APRIL 2021

NO 601

INSIDE OR

THE SCIENCE OF BETTER AT THE HEART OF ANALYTICS

Reinvigorating soft OR:

Dispelling myths on a thriving subject

inside:

Delivering reliable school exam grades

How to find a solution to ensure fair results

Modelling in uncertain times

When history no longer provides a baseline for observations

Living with imposter syndrome

Learning what triggers imposter syndrome and how to address it

theorsociety.com

DIARY DATES 2021

EVENT	DATE	VENUE
3rd IMA & OR Society Conference on Mathematics of Operational Research	20-23 April 2021	Online event
WORAN event: Raising the profile of women in OR/ analytics	26 April 2021	Online event
38th ISMOR	20-23 July 2021	Online event
OR63 Annual Conference	14-16 September 2021	Online event
Careers Open Day	17 November 2021	Online event

The OR Society is following advice from the government, Public Health England and the World Health Organisation about COVID-19. Face to face events and training courses have been replaced by online alternatives for the foreseeable future. Rescheduled dates for ORS events are detailed above, please check our website for the latest details or contact us at **event.enquiry@theorsociety.com** for specific enquiries.

Submitting Articles for Inside OR

Guidelines and format:
1) MS Word document of 500 words.
2) Articles may be edited for space, grammar and accuracy.
3) Inside OR adheres to the University of Oxford Style Guide.
4) Deadline for submissions for the May edition is 1 April.

Contributions should be submitted as an MS Word document to **insideor@theorsociety.com** and will be edited at the discretion of the editor. Please submit print-quality, high-resolution photos or graphics attached as one of these files formats: JPEG, TIFF, PSD, EPS or AI with the articles. Print-quality resolution requires a minimum graphic size of 640 x 480px or scans made at 300dpi. Do not submit copyrighted photos, graphics or content unless you are the copyright holder or have written permission for reproduction from the copyright holder, which should be part of your submission. Photos and graphics copied from websites are almost always not suitable for printing and are usually copyrighted by someone. The editor's decision on all contributions is final and no correspondence will be entered into.

About Inside OR

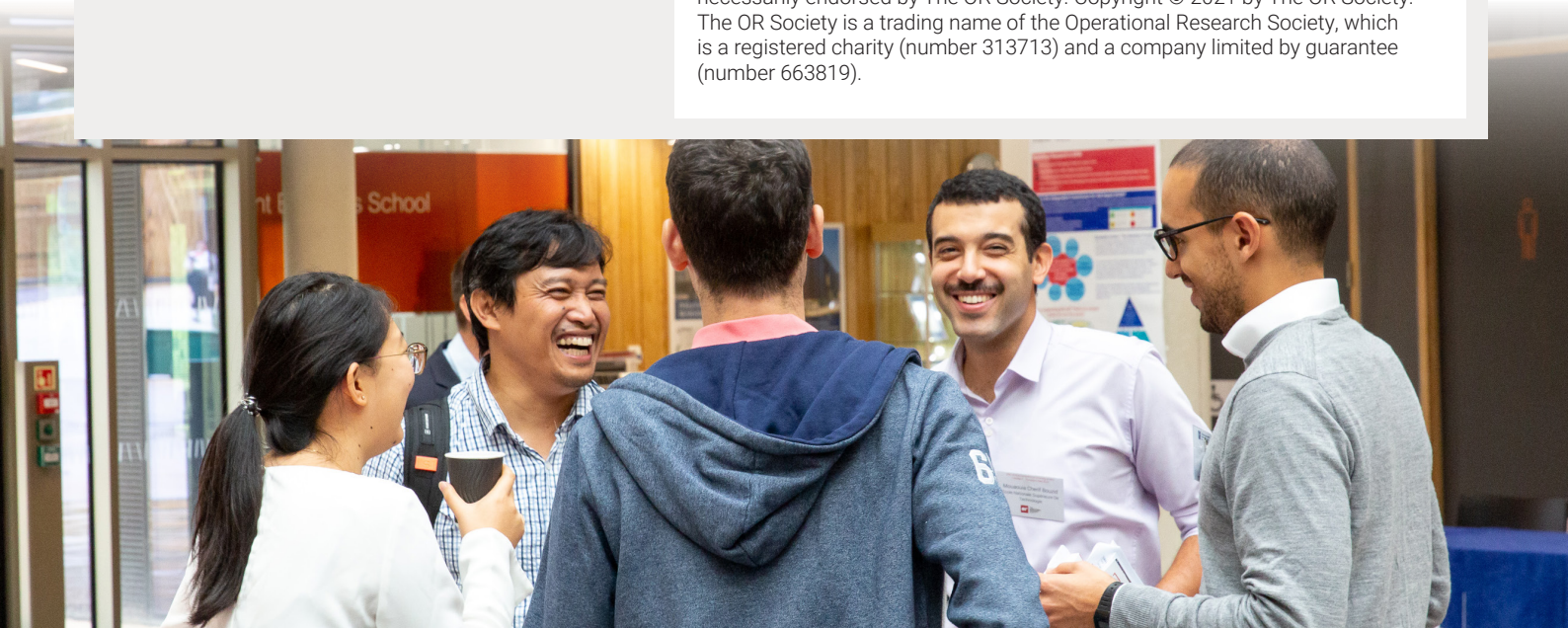
Inside OR is published monthly by The OR Society,
12 Edward Street, Birmingham B1 2RX

Tel: 0121 233 9300

www.theorsociety.com

Editor: John Crocker
Journalist: Nigel Cummings
Content Manager: Rachael Howes-Tonks
Creative Designer: Elli Michael

Electronic access to each issue is emailed to members registered to receive electronic copies in the same period as the printed copy is distributed. Advertising sales enquiries and advertising copy should be directed to insideor@theorsociety.com or the given postal address.



Editorial

APRIL 2021

JOHN CROCKER, FORS

After a year under severe restrictions due the COVID-19 pandemic, there appears, at last, to be a light at the end of the tunnel. Many aspects of life have changed dramatically, whether for good or bad, largely depends on your viewpoint. It is ironic that our school children are one of the groups most affected by the restrictions, but also happen to be the group least likely to be infected or suffer serious illness.

It has already been decided that there will no GCSE or A-level examinations this year and that students will be assessed and graded by their teachers. As Dennis Sherwood points out in his article this month, this should provide an excellent opportunity to take a serious look at the way these examinations are graded.

Soft OR is a strange beast. It has been with us almost as long as "hard" OR – that which is more mathematically based – but it is still very much under-represented in the academic journals. Both Emma Murray in her article "Modelling in uncertain times" and John Hopes in this month's leader talk about the importance of this area. Many markets have become extremely erratic during the pandemic to the point where traditional analytical methods are simply not working. This follows on nicely from the last two OR-20 articles in which both Ken Bowen and Pat Rivett argued that OR is not a box of tricks, it is about solving difficult problems.

Although we are under lockdown, there have still been a number of very successful events, albeit that they have had to be held online via Zoom – what would we have done without it. Firstly, there was the WORAN meeting that discussed Imposter Syndrome and is reported by Kim Agate. Next was the Analytics Summit and most recently, the annual Beale Lecture incorporating a presentation by the Doctoral Award winner (Geraint Palmer) and a Panel Session in honour of the Beale medallist, Ailsa Land.

Although I have no inside knowledge of how our investments have performed over the past year, I am in a position to tell you that there has been a welcomed increase of around £30K in the income from our publications contract with Taylor & Francis (i.e. our academic journals). It also looks like we will be seeing an increase in the number of issues of both the Journal of Simulation (JOS) and Knowledge Management Research and and Practice (KMRP) in 2022.

Another snippet of news from the Publications committee meeting was that whilst there have been 13 applicants for the editor of HS vacancy there was exactly thirteen fewer for the editor of InsideOR vacancy, so it looks like you are going to have to put up with me for a little longer. (Is that an example of false modesty or imposter syndrome or, simply, a poor attempt at humour?)

As regular readers of this column will know, I am fascinated by coincidences and not to disappoint you, I have found another, but you will have to read OR-30 to find out what it is.

Contents

Leader

Reinvigorating soft OR 8

News and Features

News in brief 4-6
Modelling in uncertain times 10
How to deliver reliable school exam grades 11
Government Operational Research Service reaches landmark size 12
Isadore Singer obituary 14
The 2021 Analytics Summit 15
The 2021 Beale Lecture 16
Living with imposter syndrome 21

OR Society Business

WORAN spring events schedule 19
OR Society events 22
Training courses 23
Celebrating excellence in OR 24
Funding opportunities within OR 26
Call for journal reviewers 27
OR Minus 20 29
OR Minus 30 30
Member news 31
OR63 32

Kellogg's next generation analytics

Increased sales and new customers have put pressure on Kellogg's supply chain.

As part of an advanced analytics initiative to overcome such challenges, Kellogg's have combined data from 33 million US household participants in a family rewards loyalty program. Using data from its Keystone platform that tracks social, point-of-sale and contextual data and real-time analysis from its Kube analytics platform, Kellogg's will create targeted and effective customer communications.

The initiative is part of a worldwide rollout that will see next-generation analytics adopted across the board at Kellogg's and its subsidiaries.

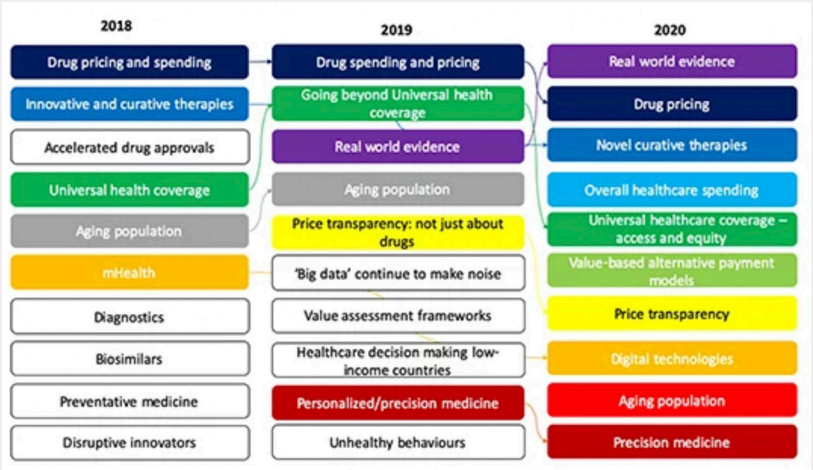
Read more at: **bit.ly/37zMaOo**

Tensor trains drive efficiency

Georgia Tech and Facebook AI researchers have devised a new Tensor Train approach (called TT-Rec) to significantly reduce the size of deep learning recommendation models (DLRM).

With more employees working from home on a regular basis, the driving force behind the size reduction will be the replacement of the large embedding tables in DLRM with a sequence of matrix products. They will be developed by making use of tensor train decomposition - a tool structured to work with tensors using a generalisation of low-rank decomposition efficiently.

