DECEMBER 2022

NO 621

INSIDE OR

THE SCIENCE OF BETTER AT THE HEART OF ANALYTICS

Fraud: What do operational researchers and analysts need to know?

inside:

theorsociety.com

DIARY DATES 2022

EVENT	DATE	VENUE
Blackett Lecture	7 December 2022	London
WORAN Christmas Event	15 December 2022	London and Online
Simulation Workshop	27-29 March 2023	National Oceanographic Centre, Southampton

Please check our website for the latest details or contact us at **event.enquiry@theorsociety.com** for specific enquiries.

Deadline for submissions for the January edition is 1 December.

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 January edition is 1 December.

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*

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12 Edward Street, Birmingham B1 2RX

Tel: 0121 233 9300

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Editor: John Crocker
Journalist: Nigel Cummings
Marketing Manager: Rob Chidley
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Editorial

DECEMBER 2022

JOHN CROCKER, FORS

As always, there seems to be a lot of activity on the AI front. Deep Mind, or whatever its current name is, has managed to devise a new algorithm for multiplying matrices which is a significant improvement on the current fastest algorithm although it doesn't appear to be particularly easy to apply. According to yet another survey, IT professionals still have a very high opinion of the capabilities of AI even though less than half of them are using it or even planning to use it. The latest from Microsoft is to use AI to resurrect the dead by creating chatboxes that look, sound and behave like one's dead loved one. To me this is a case for an extension to the Data protection Act which ensures our data dies with us – I would be most interested to hear your views on this.

Unfortunately, Robert Dyson was unable to give his keynote presentation on Soft OR and Problem Structuring Measures at OR64 but by the sounds of it Frances O'Brien and Mike Yearworth did a very good job in his absence. The inaugural Land Lecture (named for Ailsa Land who was the first female professor of OR and the first female recipient of the Beale Medal) was not so much a lecture as a "fireside chat" between Professors Carole Mundell and Sally Brailsford. You can read about both of these events in this issue (pages 11-12 and 14-15 resp.) or watch the videos available through our website.

Apparently, 17-21 October was Charity Fraud Awareness Week. To mark this occasion, Peter Tickner gave a lunchtime webinar on this subject to the OR in the Third Sector SIG. It would seem charities are particularly vulnerable to fraud possibly, as Paul Randall who introduced the talk suggested, because they are very trusting of both colleagues and clients. Why would someone who has volunteered to help a charity then embezzle them of thousands of pounds – maybe that is why they volunteered or maybe they saw how easy it might be having got to know the organisation (see pp 16-17) or watch the video.

This year's Blackett Lecture is being held "in person" on 7 December at a new venue – Prince Philip House, 3, Carlton House Terrace. The speaker is one of our Vice Presidents, Professor Christina Pagel – you should already have received your invitation by email but if you haven't and would like to attend, please go to the ORS website. Maybe, next year we could invite an AI-resurrected Lord Blackett to give a talk although there may not be enough footage of him to be able to generate a realistic chatbox, although, according to another article this month, using artificially generated data can provide better results than using real data (see page 21).

May we, the *Inside OR* team, be among the first to wish you, our loyal readers, a very merry Christmas.

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News and Features

OR Society Business

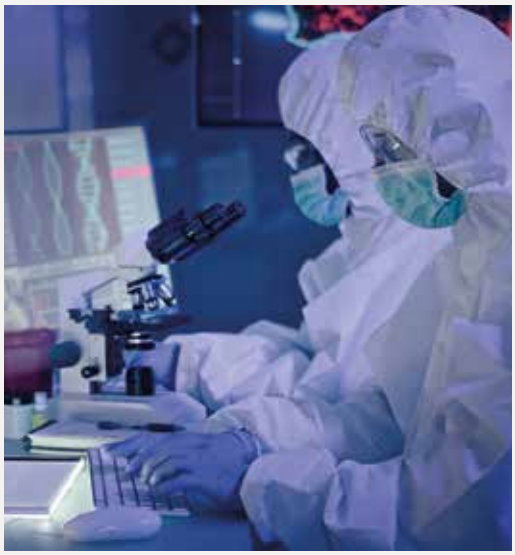
Jaguar's digital future

Jaguar Land Rover (JLR), through its *Reimagine* strategy, is collaborating with Multiverse to enhance the data skills of its employees as it accelerates its digital transformation.

There is a serious shortage of data skills in the UK which Multiverse is looking to address by building an outstanding alternative to university and corporate training through apprenticeships.

A 15-month Data Fellowship course will be offered to JLR employees to help them transition from spreadsheets and desktop data work to working from cloud resources which is considered to be essential to the future of JLR.

More at: https://bit.ly/3E4HRvA



Saliva test for severe COVID-19 cases

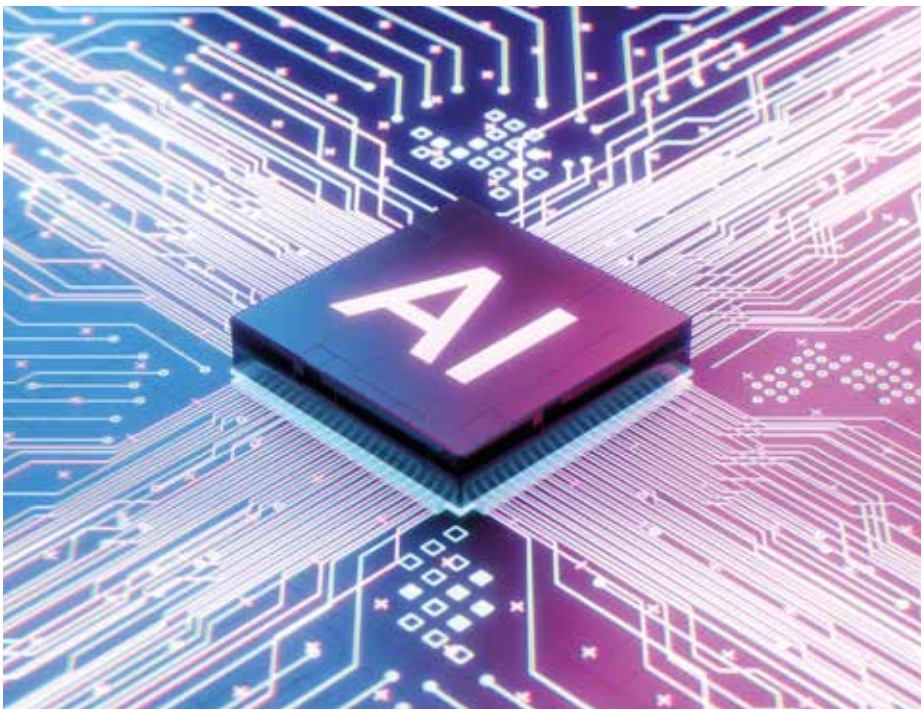
A paper co-authored by Professor Melanie Bailey (University of Surrey) says that that amino acids in saliva could help healthcare professionals separate patients that suffer from a severe form of COVID-19 from those with milder cases.

Of the sample size of 75, 28 gave a negative PCR, ten were classed as showing high severity COVID-19, 34 were classed as showing low severity and there was insufficient clinical information to classify the last three with severity scorings.

The team found that amino acids changed the most when looking at the difference in saliva samples between patients with low and high severity of COVID-19.

More at: https://bit.ly/3F4KuxR

The future of AI



In a worldwide survey of over 1,400 IT professionals, 74 percent believe AI will automate tasks; 67 percent believe AI will be mission-critical to success in their work; 62 percent believe they will be working alongside 'robots' within five years; 59 percent believe it will create major data privacy issues; 51 percent think it will put (human) IT jobs at risk; 49 percent think it will cause an existential threat to humanity; and 45 percent plan to use AI for data analytics within the next two years.

The data used by Atlas is based on Spiceworks Ziff Davis's The 2023 State of IT report on IT budgets and tech trends.

More at: https://bit.ly/3TuBuGN

Data science opportunities

A Heriot-Watt University report looks at the opportunities in data science alongside typical salaries for each career path. Data science is currently one of the most sought-after fields in the United Kingdom.

Those with a degree in data science are expected to collect and analyse large quantities of data with the aim of using their findings to improve business performance.

The entry salary for a data scientist is between £25,000 and £30,000 pa, rising to £40,000 to £60,000 with experience and anything upwards of £60,000 for lead/chief data scientists.

More at: https://bit.ly/3THJUu0

Global GovTech Dashboards

Deep Knowledge Group recently launched five DeepTech and GovTech Big Data Analytical Dashboards at the GovTech 2022 conference in London. The dashboards include: AI-driven Global GovTech Big Data Analytics System; Deep Knowledge Analytics' DeepTech in UK Dashboard; GovTech in UK Dashboard; Global Longevity Governance Dashboard; and Longevity Governance in the UK Dashboard.

The dashboards constitute effective tools for strategic decision-makers across the private sector, global investment community and financial industry, as well as those in governance and policy. Each dashboard has been made 'open-access' for a limited time on a freemium basis.

You can request Freemium access at: https://bit.ly/3z9ayo5

EPSRC's Big Ideas Initiative

EPSRC's Big Ideas initiative provides a route by which members of various communities can engage and inform EPSRC. Its aims are to collect and develop a bank of ideas from which EPSRC can draw.

It is hoped that the initiative will identify 'exciting, adventurous and potentially transformative' ideas that will spark creativity and attract the enthusiasm of researchers, the public, industry and government.

EPSRC has recently updated the 'Big Ideas' process to make it simpler and easier for people to share their ideas.

Submission forms at: https://bit.ly/3D8GYjM

Cosmic Ray path simulation

Published in the *Journal of Cosmology and Astro Particle Physics*, Ruhr-Universität Bochum (RUB) researchers have revealed how their programme named 'CRPropa' traced the trajectories of cosmic rays from their formation to their arrival on earth. It is hoped that this model will help understand how these are formed and from whence they cometh.

