

THE SCIENCE OF BETTER AT THE HEART OF ANALYTICS

INSIDE O.R.

DECEMBER 2015 NO 540



WHEN THE LIGHTS GO OUT

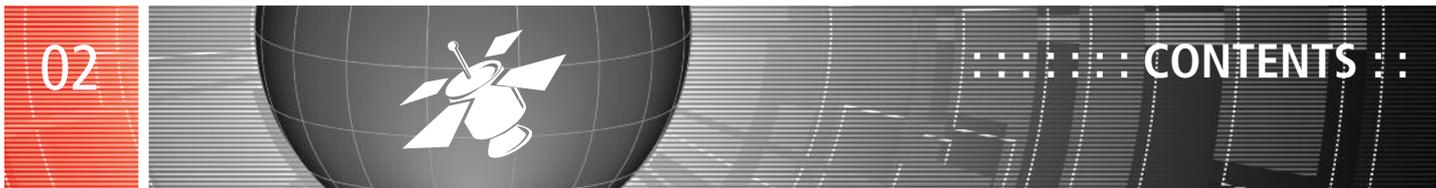
:: INSIDE THIS MONTH :: :: :: ::

DRIVING PERFORMANCE THROUGH INNOVATION
SIMULATION, SIMULATION, SIMULATION
MOBILE WALLETS: THE NEW FRAUD FRONTIER
HOW SECURE IS YOUR DATA?



THE OR SOCIETY

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EDITORIAL

JOHN CROCKER

By the time you read this, we will be in Advent, at one time, the signal that Christmas was approaching but as Louise notes in her Y2OR section, the John Lewis 'Christmas Ad' was launched on 6th November (one day after Guy Fawkes Night) and 49 days before Christmas day. It will be interesting to see which of the big stores has the best Christmas this year and whether the effectiveness of the advertising is still inversely correlated with the cost. Perhaps the adage, 'it pays to advertise' should carry a caveat 'but not too much'.

What are your impressions of the new *Impact* magazine? I have to admit I have not read all the articles in the second issue yet but I have enjoyed those that I have. One of its aims is to make more people aware of what O.R. is and what it can do for them. Thinking about this, it is difficult to know how best to monitor this – if one was creating a KPI, what form would it take. If you were stop people in the street and ask them if they had heard of O.R. and, if so how might one use it, say, how many people would you need to stop before you got positive responses? Unfortunately, one suspects the answer is such that it would be impractical. One could ask the 650 MPs but, once you have asked them once you cannot use that sample again since by asking them the question you have automatically made them aware of its existence, although whether they will remember is quite another matter. The statistics of rare events is a fascinating one – in most studies the person who has heard of O.R. in a sample would most probably be excluded as an anomaly!

Humans seem to be very good at noticing coincidences – one happened to me on 15th November. In the *Sunday Times* Business section (something I do not very often read these days), there were two articles that drew my attention: one was about the current share value of Rolls-Royce and the other about the potential closure of the steel works in Scunthorpe. BSC Scunthorpe was where I started my career in O.R. (in 1970) and Rolls-Royce was where I ended it at the end of 2013 (also coincidentally(?) the date when RR's shares started to fall).

Talking of risks, John Hopes in his Leader explores the 'third leg of the value stool': risk reduction. This, he argues, is just as important as cutting costs and revenue enhancement, but, he suggests it is cost-cutting, certainly in recent times, which seems to get the most attention. (Coincidentally, again, this seems to be the case with Rolls-Royce – apparently the latest CEO is looking at taking a large pair of secateurs to middle management. I remember from my early days at RR a cartoon that went the rounds depicting the RR rowing team as having eight coxes and one oarsman so the boat was going round in circles- I will leave you to guess the recommendation.)

You will see in the News in Brief section that there is a new rival Blackett event. I hope this will not deter any off you from attending our own Lecture held in his memory but you will need to be very quick if you have not already booked, in fact by the time you read this it may be too late. If you miss the Blackett, there may still be a chance for you to take part in the debate on the future of professional societies – a joint meeting with and hosted by the RSS on 4th December.

I hope you all thoroughly enjoy your Christmas, Saturnalia, winter solstice or whatever festivities and are ready to send me all your interesting articles in the New Year.

:: NEWS :::::

EDITORIAL	02
WHEN THE LIGHTS GO OUT	03
IN BRIEF	04
GREAT FEEDBACK FROM DIABETES UK	07
BEALE LECTURE 2016	08
WILL STATISTICS AND OPERATIONAL RESEARCH STILL BE HERE IN 2025?	12
DRIVING PERFORMANCE THROUGH INNOVATION	13
TAX RELIEF ON PROFESSIONAL SUBSCRIPTIONS	17
SIMULATION, SIMULATION, SIMULATION	18
SW16 – SUBMIT YOUR SIMULATION POSTERS TODAY!	19
PR (MY THUNDERBIRD IS GO) = 0.2	20
CALLS FOR PRACTITIONER CASE STUDIES	22
GOOD LABORATORY PRACTICE FOR OPTIMIZATION RESEARCH	23
OR58 DIARY DATE	26
OR58 ANNUAL CONFERENCE – CALLING FOR PAPERS	27
HOW SECURE IS YOUR DATA?	28
OR SOCIETY SIGNS THE SCIENCE COUNCIL'S DECLARATION ON DIVERSITY, EQUALITY AND INCLUSION	29
MY FIRST PROJECTS	30
A DISASTER WAITING TO HAPPEN	31
HUGH MURRAY 1919-2015: AN APPRECIATION	32
OBITUARY – CATHERINE BENFIELD, 1963-2015	33
Y2OR CHRISTMAS 2015	40
:: LEADER :::::	
THIRD LEG OF THE STOOL	16
:: ANALYTICS :::::	
MOBILE WALLETS: THE NEW FRAUD FRONTIER	24
:: REGULARS :::::	
CONFERENCE NEWS	09
TRAINING	14/15
NEWS OF MEMBERS	21
WHERE ARE THEY NOW?	29
SPECIAL INTEREST GROUPS	34
REGIONAL SOCIETIES	36
SOCIAL MEDIA	38
LAST WORDS	42

ISIS in Crisis?