More at: **bit.ly/3bmnM3Y**



Changing Trends in HEOR

The International Society for Pharmacoeconomics and Outcomes Research (ISPOR) has published its third issue of the top trends in health economics and outcomes research (HEOR). It chronicles many of the changes that have taken place in this field over time.

Real-world evidence has emerged as the top issue for 2020, followed by drug pricing at No. 2 (down one place) and curative therapies at No. 3 after a year's absence.

More at: **bit.ly/3s4IA6H**

Tracking disease propagation

University of Virginia researchers have used smartphone data and machine learning to forecast the spread of disease. Their model is as good as or better than applications using commuter data.

They used anonymised data to teach a machine-learning system to recognise human movement on a map of New York City. They added data from models built to depict influenza transmission rates based on patient hospital visits and lab reports for the 2016/17 influenza season. The results were then compared with records of the actual flu season.

More at: **https://go.nature.com/2LPWSZs**

Simulations catch climate disaster

A team at Barcelona's Supercomputing Center are working on complex models that they hope can better detect the next extreme weather event. They are using data collected by European satellites as part of a multibillion-euro project called Destination Earth, which seeks to develop the world's best digital simulations of Earth.

It is hoped that the first digital-twin simulations could be ready by 2028, with everyone from scientists to farmers able to use the data to improve their own simulation models of weather.

For more information visit: **bit.ly/3kDB9kr**

Neural network tutorial

Jason Brownlee, MachineLearningMastery.com, sets out to demystify the processes involved in building neural network models that can be used for classification and regression predictive modelling problems.

His tutorial shows how to load and summarise the dataset and use the results to suggest data preparations and model configurations to use. Additionally, it explores the learning dynamics of simple MLP models on the dataset and methods for developing robust estimates of model performance, tuning model performance, and making predictions on new data.

More at: **bit.ly/3qfxATr**

Glasses may offer some protection

Research conducted by Amit Kumar Saxena, a senior ophthalmologist in India, seems to indicate that wearing spectacles could reduce your risk of contracting Covid-19. People who wear glasses tend to rub their eyes less frequently and hence are less likely to transfer viruses from their hands to their eyes.

In a non-peer-reviewed study published on the website medRxiv, the researchers suggest, from a relatively small sample, that those wearing glasses are some 2-3 times less likely to be infected. Of the 304 hospitalised patients suffering from COVID-19, only 58 wore glasses regularly.

More at: **bit.ly/3k9hlQq**

ARIA could be music to your ears

A new research agency, the Advanced Research & Invention Agency (ARIA), is being launched in the UK to support high risk, high reward science. ARIA will be led by scientists who will have the freedom to identify and fund transformational science and technology at speed.

Backed by £800 million to fund the most inspiring inventors to turn their transformational ideas into new technologies, discoveries, products and services, ARIA is intended to help maintain the UK's position as a global science superpower.

More at: bit.ly/3brYCB9

State of Mathematical Optimization Report

Gurobi Optimization, LLC has released its first annual *State of Mathematical Optimization Report*. The findings are based on a survey of 251 commercial users across 42 industries using AI technology to solve business problems, maximise revenue, minimise costs and maximise resource utilisation.

The report provides insight into who is using mathematical optimisation technology, how mathematical optimisation solvers are being deployed in various off-the-shelf and custom-built applications, what business benefits mathematical optimisation delivers and why the use of this AI technology is expanding into new areas.

More at: bit.ly/379GmLj

New consortium to model COVID-19

The 'Joint UNIversities Pandemic and Epidemiological Research' (JUNIPER) consortium will bring together leading mathematical and statistical modellers from seven UK universities, using an initial funding of £3 million from UKRI.

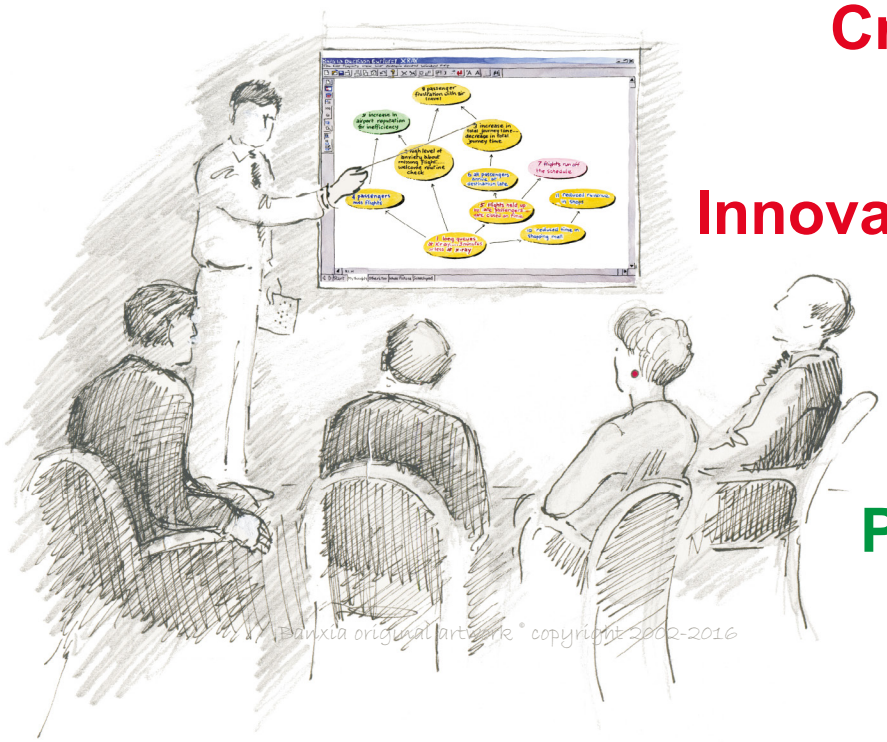
It will be responsible for feeding regular updates, using existing and specially developed models, into SPI-M, the modelling group that provides "evidence" to SAGE.

JUNIPER's modelling will investigate the effectiveness of different testing strategies on virus transmission and suppression and report on the spread and impact of new COVID variants.

More at: bit.ly/3s95UAa

Creative thinker?

Innovative individual?



Problem solver?

Equip yourself with the tools and techniques to develop and implement winning strategies.

We offer a variety of well established, easy to use, decision support tools.
www.banxia.com

- **Connect**™ - allows a group of people in the same location to collaborate in the entry of ideas around a topic, and then to organise them by preferencing, rating or otherwise evaluating them. Designed to support Visual Strategy Making alongside our Decision Explorer® software, it is free to try it out, and supports up to 32 participants using tablets or laptops with any modern browser. Decision Explorer Connect™ starts from £99 + VAT for 8 participants.

- **Decision Explorer**® - an ideas mapping tool used to organise and structure an individual's or group's ideas about a problem or issue. This is a piece of software with many uses, in areas such as strategic management, risk assessment, project planning/ definition and general problem structuring. Single user licenses start from £99 + VAT.

> "Decision Explorer® has proven to be a powerful facilitative tool. Used 'live' in workshops it provides a very efficient and productive means of keeping participants focussed and communicating. As a means of joint decision making, I have not found better." *Kenny Forsyth, Consultant*

- **Frontier Analyst® Professional** - a performance measurement tool, using Data Envelopment Analysis (DEA), to give a relative assessment of the performance of a group of business units. Used in organisations that have a network of branches/ depots or in situations where a group of similar "units" can be identified (for example, hospital wards, banks, shops, teams within a company and so on). Single user (75-unit analysis capability) licenses start from £195 + VAT.

Contact us for details of any of these products.

Banxia Software Ltd, 141 Highgate, Kendal, LA9 4EN
Tel: +44 (0) 1539 815 660 Email: info@banxia.com
www.banxia.com

BANXIA® SOFTWARE

Visualize your knowledge™

Reinvigorating soft OR

JOHN HOPES, PAST-PRESIDENT

When the Heads of OR and Analytics Forum (HORAF) invited me to join John Ranyard and Emma Murray in an initiative aimed at reinvigorating soft OR for practitioners, I was keen to help. It is almost 40 years since Colin Eden opened my eyes to the power of soft OR when he was brought in to address a particularly knotty problem at Shell using cognitive mapping. This emphasised to me that there was a large category of messy problems, involving complexity, multiple stakeholder groups, conflict and uncertainty that could be structured and resolved using soft OR, often without any quantification whatsoever. I have been a big fan of the subject ever since.

This enthusiasm of mine was further boosted three years ago at a meeting on the future of soft OR at the EURO conference. This led me, as ORS President, to support the relaunch of the ORS Problem Structuring Methods Special Interest Group (PSM SIG) in 2019. I feel that soft OR has long been an important differentiator for OR in the UK. In continental Europe it sometimes feels (I am sure unfairly) as if OR is defined as optimisation. In the US, simulation and analytics are also allowed into the fold. But it is only in the UK that we also have such a focus on soft OR, which is unsurprising, given that the founders of the field originated here.

The recent discussion at HORAF has revealed that many non-academic practitioners are still using soft OR, but that this use could be reinvigorated further with the right support. This prompted a quick review of the current landscape in terms of approaches being used, available training, active relevant groups, and illustrative case studies to help with promotion. The initial conclusion of the review was that several myths concerning the supposed decline of soft OR need to be dispelled. For example, the PSM SIG under the energetic leadership of its co-chairs, Martin Parr, and Christina Phillips, has been going from strength to strength in the two years since it was re-established and now has 1,266 members, making it second in size to the Analytics Network among ORS groups. It is currently holding regular well-attended online meetings featuring big name speakers in the field.

Another myth to dispel is that there has been a decline in academic research in soft OR. There have in fact been many highly cited papers published over the past 20 years although, admittedly, far more have been in EJOR than in our own journal JORS. Also, some academics we spoke to did mention that it can be difficult to get soft OR papers published.

It shouldn't be a surprise that soft OR is still thriving, as there are just as many messy problems about today as there were in the 1980s. Some of the other key findings from the HORAF review were that:

- ORS training courses on soft OR provided by Mark Westcombe and Giles Hindle are mainly attracting GORS/DSTL and NHS staff
- Among practitioners it is the external consultants and Government groups that are making the most use of Soft OR

- From work the PSM SIG has done, the most popular methods being deployed are SSM, SODA, VSM, causal loop diagrams and individual components of methods such as Rich Picture
- It is hard to find case studies. A few have been collected, but more are needed to help promote the value of Soft OR to practitioners and decision makers

In addition to the PSM SIG there are other active ORS groups that at least overlap with soft OR. The Public Policy Design SIG hosted the John Friend 90th birthday event that was reported on in the last issue of Inside OR. In addition, the Behavioural OR SIG covers topics of mutual interest with the PSM group.