The researchers' new programme has the ability to simulate not only cosmic ray propagation but also the signatures of neutrinos and gamma rays produced through cosmic ray interactions.

More at: https://bit.ly/3gtgnGa

Nuclear war simulation

Christopher Minson has created a tool that simulates the impact of a nuclear attack on the US.

Minson says it is critical that the public understands the nature of nuclear war and what it would entail. The number of visits to the site acts as a proxy measure of international tensions.

Public interest in his simulation has soared since Russia's invasion of Ukraine.

Minson's simulation tool is available as a public service to educate users about the consequences of nuclear war.

More at: https://bit.ly/3WaNH5i

Every Cloud...

A report from Frost & Sullivan, commissioned by Innovaccer, shows that the more digitally mature a [US] health system is the more likely it has moved its IT workload to the cloud. These systems are also likely to have adopted data analytics and AI.

The report indicates that health IT investments are concentrated on digital transformation projects and technologies, including automation, analytics and streamlining or unifying existing digital systems.

It also recommends organisations aim to leverage the cloud as a platform for health IT to help make deployments and the scaling of new solutions more efficient.

More at: https://bit.ly/3zk8ERB

The Bill and Melinda Gates foundations invests in maths education

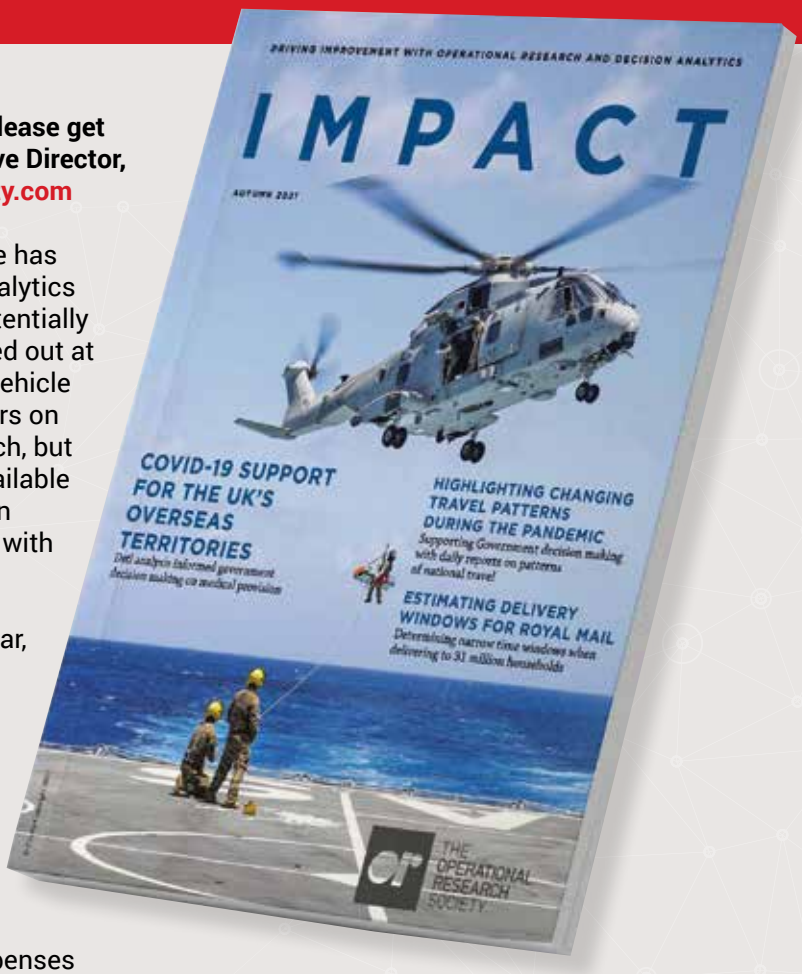
The Bill & Melinda Gates Foundation is investing $1.1 billion over the next four years to create more and better-trained maths teachers. They will also create a new set of engaging and effective teaching materials which will aim to provide a clearer sense of how to teach a subject that many students now find dry and intimidating.

Maths educators hope the foundation will consider the perspectives of seasoned educators, something many saw as lacking in past Gates initiatives on standards and teacher evaluation.

More at: https://bit.ly/3f5glyN

Impact Magazine: Call for Editor

Impact is The OR Society's magazine for decision-makers that shows the value of operational research through real-world examples of how OR is used to make better decisions. Its Editor in Chief, Graham Rand, will be stepping down shortly after eight years leading this influential, prestigious operational research magazine.



If you would like to be considered for this editorship, please get in touch with Gavin Blackett, The OR Society's Executive Director, before 31 December 2022. gavin.blackett@theorsociety.com

The magazine is published twice a year, and each issue has 48 pages (plus covers). There are articles on an OR/analytics group in each issue, why a particular "technique" is potentially helpful, and short descriptions of recent projects carried out at universities. The magazine is an extremely important vehicle for reaching new industry and business decision-makers on the latest developments and use of operational research, but it is also valued by ORS members. The magazine is available in print and online. Last year saw tremendous growth in readership with downloads for 2021 up 95.8% on 2020 with 35, 861 downloads for the full year.

Publishing cycle: The magazine is produced twice a year, in Spring and Autumn.

Production: Pre-production work is undertaken by our publishers Taylor and Francis, in conjunction with the Editor. A mailing house is used for print and distribution. Promotional advertising support is provided by The OR Society's marketing team.

Budget responsibility: No income is derived from the publication. The Executive Director sets annual expenses in collaboration with the Editor. There is a small budget for commissioning articles from freelance journalists.

Key Duties

- Commissioning high-quality, relevant content for the magazine (approx. six per issue). Content is initially sourced from journals, conferences, webinars, networking, and referrals.
- Once a potential article lead is identified, following this up with the author to convert this to a pre-edited article. Not all leads come to fruition. Editing work with authors and obtaining copyright permissions for images.
- Liaising with the Production Editor at Taylor and Francis, our publishers.
- Working with two freelance writers who occasionally produce articles when that is the preference of the person initially contacted.
- Writing the magazine Editorial for each issue.
- Oversee the magazine's layout, appearance, and content, including legal compliance, timeliness, accuracy, and relevance. This process includes completing the final checks pre-production.
- Attend quarterly Publications Committee Meeting.

Currently, an Associate Editor assists the Editor, and there may be scope to build an Editorial Team.

Requirements

- An active member of the OR Society
- Work remotely and attend key OR Society events such as the Annual Conference, Blackett Lecture and Beale Lecture. Attend in-person or online OR Community events such as INFORMS Annual Conference.
- Knowledge of magazine production, including knowledge of publishing laws, is helpful, but not essential.

Remuneration

A small honorarium is available. Annual expenses are set and agreed upon with the Executive Director.

Leader: A less than normal year in the life of the Treasurer ...

Whatever the new normal is, it doesn't seem to have arrived just yet!

Bob Scott, Board Member and Honorary Treasurer

Having taken over the Treasurer's role at the end of 2021, I recall the parting words from my predecessor Janet Williams (for whom we should be very grateful for her long stint in the role): "Good luck, but you shouldn't need it; the Treasurer's year follows a pretty well-trodden calendar and not much exciting happens really"; or words to that effect. So, I did my own handover to John Medhurst, our new Chair of Events and Conferences, and filled my upcoming diary with the various committee meetings, Board meetings and General Council sessions.

I was, of course, aware of a number of things that were due to deliver or change during the Financial Year and these mostly passed/concluded without incident. We had appointed our new auditors, Sayer Vincent, and were well prepared for the annual process. They made some recommendations to the Board to tighten up our procedures and maximise our charitable status, which have all been actioned. Our Annual Report was published, and the AGM held.

Next up was the conclusion of our new publishing contract with Taylor & Francis (T&F). Gavin and the Publications team had this all in hand, so there was little for me to do. However, as it's the largest source of income for the Society, the implications for the contract on our ability to deliver our strategic priorities should not be understated. The future for the academic publishing sector, including open access, has been discussed here over a long time. The bottom line for the new contract is that we have a lower guaranteed revenue and the risks within the normally upside year end reconciliation bonus are shared between ourselves and T&F, with more of the risk on us. We are due to have a checkpoint meeting with T&F in November.

And so we come to the more interesting bits. Our investment activities had been making a steady recovery from the COVID plunge in early 2020. We have a substantial investment portfolio managed by Investec and you will recall Gavin and I wrote a short piece for *Inside OR* in March regarding our Environmental, Social and Governance Investment approach. Our risk appetite is medium and is a long-term strategic portfolio of good company equities and other normally stable investment vehicles. The combined effects of a number of global changes (the war in Ukraine, energy price rises, China's zero COVID-19 policy) and the general cost-of-living crisis in the UK, resulted in knocking almost £250k off our portfolio value, overnight. Investec wrote to us, their standard customer compliance letter, alerting to a

reduction of value of plus ten percent in 24 hours. I don't want to receive too many of those, thank you.

The cost-of-living crisis was not only impacting our investment activities, but the Board also considered its impact on our members and customers (e.g. training and conferences). We had already instigated a review of all of the Society's contracts for supply of products and services, which had delivered some savings. The Finance committee undertook a sensitivity analysis of all the revenue and cost line items in our budget. We analysed each item's susceptibility to further increases in inflation and under different scenarios our approach to addressing them. This work has been essential for the Board to understand the range of our likely outturn for 2022 and in preparation for the 2023 budget. This work must continue as business as usual into the New Year, with the new management team.

You can't just "cut your way to greatness" and therefore opportunities for growth are a focus. Retention of existing members and recruiting new ones are key to this and we all have a part to play. Extending and expanding some of our existing activities are important too. The Board is also continually looking for diversification of our activities and revenue streams. This involves investment of which the apprenticeship programme is a good example. As we develop our capabilities as an end point assessment organisation, a new revenue generating activity is born. If we are to continue to fulfil our charitable aims, we need a long-term sustainable plan, balancing the new with the old and meeting the needs of our members. We welcome ideas from the membership to assist us in this respect.