An artificial intelligence-driven method of modeling the behaviours of militant groups is being tested by the US Department of Defense. Results so far have been encouraging, a team led by Paulo Shakarian of Arizona State University used 2,200 individual data points on ISIS-related incidents from the Institute for the Study of War to build a descriptive model of ISIS's behaviour.



The algorithm identified two ISIS-favoured targets and noted a tactic which tries to draw security forces away from the areas they intend to target. One suspects that now they have been told there are ways of predicting their behaviour, they will adopt new tactics.

More at: <http://bit.ly/1O6Db6a>

Gatwick in the Clouds

Gatwick handles 40 million travellers on 52 airlines per year. This is no mean logistical feat by any standards. In a bid to reduce incidents and factors which could influence its peak performance Gatwick is looking to the 'cloud', and in particular to cloud analytics.



Joe Hardstaff, business systems architect at Gatwick airport, recently confirmed that Gatwick will be using 'Splunk Cloud

Analytics' to predict the performance of its operations four hours in advance by linking multiple data sources together. This will allow them to anticipate problems and take the necessary actions to ensure the smooth running of the airport.

More at: <http://bit.ly/1OBIZqD>

Just one more cigarette

Increasing taxes on cigarettes, and making them generally more expensive, may, according to a new INFORMS study steer tobacco users toward more dangerous products.



In a paper entitled 'The Unintended Consequences of Counter-Marketing Strategies' written by Yanwen Wang, the University of Colorado Boulder; Mike Lewis, Emory University; and Vishal Singh, New York University the indication is that whilst taxation may reduce overall demand, it can lead to individuals switching to higher nicotine products which is likely to result in increased addiction levels.

More at: <http://bit.ly/1iYGp0k>

I Believe in Miracles

Nottingham Forest are once again making the news all over the world thanks to a film charting the Reds incredible success. I Believe in Miracles, which tells the story of Brian Clough and Peter Taylor's all-conquering side has been put together by Jonny Owen and was released in cinemas at the beginning of November.

But how would the 1979 team have fared today? According to analysis derived from a football manager simulation, and received from Sports Interactive, Brian Clough's



Nottingham Forest of 1979, when compared to the 2015-16 Premier League would have finished seventh just above Everton, and would have been knocked out in the semi-finals of the League Cup by Arsenal despite the total of 31 goals netted by Garry Birtles and Tony Woodcock.

More at: <http://bit.ly/1O6Dhur>

Successful Publishers use Analytics

Print media companies have struggled to make money in the 21st century, but the exception seems to be The New York Times, a publication which is thriving thanks to the application of predictive analytics tools which have given it a competitive edge.



This has enabled them to develop strategies to get more subscribers, to promote articles on social media and use predictive models to guide many of their business decisions. The New York Times also uses natural language processing to understand content topics that generate the most reader engagement, so marketing teams can know what types of articles to promote.

More at: <http://bit.ly/1L8XS00>

New Blackett Colloquium

On 24 October this year, more than 80 alumni and guests joined leading Imperial scientists to explore one of the biggest mysteries in physics, dark matter.



Welcoming guests to the event, Professor Jordan Nash (Head of the Department of Physics) explained that the new Blackett Colloquium lecture series would be an annual opportunity for alumni and members of the public to find out more about the Department's work.

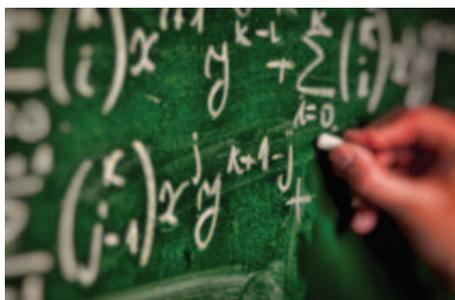
Presentations at the inaugural Blackett Colloquium were provided by Dr Roberto Trotta (Senior Lecturer in Astrophysics, author of 'The Edge of the Sky'), Dr Henrique Araujo (experimental astroparticle physicist with the High Energy Physics group) and Dr Sarah Malik (researcher attached to the Large Hadron Collider Physics Centre), as well as Professor Tom Welton (Dean of the Faculty of Natural Sciences) and Professor Jordan Nash (Head of Department of Physics).

For more information and a link to a video of the event: <http://bit.ly/1PFqukB>

Doing the Sums

According to the Department for Education (DfE), there will be a demand for 3,102 trainee maths teachers in 2016, an increase of 521 (20%) on this year. It is not quite clear where these students will come from

as only 95% of the places for 2015 have been filled – paying their tuition fees would certainly be a help.



The increase in demand is as a result of the introduction of the core maths qualification for post-16 pupils; a continuing increase in pupils opting for further maths A-level and a new maths GCSE curriculum requiring more teaching time.

More at: <http://bit.ly/1LRV9FB>

Could do better

According to findings from a survey of 297 SMEs undertaken by Source for Consulting and Advanced Business Solutions, 95% of businesses admitted they are not making the best use of analytics. Advanced's research highlighted that while many businesses had some elements of analytics in place, there was an almost unanimous belief that the technology could have a greater impact if it was more widely utilised.



Nearly two thirds felt that the outputs and benefits were not meaningful or sufficiently visible and nearly as many believed their organisations' expectations were unrealistic. Only 10% cited a lack of data.

Businesses who fail to embrace analytics are likely to be left behind but it must be implemented throughout the organisation and it is vital to articulate what benefits can

be expected and how they will be measured.

More at: <http://bit.ly/1iYGBN3>

Onwards and upwards

Knowledge of analytics is the most in-demand marketing skill, according to research from Forbes Insight. 68% of marketing executives ranked analytics and predictive analytics as 'important' or 'extremely important'. 71% of employers provide on-site training and education and 61% actively encourage coaching and mentoring.



The most valued skills were digital content development and management (63%), marketing operations (61%) and digital channel management/demand generation (60%).