The link between Systems Thinking and soft OR is an interesting one. They each have methods that address similar types of problem, and there are several leaders in the field who straddle the two. We have had a strong Systems Thinking stream at the ORS conferences over the last few years which emphasises how vibrant the area is. In Government, there is now a Systems Thinking network of over 200 members, many of whom are outside the OR community. Niki Jobson, who was consulted in the review, leads a team of Systems Thinking specialists at DSTL and has led the implementation of a level 7 apprenticeship in Systems Thinking.

The current situation with soft OR is reminiscent of that with analytics a decade ago. There is a large and active community which overlaps with the ORS membership while, at the same time, bringing in people who don't necessarily see themselves as 'OR.' As with analytics I believe the ORS is the learned society that provides a natural home for the community.

With analytics we took a holistic view of what the Society could do to support the community, covering events, training, accreditation, publishing of research, partnerships with other organisations and more. With soft OR we could do something similar, driven by the needs and wishes of the community. We are starting with a very strong base but could do more to ensure that soft OR is being deployed more widely. Many organisations are grappling with their responses to issues such as climate change, automation and the 'new normal' post pandemic. These all involve competing objectives of different stakeholder groups, uncertainty, and complexity. The need for soft OR practice is therefore spread right across the economy.

Soft OR does, however, share with OR in general a lack of visibility. If many in the OR community are unaware of the current strengths of soft OR, then the decision makers struggling with complex problems are even more in the dark.

It is important therefore to make sure that soft OR is made available to all who need it. Further research is important, but even more important is ensuring that the results of decades of research are being deployed to help make better decisions.

"It is almost 40 years since Colin Eden opened my eyes to the power of soft OR when he was brought in to address a particularly knotty problem at Shell using cognitive mapping. This emphasised to me that there was a large category of messy problems, involving complexity, multiple stakeholder groups, conflict and uncertainty that could be structured and resolved using soft OR, often without any quantification whatsoever. I have been a big fan of the subject ever since."

Modelling in uncertain times

EMMA MURRAY, IBM GLOBAL BUSINESS SERVICES

On a dreary morning in mid-November, the Heads of OR and Analytics Forum (HORAF) held its third quarterly meeting since the start of the pandemic. While our previous meetings had focused on the challenges that come with leading remote teams and adapting to entirely new ways of working, our panel discussion now centred on whether the actual nature of the work we do had changed as a consequence of the pandemic.

Over the last decade, we have seen an exponential increase in the development and deployment of machine learning models. But most of these models work because they are predicated on the simple assumption that the behaviours and patterns observed in historical data will continue into the future. What happens when history ceases to provide a reliable baseline for what we are observing around us?

For myself at least, many of the use cases I've worked on over the last year have moved away from reliance on pure ML modelling, with a marked shift towards the application of soft OR techniques and systems thinking. With the advent of lockdowns, policy interventions, and other externalities, it's not enough to rely purely on the data. Scenario and sensitivity modelling, along with other soft OR techniques, have come back to the fore. Data analysis continues to be an important part of the job – but the reliability of the insights has become less robust as the pandemic continues to drive fluctuations in behaviour. The application of soft OR techniques has helped mitigate some of these challenges and provided a useful construct for modelling the impact of behaviours not previously observed in historical data sets.

Tom Dewar, Hartley McMaster, shared his view that "particularly now, with the massive shifting world we live in, it's precisely those types of tools and techniques which would add more value at this time. OR equals data plus logic to help people make better decisions."

Ruth Kelly, NAO, suggested that OR has benefited from using greater volumes of data, but that in a more uncertain environment, there is always a place for the softer side to better calibrate the assumptions that are used and to consult with the broad range of stakeholders needed to input and understand those assumptions.

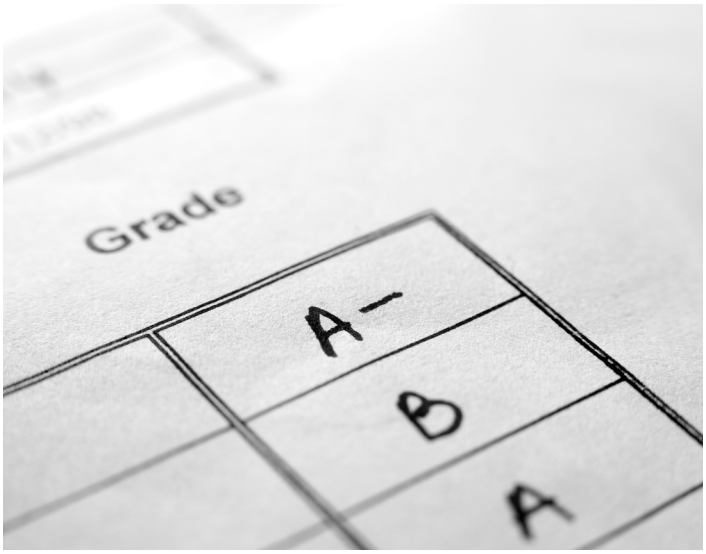
Sandra Weddell, TfL, shared some of the challenges that come with modelling demand for transport in these times and the need to revisit old models. "The challenge is the rate of bounce back and behavioural change… Will people feel old levels of crowding are acceptable? How do we forecast the numbers, and how will that feel for our customers? That's an additional consideration."

After a very rich discussion, it was clear that the pandemic has disrupted how many organisations approach building models – but it has also presented an opportunity to apply more traditional, Soft OR techniques that have fallen out of use.

Following this discussion, John Hopes and John Ranyard undertook an investigation to better understand the current landscape of where and how Soft OR is currently being applied. Their investigation found that the Soft OR community is thriving. There is a wealth of resources available to those who want to see how these techniques can help improve modelling in these uncertain times (see this month's Leader by John Hopes).

How to deliver reliable school exam grades

DENNIS SHERWOOD, SILVER BULLET



February's editorial invited ideas as to how the school exam grading system might be improved. Even though exams have been cancelled for this year too, sooner or later, they will be back. The enforced gap provides an excellent opportunity to fix the problem, now acknowledged by Ofqual, that exam grades are only "reliable to one grade either way" [1].

Let me suggest three solutions, each delivering grades approaching 100% reliability – with "reliability" being the probability that a re-mark confirms the originally-awarded grade.

All recognise that a script originally marked m by one examiner might be re-marked m* by a second, for it is well-accepted that different examiners can legitimately give the same script different marks [2]. This can be represented by a distribution r(h), defining the probability that m* = m + h, and characterised by a width parameter 2f defined to include whatever proportion of the population that might be agreed [3]. Importantly, f is a property of the subject, not the script [4].

The first solution is to determine the grade not, as currently, by the mark m, but by the 'upward adjusted' mark m + f. This recognises that another examiner might mark the script as high as m + f, giving the candidate 'the benefit of the doubt.'

If the candidate appeals, and the script re-marked m*, the current policy is to confirm the original grade if m* is within the same grade as m, but if m* lies within a different grade, the award is changed accordingly.

The new policy is different. Since the original grade has been determined according to m + f, the possibility that a re-mark m* might be different from the original mark m has already been taken into account. Accordingly, if the re-mark m* lies within m ± f, the original grade is confirmed. Only if m* is greater than m + f or less than m – f would the grade be 'reset,' as determined by m* + f, which may or may not result in a grade change, depending on the location of the grade boundaries.

The value of f, therefore, determines the probability that the originally awarded grade will be confirmed following a fair remark. If much of the distribution r(h) is encompassed within 2f – say 99.9% – this probability will be high, which is why this solution delivers reliable grades.

A second possibility is to determine grades based on m – f, with a similar policy for appeals – the originally-awarded is confirmed if the re-mark m* lies within m ± f, or 'reset' according to m* – f otherwise.

Whereas m + f is 'generous,' giving candidates 'the benefit of the doubt,' m – f is 'stringent,' eliminating the possibility that a candidate might be given a lower grade by another examiner. This ensures that the candidate is fully qualified, at least as far as the exam was concerned – so hopefully, qualifications for brain surgery are based on m – f rather than m or m + f, likewise plumbing, gas fitting and driving. But why not be generous to GCSE and A level candidates and grade them according to m + f ?

A third solution is to discard grades and issue certificates showing m, associated with that subject's f, with all re-marks within m ± f confirming the original award.

There are probably others too. None is 'perfect' – all have benefits, all have problems. But the current solution is not perfect either: to me, grades that are "reliable to one grade either way" are a grave injustice [5]. And although there will be no exams this year, sooner or later, they will be back. When they are, this injustice must not recur. or