I started writing this leader article whilst at the OR64 annual conference at Warwick. After all the goings on over the last few years, it was nice to meet people again in person, attend some interesting presentations, plenaries, participate in some workshops and even dance a little! I had intended to complete it on my holiday, the first time we had been away since autumn 2019, like many, to take a break and enjoy the sun. Well, the tropical storm, soon to be hurricane, proved to be creating a less than settled weather forecast – mirrored by the changes with the political and economic turmoil back in the UK. On my return I tested positive for COVID-19, something I had dodged for almost three years at home in the UK. I don't think I've ever experienced such a period of instability in our society and economy as the one we are stuck in. This "New Normal" might not be all it's cracked up to be; maybe we need a change!

The cost-of-living crisis was not only impacting our investment activities, but the Board also considered its impact on our members and customers

Celebrating the contribution of Robert Dyson to Soft OR and Problem Structuring Methods

and looking to the future of the field

Christina J Phillips, Jane Christie, Chris Smith, Mike Yearworth, Frances O'Brien

At OR64, the SORPS (Soft OR and Problem Structuring Methods) stream was the second largest and included a keynote by Robert Dyson, looking back at six decades of SORPS including his career as an OR researcher and his time as Editor at the *European Journal of Operational Research* (EJOR). Unfortunately, Robert was unwell on the day, so Frances O'Brien and Mike Yearworth agreed to stand in.

Mike started from Robert's presentation with an overview of his contribution across OR (let's not forget his work in data envelopment analysis) before delving into his definition of SORPS and an overview of the early work that led to its establishment as a distinctive field within OR (Dyson, 2022).

Frances took us through a tour of Robert's work and how he related it to an end-to-end OR process that included SORPS. There were surprising additions that few of us had considered such as his JORS paper on the qualitative modelling of a peat bog (Dyson, 1983). This paper reported how relationships between variables were modelled using a qualitative assessment of their impact to help formulate a strategy for the peat bog's management. Another surprising addition was Robert's personal use of SORPS to support strategy development at the University of Warwick and Warwick Business School.

Professor Robert Dyson at a recent EURO conference

Next Mike looked back over Robert's huge contribution to the field through his work as editor at EJOR for the PSM, Soft OR, BOR and Community OR subject streams (and others) from 2006 to the end of 2020. This included a summary of some the most influential SORPS work published in EJOR during his time as editor.

Frances then showed how these accounts of soft OR practice tied in to their most recent paper that explores the links between soft OR and the founders of OR (Dyson, O'Brien, & Shah, 2021). Almost all of the founders started their careers as working on real problems which often involved handling ill-defined situations involving multiple actors and stakeholders, (i.e. soft OR).

Mike ran through Robert's view of the future directions of SORPS as an introduction to the panel discussion on the future of SORPS. The panellists were Jane Christie, Frances O'Brien, Mike Yearworth, Chris Smith and Christina Phillips, and was facilitated by Mike. He began by asking each panel member for their initial thoughts on the 'future directions and a research agenda for SORPS'.

Christina focused on education calling for a more purposeful education of SORPS philosophy and methods on OR, analytics and related courses. She noted how this has long been called for but continues to be under-taught across many programmes.

Frances also spoke about achieving a more rounded education in areas like strategy, management, and analytics by including SORPS methods and underlying philosophies.

Our 2022 annual conference, OR64

Jane proposed six themes prompted by Robert's keynote: new technology; multimethodology; collaboration across OR; impactful, applied research; research into OR practice; and crossing disciplinary boundaries. She then highlighted renewed interest in multimethodology for addressing complex issues, as captured in John Ranyard, John Hopes and Emma Murray's (2022) report for HORAF and John and Emma's articles in the April 2021 issue of *Inside OR* (Issue 601).

Jane concluded with practical suggestions: first, if we seek 'a' research agenda, to undertake a collaborative review identifying specific, shared research priorities across OR practice, looking at existing SORPS for strengths, weaknesses, and gaps. This would identify developments required, and specific research collaborations for which funding can be sought. The beneficiaries could include practitioners, their clients, and early career researchers looking to establish their own programmes. The second suggestion, if we are concerned about the future of SORPS (within and beyond the discipline of OR), was a review of the future of the field using a SORPS-led approach, with an advisory board of pioneers and/or a steering committee of current leaders.

Chris identified three points critical for the future of SORPS.

First, opportunities to be influential in the work of quantitative-focused colleagues, in all fields. We should seek to work with quantitative colleagues across their research programmes to address the grand challenges of the day. This has the dual benefit of improving outcomes while allowing more papers to be written about the same piece of work.

Second, the need to support the development of more generic approaches to problem structuring. Typically, researchers and practitioners tend to stick within their own methodological sphere. However, while certain approaches may make good enough progress with a problem, we should be supporting colleagues to develop a broader set of tools. This facilitates bespoke approaches to novel problems and offers greater methodological flexibility.

Third, research should zoom out and consider the implications for PSMs in general. As a community we should be looking across PSMs to see what our own research can do to support the strengthening and understanding of SORPS more broadly.

Mike rounded up the session with a summary. In addition to the 'future directions' that Robert had assembled and the contributions from the panel, there were several concrete proposals that emerged, including from Ruth Kaufman who issued an open invitation for presentations on SORPS to the EURO Working Group on the Practice of OR. Other strands of discussion for follow-up (keep an eye on the PSM SIG page for updates) were i) a return to problem structuring as 'normal' OR practice (back to Ackoff's agenda-setting articles, (re-)asserting SORPS into the OR narrative), ii) contribution to addressing Grand Challenges, iii) getting problem structuring into school curricula, involving young people, and iv) coordinating more with the Policy SIG.

For more on the various aspects covered see:
https://bit.ly/3WQr7iO
https://doi.org/10.1057/jors.1983.24
https://doi.org/10.1287/OPRE.2020.2051
https://bit.ly/3fGph38

Early Career Research Network Event at OR64

Laura Boyle

The OR Society Early Career Research (ECR) Network held an in-person event on Tuesday 13 September during the OR64 conference in Warwick. The theme of the event was *'forging collaborations and solving problems with industry'*. Attendees heard engaging presentations from colleagues working in industry, Dr Christoph Werner and Dr Kiko Rul-lan.

Dr Christoph Werner is a Senior Simulation Consultant at Simul8. He has been working as part of Simul8's 'Simulation Excellence Team' since 2018, where he has delivered numerous simulation projects in many different countries and application areas, ranging from the automotive, defence, food and energy industries to healthcare and other service sectors.

Dr Kiko Rul-lan is a Principal Data Scientist at Datasparq. He works on metaheuristic optimisation of vehicle routing and planning, dynamic pricing and statistical learning with industrial applications.
Both speakers shared their experiences of the challenges faced when working in industry, touching on a wide range of application areas including vehicle routing, matching job applicants to employers, manufacturing settings, and improving patient flow in hospitals.


Laura Boyle

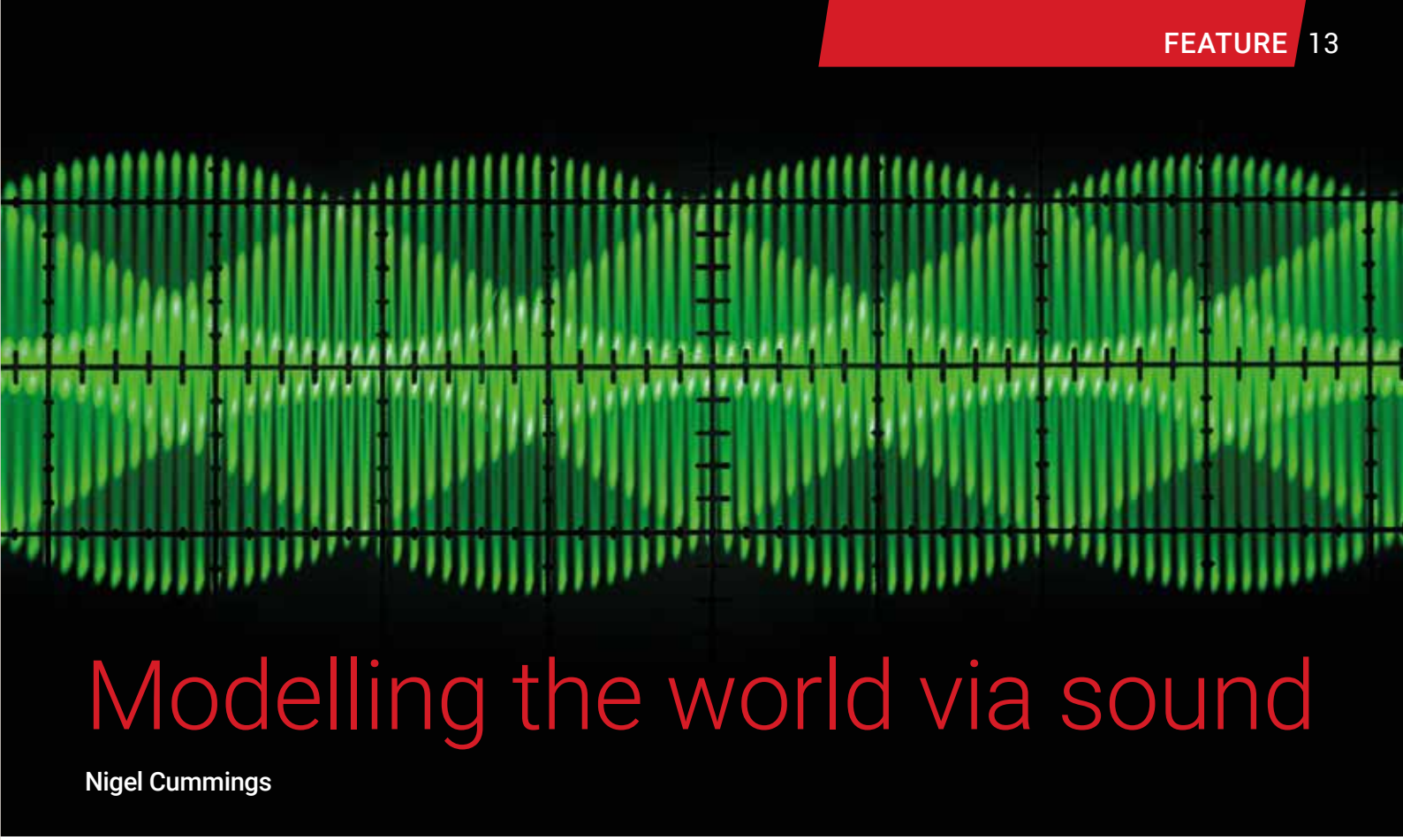
Their presentations provided an excellent opportunity to demonstrate the diversity of topics and application areas to which operational researchers in industry can contribute and, in particular, the variety of different areas of work for operational researchers within a single company. It was interesting to learn about the research projects which are carried out by each speaker's company. One of the key take-aways from their talks was the emphasis that timelines for completing research work in industry are usually much shorter than in academia.