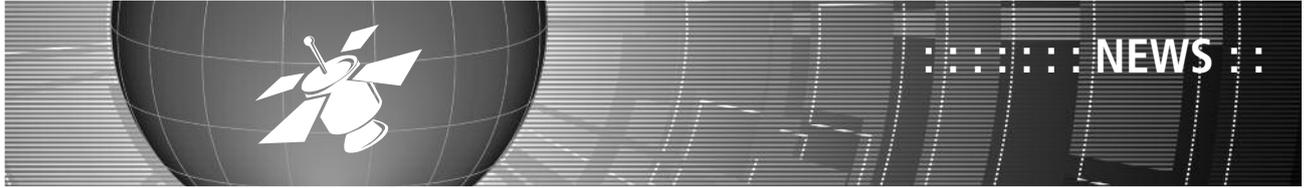
Forbes Insights commented: 'Organisations need highly skilled professionals, versed in everything from data science to content development, to make their analytics efforts work. A majority of organisations have rolled out internal training programmes that will help develop such skills.'

More at: <http://onforb.es/1N4XdIU>

Guilty as charged

According to a survey commissioned by the Coalition of Technology Resources for Lawyers (CTRL) via research performed by the Information Governance Initiative (IGI). The legal industry is in the midst of an analytics revolution.

The CTRL survey 'Data Analytics in the Legal Community: 2015-2016 Trends' indicates that analytics will play a 'central role' in the legal field with 93% of its respondents reporting that data analytics will be



BEALE LECTURE 2016 - Thursday 25 February 2016 **The Priory Rooms Conference Centre, Birmingham - (Free Event)**

The Beale Medal, in memory of the late Martin Beale, gives recognition to a sustained contribution over many years to the theory, practice, or philosophy of O.R. in the UK, or to some combination of those areas.

COME AND LISTEN! OUR SPEAKERS WILL BE.....



Beale Medal Winner 2014 - Prof. Robert Fildes **Title: Research in practice**

'In theory there is no difference between theory and practice. In practice there is'. Multiple attributions including Einstein and Yogi Berra

My early academic life was rooted in mathematics. But by a series of chances I found that practice whether it is in a field or an organisation differs substantially from what modellers typically study. This presentation will briefly examine the roots of O.R. and how it has developed with an increasing gap between theory and practice. But why is such a gap important for the profession? Working with John Ranyard and sponsored by the OR society in the 1990s and IFORS ten years later, we have investigated the state of O.R. in practice. The primary techniques and application areas of O.R. practitioners have changed little. However, O.R. and its

boundaries are increasingly disputed and O.R. is yet again at risk of being side-lined in practice. Read the full abstract and Roberts' biography here www.theorsociety.com/beale2016



Doctoral Award Winner 2013 – Mr Tom Lidbetter **For 'The Most Distinguished Body of Research leading to the Award of a Doctorate in the field of O.R.'**

Title: Mining coal or finding terrorists: the expanding search paradigm'

We show how to optimise the search for a hidden object, terrorist, or simply Hider, located on a rooted network according to a known or unknown probability distribution. We modify the traditional model of searching using a path on the network to a new notion of 'expanding search', where arcs are chosen in a contiguous manner so that the area that has been searched is an expanding subset of the network. This has

a natural interpretation in terms of mining along coal seams, where the area that has been mined expands over time. It also has an interpretation relating to multiple agent search. In the case of a known hiding distribution, we solve the problem of finding the search of least expected time on tree networks. In the case of an unknown hiding distribution, we model the problem as a zero-sum game between a time minimising Searcher and a malicious Hider. We solve the game, finding optimal strategies on various classes of networks and give an approximate solution for general networks. We also consider a variation of the game in which several hidden objects must all be found. For star networks, this game can be considered as the search for k balls hidden in m boxes, and we give a neat and rather surprising solution to the game.

Read Tom's biography here www.theorsociety.com/beale2016

Job Title:

Senior Consultant – Decision Optimisation & Predictive Analytics

Location: UK / Ireland

As part of our ambitious growth plans for our business, we are looking for exceptional candidates with Operations Research / Decision Optimisation modelling and consulting experience gained within a leading company or major consultancy.

Main Roles & Responsibilities:

Provision of superior consultancy and business analysis in the areas of advanced analytics, data analysis and manipulation, and application of decision optimisation/operational research techniques on Client data.
Leading role in building long term relationship and on-going business with key client accounts.
Creation, interpretation and deployment of decision optimisation models .
Production of reports and presentations adapted to a variety of audiences both technical and business.
Pre-sales support including demos, workshops, solution design and presentation .
Creation of new product ideas and contribution to thought leadership drawing on your experience.

Candidate Requirements:

Exceptional analytical skills, highly proficient in IBM iLOG / Cplex (or equivalent), excel and comfortable handling and analysing large data sets. Knowledge of Operational Research techniques is essential.
Master or PhD from a leading University in a quantitative discipline such as mathematics, Operational Research, physical or computer science.
Strong practical understanding of the application of analytics to business issues across multiple industries and varying size client engagements.
Ability to support customer in building term vision for Analytics/Optimisation capability to support their business
Experience in conducting analysis for evidence based decision making, developing models and decision support tools or building business cases for investment decisions.
Experience with a Predictive Analytics tool e.g. SPSS, Enterprise Miner an advantage .
Desire to learn and implement Predictive Analytics techniques that will feed into Decision Optimisation.
Desire to understand and develop the integration of Decision optimisation in multiple planning scenarios.
Excellent presentation, written and verbal communications skills.
Excellent inter-personal, organisational and time-management skills, even when under pressure.
Can coach less experienced team members and colleagues.