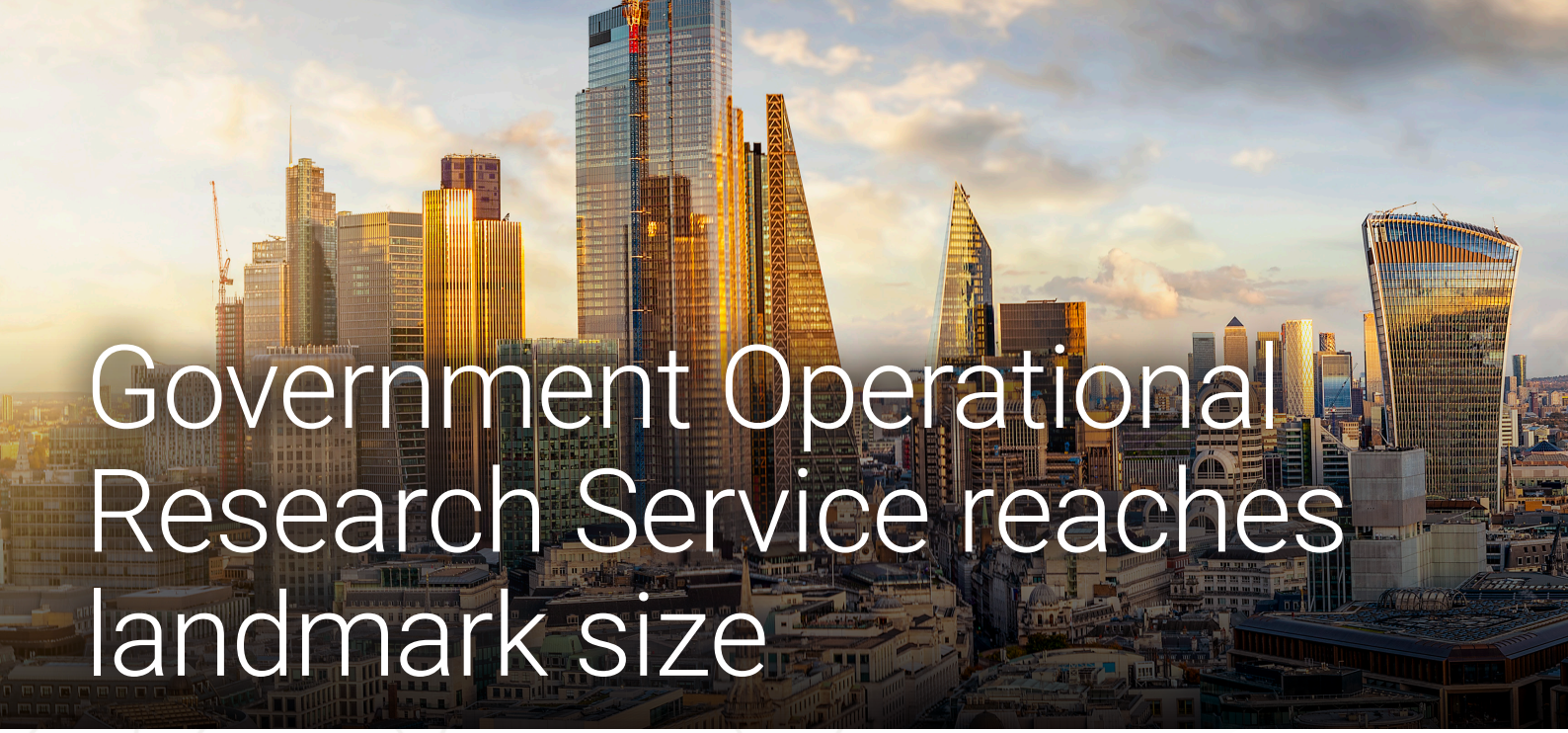
1: bit.ly/388sQly

2: bit.ly/3bXhecj

3: bit.ly/3kJXgpp

4: bit.ly/2PlQr1E

5: bit.ly/3kHZwNO



Government Operational Research Service reaches landmark size

AIDAN CROSS, GOVERNMENT OPERATIONAL RESEARCH SERVICE

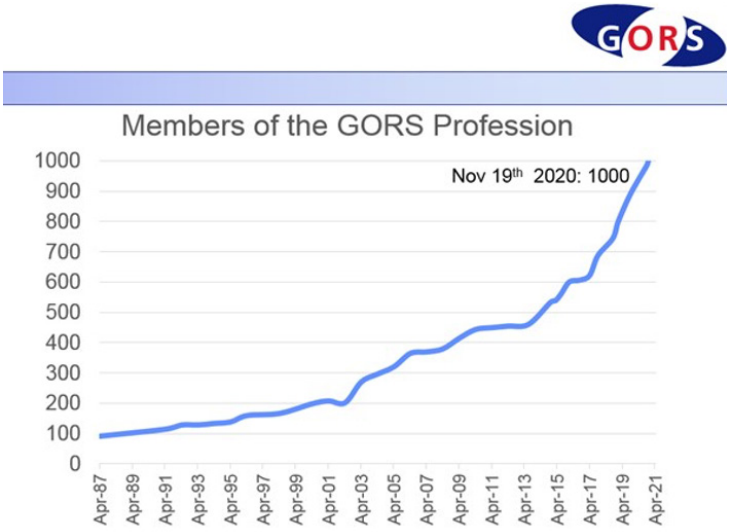
There have been a few times 19th November has been a significant day in years past. 1493 saw Columbus arrive in Puerto Rico, in 1969 Apollo 12 became the second mission to land on the moon, and 1994 saw the first draw of the UK national lottery (with seven winning tickets winning sharing a prize a just under £6M). Last year, while England was in the second lockdown, it was the day that membership of the Government Operational Research Service (GORS) passed 1000 people. To celebrate this occasion, we have put together a short history of GORS and its precursors and offer a glimpse into what the future of OR in Government might be [1].

Early History

OR in government famously stretches back to Blackett and his early pioneers in the late 1930s and early 40s. The organisation that became GORS itself was formally established in the late 60s, but the GORS nomenclature wasn't formally used until the 1990s. The cross-departmental approach to Operational Research in government, which ultimately led to GORS as we recognise it today, began with the Fulton Report, published in 1968. This led to the creation of the Civil Service Department (CSD), which had an OR team and was responsible for encouraging new management techniques in government departments. However, prior to the establishment of this cross-government function, smaller community ORs were already embedded in a number of departments and nationalised industries.

Growth

By the late 80s, GORS had around 100 members, which grew steadily to around 200 by the millennium. At this point, the rate of growth began to increase, with the number of active members reaching 500 in 2015 and is currently on track to grow by 100 per year in the early part of the 2020s. Nobody has yet been bold enough to fit a curve to the data, but we assume the rate of increase will be sigmoidal and that we aren't facing the potential of a future Government OR singularity.



As you might expect for a government function, most members of GORS are based in London (60% when we are able to attend offices regularly again). However, of the remaining 40%, 150 are in Yorkshire and 100 in the North West of England, with the largest collection in a single city outside London in Sheffield. New clusters are starting to emerge, with 40 in Wales centred mostly in Newport and about 30 in the North East of England, and emerging communities in Scotland and the West of England.
Present Day

The biggest OR communities are in HMRC and DWP, with over 140 OR analysts each. The other substantial departments are the Home Office, Ministry of Justice and Department of Education, which each have over 100. At the time of writing HMRC, has the most ORs in government by a whisker, which is a source of disappointment for the authors, both of whom work in DWP. Size isn't everything, however. New OR functions are being established and growing across almost every government department and function, with GORS offering a cross-government community, training and careers path for all OR analysts in government.

GORS has been led by Tony O'Connor for over a decade now, and during that time, the breadth of the work done by ORs has increased significantly. OR has remained true to its roots and remains involved in classic OR modelling problems like the health service, coastguard and air-sea rescue response and optimising staffing for frontline delivery of government services.

Over time the increases in computing power and data availability alongside sophisticated tools allow the creation of integrated central models like PENSIM2, which has brought OR into the very heart of government, helping forecast policy impact decades into the future. Advanced models of electricity generation project capacity for decades ahead to ensure the lights will stay on with minimal environmental impact whilst also ensuring that the supply is stable at time frames down to days and hours. For those interested in finding out more about the work of Operational Research in government, we have included a list of links to some of the published work, which can be found at the end of the article.

As you might expect OR has been at the heart of the government response to COVID-19. COVID-19 has touched all aspects of our lives, and for every new challenge, there will be a team of analysts, including Operational Researchers behind the scenes supporting decision making. Less of this work is currently published but covers things like cutting edge analytics to create dashboards using a huge range of live data tracking areas such as energy use, uptake of unemployment benefits, changes in consumer spending, to name a few amongst many. OR has been used in scenario planning, forecasting things like longer term impacts of changes in behaviour for transport usage. Even when things return to something close to normal, the challenges for Operational Research in Government are going to be many and varied. If you're interested in finding out more about how you could use your skills to support decision making at the national level, then please go to: **bit.ly/305GxDH**.

Further links to a few examples of OR in Government

Modelling 2050 electricity system analysis **bit.ly/3reV7V4**

The Work Programme – a quantitative impact assessment **bit.ly/387ipEV**

The Carbon Calculator **bit.ly/3v1L8Vz**

[1] The authoritative History of OR in Government was put together by Mick Hudson and can be found at: **bit.ly/308udCy**

Isadore Singer, the man who Bridged the gulf between Mathematics and Physics

NIGEL CUMMINGS

Isadore Manuel Singer (3 May, 1924 – 11 February, 2021)

We are sorry to report the death on 11 February, 2021, at the age of 96, of Isadore Singer, the mathematician who led much of the interaction between mathematics and physics during the 1970s and 1980s.

Singer was born on 3 May, 1924, in Detroit, Michigan, to Polish Jewish immigrants. He studied physics at the University of Michigan, graduating in 1944 after two-and-a-half years so that he could join the military.

His military service saw him acting as a radar officer, and he also operated a communications school for the Philippine Army. During his free time, he undertook correspondence courses in mathematics to satisfy the prerequisites for relativity and quantum mechanics.

Upon his return from military service, Singer studied mathematics for one year at the University of Chicago. Even though he initially intended to go back to physics, his interest in mathematics grew, and he continued with the subject. He achieved an M.S. in Mathematics in 1948 and a PhD in Mathematics in 1950 under the supervision of Irving Segal.

Following this, Singer held a postdoctoral fellowship as a CLE Moore instructor at the Massachusetts Institute of Technology (MIT). After appointments at the University of California, Los Angeles, Columbia University, and Princeton University, he returned to MIT as a professor in 1956 and was appointed as the Norbert Wiener Professor from 1970 to 1979.

In 1979, he moved to the University of California, Berkeley as Miller Professor. He returned to MIT in 1983 as the first John D. MacArthur Professor before being appointed as an Institute Professor in 1987.

Partnering with British-Lebanese mathematician Michael Atiyah, Singer worked on creating a linkage between the fields of analysis, especially differential equations, and topology. While the consensus of the time was that the two fields could not be combined, Atiyah and Singer applied Atiyah's topological constructs to solve Singer's differential equation problems. This paved way to a field of mathematics called Index theory. The development of Atiyah-Singer index theorem relied upon the Dirac operator, where Singer rediscovered its importance to mathematics before the formulation of his famous contribution. (In 2004, Atiyah and Singer were awarded one of the first Abel Prizes.)

With Richard V. Kadison, he proposed the Kadison–Singer problem in 1959. Inspired by quantum mechanics, it turned out to have reformulations in engineering and computer science. It was finally proved in 2013.

In 1975, he worked with mathematician Jim Simons and physicist Yang Chen-Ning to extend a construct to physics, drawing a linkage between gauge theory and fibre bundle. This theory was hailed as a significant unification effort between pure mathematics and theoretical physics.

In a long and productive career, he also found the time to develop analytic torsion with D.B. Ray and with Henry McKean introduced heat equation formulae to the Atiyah-Singer index theorem. Singer's other notable contributions in mathematics include the Ambrose–Singer holonomy theorem and the McKean–Singer theorem.

Much of the history of the modern interaction of mathematics and quantum field theory can be traced to an origin in 1976, when Singer talked to physicists about gauge theories, geometry and the BPST instanton (Simons and Yang a year earlier had started to realise how gauge theory, geometry and topology were linked).

The next year he was in Oxford working with Atiyah again and Hitchin on instantons, which set off an explosive development of new ideas, inspiring and fascinating both mathematicians and physicists.

To read more about the life of Isadore Singer, please take a look at: **https://nyti.ms/3qtHxwF** and **bit.ly/2ZpEGt6**

Analytics Summit 2021

NIGEL CUMMINGS

Our annual Analytics Summit event gives attendees the tools and skills to drive business results with their data and provides them with the latest developments affecting analytics, OR and AI.

The event was held virtually and attended by lots of analysts eager to gain key insights from experts in government, industry, and academia, to share with their businesses.