We concluded the talks with a Question & Answer session, where the speakers contributed their personal perspectives of solving research challenges in industry versus in academia, as well as explaining some of the challenges and opportunities experienced by academics moving to apply their skills in an industrial setting.

After the talks and Q&A, we enjoyed an informal networking reception with early career researchers, the speakers, and other industry practitioners who were attending OR64. This was my first experience of attending the OR Society Conference and an ECR Network event in-person (having been to some events online during the pandemic). I found that many of the other ECRs have had the same experience, so it was great for us to have an opportunity to meet and chat.

We had 30 people attend the talks, and more joined us at the networking event after the other simultaneous sessions had concluded. If you missed this event, keep an eye out for events we have upcoming this year. We look forward to holding in-person events more frequently, including an exciting full-day workshop before OR65 in September 2023.

Dr Laura Boyle is a lecturer in Data Analytics at Queen's University Belfast and Chair of the OR Society's Early Career Researchers Network. Laura's research interests are in simulation modelling and data analytics with healthcare applications. Laura can be contacted at laura.boyle@qub.ac.uk



Modelling the world via sound

Nigel Cummings

Researchers at MIT and the MIT-IBM Watson AI Lab are exploring the use of spatial acoustic information to help machines better envision their environments. Together they have developed a ML model that can capture how any sound in a room will propagate through the space, enabling the model to simulate what a listener would hear at different locations.

By accurately modelling the acoustics of a scene, the system can determine the underlying 3D geometry of a room from sound recordings. With this information, researchers can use the acoustic information their system captures to build accurate visual renderings of a room, similarly to how humans use sound when estimating the properties of their physical environment.

In addition to its potential applications in virtual and augmented reality, this technique could help artificial-intelligence agents develop better understanding of the world around them. Not only is vision important, but sound is also important too.

In computer vision research, a type of machine-learning model called an implicit neural representation model has been used to generate smooth, continuous reconstructions of 3D scenes from images. If one looks at the same object from two different locations, the object looks roughly the same. Add a sound component though and change locations and the sound one hears could be completely different due to obstacles, distance, etc. The researchers overcame these problems associated with sound location by incorporating two properties of acoustics into their model: the reciprocal nature of sound and the influence of local geometric features.

Sound is reciprocal, which means that if the source of a sound and a listener swap positions, what the person hears is unchanged. Additionally, what one hears in a particular area is heavily influenced by local features, such as an obstacle between the listener and the source of the sound.

Researchers can feed the visual information about a scene and a few spectrograms that show what a piece of audio would sound like when the emitter and listener are located at target locations around the room. Then the model predicts what that audio will sound like if the listener moves to any point in the scene.

When the researchers compared their technique to other methods that model acoustic information, it generated more accurate sound models in every case. And because it learned local geometric information, their model was able to generalize to new locations in a scene much better than other methods. They also found that this can lead to a better visual reconstruction of the scene.

The researchers plan to continue enhancing the model so it can generalise to brand new scenes. They also want to apply this technique to more complex impulse responses and larger scenes, such as entire buildings or even a town or city.

This new technique might open up new opportunities to create a multimodal immersive experience in the metaverse application by using machine-learning methods to accelerate acoustic simulation or model the acoustics of real-world scenes. (Help!)
More at: https://bit.ly/3sVZxmh


Pioneer Professor Ailsa Land

The first WORAN Land Lecture

Named in honour of Professor Ailsa Land

"It conveyed a life-enhancing attitude, not only for women but for all."

"Excellent talk; got a good insight into the challenges and highlights of an exceptional career."

"It was a really inspiring event and I am so glad I was able to attend and stay for the group discussions."

This was some of the audience feedback on our first WORAN Land Lecture. If you want to know what they're talking about, you might want to skip the next few paragraphs on context and go straight to content.

Some history

As regular readers know, the Women in OR and Analytics Network (WORAN) was launched as part of The OR Society's response to research that showed the value of supportive networks in breaking down barriers to participation.

When WORAN was launched in 2019, the plan was to have an annual networking event with an inspiring speaker or speakers, to build opportunities for meeting and sharing. The inaugural event, in 2019 at the Royal Society, was everything we could have hoped – illuminating talks and a buzz of energy.

Then, of course, coronavirus dramatically transformed our vision of what a networking event looked like, and WORAN shifted all its activities on line and upped the frequency to roughly once a month. But we have kept the vision of having a particularly special event once a year.

This year, we have rebranded that special event: it is now the WORAN Land Lecture, named after Professor Ailsa Land (with the kind permission of her widower Professor Frank Land). Ailsa was a pioneer of OR in the UK. Amongst much other work, she was (with her colleague Alison Doig) the developer of 'branch and bound' – a fundamental technique, still in use today.

Professor Land was innovatory in using computational tools to turn clever maths into practical application. She was the first female professor of OR in Britain, and a role model and mentor to many. She was the first woman to win one of The OR Society's most prestigious awards, the Beale Medal, in 2019, only a short time before she died.

The WORAN Land Lecture has the specific remit of inviting an eminent female guest speaker, to talk on a topic that has particular resonance for women and for anybody who is concerned about female representation in OR and analytics. It also aims to inspire, inform and support by making women visible as role models and contributors to science, exploring issues affecting women, and ensuring that women's voices are heard.

We plan to hold it annually on/around Ada Lovelace Day, the day for celebrating the achievements of women in STEM.

The 'fireside chat'

And so to this year's event – which was not a lecture at all, but took the form of a 'fireside chat' between our guest, Professor Carole Mundell, and Professor Sally Brailsford. Carole's career has straddled academia and practice, and has seen a number of firsts: the first female Chief Scientist at the Foreign and Commonwealth Office (as it was then); the UK's first ever Chief International Science Envoy; and the founding Head of Astrophysics at the University of Bath. She is currently also the first female President of the Science Council, the umbrella body for scientific membership societies, of which The OR Society is a member.

Sally Brailsford, Professor of Management Science at Southampton Business School with a long list of achievements to her own name, led the conversation down several paths. We leapt straight in with Carole's discovery of OR professionals from her period in government, and her enthusiasm and admiration for the work that they do.

Sally spoke for many in the OR community, querying whether OR scientists were adequately involved in government decision-making during the first years of the pandemic; Carole, who had been a member of SAGE, had no doubt that OR was integrated right across government activity.

Going back in time, the conversation explored Carole's early years in science, from A-Levels where she was one of three women in a class of 40 to her experiences as a doctoral student where she was inspired by a visit from Dame Jocelyn Bell Burnell to believe that she too could be an astronomer. It went on to cover her experience of whistle-blowing as a senior academic in a department where younger women were experiencing sexual harassment.

Moving on to Carole's time in government, where she worked part of the week as a civil servant and part as an academic, the phrase "cognitive overload" resonated with many of the audience, and the importance of understanding the tax on energy of continual context switching, and of setting boundaries to preserve the 'life' part of the work-life balance, also struck chords.


Our lecturer, Professor Carole Mundell

Carole also shared insights into the cultural differences between academia and the civil service, especially for women; and what each could learn from the other.

Finally, she touched on her ambitions for the Science Council, supporting professional conduct, welcoming diverse entrants and recognising diverse pathways, building and defending trust in science.

And just as important, the audience

For an event that is intended to support the development of a network, it's important to know who's in the audience. We welcomed a mix of academics and practitioners, at all stages from student to retired, male and female, and from scientific homes beyond OR as well as from the OR community; and they contributed actively through question and comment. We were particularly pleased that Frank Land was able to join us.

Not everybody could stay for the discussion groups that followed the initial conversation, but for those who did, the discussion kept up the energy and challenge of the talk.

As well as the enthusiastic feedback sampled at the start of this article, several respondents made a point of praising the openness of the conversation:

"We are so often subject to people saying what they think they should say, and it was refreshing to have a dialogue of openness for discussion."

"Carole Mundell was so honest and real."

"[The best aspect was] the frankness/openness of discussion".

I've just touched on the bare bones of the event here. The full recorded event is online and I encourage you to watch it on The OR Society's Land Lecture event webpage: https://www.theorsociety.com/WORAN

Fraud: What do operational researchers and analysts need to know?

Malcolm Fenby

To mark this year's Charity Fraud Awareness Week (17-21 October), the OR in the Third Sector SIG arranged a lunchtime webinar on fraud within charities.

The event started with a short introduction by Paul Randall, describing "Charities and fraud – what's different?" in which Paul talked through reasons why charities are particularly susceptible to fraud.

To summarise Paul's introduction: charities tend to be very trusting – of both colleagues and clients; fraud tends to be low on the priorities of charity staff, volunteers and trustees; trustees are rarely (if ever) appointed on the basis of anti-fraud expertise. For charities, there are risks beyond the financial; there is the reputational risk and associated risk of losing donors.