Competencies:

Commercially astute.
Identifies and defines complex problems, assesses appropriate solutions from options developed logically.
Quickly adapts to and recognises the implications of changes in business strategy before and during projects.
Capable of leading workshops and architecting a solution from an IT perspective, system requirements, supporting software installations and versioning, and understanding of DB and automation (incl. C&Ds).
Plans and organises complex work streams; manages materials/technology effectively to best deliver value and quality to the client.
Develops project plans based on CRISP and Presidion PM approach incorporating experience into estimates and risk mitigation.
Engages clients using a range of influencing skills.
Generates leads and referrals through an understanding of client needs or sector opportunities.
Ensures that their personal actions safeguard Presidion's interests.
Demonstrates a collaborative work approach and supports their Presidion and client colleagues to work together to achieve success.
Respects, accommodates and adapts to the diversity of individuals, work arrangements, travel, styles and approaches.
Proactively delivers excellence in all circumstances and encourages other to also.
Enthusiastic, energetic, hard-working, passionate, goal focused, and willing to learn.

Remuneration:

Commensurate with experience and ability. Top market rates.

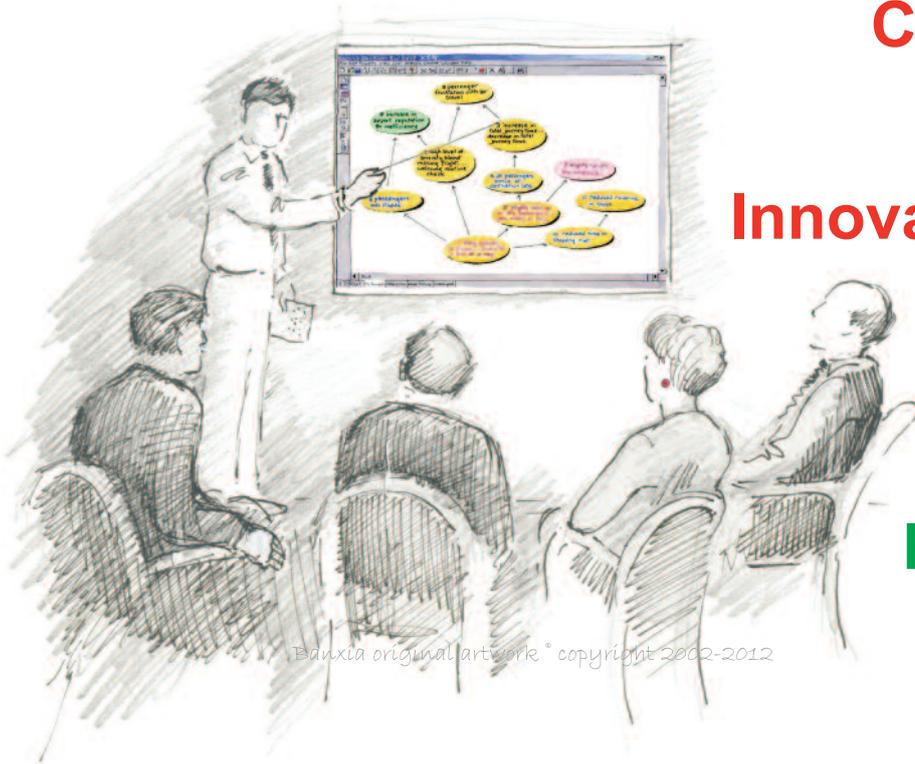
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Problem solver?



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- ❑ **Decision Explorer®** - an ideas mapping tool used to organise and structure an individual's or a 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.

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JOINT EVENT

WILL STATISTICS AND OPERATIONAL RESEARCH STILL BE HERE IN 2025?

How should our professions react to a world in which digital services and new technologies are demanding new approaches from our established disciplines?

Come and help us navigate the next 10 years with a day of panel discussions, workshops and presentations with speakers from across industry



Speakers include:

Peter Diggle *President of the Royal Statistical Society*

Stewart Robinson *President of the OR Society*

Tony Bendell *Chair RSS Quality Improvement Section*

John Hopes *Vice President of the OR Society*

Neil McIvor *Statistics Deputy Head of Profession in the Department for Work and Pensions*
Guest Plenary Speaker from Industry



Workshops covering:

How can the two Societies benefit from Data Science and Analytics and how can our offer to the new professions be improved?

Which work areas have moved from the realm of O.R. and Statistics and are now being claimed by Data Science and Analytics?

Which new areas have Data Science and Analytics created that O.R. analysts and Statisticians need to learn?

How have new digital technologies enabled the Data Science and Analytics professionals to forge new communities and can we learn from them?

Starting to build a soft systems model to understand how increasing numbers of Data Science and Analytics professionals affect academic institutions, government departments, private sector bodies and the Societies



4 December 2015, Royal Statistical Society, 12 Errol Street, London EC1Y 8LX

9:30am Refreshments for a 10:00am start with an introduction from both Societies

To book a place please go to <http://bit.ly/1jged9Q> Event cost is £40 (including lunch)

For further information, please email events@rss.org.uk

ACTIONABLE INTELLIGENCE

23 February – Birmingham; £555+VAT for OR Society members. Ian Taylor

THE SCIENCE OF DATA VISUALISATION

24 February – Birmingham; £615+VAT for OR Society members. Hands-on course. Ian Taylor

FROM BIG DATA TO OPEN DATA

25 February – Birmingham; £555+VAT for OR Society members. Jacqui Taylor

DEVELOPING STRATEGY AND PERFORMANCE WITH THE PUBLIC SECTOR SCORECARD

2 March – Birmingham; £500+VAT for OR Society members. Hands-on course. Max Moulin

ORGANISING AND PRESENTING DATA IN EXCEL

3 March – Birmingham; £455+VAT for OR Society members. Hands-on course. Simon Pegg

SIMULATION: A PRACTICAL GUIDE TO DEVELOPING AND USING MODELS

8-10 March – Birmingham; £1,665+VAT for OR Society members. Hands-on course. Stewart Robinson

THE COLLABORATIVE APPROACH TO SIMULATION MODEL BUILDING

14-15 March – Birmingham; £1,190+VAT for OR Society members. Hands-on course. Kathy Kotiadis and Antuela Tako