The keynote talk was given by Professor David Hand and concerned AI validation, reliability, and maintenance. It presented a view of requirements for valid, reliable, and robust AI systems. It started with Professor Hand defining the purpose of 'the system,' and then he examined the risks arising from inadequate data and made suggestions of how to overcome them.

His talk moved on to discuss the challenges, in practice, that arose from the fundamental non-stationarity of the world. Professor Hand also spoke about the need for AI systems to work in a human social context and the need for systems to work effectively in an AI context, especially as he believes the internet of things (IoT) is becoming more dominant.

Ganna Pogrebna, Professor of Behavioural Economics and Data Science at the University of Birmingham and a Fellow at the Alan Turing Institute, provided information about improving productivity and the customer experience in the entertainment industry.

The entertainment industry relies heavily on a consumer-centric framework that puts customers at the centre of content development and production. Data science using natural language processing, image recognition and sound analytics, combined with econometric analysis, can explore the extent to which human emotions, imagery, and audio shaped consumer preferences for media and entertainment affects content.

Marilena Karanika, Head of Categorisation at Experian/ Castlight, spoke about categorisation in the age of Open Banking. The Open Banking initiative presents opportunities for consumers to use their transactional data to access better financial products and services. It also helps businesses to improve their decision-making processes by providing their customers with the best possible experience.

Paul Laughlin, Managing Director of Laughlin Consultancy, related how, after 20 years of experience in creating and leading data & analytics teams, he had now reached a point where he primarily focussed on helping other leaders master "the people side of data and analytics."

Paul explained how he published both academic research and opinion pieces based on his commercial experience. These included chapters in books such as 'The Dark Side of CRM' and numerous articles in journals, including 'The Bottom Line.'

Jack Snape, Principal Analyst at Transport for the North, provided insight about methods for making sense of simulated worlds, using the principles of predictive analytics to make complex simulation models more usable. Simulation models are moving closer to realistic levels of detail and are now being linked together into complex ecosystems. Such connection and linkage are necessary to understand interactions between sectors, such as transport, land-use, and electricity generation.

Jack, who has a PhD in physics and has worked as an analyst in the Civil Service and Local Government across a range of policy areas, shared his experiences using predictive analytics principles to make complex modelling ecosystems more usable.

The Analytics Summit 2021, despite the limitations imposed by the COVID pandemic, proved to be a triumph in steering and informing those who attended toward new and reliable paths to take in analytics.

Beale Lecture 2021

Panel Presentation in honour of Ailsa Land

NIGEL CUMMINGS

This year's Beale Lecture was hosted by Professor Edmund Burke, President of the OR Society. It differed from other years in two ways: firstly, it was presented online (via Zoom) due to the COVID-19 restrictions and secondly, it was not presented by the Beale Medal winner, Professor Ailsa Land, herself, but was an appreciation of her work given by a panel of experts chaired by Emeritus Professor Douglas Shier, Clemson University.

The panel session was titled 'Real-World Optimisation Models: Successes and Pitfalls' in celebration of Professor Land's work.

Algorithmic advances and modelling sophistication have fuelled the rapid proliferation of optimisation models to aid decision-makers. Ailsa Land and Alison Doig's breakthrough work in 1960 made the solution of models that include discrete-choice variables feasible. Land's subsequent work with Susan Powell, developing computer codes for mathematical optimisation, significantly advanced the ease of applying these techniques to many societal problems.

Professor Shier introduced the first speaker, Professor Anna Nagurney, University of Massachusetts, who provided a wonderful background on Ailsa Land and her work and related how Ailsa had been interviewed by Laszlo Vegh, LSE, during July 2019 as part of the INFORMS History and Traditions project.

Anna said of the interview, in "her fantastic, panoramic and very interesting interview, Ailsa Land had commented about the LSE's seminar series and her first steps into mathematical optimisation and the OR world of optimisation." This 97 min interview can be accessed at: **bit.ly/37Ss9Ty**

Anna concluded her tribute by thanking Professor Land for her "extraordinary impact on OR and on the practice of OR", and "today, we thank you and salute you, we will make sure that the contributions of those working in OR will continue to make positive difference."

Professor Karla Hoffman, George Mason University, a past president of INFORMS, said, "Ailsa Land's work had an extraordinary impact on everything that people do, when they were modelling and optimising, and when there were any integer variables, her work is what we all 'stand on' when we try to do that!"

Professor Jeffrey Camm, Wake Forest University, then spoke about Ailsa's work, and he commented that he wondered, "if not for branch and bound what would I have been doing for the past 30 years? So, thank you so much Professor Land for all of your work."

He related how he had drawn on some of Professor Land's work when, as a young assistant professor, he needed help to solve a supply chain problem for Proctor and Gamble, a problem concerning supply to locations in North America.

At the time, such problems were routinely solved on mainframe computers. However, after studying Dr Land's work in branch

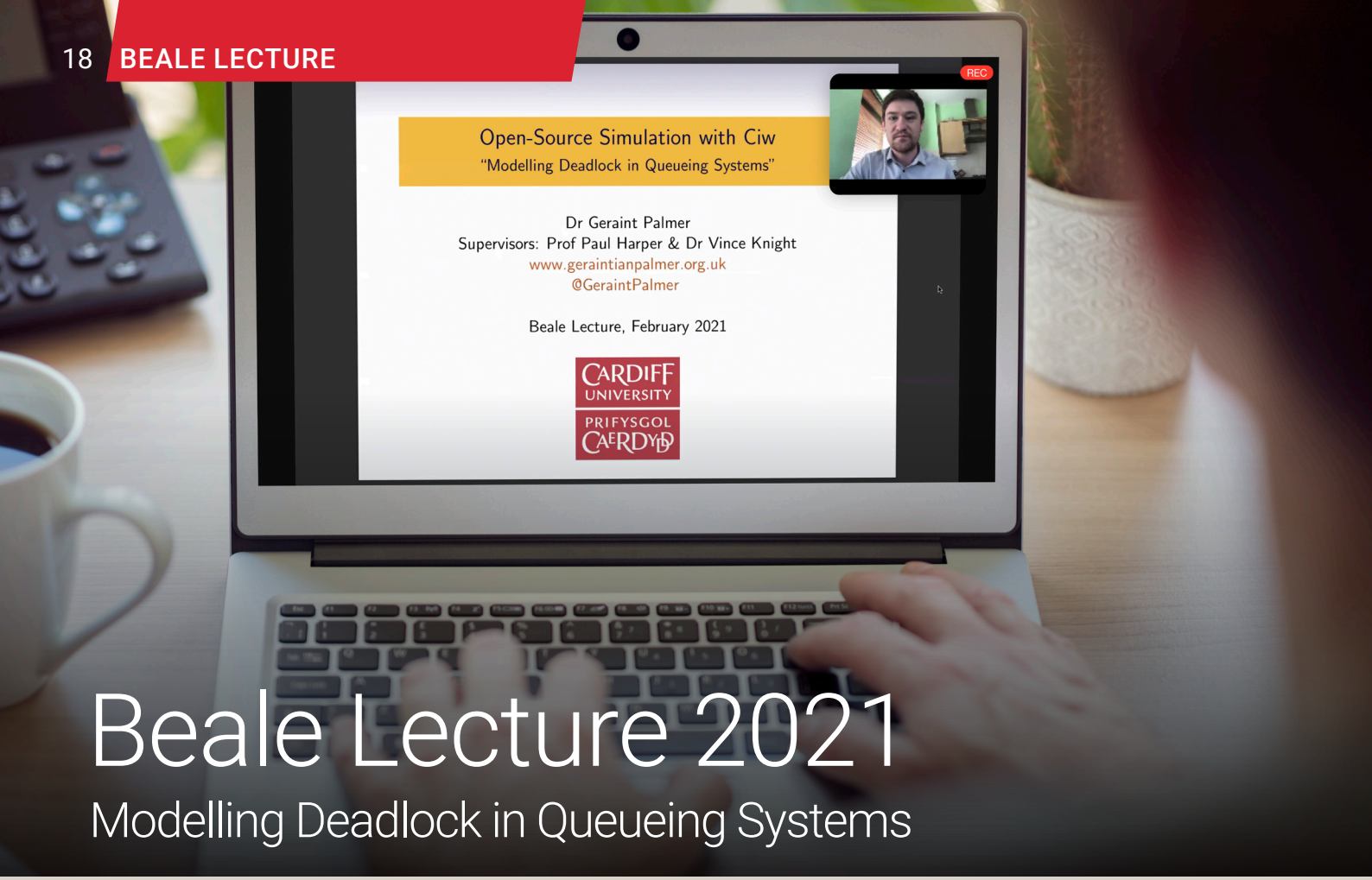
and bound he was able to successfully solve the problem on a laptop, thus providing a far more portable and usable solution than any mainframe could. He said that without Ailsa's work, he would not have been able to undertake and complete such a task. He concluded, "Thank you Professor Land for your seminal work in branch and bound; it has enabled me to focus on modelling and having so much fun for the last 30 years."

Susara van den Heever, Director at IBM, related how despite having never met Ailsa Land, her work had "a huge impact on my life both professionally and in personal life." Land's work had triggered in her excitement about optimisation during her early career. Since that time, she has used Ailsa Land's branch and bound insights wherever possible to assist her, creating effective and useful simulations. For this, she had much to thank Professor Land.

Professor Ivana Ljubic, ESSEC Business School, France, gave the final presentation. She said, "It is a great honour to have the opportunity to discuss Ailsa's achievements in respect of branch and bound, and to look into the future of branch and bound and the overall research of mathematical optimisation. [It] has been part of my life for at least twenty years, and I have spent hours and hours with my PhD students and my colleagues, looking at my screen and seeing how lower bounds are reaching upper bounds."

Ailsa Land started this work, but it is not yet finished!

To watch a recording of the video, please visit:
www.theorsociety.com/events/beale-lecture



Beale Lecture 2021

Modelling Deadlock in Queueing Systems

NIGEL CUMMINGS

This year's Beale Lecture included a presentation from Dr Geraint Palmer, Cardiff University, the 2018 winner of the Doctoral Award for his work on Modelling Deadlock in Queueing Systems.

In his talk, Geraint related how he had developed a discrete-event simulation package in Python called Ciw (which he explained was Welsh for "queue") that was free to download, edit, reproduce, and improve by others.

Using the Python library is most useful in terms of best practice and reproducibility for computational research. Some simulation packages came with several disadvantages compared to using Ciw, for example, high costs, licences, training, plug-ins, and maintenance. They often lacked modularity, had low model reusability, and a lack of access to the source code could impede understanding, customisation, and flexibility.

Not so with Geraint's work, as his Ciw modelling took full advantage of Python's open-source library. It was easily reproducible, as his software could be seen in six phases: automate, readability, access, collaboration, testing, and version control. The simulation engine in it was built with the ability to detect deadlock. It could also determine how long it took to reach deadlock and could stop when that point was found.

