care Modelling time varying activities at a Hospital	2010 - 2011
6.	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)  Bed management in a critical care unit	2010 - 2013
4.	lem:lem:lem:lem:lem:lem:lem:lem:lem:lem:	2009 - 2012 emergency
3.	Fern Gould (BSc.)  Game Theory and the Iterated Prisoner's Dilemma	2009 - 2010
2.	Tamsin Griffiths (BSc.)  Troops to Task Tool and Refugee Estimation	2009 - 2010

1. Leanne Smith (PhD) 2008 - 2013

#### GRANT FUNDING

Cardiff University CUROP Award
Further game theoretic dynamics of Rhino poaching
£2,100

2018 - 2018

ESRC

Hate speech? Understanding the modelling of social media identity formation and behaviour through the Cardiff Online Social Media Observatory (COSMOS)

£7,015 2013 - 2016

Health Foundation and Cardiff and Vale University Health Board

Estimating quality improvement and cost reduction for the patient and local health economy of transferring ENT/audiology services into a community setting

£61,237 2013 - 2014

Aneurin Bevan Health Board

Creation of a Mathematical/OR Modelling Unit to Support the Aneurin Bevan Health Board £319,944 2013 - 2015

**EPSRC** 

Identifying and modelling victim, business regulatory and malware behaviours in a changing cyberthreat landscape

£101,659 2013 - 2016

 $Sustainable\ software\ institute$ 

Fellowship

£3.000 2013 - ongoing

Cardiff and Vale University Health Board

Operational Research Modelling to Support Cardiff and Vale UHB

2013 - 2018 £371,427

Cardiff University CUROP Award

Developing and Evaluating Mathematical Teaching Resources through Open Source Software

£2,200 2012 - 2012

LANCS (EPSRC)

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

2010 - 2012 £2,500

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