ESSENTIAL O.R. SKILLS FOR PRACTITIONERS

16 March – Birmingham; £500+VAT for OR Society members. Hands-on course. Dr David Halsall and Dr Louise Plewes

USING SOFT SYSTEMS METHODOLOGY

21 March – Birmingham; £550+VAT for OR Society members. Mark Westcombe

PRACTICING SOFT SYSTEM METHODOLOGY

22 March – Birmingham; £550+VAT for OR Society members. Mark Westcombe

USING COGNITIVE MAPPING **NEW FOR 2016**

23 March – Birmingham; £575+VAT for OR Society members. Hands-on course. Mark Westcombe

FACILITATING GROUPS WITH COGNITIVE MAPPING **NEW FOR 2016**

24 March – Birmingham; £575+VAT for OR Society members. Mark Westcombe

INTRODUCTION TO O.R. I

4-8 April – Birmingham; £2,850+VAT for OR Society members. Hands-on course. Frances O'Brien

DATA PRESENTATION FOR ANALYSTS

14 April – Birmingham; £555+VAT for OR Society members. Hands-on course. Greg McCormick

SUPPORTING STRATEGY

19-20 April – Birmingham; £1,140+VAT for OR Society members. Hands-on course. Frances O'Brien, John Morecroft

DECISION AND RISK ANALYSIS UNDER UNCERTAINTY **NEW FOR 2016**

21 April – Birmingham; £590+VAT for OR Society members. Hands-on course. Jian-bo Yang and Dong Ling Xu

FROM BIG DATA TO OPEN DATA

26 April – Birmingham; £555+VAT for OR Society members. Jacqui Taylor

THE SCIENCE OF DATA VISUALISATION

27 April – Birmingham; £615+VAT for OR Society members. Hands-on course. Ian Taylor

ACTIONABLE INTELLIGENCE

28 April – Birmingham; £555+VAT for OR Society members. Ian Taylor

DATA MINING: TECHNIQUES & APPLICATIONS

10 May – Birmingham; £665+VAT for OR Society members. Hands-on course. Bart Baesens and David Martens

DATA MINING: ADVANCED DATA MINING

11 May – Birmingham; £665+VAT for OR Society members. Hands-on course. Bart Baesens and David Martens

USING MORPHOLOGICAL ANALYSIS FOR FORESIGHT, STRATEGY MODELLING AND INNOVATION **NEW FOR 2016**

17 May – Birmingham; £600+VAT for OR Society members. Hands-on course. Nasir Hussain and Bruce Garvey

MASTERCLASS ON THE PURSUIT OF ORGANISATIONAL EXCELLENCE AND A CRITIQUE OF THE EFQM EXCELLENCE MODEL **NEW FOR 2016**

18 May – Birmingham; £410+VAT for OR Society members. Tony Bendell

PROCESS OPTIMISATION & ANTI-FRAGILITY-FRIENDS OR ENEMIES

19 May – Birmingham; £380+VAT for OR Society members. Tony Bendell

Your OR Society Training Course schedule for 2016

DATA SCIENCE AS A FRAMEWORK - DSAAF™ NEW FOR 2016

7 June – Birmingham; £475+VAT for OR Society members. Hands-on course. Sayara Beg

AN INTRODUCTION TO USING R FOR BUSINESS ANALYTICS NEW FOR 2016

8 June – Birmingham; £500+VAT for OR Society members. Hands-on course. Richard Vidgen

MANAGING SUCCESSFUL ANALYTICAL PROJECTS

14-15 June – Birmingham; £1,010+VAT for OR Society members. Ian Seath

PERFORMANCE MANAGEMENT WITH DEA

24 June – Birmingham; £550+VAT for OR Society members. Hands-on course. Ali Emrouzejad, E Thanassoulis

INTRODUCTION TO MEASURING AND DEMONSTRATING IMPACT IN COMPLEX SYSTEMS

6 September – Birmingham; £495+VAT for OR Society members. John Newman and Sam Mackay

INTRODUCTION TO O.R. II

19-23 September – Birmingham; £2,875+VAT for OR Society members. Hands-on course. Frances O'Brien

O.R. AND SUPPLY CHAIN MANAGEMENT

27-28 September – Birmingham; £1,550+VAT for OR Society members. Hands-on course. Nicholas Cron and John Wilkes

ESSENTIAL O.R. SKILLS FOR PRACTITIONERS

11 October – Birmingham; £500+VAT for OR Society members. Hands-on course. David Halsall and Louise Plewes

USING COGNITIVE MAPPING NEW FOR 2016

7 November – Birmingham; £575+VAT for OR Society members. Hands-on course. Mark Westcombe

FACILITATING GROUPS WITH DECISION EXPLORER CONNECT NEW FOR 2016

8 November – Birmingham; £575+VAT for OR Society members. Mark Westcombe

USING SOFT SYSTEMS METHODOLOGY

9 November – Birmingham; £550+VAT for OR Society members. Mark Westcombe

PRACTICING SOFT SYSTEM METHODOLOGY

10 November – Birmingham; £550+VAT for OR Society members. Mark Westcombe

AGENT BASED MODELLING: WHAT, WHEN & WHERE

15-16 November – Birmingham; £1,180+VAT for OR Society members. Hands-on course. Benjamin Schumann

IMPLEMENTING CREDIT SCORING SUCCESSFULLY NEW FOR 2016

18 November – Birmingham; £475+VAT for OR Society members. David B. Edelman

FOUNDATION COURSE SERIES BASED IN LONDON* £575+VAT for OR Society members

O.R. AND THE O.R. PROCESS 28 January, Stewart Robinson,

STATISTICAL METHODS IN O.R.: DESCRIPTIVE STATISTICS, SAMPLING AND REGRESSION 25 February, Maureen Meadows

SIMULATION 18 March, Kathy Kotiadis

STATISTICAL METHODS IN O.R.: FORECASTING 22 April, Katy Hoad

OPTIMISATION AND (META-) HEURISTICS 17 May, Victor Podinovski

SYSTEM DYNAMICS 7 June, Martin Kunc

STATISTICAL METHODS IN O.R.: MULTIVARIATE MODELS 12 September, Maureen Meadows

PROBLEM STRUCTURING METHODS 11 October, Giles Hindle

DATA ENVELOPMENT ANALYSIS 15 November, Victor Podinovski

O.R. & STRATEGY 8 December, Frances O'Brien

***Civil Servants / Members of the Government O.R. Service need to book these courses through the Civil Service Learning portal. (Go to <http://bit.ly/1PrGBSB>)**

For details of all courses and to book online, visit
www.theorsociety.com or call Jennie Phelps on 0121 234 7818



THIRD LEG OF THE STOOL

JOHN HOPES



‘This is an area where O.R. and analytics have some unique selling points in providing tools for identifying and quantifying risks.’

