

## 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

- *Deputy director of engagement*
- *Member of the PyCon UK organising committee*
- *Sustainable Software Institute Fellow*
- *Editor for the Cardiff Centre for Education Innovation Learning Hub*
- *Phoenix project advisory board*
- *Cardiff Python User Group Meetup Organiser*
- *Mathematical modelling area editor for Health Systems*
- *Chair of OR in Schools*

### AWARDS

- *2017: John Pinner award for contribution to the Python community*
- *2017: Times higher education award for international collaboration: Phoenix Project.*
- *2016: School of Mathematics student award for best lecturer*
- *2015: Times higher education award for modelling unit*
- *2014: Cardiff University Recognising Excellence Rising Star Award*
- *2005: Cardiff School of Mathematics - graduated top of my year*

### RESEARCH INTERESTS

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

### APPOINTMENTS

<i>Senior Lecturer</i> <i>Cardiff University</i>	<i>2016 - present</i>
<i>Lecturer</i> <i>Cardiff University</i>	<i>2011 - 2016</i>
<i>Post Doctoral Researcher</i> <i>Cardiff University</i>	<i>2009 - 2011</i>

## 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

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: **Ciw: An open source discrete event simulation library**  
Geraint Palmer, Vincent Knight, Paul Harper, Asyl Hawa  
**Arxiv pre print**  
<https://arxiv.org/abs/1710.03561>
31. 2017: **Reinforcement Learning Produces Dominant Strategies for the Iterated Prisoner's Dilemma**  
Marc Harper, Vincent Knight, Martin Jones, Georgios Koutsovoulos, Nikoleta Glynatsi, Owen Campbell  
**Arxiv pre print**  
<https://arxiv.org/abs/1707.06307>
30. 2017: **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  
**Arxiv pre print**  
<https://arxiv.org/abs/1707.06920>
29. 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>
28. 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>

27. 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=JAsSHKTcTl3NH3k5sWULii-5FaAMov8cp-zDTP1PJoVIArpmmPDcS9szSXf4MFhLgmkgDfNf-Es-tfeeFIWjcAd9ghBNqM6EkW%3D%3D](http://www.readcube.com/articles/10.1057/s41274-016-0100-8?author_access_token=JAsSHKTcTl3NH3k5sWULii-5FaAMov8cp-zDTP1PJoVIArpmmPDcS9szSXf4MFhLgmkgDfNf-Es-tfeeFIWjcAd9ghBNqM6EkW%3D%3D)

26. 2016: **An Open Framework for the Reproducible Study of the Iterated Prisoners Dilemma.**

Vincent Knight, Owen Campbell, Marc Harper, Karol Langner, James Campbell, Thomas Campbell, Alex Carney, Martin Chorley, Cameron Davidson-Pilon, Kristian Glass, Nikoleta Glynatsi, Tom Ehrlich, Martin Jones, Georgios Koutsovoulos, Holly Tibble, Jochen Mller, 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/>

25. 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, 2223.**

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

24. 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**

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: **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)**

21. 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.**

20. 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>

19. 2015: **Containment of socially optimal policies in multiple-facility Markovian queueing systems.**

Rob Shone, Vincent Knight, Paul Harper, Janet Williams, John Minty

18. 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***
17. 2014: ***Operational research ambassadors in schools***  
Noel-Ann Bradshaw, Paul Harper, Vincent Knight, Louise Orpin  
***Proceedings of the HEA STEM, Edinburgh 2014***
16. 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)***
15. 2013: ***Selfish routing in public services.***  
Vincent Knight, Paul Harper  
***European Journal of Operational Research. 230 (1) 122-132***
14. 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***
13. 2013: ***Using Singular Spectrum Analysis to Obtain Staffing Level Requirements in Health-care.***  
Vincent Knight, Jon Gillard  
***Journal of the Operational Research Society***
12. 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***
11. 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***
10. 2012: ***Modelling Emergency Medical Services with Phase Type Distributions.***  
Vincent Knight, Paul Harper  
***Health Systems. 1 53-68***
9. 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.***

8. 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**
7. 2011: **Bed Management in a Critical Care Unit.**  
Jeff Griffiths, Vincent Knight, Izabela Komenda  
**IMA Journal of Management Mathematics.**
6. 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.**
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: **Operational Research Informing National Health Policy**  
Paul Harper, Vincent Knight, Israel Vieira, Janet Williams  
**Cardiff University. ISBN: 978-0-9569158-0-1**
3. 2011: **Forecasting Welsh Ambulance Demand using Singular Spectrum Analysis.**  
Janet Williams, Jon Gillard, Paul Harper, Vincent Knight  
**In Journal of the Operational Research Society**
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

- |     |   |                |
|-----|---|----------------|
| 33. | Henry Wilde (PhD)<br><b>Costs in healthcare</b>   | 2017 - present |
| 32. | Mansour Hakem (Nuffield Research Placement)<br><b>Investigating Axelrod's second tournament</b> | 2017 - 2017    |
| 31. | Toby Devlin (BSc)<br><b>Machine learning for optimisation of move sequence</b>                  | 2017 - 2017    |
| 30. | Will Guo (Nuffield Research Placement)<br><b>Investigating Axelrod's second tournament</b>      | 2017 - 2017    |