He said he had verified and tested his modelling by running Markov models that were known to exhibit deadlock – on the grounds that, if a queuing system could reach deadlock, it would be guaranteed to reach deadlock at some point no matter how long it took.

This was useful in computation with open restricted queueing networks which gave rise to the phenomenon of deadlock, whereby some clients might be unable to ever leave a server due to mutual blocking.

Geraint's doctoral work had explored deadlock in queueing networks with limited queueing capacity and presented a new and effective method of detecting deadlock in discrete event simulation (DES). It was also capable of building Markov chain models of such networks.

Networks for which Markov models were given in his presentation included single and multi-server networks for one and two-node systems. The expected times to deadlock of these models was, for example, compared to results obtained using a simulation of the stochastic process, together with the developed deadlock detection method.

Such models have applications in many varied settings such as healthcare, supply chains, manufacturing, and communications systems. However, these types of models do have limitations due to their potential to become permanently blocked-in deadlock.

These deadlocks could be real and observed in reality, in which case accurate modelling of deadlock was needed; or they could be seen only as a symptom of a model unable to capture certain behaviours. This could occur in models where deadlock situations were easily adjusted in reality. So, a good understanding of deadlock was needed in order to model the adjusted reality.

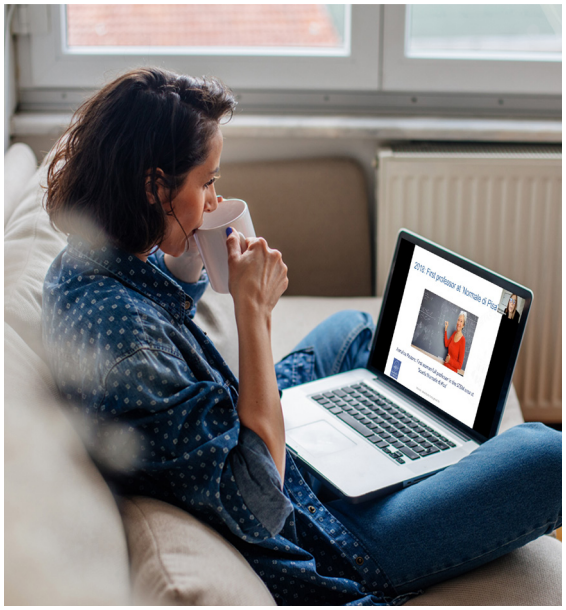
Dr Palmer's presentation was accompanied by a variety of slides which illustrated the processes involved in his modelling and the type of modelling for which his doctoral work could be applied.

Regional and Special Interest Groups events

WORAN Online: Spring 2021

Date: 26 April 2021

Time: 14.00-17.00 GMT



WORAN online meetings aim to make women visible as role models and contributors to OR, to explore issues affecting women, to help build and consolidate professional interaction and networking, to make sure that women's voices are heard, and to be an enjoyable opportunity to 'get out and about'. These goals and issues are relevant to the whole community, not just to women, so the meetings are open to everybody.

Raising the profile of women in OR/analytics - a wikithon

Join us to celebrate the women in OR/analytics that deserve a more prominent place in the online historical record. We'll start by learning how to edit Wikipedia in order to harness the power of the web to share your knowledge, and then use this new-found learning collaboratively to get the information out there. Why bother? Read this, on gender bias in Wikipedia, for some motivation: **bit.ly/2YM8Gic**

Although the whole event lasts three hours, if you are hard-pressed you can stay for just the first hour to learn how it's done, then either dip in and out, or carry the project forward in your own time.

We'll be led by Dr Alice White, an expert Wikipedian and Digital Editor at the Wellcome Collection, and Sonya Crowe, Deputy Director, Clinical Operational Research Unit.

bit.ly/302NvJl

Women in OR and Analytics

Date: May 2021

Time: TBC

Event details to be announced. To keep in touch with what's coming, join the WORAN mailing list by visiting the WORAN webpage.

www.theorsociety.com/WORAN

Southern OR Group

Date: June 2021

Time: TBC

Joint meeting with Southern OR Group: Reflections on my weird career (Sally Brailsford) and WORAN in time of COVID (Ruth Kaufman)

www.theorsociety.com/SORG

THE UNIVERSITY of EDINBURGH

Launch your career in industry.

Study an MSc in Operational Research.

Gain first-hand experience with the option of an industry-based dissertation project, and develop a deep knowledge of operational research, optimization and data analysis techniques.

Our intensive programme allows you the flexibility to focus your studies in an area that best suits your career goals, with MSc programmes available in:

- Operational Research
- Operational Research with Computational Optimization
- Operational Research with Data Science
- Operational Research with Risk

"I could not recommend this programme more – it is a wonderfully challenging, interesting, and dynamic year, and you will learn more in this 12 months than you ever thought possible!"

Alexandra - MSc Operational Research with Data Science graduate

Find out more at ed.ac.uk/maths/msc/or

Open to the world

WORAN Event: Living with imposter syndrome

Hosted by Ruth Kaufman and Rosemary Byde on 18 Feb 2021

KIM AGATE, MINISTRY OF DEFENCE

The latest event held by the Women in OR and Analytics Network was held on 18 February over Zoom with approximately 70 attendees.

What is Imposter Syndrome?

Imposter syndrome can broadly be described as an experience of believing you are not as competent as others perceive you to be. It can take many forms and impact people in a variety of different ways and to varying levels of disruption.

An initial poll identified that 89% of the audience experience imposter syndrome, with 82% stating it affected their personal life. Attendees were guided through examples of some high-profile individuals from Einstein to Michelle Obama, all of whom expressed some feelings of imposter syndrome. It was clear that those experiencing this feeling were not alone.

While a world where everyone felt entitled and deserving of their accomplishments may be a less palatable one, imposter syndrome can have serious negative implications on careers and personal lives. It can stop people from speaking up, reduce aspirations and diminish progress. As women are more likely to be impacted, it may then mean that we hear the voices of fewer women or some of our best experts.

What triggers imposter syndrome?

Breakout sessions identified many things which can cause imposter syndrome, including the following:

Tactics to address imposter syndrome:

The session then held discussions to suggest tactics to address imposter syndrome. Some of the ideas of how individuals can help themselves included:

- Understanding you are not the only person feeling this way
- Feeling comfortable to not know something and understand that you can take an action to get back to someone
- Allowing mistakes to happen and taking a realistic approach to your own capabilities. Understanding others fail too, and that it isn't often career-ending
- Decouple individual negative experiences from 'your whole career'
- Maintain awareness of the facts of the situation rather than focussing on your feelings about it
- Prepare both your facts and feelings ahead of meetings and events
- Maintaining awareness of your own achievements, such as creating a list and referring back to them
- Listen to positive feedback and ask for it too
- Engage in mentoring schemes and work to enhance your own presentation skills
- For events such as judgement panels, don't second guess the outcome in advance, accept that it is their job to judge
- Frame yourself as collaborative rather than adversarial, there to contribute rather than compete with others who may be experts
- Create familiarisation by practising challenging situations e.g., role play
- Seek out employers with a better gender-balance if that is an issue
- Consider being upfront about gaps in expertise, but do not overstate them.

As well as methods to help alleviate Imposter Syndrome within others by:

- Not holding others to unachievable standards
- Taking a realistic approach to individuals' capabilities
- Having a strong chair in group situations who will invite everyone to contribute
- Work with others to foster feelings of shared experience
- Consider promoting people who have empathy and inter-personal skills, as well as expertise
- Stimulate creativity and participation in your peers and in group settings
- Highlighting the achievements of others, particularly in the face of unfair accusations such as nepotism and quota recruitment
- Give positive feedback.

As ever, the event was well-attended with a broad range of experience from across the globe and with broad insights from their varying experience and careers. Attendees polled at the end of the event indicated they felt better equipped to deal with Imposter Syndrome and were provided with a toolkit to make steps to tackle it.

The next WORAN event will be "Raising the profile of women in OR/analytics" on the 26th of April 2021, 14.00-17.00. You can register for this online event here: **bit.ly/302NvJl**

THE OPERATIONAL RESEARCH SOCIETY

OR SOCIETY EVENTS:

Join us at our online events to hear from expert speakers, learn new techniques and network with like minded OR colleagues. Our events are currently taking place online due to the ongoing COVID-19 pandemic, meaning that you can join from the comfort of your own home with our events portal.

11 May

3rd IMA & ORS Conference on Mathematics of Operational Research

A conference that brings together our community of researchers and practitioners to showcase the work of those developing new mathematics with relevance to operational research.

20 - 23 Jul

38th ISMOR

This four-day annual international symposium is sponsored by the UK Ministry of Defence and offers a unique opportunity to spend quality time exploring the application of analysis to practical issues in defence and security with a wide range of colleagues from across the world.

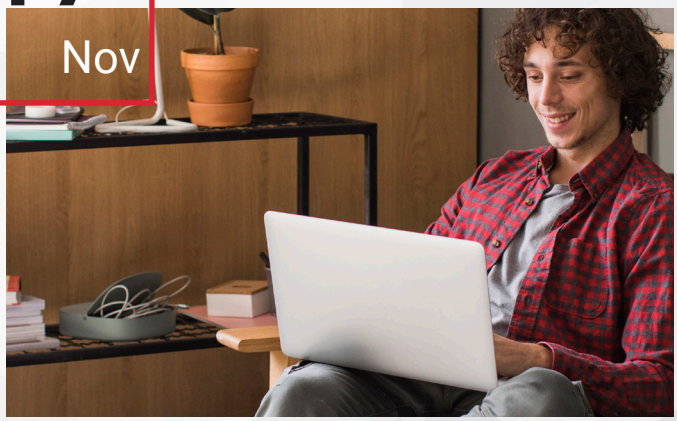
14 - 16 Sep

OR63 Annual Conference

One of the biggest yearly events in Operational Research, our annual conference will be online this year to bring together hundreds of participants for three days of speakers, challenges, networking events, awards and much more.

17 Nov

Careers Open Day



Explore the different aspects of OR, engage with potential employers and discover the job opportunities available. Your future, your job, your career path.