The main (title) talk was given by Dr Peter Tickner, who is the author of several books on fraud prevention and has experience providing anti-fraud services in both the public and third sectors.

Peter started by talking through an example, where someone (an apparently respectable person within an

entirely respectable organisation), who had financial responsibility, was able to embezzle a substantial sum (over many years) without arousing suspicion (until they were eventually caught).

I was surprised to hear that fraud was only legally defined in England, Wales and Northern Ireland by the Fraud Act 2006 (prior to that the Theft Acts 1968 and 1978 were used to cover Fraud offences). In Scotland a plethora of common law offences on fraud and some statutory regulations are used for specific frauds in certain industries and activities.

There are three key offences in the 2006 Fraud Act that affect organisations (including charities), they are:

- Section 2: Fraud by false representation (making statements, including financial, that are not true).
- Section 3: Fraud by failing to disclose information (withholding information that would have influenced the victim to act differently).
- Section 4: Fraud by abuse of position (originally this was intended to cover people defrauding vulnerable individuals, but now includes any position (including positions of responsibility within employment)).

Another significant classification is between:

- External fraud – conducted by people from outside the organisation, in contrast to:
- Internal fraud.

The Charity Commission recommends that charities should have a Fraud Response Plan. The Charity Commission also have an eight-point set of Guiding Principles:

1. Fraud will always happen – being a charity is not a defence.
2. Fraud threats change constantly.
3. Prevention is (far) better than cure.
4. Trust is exploited by fraudsters.
5. Discovering fraud is a good thing.
6. Report every individual fraud. (Peter feels that this is unnecessarily onerous for charities. For instance, if a part-time contractor defrauded a charity over each piece-work claim then each individual false claim would be classed as a separate fraud that needed to be reported.)
7. Anti-fraud responses should be proportionate to the charity's size, activities and fraud risks.
8. Fighting fraud is a job for everyone.

Peter then talked through Red Flags, which may indicate fraud is taking place. When applied to individuals these may indicate that an individual is involved in fraud. (Although in one case he has experienced, the individual was relatively innocent, in that they knew fraud was being conducted by a senior manager, but had been intimidated into remaining quiet).

Peter then described how organisations have 3 systems, namely:

- The prescribed system – how processes are documented.
- The alleged system – how managers describe how staff conduct their work.
- The actual system – how staff actually conduct their work.

These three systems and their differences are useful in tracking down possible frauds.

The talks were followed by a Q&A session. There were then questions regarding the use of analysis to detect fraud. The first question was specifically regarding the use of AI – Peter replied that AI systems tend to be very expensive and find a lot of false-positives. In general terms (regarding the use of analysis) Peter recommended the cheaper alternative of applying Benford's law to datasets (including datasets from individual suppliers). (Benford's law states that the first significant digit of a set of numbers (including financial numbers) is not random; often "1" is the most common first digit. Think of the relative lengths of a log axis for the nine units from 1-10.)

This talk was recorded and will be available on The OR Society YouTube channel.

Pro Bono OR case study

Louise Allison, Pro Bono OR Manager

The OR Society's Pro Bono OR scheme connects volunteer analysts with good causes. Analysts donate their time and skills to help charities or other voluntary organisations facing difficult decisions or looking for improvement.

The OR Society wants more organisations to benefit from operational research (OR) and recognises the great opportunity to bring together third sector organisations who would find OR hugely beneficial.

The following case study summarises a project for a major charity which has requested to remain anonymous, due to the nature of their work.

The project was undertaken by three analysts from the Government OR Service (GORS): Rachel Dunne, Katherine Chant and Ana Pereira. Rachel led the team and had this to say at the end of her volunteering experience:

"Taking part in the Pro Bono OR volunteering scheme was a great opportunity to work on a project I really cared about. I was able to lead a team of like-minded people and it was a lovely experience getting to know them, as well as colleagues at the charity we were working with."

The project was initiated by another volunteer, Paul Randall, who undertook a preliminary overview of the literature on what climate change might mean for the known drivers of child and adolescent abuse, neglect and exploitation. That review formed the basis for a short report setting out the main findings that was then utilised by Rachel and her team.

The Client

A charity that works to protect children from abuse in the UK.

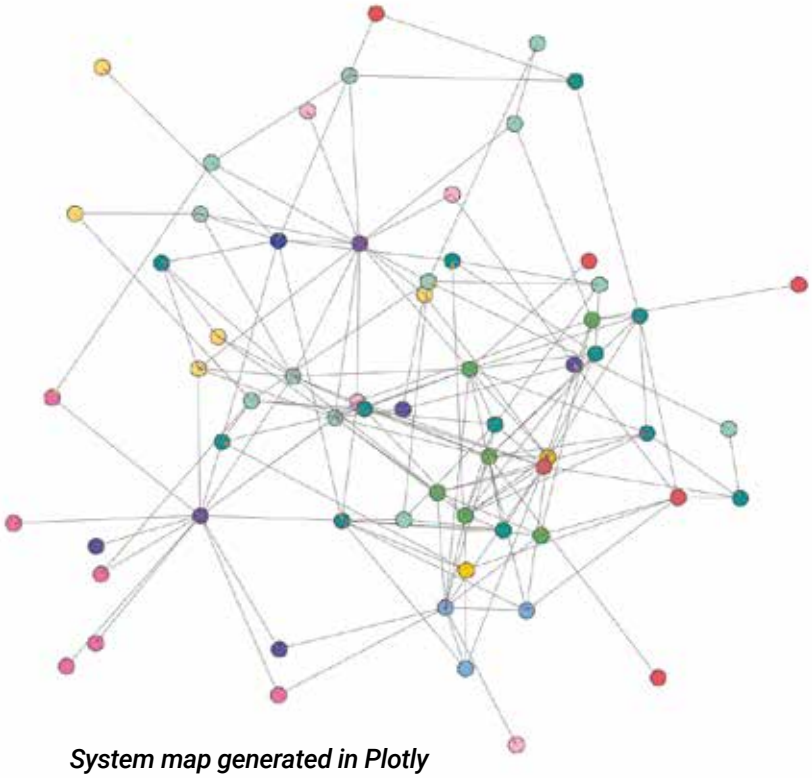
The Client's Problem

The charity wanted to learn more about the links between climate change impacts and child abuse in the UK over the next ten years.

The Approach

We used system mapping to meet the needs of the charity. Our method was as follows:

1) Read through literature review carried out by a previous volunteer and additional literature on climate change impacts and child abuse.
2) Used the online tool Miro to create a first draft of the systems map as a team.



System map generated in Plotly

3) Organised a hybrid workshop with a diverse range of people from the charity with knowledge and experience in different areas to get feedback on our draft system map.
4) Finalised the system map based on workshop feedback.
5) Used the igraph package in Python to generate a final static system map, and the Plotly package to generate an interactive version.
6) Shared these final products with the charity alongside the code used to generate them and a report summarising our work.

The Solution

Key deliverables were:

- Static and interactive system maps of links between climate change impacts and child abuse
- Code used to produce the system maps
- Report detailing our method, results and how to use the system maps.

The Benefits

- Insight into the links between climate change impacts and child abuse in the UK over the next ten years, including key pathways and potential points at which the charity could intervene.
- Robust approach incorporating knowledge not just from the literature, but also from the charity's experts.
- Visually appealing outputs that can be used to present findings to the charity's senior leadership.

New Scientist Live

Taking OR in Education out to its audience

Matthew Robinson, Chair of ORiE taskforce and volunteer

New Scientist Live returned to an in-person event from 7-9 October 2022 at the eXcel Centre in London, after an absence for two years owing to the pandemic.

I was slightly nervous about volunteering on The OR Society stand on the first day, hoping that the event would be as good as expected and the stand would have enough volunteers. I needn't have worried on either count.

When the doors opened, a deluge of young people entered the event eager to learn and experiment with science. Our stand had a variation of the Travelling Salesman problem, where a delivery driver had to go to ten points on a pin board and return to base with a limited amount of fuel (string) to determine the shortest route.

What I always find encouraging when doing these types of puzzles at events like Big Bang Fair is the engagement arising from such a simple puzzle. If a route between two points was unavailable, would it possible to visit all points? Or how would you cope with multiple points and multiple delivery vehicles available?

Thankfully there were enough volunteers who did a fantastic job of engaging with students and teachers alike.

The number of discussions with teachers was also very encouraging, with many teachers not realising that problem-solving could lead to a career in OR and that ORiE could provide resources including careers talks or workshops in schools to ensure that young people could consider the opportunities that OR presents.

A huge thank you to The OR Society's Fay Moore for all she does, and to the other ORiE volunteers who worked me over the weekend:

- Tony Lewins
- Christine Peachey-Pace
- Harvey Sturgess
- Balakva Dey
- Jodi Mann

Volunteers always make events such as New Scientist Live and other ORiE events such a success in promoting OR and the activities of The OR Society.

If you would like to know more about OR in Education, visit **www.theorsociety.com/ORiE**

A knotty problem

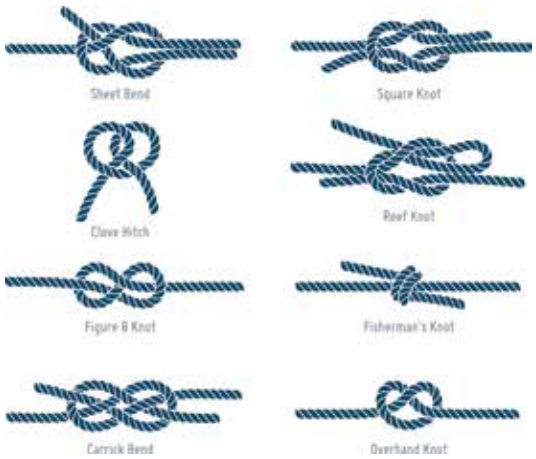
Nigel Cummings

In 1867, when scientists were trying to figure out what could account for all the different kinds of matter, Scottish mathematician and physicist Peter Guthrie Tait showed his friend Sir William Thomson his device for generating smoke rings.