It may be to do with getting older, but I have recently been thinking about risk. This is, of course, in the context of O.R. and analytics where I believe there are some particular opportunities.

In the world of corporate finance, for example, a key focus is on shareholder value, which is increased by enhancing revenues, cutting costs or reducing risk. And the joy of O.R. and analytics is that they can make big contributions to all three of these. But since the financial crisis and recession there has, in my perception, been a particular and understandable emphasis for O.R. and analytics on the cost reduction agenda in both the public and private sectors, whether through smarter ways of distributing product, more efficient ways of deploying people on tasks, reductions in working capital including inventory or pruning branch networks. In all these cases and others O.R. has been used to identify the best ways in which the business can deliver the same for less or more for the same.

This is not to say that O.R. and analytics have been absent from revenue enhancement, for example in optimising pricing strategies, marketing spend, promotions and website interactions; it is just that it seems as if the higher priority has been cost reduction. But what about the third leg of the value stool: risk reduction? This is an area where O.R. and analytics have some unique selling points in providing tools for identifying and quantifying risks. And this is what I wanted to cover in this article, because I think it is time for us to raise the profile of O.R. and analytics in the context of risk.

First, in terms of demand, there seems to have been a management progression from cutting cost in order to survive to chasing growth in the upturn to the beginnings of a perception that risk management focus might have been lost. This has been highlighted by some headline risks including cyber-attacks, the VW emissions fiasco, Libor rigging and commodity price crashes. But across the board there are signs of a return to a need to reflect risk in decision making in a more systematic way.

As is so often the case for O.R. a lot of this is not about solving new problems, but is often more about applying techniques and methodologies that have been around for decades. There is, however, an added opportunity in the area of advanced analytics that arises from the recent data explosion and the rapidly expanding internet of things.

Starting at the more long-established end of the spectrum, my personal observation is that 20 years ago a great deal of what I did as an O.R. analyst and modeller had to do with risk quantification. There also seemed to be a lot going on in O.R. and risk generally in those days as championed by Chris Chapman at Southampton and

others. Monte Carlo simulation and other risk modelling techniques were being used to quantify such diverse things as nuclear power station decommissioning provisions, major project cost estimates or the risk transfer associated with PFI schemes or privatisations. Indeed Monte Carlo simulation is yet another of those O.R. techniques that has gone so mainstream that most of its users do not think of themselves as O.R. analysts. For example, in complex security valuation the complexity does not have to become very great before simple approaches such as Black Scholes cannot handle the problem and Monte Carlo simulation becomes the preferred approach. And yet very few quants would think of themselves as using an O.R. technique.

In the nineties I remember running workshops for clients entitled 'why are projects always late'. This started with a simple example in which two people are planning to meet at 9am, with both of them being just as likely to be up to five minutes early as up to five minutes late. When asked what time, on average, the meeting will start it is amazing how many experienced project managers say nine o'clock. And this probably goes to show why meetings and projects are still always late. There are a number of O.R. techniques to allow project plans to reflect risks, options and dependencies, but they are still generally not deployed, as a result of which management make decisions with an incomplete information set.

In terms of the newer opportunities, some of the most interesting and, more importantly, high value applications of advanced analytics are in the risk domain, including using machine learning

and other techniques to identify fraud or evidence of cyber-attack. Similarly, with sensors distributed through manufacturing or other operations, predictive analytics is being used to estimate risks of process or component failure. Other opportunities range from quantitative support to bank stress testing to quantifying supplier risk. The digital age is creating major new risks but is also providing far more data and new mechanisms for managing both these and more conventional risks.

But what does all this mean for the O.R. Society? Well, there seems to be less on risk management applications at our conferences than there once was, although I could be wrong. Also, on our training programme, there is one course on decision and risk analysis, so we certainly have something, but there could be more. And when it comes to special interest groups and publications, well the best that could be said is that the topic is embedded in them somewhere. But most importantly, risk is another high profile management issue where O.R. and analytics should have a point of view which is expressed loudly.

In conclusion, in some ways O.R. / analytics and risk is just an example of a more general rule. We often seem to be solving the same old problems for a new generation of decision makers. But, at the same time, there are some genuinely new and highly important problems to solve, particularly arising from the impact of digital technology and the data explosion. This is an ideal combination to ensure that O.R. and analytics remain relevant.

<OR>

TAX RELIEF ON PROFESSIONAL SUBSCRIPTIONS

The OR Society is one of the HMRC approved professional bodies under Section 344 of the Income Tax (Earnings & Pensions) Act 2003 - and is published by them as 'List 3' - therefore, if you are a UK tax payer and pay your own membership fees, you may be entitled to claim tax back on your subscription fee.

Who can claim?

If joining the OR Society is advantageous to you in carrying out your work or is relevant to your job, members employed in the UK may claim tax relief on their membership subscription fee.

Who can't claim?

Non UK tax payers, or members whose subscription fee is paid by someone else (e.g. employer).

How much can I claim?

Higher rate taxpayers can claim 40% of their membership fee, while lower rate taxpayers can claim 20% of their membership fee.

How to claim?

You must claim using a Self Assessment tax return if you already fill one in.

If you don't already fill in a Self Assessment tax return fill in form P87 and send it to the address on the form.