For more events visit:
https://www.theorsociety.com/events

ONLINE TRAINING CALENDAR 2021

APRIL

12/04/2021 - Statistical Methods in OR: Forecasting with ARIMA
13/04/2021 - Foundations of OR: Data Envelopment Analysis
14/04/2021 - Foundations of OR: Problem Structuring Methods
21/04/2021 - Data Mining: Techniques & Applications
27/04/2021 - Data Presentation Skills Online
28/04/2021 - Foundations of OR: Essential OR Skills for Practitioners Online

MAY

10/05/2021 - Introduction to Prescriptive Analytics: Models and Applications
10/05/2021 - Version control with Git & RStudio
11/05/2021 - Foundations of OR: Optimisation and (Meta-) Heuristics
12/05/2021 - Building and Using Living Business Models (part 1: Core Skills)
13/05/2021 - Foundations of OR: Simulation
17/05/2021 - Foundations of OR: Statistical Methods in OR: Multivariate Models
19/05/2021 - Building and Using Living Business Models (part 2: Extensions)
20/05/2021 - Delivering OR for Practitioners
25/05/2021 - Foundations of OR: System Dynamics Online
25/05/2021 - The Science of Data Visualisation Online
27/05/2021 - The Art of Data Visualisation Online
28/05/2021 - Modelling and analysis using complex networks

JUNE

02/06/2021 - Introduction to Soft Systems Methodology
15/06/2021 - Data Visualisation with Tableau
16/06/2021 - Foundations of OR: OR Process Online
17/06/2021 - Geospatial Data Visualisation with Tableau
28/06/2021 - You too can be creative – how to build creativity into Analytics and Modelling
28/06/2021 - Reproducible Data Reports with R Online

JULY

01/07/2021 - Introduction to the Viability and Sustainability (V&S) Methodology
05/07/2021 - How to build a creative culture in an OR/Analytics team

SEPTEMBER

14/09/2021 - The Science of Data Visualisation
16/09/2021 - The Art of Data Visualisation
20/09/2021 - Developments in Credit Scoring

OCTOBER

04/10/2021 - Improving and evaluating performance with the Public Sector Scorecard
06/10/2021 - Introduction to Soft Systems Methodology

NOVEMBER

10/11/2021 - Artificial Intelligence Deployment Through Cloud Computing
22/11/2021 - Consumer Willingness to Pay Using Conjoint Analysis
30/11/2021 - How to design and deliver high impact data analytics projects

DECEMBER

01/12/2021 - Introduction to Cognitive Mapping

The President's Medal

The President's Medal is one of The OR Society's most prestigious awards.

What does this award recognise?

The President's Medal is awarded for the best practical application of OR submitted. A wide definition of OR is used, and entries are welcomed from both industry-based OR workers or consultants as well as from academics.

One of the main qualifications for entry is that the work has been implemented before submission. If you're thinking of giving a case study-based paper at our annual conference OR63 this year, why not consider entering your work for the President's Medal? If you know of a colleague or friend who has completed work that would qualify, please encourage them to consider applying to highlight their work in the OR industry.

What criteria is used to judge this award?

Criteria for judging this award includes:

- The level of demonstrable benefit
- The intellectual and novel content of the solution
- The likely longevity of the solution
- The excellence of the OR process

Successful applicants for this award will then be invited to present their work at our annual conference, OR63, where a special judging panel consisting of the OR Society president, past president, and a distinguished OR practitioner together with help from the audience helping to select which piece of work they think is most worthy of the accolade.

Who has received this award in the past?

In 2020 the President's Medal was awarded to Harminder Mann, Jordan Low, Kim Brett, Lizzie Baggot, Mary McKee, Sara Smith, and Sam Rose for their work on "Creating new population movement insight to shape the UK Government's response to the Coronavirus pandemic."

The judges were very impressed by this project's rapid development approach that delivered previously unavailable mobility information to policymakers and managers against the intensely demanding timescales of the pandemic crisis, with the first results coming through only 48 hours after a new unit was established to produce them. The solution combined existing modal mobility data with mobile telecoms and additional open-source or government data sets, and results from the analytics were critical in highlighting movement patterns around hotspots of infection.

The project went on to produce evidence to support significant decisions at the national and local levels as the crisis has unfolded. In addition, while meeting the mobility information needs of the crisis would be impressive enough, the team has ensured that the benefits of improved insight into mobility will be sustainable, meeting the longer-term needs of the Government.

What is the closing date for this award?

The closing date for the receipt of submissions will be 31 July, and submissions should be made to Publications and Research Officer Carol McLaughlin at **carol.mclaughlin@theorsociety.com**.

Submissions should describe the case study in no more than two sides of A5 and be accompanied by two referees, a client, and an OR Society member.

The Awards Panel will select the finalists by 31 August and will convey their decisions the Research & Publications Officer, who shall notify the candidates and the annual conference committee of the decisions. Finalists will be required to present their work at the annual conference.

For full guidelines, please visit: **bit.ly/3bboAJY**

Candidates for the President's Medal will present their work at the annual conference on the 14 – 16 September.

Be recognised for OR achievements

May Hicks Award

Deadline for submission: **30 April 2021**

Who should apply?

The May Hicks Award is for student projects carried out for a client organisation. Entries are invited from any eligible courses, and those on a masters course in OR or Management Sciences are automatically eligible. Entries to the May Hicks Award should be made by the course director or a faculty member rather than by a student directly.

Projects submitted should be examples of effective work for the organisation and of strong quality. The award is then decided by judges, with the winners encouraged to present their work at a society conference.

Contact for submission:
All submissions are to be made by email to the Publications and Research Officer Carol McLaughlin
carol.mclaughlin@theorsociety.com

The Lyn Thomas Impact Medal

Deadline for submission: **30 July 2021**

Who should apply?

This accolade is awarded for academic OR research which best demonstrates both novelty and real-world impact. This impact could be in many forms, including societal, economic, cultural, entertainment, health-related and much more.

The underpinning research should have been undertaken in the previous ten years, and the impact itself must be demonstrable within the past two years. All academic researchers who are members of the Society and work at UK universities are eligible to enter.

The previous winner of this award was a team from the Clinical Operational Research Unit, University College London; Christina Pagel, Sonia Crowe, and Martin Utley, who put forward an outstanding case study on 'Improving services for children with congenital heart disease.' You can read more about this on our webpage: **bit.ly/3e3ept1**

Contact for submission:
All submissions are to be made by email to the Publications and Research Officer Carol McLaughlin
carol.mclaughlin@theorsociety.com

Doctoral Award

Deadline for submission: **31May 2021**

Who should apply?

This award is for the "Most Distinguished Body of Research leading to the Award of a Doctorate in the field of OR." The thesis submitted should have been examined at a UK university, and entries can come from any students, not just members of the Society.

The winner of this award will receive a cash prize of £1,500 and be presented with this accolade at our annual Blackett Lecture in November. The winner would also have their name engraved on the George Paterson shield as a permanent record of their achievement.

Contact for submission:
All submissions are to be made by email to the Publications and Research Officer Carol McLaughlin
carol.mclaughlin@theorsociety.com

Funding opportunities within OR

Are you aware of the range of funding opportunities available to OR professionals? Find out more about the latest funds designed to foster innovation across the UK.

EPSRC mathematical sciences small grants scheme

Engineering and Physical Sciences Research Council

This grant is open to original research projects or feasibility studies for research projects. EPSRC is looking to support grants in the region of £10-80,000 at 80% full economic cost, and of up to 12 months in duration. Full proposals can be submitted at any time and will be considered by EPSRC on a rolling basis.

Small grants are open to:

- UK higher education institutions
- research council institutes
- UKRI-approved independent research organisations
- NHS bodies with research capacity

EPSRC standard research grant

Engineering and Physical Sciences Research Council

Standard research grants are for researchers at UK higher education institutions, research council institutes, UKRI-approved independent research organisations and NHS bodies. This grant funds a wide range of projects ranging from small, short-term grants to multi-million-pound research projects. You may request funding for staff costs, equipment and other items required to carry out the project, costs related to impact, and travel and subsistence.

ESRC: Research Grants

Economic and Social Research Council

This grant funds individuals or research teams based at research organisations eligible for UKRI funding. Grants range from £350,000 to £1 million for a period of up to five years. Proposals can draw from the wider sciences, but the social sciences must represent more than 50% of the research focus and effort.

EPSRC postdoctoral fellowship

UK Research and Innovation

Apply for a fellowship focusing on either: energy or mathematical sciences. You must have either: a PhD or at least four years' experience in a relevant field by the start of your fellowship. Research grants are open to UK higher education institutions, research council institutes, UKRI-approved independent research organisations and NHS bodies with research capacity.

EPSRC Open Fellowship

Engineering and Physical Sciences Research Council

The Open Fellowship is those with a PhD or at least four years' experience in a relevant field by the start of your fellowship, focusing on any topic in the EPSRC portfolio. Applicants should be hosted and supported by an eligible UK research organisation during your fellowship and the fellowship can be up to five years long. The project can use one or a combination of discovery science, innovation, instrumentation and technique development, or software engineering.

For more information about available funding, please visit: **bit.ly/383zjUQ**

Call for journal reviewers

CAROL MCLAUGHLIN, PUBLICATIONS AND RESEARCH OFFICER

The role that reviewers play in safeguarding the quality and accuracy of the research that the OR Society journals publish is invaluable to both submitting authors and the community who benefit from the research.

As the journals and the Society continue to grow and develop, we are seeking to extend an invitation to the community to get involved and join the academic discourse.

Getting involved couldn't be easier

You simply need to find a journal that aligns with your expertise and interests and then register as a reviewer on the journal's peer review management system. Each journal has its own specific site, which can be accessed using the following URL: **mc.manuscriptcentral.com/ors-[journal acronym]**. So, for JORS, you would navigate to **mc.manuscriptcentral.com/ors-jors**.

An important step in creating an account is to attribute keywords to your profile. These are essential in helping the journal editors pair you with relevant manuscripts to review. You will, of course, be offered papers to review on an invitational basis, which will allow you to first assess the abstract to make sure it is in an area of expertise before agreeing or declining to review.

As some of the journals receive many submissions from a wide range of topics, it may be worth reaching out to one of the journal editors to express your interest in reviewing. The editor may then be able to introduce you to one of the subject-specific editors, who are often responsible for inviting reviewers and can consider you for upcoming manuscripts. Some journals will have specific requirements for who can review a journal and the editors can inform you of this.