Thomson, who later become Lord Kelvin, was inspired by the rings' shapes, their stability and their interactions. This inspiration led him to think about how the smoke rings existed as vortices in the air, vortices whose atoms were knotted and in an invisible 'ether' medium through which, physicists believed, light propagated.

His 'Vortex theory' attracted attention from the scientific community and inspired Tait to begin tabulating all knots, creating what he hoped would be equivalent to a table of elements. We now believe atoms are not knots and there is no ether. By the late 1880s Thomson had abandoned his vortex theory but Tait had become captivated by the mathematical elegance of his knots and he established knot theory which is now considered a sub-field of topology.

Sometimes it is possible to untangle a knot, so it becomes a simple circle: an "unknot." But more often, untangling a knot is impossible.



Thomson and Tate were not the first to view knots in a mathematical way. As early as 1794, Carl Friedrich Gauss wrote about and drew examples of knots and Gauss's student Johann Listing wrote about knots in his 1847 monograph Vorstudien zur Topologie. But Tait was the first scholar to work on what became the fundamental problem in knot theory: the classification and tabulation of all possible knots, he found and classified all prime knots that, when projected onto a plane, have at most seven crossings.

Tait, Thomas Kirkman and Charles Little accomplished a great deal. One thing that worked in their favour was the fact that most small knots are "alternating", meaning they have a projection in which the crossings exhibit a consistent over-under-over-under pattern. Between them, they classified all prime knots with up to 10 crossings and many with 11 crossings.

Alternating knots have properties that make them easier to classify than nonalternating knots. Tait, who for years mistakenly assumed all knots were alternating, conjectured a way to tell if you've found that minimum number: if an alternating projection has no crossings that can be removed by flipping over part of the knot, then it must be the projection with the minimum number of crossings.

In 2020, Benjamin Burton classified all prime knots up to 19 crossings (of which there are almost 300 million). Traditional knot theory makes sense only in three dimensions though: in two dimensions only the unknot is possible and; in four dimensions the extra room allows knots to untie themselves, so every knot is the same as the unknot.

In four-dimensional space we can knot spheres. Imagine 'slicing a sphere', at regular intervals. Doing so yields circles, like lines of latitude. However, if we had an extra dimension, we could knot the sphere so the slices, now three-dimensional rather than two, could be knots!

Read more about knot theory at:
https://bit.ly/3sXXZbw and https://bit.ly/3fvo9iY

Synthetic data can provide performance improvements

Nigel Cummings

According to MIT researchers, models trained on synthetic data can, in some cases, be more accurate than those trained on real data.

MIT researchers trained machine-learning models using large datasets of video clips that showed humans performing actions. It was an expensive and laborious process to gather and label millions or billions of videos and the clips often contained sensitive information, such as people's faces or license plate numbers. Using these videos might also have triggered copyright violations or data protection laws.

So, researchers decided to try using synthetic datasets that were made by a computer that used 3D models of scenes, objects and humans to produce many varying clips of specific actions, without the worry of copyright issues or ethical concerns that come with real data.

MIT, the MIT-IBM Watson AI Lab and Boston University built a synthetic dataset. It contained 150 action categories with 1,000 video clips per category. They used this to train machine-learning models. Then they showed these models six datasets of real-world videos to see how well they could learn to recognise actions in those clips.

Once the dataset was prepared, they used it to pre-train three machine-learning models to recognise the actions. This pre-training of the models showed how it was feasible to use the parameters they had already learned to help it learn a new task with a new dataset faster and more effectively.

The researchers were surprised to see that all three synthetic models outperformed models trained with real video clips on four of the six datasets. Their accuracy was highest for datasets that contained video clips with "low scene-object bias."

Low scene-object bias means that the model cannot recognise the action by looking at the background or other objects in the scene, it must instead focus on the action itself. According to Rogerio Feris, commenting on the research. "In videos with low scene-object bias, the temporal dynamics of the actions is more important than the appearance of the objects or the background, and that seems to be well-captured with synthetic data."

Building off these results, the researchers want to include more action classes and additional synthetic video platforms, eventually creating a catalogue of models that have been pre-trained using synthetic data. They also want to combine their work with research that seeks to generate more accurate and realistic synthetic videos, which could boost the performance of the models.

Read more on this at: https://bit.ly/3t0FQtw

"all three synthetic models outperformed models trained with real video clips"

Artificial intelligence is bringing the dead back to 'life'

well… sort of… but do we want it to?

Nigel Cummings

What if you could talk to a digital facsimile of a deceased loved one? Would you really be talking to them? Would you even want to? Can today's technology create the illusion for us, that the dead are still living, can AI recreate and connect us with the lifeforce that was once a 'loved one'? Personally, I hope not, but…

In recent years, technology has been employed to resurrect the dead, mostly in the form of departed celebrities. Carrie Fisher was digitally rendered to reprise her role as Princess Leia in a Star Wars film and, controversially, artificial intelligence (AI) was used to deepfake chef Anthony Bourdain's voice to provide narration in the documentary film *Roadrunner*.

These resurrections are not isolated incidents. They herald the start of a new type of big business – digital resurrection. Microsoft has, for example, recently announced it has secured a patent for software that could reincarnate people as chatbots, opening the door to even wider use of AI to bring the dead back to life. For a certain sum, you too might be able to resurrect your favourite Aunt Mabel or some celebrity from history.

Chatbots based on dead people? Is that really such a good idea? We've probably all had interactions with customer service chatbots that didn't go as planned. Asking a chatbot to help you change an airline ticket, for example, requires the AI to make decisions around several unique conditions. An easy task for a real 'live' person but, a computer might find it difficult, especially if there are unique conditions involved. Many of these AI systems are essentially just memorizing routines.

Humans understand the broader semantics and can produce entirely new responses and reactions. It is doubtful if AI resurrections will ever respond in a human-like way to new situations, convincingly enough to appear 'alive', but researchers will continue experimenting, to produce ever more intelligent digital facsimiles of people dead or alive – of that there is no doubt.

An echo after tragedy

Alison Cope is a mother grieving the loss of her son to knife crime. Ever since she lost her son, Alison

has vigorously campaigned about the devastation of knife crime. Her work has received much attention and feedback.

Her son Josh's story was all too common: a young man cut down in his prime, a promising life and career as a musician and rapper abruptly ended in a mindless act of violence. Stabbed outside a venue in Selly Oak, Birmingham, the 18-year-old managed to stagger into a doorway before being taken to hospital. Sadly, medics were unable to save this young life.

Since Josh's passing, Alison has campaigned to make the public aware of the devastating effect of knife crime. A recent contribution to raising has resulted in the release of a "unique music video" titled 'Life Cut Short'. It stars Josh, as if he were still alive today. Thanks to the power of deepfake technology, the young rapper returns from the grave to share the ugly truth of knife crime, using his most powerful tool: his voice.

Alison has achieved a partial digital resurrection for her son. The technology is clearly available, and when put towards uses such as the song, "Life Cut Short", it will clearly stimulate interest in others to follow similar paths to 'bring back' their loved ones.

You can see the video at: https://youtu.be/2Bc9x4IjhWY

Read more on this topic at: https://bit.ly/3zLrCk0 and https://bit.ly/3U9Dwg1

AI speeds up matrix multiplication

Nigel Cummings

Matrix multiplication has numerous applications in many areas of mathematics, as well as in applied mathematics, statistics, physics, economics, and engineering. Finding ways of reducing the number of multiplications could prove beneficial.

In matrix multiplication, the number of columns of the first matrix (**A**) must equal the number of rows of the second matrix (**B**). If **A** is an (m x n) matrix and **B** is an (n x p) matrix then **C** (= **AB**) will be an (m x p) matrix. The element $c_{i,j} = a_{i,1}b_{1,j} + a_{i,2}b_{2,j} + \ldots + a_{i,n}b_{n,j}$ i.e. the sum of n products so there are nmp products.

For computers, sums are easy but products take time especially if they have to be performed using floating point arithmetic.

In 1969, Volker Strassen devised an algorithm which reduces the number of multiplications from $O(N^3)$ to $O(N^{2.81})$. For two 4x4 matrices, that is a reduction from 64 to 49 products.

According to Wikipedia, there are other algorithms which are even faster than this one including the Coppersmith-Winograd algorithm. The fastest known algorithm is of $O(N^{2.373})$.

AlphaTensor, DeepMind's new AI engine has discovered a completely new method which is claimed to be some 20 percent faster than Strassen's method requiring just 47 multiplications in the above example. It apparently did this all by itself and is quite different from any other algorithm. It also has the advantage that it is relatively easy to program unlike some of the other algorithms which are actually faster that it.

AlphaTensor has now discovered thousands of functional algorithms for each size of matrix, including 14,000 for 4×4 matrices alone. But only a small minority were better than the state of the art.

AlphaTensor, according to a DeepMind blog post, (https://bit.ly/3COsVRb), builds upon AlphaZero, an agent that has shown superhuman performance on board games like chess and Go. This new work takes the AlphaZero journey further, moving from playing games to tackling unsolved mathematical problems.

Hussein Fawzi at DeepMind says the results are mathematically sound but, far from intuitive for humans. "We don't really know why the system came up with this. Why is it the best way of multiplying matrices? It's unclear."

"Somehow, the neural networks get an intuition of what looks good and what looks bad. I honestly can't tell you exactly how that works. I think there is some theoretical work to be done there on how exactly deep learning manages to do these kinds of things," says Fawzi.

James Knight (University of Sussex) says that a range of software run on supercomputers and powerful hardware, like AI research and weather simulation, is effectively large-scale matrix multiplication and if this type of approach was actually implemented there, then it could be a sort of universal speed-up.

But DeepMind's advances don't necessarily mean human coders are out of a job, at least, not yet.

Read more on this at:
https://go.nature.com/3rJsYHQ

May Hicks Award

Submissions now open!