The OR Society is listed as 'Operational Research Society' in List 3. In order to claim tax relief, you will need your invoice for your membership payment.

More details can be found on the HMRC website, www.gov.uk/tax-relief-for-employees

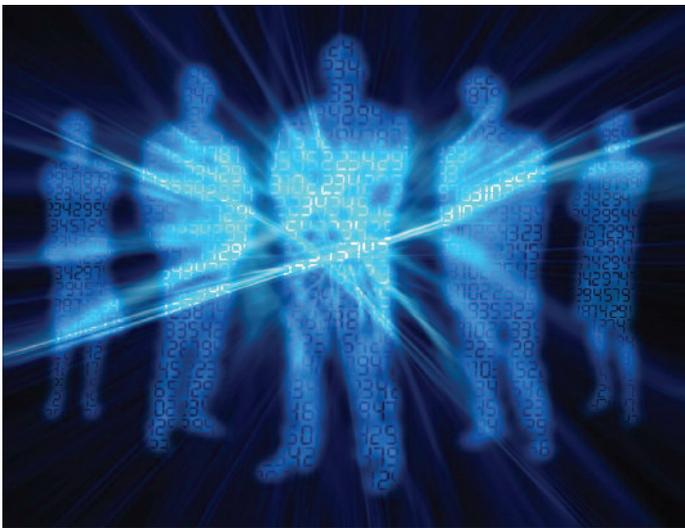
<OR>

SIMULATION, SIMULATION, SIMULATION

JOHN CROCKER AND NIGEL CUMMINGS

When I was at university, I attended a talk by Professor 'Toch' Tocher on simulation, or more precisely, discrete event simulation (DES).

Tocher is attributed to having been the inventor of the first simulation [computer] language: GSP – general simulation program. In his lecture, he described a number of mechanical/hydraulic models that had been built to help solve a number of problems mainly in the steel industry. He concluded with an interesting prediction which as I recall suggested that the future of simulation was limited, analytical methods would be developed within five years that would make simulation obsolete – that was in 1968. Ten years later, Douglas Adams wrote a series of plays that were broadcast by the BBC Radio under the title 'The Hitch-Hikers Guide to the Galaxy' (subsequently published as a 'trilogy in five parts'). In this, (I have forgotten which one of the five) he explains that the Earth was created by white mice as a simulation to answer the question, 'What is the meaning of life?' (but was destroyed by Vogans just before it produced an answer).



Alexey Turchin has asked the question, 'Simulations Map: what is the most probable type of the simulation in which we live?' He argues that there is every chance we are living in a simulation that is either being run by another civilisation or by our successors but from a period sometime in the future (a simulation of life on earth in the 21st century). He suggests that these successors may well be in the form of an artificial intelligence and that they have created a series of Matryoshka simulations (named after the Russian dolls that fit one inside the other). This means that we are a part of a simulation within a simulation, within a simulation, ad nauseum. Each of these simulations would require something like the energy equivalent to the size of our planet to run. Exactly where that

energy comes from and how it is possible to turn it into power to run a simulation is not explained nor is the fact that this particular form of AI would want to waste so much energy simulating a period in history but I guess these are minor details (left to the interested reader).

Given that a group of theoretical physicists believe we are just one of an infinite number of parallel universes then this might be consistent with Turchin's hypothesis. Each of these parallel universes could be a simulation starting from a different point in time and hence all at different stages in their own evolutions. Alternatively, they may have all be started from the same point in time but using different random number seeds. This would allow the AI that initiated them to calculate how likely it is that they exist (assuming their simulation model is a good representation of reality and has incorporated every relevant factor). Stewart Robinson has argued that a [simulation] model should be as simple as possible but as complex as necessary in his inaugural presentation at Loughborough University. The problem in this case though is knowing how complex it needs to be and how long it would need to be run to produce meaningful output.

Turchin's arguments are interesting but there does not seem to be any way of determining whether he is right so it would seem to have as much credibility as believing the universe was created by a superhuman. The interesting question is that if we are part of a simulation in this sense then do we have free will or are all our actions pre-programmed – can we change the random number generator, so to speak?

Something to ponder on when watching the umpteenth repeat of your favourite Christmas film on television over the festive season that will very soon be upon us!

For more about Turchin's theories see:
<http://ieet.org/index.php/IEET/print/11111>

Alexey Turchin is author of several books on Russian and numerous articles on the topics of existential risks and the Doomsday argument. Since 2010, he has worked at the Science for Longer Life Foundation. Now he is finishing the book "Immortality". He is one of the founders of Longevity Party, and the founder of Stop Existential Risks on Facebook.

PR (MY THUNDERBIRD IS GO) = 0.2

DAVID LANE HENLEY BUSINESS SCHOOL

'Thunderbirds' is back on television.

On Tracy Island five brothers, each with a mighty futuristic craft, wait to zoom from their secret Pacific Ocean base on rescue missions across the globe and into space. Thunderbird 1 arrives first and co-ordinates everything, Thunderbird 2 brings the equipment, Thunderbird 3 is the spacecraft and Thunderbird 4 the submarine. Orbiting Thunderbird 5 monitors Earth's transmissions for SOS calls. I saw it in the 1960s when it was first on – and adored it. I had the toys, the comics, the life-saving urge, even the uniform with the 'International Rescue' badge (I was six; let it go). I wanted to be there in 2065 with them; Scott, Virgil, Alan, Gordon and John, all elements of the masterplan of their firm but kindly father, Jeff, and Brains, the engineering genius. The puppetry was sometimes wobbly but the model work was first rate. A cherished memory of childhood.



Thunderbird 1 in action

It's back! Now called 'Thunderbirds Are Go' and made using animation. There are toys in the shops again. Best of all is the strong, brave female figure. Tin-Tin is now an action hero herself, joining the boys on missions and getting her own Thunderbird. It never occurred to me then but the original series had no female character zooming around in an awesome craft, nothing to inspire girls to do that sort of stuff. This has been corrected and I love that most of all.