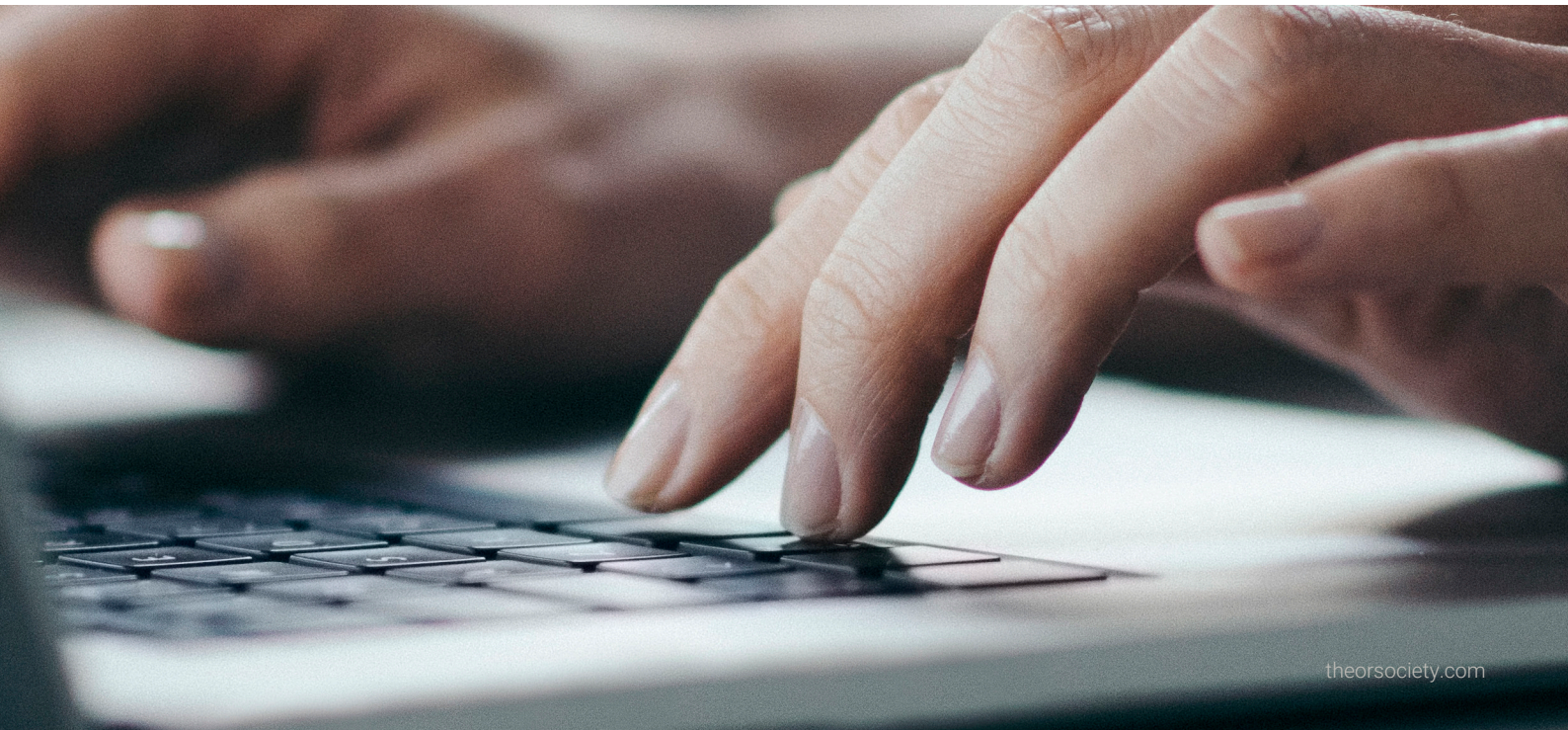
If you are unsure about reviewing or have not reviewed before, you may be interested in our publisher's guide to becoming a reviewer **[1]**. Here you will find information on the basics of peer review, best practice for writing review reports, as well as details on our Publisher's upcoming reviewer training events.

As a reviewer for one of the OR Society journals, you can help timely and cutting-edge research make real-world impact. The constructive feedback given by reviewers offers opportunities for authors to further improve their work and ensures that what is published has been validated by the community. In order to recognise the contributions of our reviewers, our Publisher has partnered with Publons, a platform for recording and recognising the contribution of our expert reviewers.

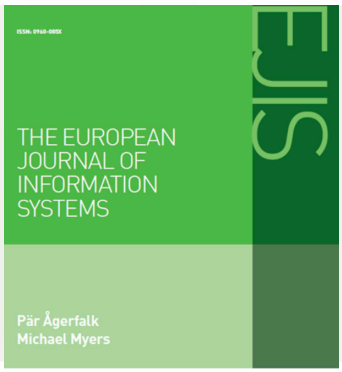
Publons is integrated with our ScholarOne peer review sites, so all you need to do is simply opt-in to recording your reviews as and when you complete them. Publons is also integrated with ORCiD, so if you use that platform, you can sync the two together to make sure that any reviewers credited in Publons are also credited in your ORCiD profile. Reviewers are also able to benefit from 30 days free access to any Taylor & Francis journal as well as a 30% discount on books published under one of the Taylor & Francis imprints.

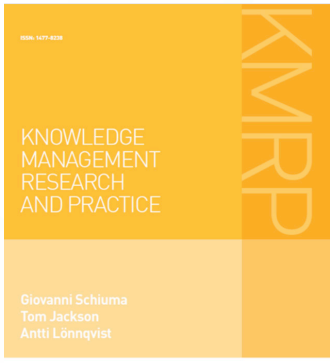
We hope that you'll consider this opportunity in 2021, and we look forward to welcoming you to our various research communities advancing the OR discipline.

[1] bit.ly/300UFOp



THE JOURNALS OF THE OR SOCIETY



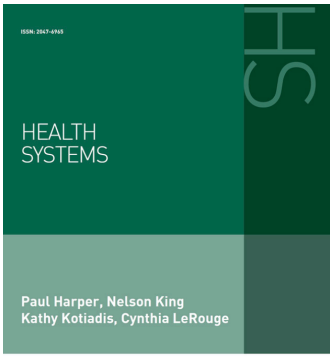


Find out about the latest OR developments

The OR Society publishes six learned journals that share the latest developments and research in a range of OR fields.

All of these are available online for our members and in print, if requested.

Delve into a copy today and find out the new breakthroughs and theories being developed all over the world by industry experts.



To access our journals, visit:
www.theorsociety.com/publications/journals

OR Minus 20

GAVIN BLACKETT, FORS

I've failed! I'm sure this isn't the first time, as plenty of colleagues, both current and erstwhile, will recall, but I think it's the first time I've failed in the context of the OR Minus 20 column. For more than ten years, each month, I've looked through the relevant copy of the OR Newsletter to find a suitably apposite, snappy, sometimes funny article from 'the olden days' to make up this column. April 2001, however, has defeated me. I've looked through the issue three times now, and nothing springs out as a candidate article. There's plenty of interest in the issue, which stretched to 48 pages, but just nothing that meets my usual criteria. In an effort to pull something from the jaws of defeat, I decided to follow John Crocker's OR-30 lead by writing about some of the highlights of the issue, so here goes.

Customer Relationship Management (CRM) systems were obviously one of the business trends of that time; the newsletter features three articles with that focus, including a case study from Dutch Railways. Similarly, e-business features heavily, including the announcement that a new version of the Society's website had gone live. There's an article on a proposed new 'unbreakable' coding system that could be a new way to code messages so as to make them indecipherable. I didn't follow this up at all, but given all the current work on cybersecurity, it would suggest the claims were a little far-fetched.

The leader column, usually a source of rich, ever-relevant material disappointed; it focussed on an upcoming conference. Similarly, the letters, responding to an article on transport planning, weren't inspiring, despite that being something else we haven't quite solved. The issue featured an article entitled 'A history of OR in 2000 words.' It might have had the header of 'Brief history,' but it's a little too long for this column. Ernest Fields, a stalwart correspondent from those time, wrote a piece on constraints in analysis. As usual, it was an interesting article, but too long to fit here. Two articles on marketing fall foul of the same issue.

The final option for me to consider was an article on that year's annual conference, which was to take place in Bath. Aside from the expected water-based headline pun, the only thing of note was a photo of one of the plenary, Prof. George P Huber, from Texas. To me, at least, he had a striking resemblance to Bob Holness, the TV presenter.

Hopefully, normal service will be resumed for next month's column!

OR Minus 30

It never ceases to amaze me how many different forms of the travelling-salesman, vehicle-routeing problem there are. You think you have seen them all and then along comes another which is subtly different from the others. Such was the case when I looked at the papers published in the April 1991 issue of JORS.

This particular example looks at the task of sweeping the roads in a rural area using vehicles designed specifically for this task. There are four categories of road (A-D) and each has to be swept a certain number of times per year. In each area, there may be one or more tips where the sweepers can be emptied. The capacity of the sweepers is such that they will need to be emptied at various times throughout the day as well as at the end of the day.

The authors, Richard Eglese and Heather Murdock, go on to describe a number of other conditions as well as desirable outcomes including, for example, the requirement that each side of a given road should be swept in the same day. It should be noted that the sweepers are not wide enough to sweep both sides of the road simultaneously nor are they encouraged to drive along the wrong side of the road.

It should be recognised that in 1991, SATNAV did not exist neither, nor for that matter did Google Maps. In fact, the road system in the area was not digitised until after the project had been completed.

Given that one of the authors of this paper is the current Chair of the Publications Committee, it would be very remiss of me not to include "A Simple Stochastic Model of Air–Naval Combat" whose authors not only include a past chair of the said committee, Jeff Griffiths, but also the current Treasurer, Janet Williams.

Basically, in a battle between a surface ship without aerial support and an enemy air force, the ship is always going to be the loser provided there are sufficient aircraft within range to maintain an attack against it. What this paper does is to attempt to calculate the probabilities and from that, estimate the number of aircraft needed to sink a ship armed with anti-aircraft guns.

The study considers two types of attacking aircraft – those armed with a single bomb and those armed with a single torpedo. The bombers attacking from a high level scored very few hits but, at the same time, suffered few losses. By contrast the torpedo bombers had to attack from a very low level and were much more successful but also suffered much higher losses.

This is a classic OR problem where there is very little reliable data, and it is totally impractical to run controlled experiments to gather more. It is very much a case of making the most of what you have got.

Both papers are, as usual, available online at no cost to ORS members. To access them, follow these links:

https://doi.org/10.1057/jors.1991.66

https://doi.org/10.1057/jors.1991.67

(For full access to the papers, log in via the OR Society website.)

Total Membership: 3238

New Accreditations

The OR Society is pleased to announce that the Accreditation Panel has admitted the following members to the categories shown. These members are now entitled to use post-nominal letters as indicated:

Admit to the category of Fellow of The OR Society (FORS)

Tom Baldwin
Ben Taylor

Admit to the category of Associate Fellow of The OR Society (AFORS)

Claire Pearce

Admit to the category of Associate of The OR Society (AORS)

Alistair Welford

Admit to the category of Candidate Associate (CandORS)

Vinod Kumar Aravind
Kieran Exley

The OR Society prides itself on connecting likeminded OR experts and enthusiasts from all areas of OR, wherever they are. Our special interest groups and regional societies exist to support

Interested in joining one of our special interest groups or regional societies?

Find out more on our website here: **bit.ly/3uS5twCbi**

THE OPERATIONAL RESEARCH SOCIETY

Join us on 14-16 September for our Annual Conference

The biggest event on the OR calendar will take place virtually this year, allowing you to join in the debates, sessions, awards and challenges, all from the comfort of your own home. We are looking forward to seeing you there!

Call for papers opening in April