29. Thomas Rodwell (PhD) 2017 - present  
**Diary planner for healthcare ward**
  
28. Lewis Parsons (Summer) 2017 - 2017  
**Building a framework for research excellence framework submission coordination**
  
27. James Campbell (BSc) 2016 - 2016  
**Fingerprinting prisoner's Dilemma strategies**
  
26. Cindy Huang (Nuffield Research Placement) 2016 - 2016  
**Investigating deadlock in queues with vacation and baulking**
  
25. Nikoleta Glynatsi (PhD) 2016 - present  
**Machine learning and the Prisoner's Dilemma**
  
24. Rhys Ward (Summer) 2015 - 2015  
**Building Game Theoretical Software in a Research Environment**
  
23. Tobenna Peter Igwe (Google Summer of Code) 2015 - 2015  
**Extending Game Theory in Sage**
  
22. Ffinian Sullivan (Nuffield Research Placement) 2015 - 2015  
**Understanding mixed behaviour in queue balking threshold policies**
  
21. James Campbell (Summer) 2015 - 2015  
**Building Game Theoretical Software in a Research Environment**
  
20. Hannah Lorrimore (Summer) 2015 - 2015  
**Building Game Theoretical Software in a Research Environment**
  
19. James Campbell (Summer) 2014 - 2014  
**Building Game Theoretical Software in a Research Environment**
  
18. Geraint Palmer (PhD) 2014 - present  
**Jackson networks and healthcare**
  
17. Imogen Dunne (BSc.) 2014 - 2015  
**The Effect of Personality Traits on Academic Achievement in Flipped versus Traditional Learning Environments**
  
16. Rhys Jones (BSc.) 2013 - 2014  
**Modelling Rugby Lineout Strategies Using Game Theory**
  
15. Jason Young (MMath) 2013 - 2014  
**Markov Decision Processes for the study a system of two queues in series.**
  
14. Ceri Morse (BSc.) 2012 - 2013  
**Modelling Lineout Strategies using Game Theory**

- |   |             |
|---|-------------|
| 13. Jason Young (Summer)  | 2012 - 2012 |
| <b>Understanding the effect of selfish behaviour in a series of 2 queues</b>  |             |
| 12. Chappman Sin (BSc.)   | 2011 - 2012 |
| <b>Mathematical modelling of Risk (the board game)</b>  |             |
| 11. Iain Reynolds (Summer)  | 2011 - 2011 |
| <b>Modelling patient choice in healthcare systems development and application of a discrete event simulation with agent-based functionality</b>                             |             |
| 10. Rob Shone (PhD)   | 2011 - 2014 |
| <b>Individually and Socially Optimal Policies in Queueing Systems with Multiple Heterogeneous Facilities</b>  |             |
| 9. Angelico Fetta (PhD)   | 2011 - 2014 |
| <b>Agent Based Simulation for Complex Health Systems Interventions</b>  |             |
| 8. Izabela Komenda (PhD)  | 2010 - 2013 |
| <b>Bed management in a critical care unit</b>   |             |
| 7. Stuart MacGregor (BSc.)  | 2010 - 2011 |
| <b>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</b> |             |
| 6. Catherine Fortune (BSc.)   | 2010 - 2011 |
| <b>Game Theory and the Lemke-Howson algorithm</b>   |             |
| 5. Tatjana Timofejeva (BSc.)  | 2010 - 2011 |
| <b>Impact of unscheduled care Modelling time varying activities at a Hospital</b>   |             |
| 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

EPSRC

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

£101,659

2013 - 2016

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: Choice and Healthcare Investigation Project £2,500	2010 - 2011
Aneurin Bevan Health Board Creation of a Mathematical/OR Modelling Unit to Support the Aneurin Bevan Health Board £319,944	2013 - 2015
Sustainable software institute Fellowship £3,000	2013 - ongoing
LANCS (EPSRC) Post-Doctoral Training Scheme Grant: Investigating the Effects of Individual Behaviour on Hierarchical queueing Systems £5,000	2012 - 2012
Cardiff and Vale University Health Board Operational Research Modelling to Support Cardiff and Vale UHB £371,427	2013 - 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
Cardiff University CUROP Award Patient Choice: A Discrete Event Simulation £2,500	2010 - 2012

## TEACHING

Courses I am currently teaching:

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. Computing for Mathematics: A course introducing programming to mathematics students
1. Research Software Development: A course introducing best practice for software development

Courses I have taught in the past:

4. Advanced Statistical Packages: A course teaching the SAS and R software packages
3. OR Methods: A course covering: queueing theory, game theory and Markov processes



2. *Introduction to LaTeX: A brief introduction to LaTeX*
1. *MSc. Week 0: An overview of fundamental mathematics concepts for new MSc students*

### **MEDIA**

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.*

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

### **SOFTWARE PROJECTS**

- *Axelrod: A Python library/github project that replicates Axelrod's tournament.*
- *Ciw: A Python library for simulation 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.*
- *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.*
- *PyDiff: I help organise the Cardiff Python user group meetup.*
- *Python Namibia: I help run the Pycon Namibia conference.*
- *School of mathematics code club: I help run a code club open to mathematics students.*
- *sklDj: A Django web app interface to machine learning algorithms*