The May Hicks Award is given for student projects carried out for a client organisation. It offers masters students the chance to receive recognition for early impact in their careers as operational researchers.

It is funded by a generous bequest from the estate of Mrs May Hicks, wife of Donald Hicks OBE, who was a major contributor to operational research and the first treasurer of The OR Society.

Submissions are opening for this £1000 prize

Do you know a student of OR (or related discipline) who has demonstrated outstanding impact or innovation in their work? They could win the first prize of £1000 or perhaps be one of two runners-up, winning £250 each.

Entries must be operational research projects carried out for a client organisation rather than within the university, and submissions must be made by the Course Director or a faculty member no later than 30 April 2023.

All submissions must be made to carol.mclaughlin@theorsociety.com

Meet some recent winners:

2022: Laura Hannula (University of Southampton)

Project: 'Exploring the business value of free text data and the use of problem structuring in the Wärtsilä Marine Power Sales organisation'

While numerical data is widely and successfully used across the company (Wärtsilä) to support customers, Laura's dissertation focused on generating actionable insights from less commonly utilised free-text data. Her practical work highlighted the immense value of drawing insights from free-text comments written by employees of various levels of seniority and using these to establish a development roadmap.

2021: Joseph Bampton (University of Southampton)

Project: Training Optimisation and Learner Assessment through Data Exploitation at Babcocks Ltd

Joseph's project used a wide variety of Machine Learning methods to analyse the training programme being provided by Babcock for the British Army. The project enabled the company to identify students who were performing above or below expectations and thus provide targeted support which will reduce dropouts.

How to enter:

Eligibility

Entries are invited from any eligible courses. Masters courses in OR or Management Sciences are automatically eligible. Other courses should, before contemplating entry, seek confirmation of their eligibility from the society.

Entry

Entries should be made by the Course Director or a faculty member acting on his/her behalf (and not by students direct). One entry per 15 students on the course, or part thereof, is allowed.
Projects entered should be OR projects carried out for a client organisation (and not, for example, desk research carried out within the university). Joint projects are allowed.

The initial entry should consist of the following:

- a summary of not more than two pages of the project and its effects;
- endorsement of the project's effectiveness by the organisation which hosted the project; and;
- an endorsement by an independent academic (eg the external examiner) of the project's quality.

Full details of how to enter are available on The OR Society's website: **https://www.theorsociety.com/MayHicks**

Science Council Climate Conference:

The UK Pathway to Net-Zero

Ruth Herbert

On 29 September 2022, the Science Council held its first ever policy conference, entitled 'The Science Council Climate Conference – The UK Pathway to Net-Zero'. The event brought together Science Council members and other organisations from across the science and engineering community to discuss how the UK can meet its targets for reducing emissions and reaching net-zero in the coming years.

The conference drew on the diverse expertise of Science Council member organisations, exploring in depth topics such as the challenges and opportunities in the food system, achieving net-zero in the steel industry and the role of hydrogen in balancing future supply and demand.

Speaking at the conference, Sir Patrick Vallance, Government Chief Scientific Adviser and National Technology Adviser, said:

"Every year, we're losing Arctic sea ice and CO2 levels have dramatically increased since the industrial revolution. There are clearly unarguable changes that are occurring. Science and technology are undoubtedly central to what we need to do. We need to be focused on technologies that we can already see, technologies that we have already invented, and ask how do we work out which of those we can implement and scale."

The Science Council's President, Professor Carole Mundell, closed the day by summarising six themes that became evident to her throughout the discussions. These were science, scale, society, supply chains, systems and solutions. Professor Mundell also thanked all of the societies, partners, speakers and participants for their part in making the day so inspiring, insightful and motivating.

The Science Council aims to build on the connections and conversations from the conference and will continue its convening role within and beyond its membership.

To find out more about future events held by the Science Council and its professional body Members see their website: https://sciencecouncil.org/category/event/

Videos of the livestreamed sessions can be found here:
Plenary Panel 1 – The UK's Net-Zero Challenge:
https://youtu.be/cCLGOmlQS-I
Keynote Address by Sir Patrick Vallance:
https://youtu.be/CZx9jnQcmQ8
Plenary Panel 2 – The role of the UK science and engineering community: https://youtu.be/XJaIbQ7QVME

The full programme of the conference is available here:
https://bit.ly/3U9FAEF

Emma's dream job:

Optimising health care logistics in Africa


Emma Gibson

Emma Gibson is a PhD student who has sought to improve patient care across southern Africa by helping facilities use their limited resources more effectively. Having grown up witnessing the devastating effects of HIV and AIDS on her home country of South Africa, Emma turned her childhood fear of the infection into a resolve to combat it as an adult, throughout her career.

Emma began by studying mathematics and logistics in higher education in South Africa, earning a Bachelor's in Mathematical Sciences (University of the Witwatersrand) and subsequently achieving her Master's Degree in Operations Research (Stellenbosch University). These courses equipped her with the skills to solve complex decision-making problems using maths, statistics and computer science, specifically simulation.

During her time at Stellenbosch University, Emma's studies looked at the operational challenges faced by health care facilities in one of South Africa's poorest provinces. Working with staff at Zithulele Hospital in the Eastern Cape, Emma focused on ways to reduce hours-long wait times for patients seeking same-day care and she developed a software tool to model patient congestion throughout the day. This enabled the optimisation of staff schedules, which led to more efficient care for a greater number of patients.

After completing her master's, Emma began a PhD in Operations Research [sic] at the Massachusetts Institute of Technology (MIT) where she worked on a project to improve breast cancer treatment in US health care.

Since moving to the USA, Emma has worked on a new project to improve diagnostic services in sub-Saharan Africa in collaboration with researchers at the Indian School of Business and Northwestern University. Her current project seeks to improve diagnostic services in Malawi.

"We have the tools [to diagnose and treat diseases like HIV]," she says, "but in resource-limited settings, we often lack the money, the staff, and the infrastructure to reach every patient that needs them."

In order to provide diagnostic testing, clinicians in Malawi collect samples from patients and send them to a laboratory for testing; after which they return the results to the clinic. Malawi has developed a national sample transportation network to move medical items between facilities and laboratories, doing important work to link patients visiting remote, rural facilities with laboratory services. Samples are collected and moved from clinics via district hubs onward to urban-based laboratories. Because most rural facilities do not have modern communications infrastructure, results are returned to them as printed documents, via the same transport service.

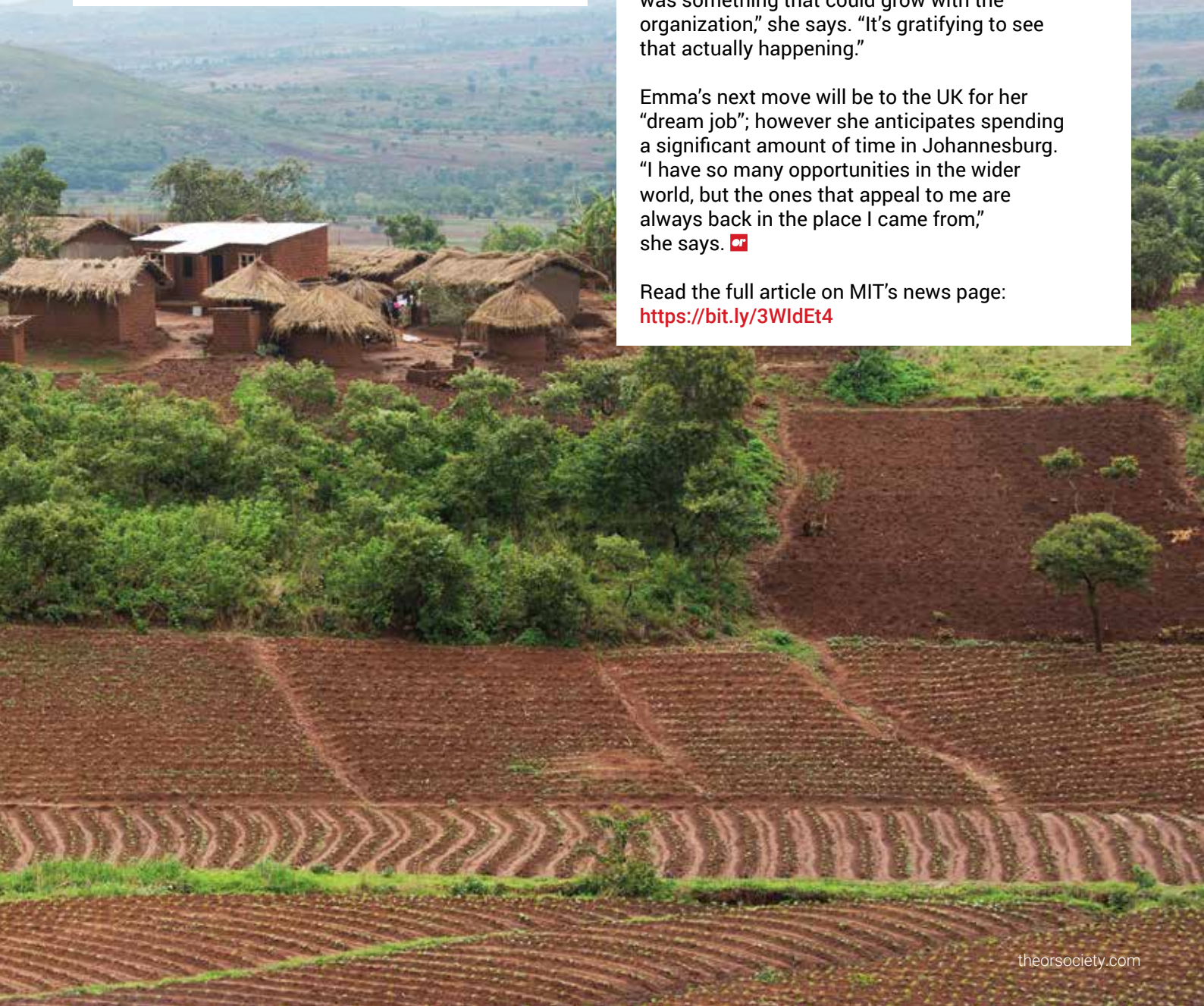
To make sample transportation more efficient, Emma developed a dynamic scheduling system that adapts to the current demand for diagnostic testing. The system consists of two main parts: an information sharing platform that aggregates sample transportation data, and an algorithm that uses the data to generate optimised routes and schedules for sample transport couriers.

In her 2019 pilot, Emma tested this system in three of Malawi's 27 districts. For four months, six couriers transported over 20,000 samples and results across 51 health care facilities and 150 health care workers participated in data sharing.

The pilot was a success. Emma's dynamic scheduling system eliminated about half the unnecessary trips and reduced transportation delays by 25 percent — a delay that used to be four days was reduced to three. A version of Emma's system has since been adopted by the transportation service on a national scale. "We focused on making sure this was something that could grow with the organization," she says. "It's gratifying to see that actually happening."

Emma's next move will be to the UK for her "dream job"; however she anticipates spending a significant amount of time in Johannesburg. "I have so many opportunities in the wider world, but the ones that appeal to me are always back in the place I came from," she says.

Read the full article on MIT's news page: https://bit.ly/3WIdEt4



Future Events

Blackett Lecture 2022

It is our pleasure to announce this year's lecture will be given by The OR Society's Vice President Professor Christina Pagel. Prof Pagel is widely known for her position within Independent Sage which helped advise the British government during the COVID-19 pandemic.

When: 7 December 2022, 16:00-18:45

Where: Prince Philip House, 3 Carlton House Terrace, London, SW1Y 5DG

Talk title: "UK response to the COVID-19 pandemic: the vicious circles, the brilliant science and where science was not enough"

Christina Pagel will discuss how the fundamental nature of COVID-19 transmission and illness led to a vicious circle of repeating waves of infection, disproportionately affecting those in more deprived communities. She will highlight how there was much brilliant science to tackle the pandemic but uncoupled from other expertise and responsive policy and without a systems approach, some major issues were never resolved.

Prof Pagel is also Professor of Operational Research and Director of the Clinical Operational Research Unit at University College London, using mathematical tools to support the delivery of health services and runs a large programme to understand and communicate outcomes in congenital heart disease. She is co-director of the new UCL CHIMERA hub where researchers examine anonymised data to develop a better understanding of how people's physiology changes during intensive care.

Find out more at www.theorsociety.com/Blackett

Women in OR and Analytics (WORAN): events for the whole OR community

Where: online and physical!

When: 15 December, 4pm-5pm

The WORAN Christmas Party will be held on Zoom – but, in addition, we welcome teams joining us in a group from a physical location. So: make this social event even more social, by having a get-together in your workplace or region. Join us either as an individual in the comfort of your own home or office, or as the online face of your local team. Games, chat, and refreshment (that last bit is for you to provide).

Save the time in your diary, invite your colleagues, and register at:
https://www.theorsociety.com/WORAN

2023: Reserve the Third Thursday at Thirteen-Thirty

The WORAN events committee is currently planning a full programme for 2023. We hope to be able to keep to a standard time of the third Thursday of the month, at 13.30, for online events; as well as holding events at ORS conferences. Details will appear in Inside OR and on the website, but if you can, do note the time in your diary now.

To keep up-to-date with WORAN developments and be sure of receiving our emails, please register as a member, on https://bit.ly/WORAN

University of Saskatchewan Archives and Special Collections

Obituary: Computing pioneer Dr Kathleen Booth

9 July 1922-29 September 2022

Dr Kathleen Booth was one of the very first computer programmers, as well as being the author of one of the first books on computer programming.

In 1951, Kathleen and her future husband, Andrew Booth, developed a highly complex algorithm – the Booth multiplier. This was used to construct a hardware circuit to be part of a computer. They also designed some of the first operational computers including the Apexc (All Purpose Electronic (X) Computer) from which the ICT 1200 computer was derived. This went on to be the UK's best-selling computer in the 1960s.

The Booths also developed the first drums – rotating brass cylinders with a magnetic oxide coating. These were the computer equivalent to the phonograph's cylinders, both of which were succeeded by discs.

Kathleen Booth's most important contribution to computing was, arguably, the first 'assembly language'. Prior to this, programming a computer entailed physically rewiring and changing switches which meant 'programs' were physically limited in size and complexity. Although assembly languages are extremely tedious to use, they allowed the development of programming languages such as Fortran, Algol, Basic and dozens (if not hundreds) more.

To quote from the obituary published in *The Times*, on 11 November 1955 Kathleen Booth typed some French words into a computer: "C'est un exemple d'une traduction fait par la machine à calculer installée au laboratoire de Calcul de Birkbeck College, Londres." Out came the English equivalent: "This is an example of a translation made by the machine for calculation installed at the laboratory of computation of Birkbeck College, London."

In 1958, Booth became the first woman to publish a book on computer design, Programming for an Automatic Digital Calculator. By 1962, however, both Kathleen and Andrew had become disillusioned with England and, frustrated at the lack of recognition afforded them at Birkbeck, they emigrated to Canada where Andrew was appointed Dean of Engineering at the University of Saskatchewan and Kathleen eventually became an associate professor.

Kathleen Hylda Valerie Britten was born in Stourbridge, Worcestershire in 1922, educated at King Edward's School, Birmingham before going to Royal Holloway College to read mathematics. Her first job was as a junior scientific officer at the Royal Aircraft Establishment in Farnborough working on aerodynamics. After the war she became a research assistant with a team pioneering the use of X-ray crystallography whose work led to the discovery of the double helix shape of DNA.

In 1947, she spent six months at Princeton University with John von Neumann. Kathleen and Andrew married in 1950, the same year she completed her PhD. Andrew died 12 January 2010.

Kathleen and Andrew are survive by their two children, Ian (a physicist) and Amanda (a vet).

Write for *Inside OR*

In the latest member survey, Inside OR came top of the list of most-valued member benefits. Widely-read in print and digital forms, the magazine tries to balance the interests of a readership as diverse and interesting as the range of OR methodologies they practise. However there is always room for improvement, and your article, piece of news or case study could help!

Reason 1: You can demonstrate impact by sharing your successes.

- Like its sister publication *Impact* magazine, *Inside OR* is an excellent medium for disseminating case studies and project write-ups in short, pithy articles. Similarly, if you, your team or your project has won an award or made fascinating breakthrough, let us know. If you have been appointed to a new and exciting role, tell us.

Reason 2: You can engage with an intelligent and expert readership.

- If there is a topic within the wide range of OR disciplines you wish to raise the profile of, consider writing for the magazine. Its readers are your friends and colleagues, and you are likely to generate contributions in response to your article or news piece.

Reason 3: You can help us build up the community.

- *Inside OR* is the magazine for the OR community in and around The OR Society, so help us make it yours.

Bearing in mind the deadlines for our production schedule (see below), why not send us personal news as well as professional updates? Are you undertaking charity work and looking for sponsorship? Have you started a new initiative in your workplace or local community? Get your name and cause out there, and the OR community may add tremendous and unexpected value to what you're doing.

The deadline for submissions is the first of the month, with the hard copy usually hitting the doormat by the first of the next month (electronic versions around a week earlier). Please email submissions to John Crocker, the editor, at InsideOR@theorsociety.com

Read previous editions at: **www.theorsociety.com/InsideOR**

Total Membership: 4004

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:

Admitted to the Category of Fellow of The OR Society (FORS):

John Herington
Nicola Morrill

Admitted to the Category of Associate Fellow of The OR Society (AFORS):

Paul Thomas

Admitted to the Category of Associate of The OR Society (AORS):

Fleur Vaughan
Olga Poletaeva
Stephen Pollard

Admitted to the Category of Candidate of The OR Society (CandORS):

Ana America Tellechea Lopez
Anjolaoluwa Akintan
Cathryn Healey
Chidiebere Wisdom Obioha
Daniel Milner
Danielle Williams

Admitted to the Category of Chartered Scientist (CSci):

Gayathri Delanerolle

SW23 – The 11th Simulation Workshop

27-29 March 2023, National Oceanography Centre, Southampton

The OR Society's Simulation Workshop brings together our community of experts working in the field of modelling and simulation. The conference provides an opportunity for practitioners and academics to exchange ideas on the current and future state-of-the-art in modelling and simulation.

You're invited

Look forward to a rich programme of a keynote presentation, panel discussions, parallel streams and tutorials. Breaks between sessions and the conference dinner will provide an excellent opportunity for networking. There will be an exhibition area which will feature poster displays and some of the latest developments in simulation software tools.

A wide spectrum of topics

A technical programme comprising a wide spectrum of simulation, modelling and analysis is being put together, and is likely to feature:

Simulation Modelling Methodology

- Component-based simulation
- Collaboration methods
- Distributed simulation
- Web based simulation
- Simulation and the grid/cloud
- Simulation and artificial intelligence
- Simulation visualisation
- Simulation software
- Simulation standards
- Human performance modelling
- Discrete event simulation
- Agent-based simulation
- System Dynamics
- Hybrid simulation
- Service-oriented simulation
- Conceptual modelling
- Verification and validation
- Simulation analytic

Simulation Analysis Methodology

- Design and analysis of simulation experiments
- Simulation optimisation
- Risk analysis
- Metamodelling

Simulation in Practice

- Simulation in manufacturing
- Simulation in services
- Simulation in defence
- Simulation in healthcare
- Simulation in the semiconductor industry
- Simulation practice
- Simulation education
- Energy modelling
- Environmental simulation
- Supply chain and transportation modelling

#SW23 is held in partnership with:

SCS THE SOCIETY FOR MODELING & SIMULATION INTERNATIONAL

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Find out more at
www.theorsociety.com/SW23