Possibly I'm now talking too much about 'Thunderbirds'. Possibly. I was talking to a close friend and she was listening politely (probably quietly doing something more interesting in her head):

'You know which is my favourite Thunderbird, don't you?'
 'Yes' she replied firmly but after a tell-tale hesitation.
 'You don't know, do you?'
 'No. But I thought I had a chance of just guessing. It's one in four so a 75% chance of being wrong.'
 'Not very good odds.'

'No, perhaps not. But I was cornered and desperate.'
 'And you hadn't remembered there are five Thunderbirds?'
 'Er, no. So it's up to 80%.'
 'Well, that's only if you knew there were five and chose one randomly. I think it must be worse than that now because there's one that you definitely excluded'.

I was quite wrong.

Her Perspective. There are four options from which to choose randomly.

Pr (Friend chooses wrong Thunderbird) = $3/4 = 0.75$

My Perspective. There are five options from which my friend will choose randomly.

Pr (Friend chooses wrong Thunderbird) = $4/5 = 0.8$

But worse than either must be simply to exclude one of the five options, yes? Let's check.

Full Spectrum* Perspective. There are five options. One is excluded (though possible) and there is a random choice from the remainder.

Pr (Friend chooses wrong Thunderbird) =
 = Pr (Excluded Thunderbird was favourite) x Pr (Friend failed to choose this Thunderbird)
 + Pr (One of other four Thunderbirds was favourite) x Pr (Friend chooses wrong Thunderbird)
 = $(1/5) \times 1 + (4/5) \times (3/4)$
 = $0.2 + 0.6$
 = 0.8 again.

Not what I was expecting. It still doesn't feel right. However, I must bow to statistical rationality and adjust my intuition (especially as the result generalises – exercise for the reader).

I don't know which is worse, her not knowing my favourite Thunderbird, her not knowing there were five of them, or my incorrectly intuiting the probabilities. Probably the last. Or the fact that I will never fit in that International Rescue uniform again.

* If you get this reference then you are one of us.

CALLS FOR PRACTITIONER CASE STUDIES

The OR Society Simulation Workshop 2016 (SW16) will be held on 11 – 13 April 2016 at Ettington Chase Hotel, Stratford upon Avon, UK.



We now call for Practitioner Case Studies and Posters:

FULL PAPERS NOT REQUIRED - just a Title and Abstract

The **Practitioner Case Studies** serve as a multidisciplinary forum for industrial professionals to share what they have learned when modelling real world problems using simulation. The applications are open to all areas including manufacturing industries, service industries, healthcare, transportation, financial industries, tourism industries, among others.

Sessions consist of 30-minute presentations (including questions and answers) and presentations should focus on a specific problem where simulation was utilised to conduct an analysis and provide recommendations for potential solutions.

The intention of this session is for industrial professionals from the company or organisation where the simulation case study is conducted to present the case study.

Interested case study presenters should submit for consideration, a **title** and a **300 word maximum abstract**, to the Practitioners Case Study stream via www.theorsociety.com/SW16. The 300 word abstract should describe, at a minimum, the problem, the simulation methods used, the results, and the impact/benefits of the case study. Guidelines and Submission information can be found on the SW16 website under 'Papers, Posters and Submissions'. Those case studies selected for presentation will have their abstract appear in the final programme of SW16. Submission and consequent selection, implies that an author will register and pay to attend the conference.

Important Dates:

- Deadline for abstract submission, 15 January 2016
- Author notification, 31 January, 2016

For more details, please contact our programme chairs:

Anastasia.Anagnostou@brunel.ac.uk

Kathryn.Hoad@wbs.ac.uk

Martin.Kunc@wbs.ac.uk

Call for Posters:

Practitioners, researchers and PhD students in the field of simulation are invited to submit a poster to SW16. Submitting a poster provides an opportunity to showcase your simulation research or applied work throughout the entire conference. A poster session also allows delegates to briefly summarise their work, challenges in the use of simulation and their contribution.

Posters should summarise an applied simulation case study or a novel research project within the field of simulation. Contributions are welcome from all application domains and simulation techniques; e.g. Discrete-Event Simulation, System Dynamics, Agent Based Simulation etc. Authors are free to submit posters of work in progress.

Authors must submit for consideration, a title and a 150 word maximum abstract to the Posters stream via the Easy Chair link on the SW16 website. See 'Papers, Posters and Submissions' at www.theorsociety.com/SW16 Deadline: 15 January 2016. Submission implies that an author will register and pay to attend the conference. Authors are responsible for printing and bringing their own poster to the conference.

Please contact Anastasia Gogi at a.gogi@lboro.ac.uk for more details.

<OR>

We are grateful to the following organisations for their sponsorship of SW16. If you would like to sponsor this event, please contact hilary.wilkes@theorsociety.com





MOBILE WALLETS: THE NEW FRAUD FRONTIER

RYAN WILK DIRECTOR, NUDATA SECURITY

Mobile wallets are enjoying increasing adoption. Payments made via mobile devices in the United States are expected to total \$90 billion by 2017, a big jump from the \$12.8 billion spent in 2012, according to Forrester Research.



There are two different types of mobile payments. The first type works through contactless technologies such as Near Field Communication (NFC) built into mobile phones. In the case of contactless technologies, the payment traverses the merchant's POS system and the relevant payment-processing environment, not relying on the mobile carrier's network.

The second type of mobile payment is a mobile application (mobile wallet) that allows payment to be processed through the mobile carrier's network, as is the case with banks. A mobile wallet has several key components, including the ability to provision account information, payment origination and payment processing.

With the near-ubiquity of mobile devices, banks are under pressure to come out with their own mobile banking apps, but security fears abound.

Mobile concerns

Mobile apps currently hold many and varied credit card details, raising concerns about security. These valid concerns include loss of privacy, loss of security around financial transactions, data loss and the perception of insecurity. Legitimate applications passing user data to other applications or third parties in an unauthorised manner is gaining more attention in the public arena – as it should. In addition, a possible drawback to the mobile wallet and secure element solution is that a single pin unlocks all of the accounts stored in the wallet, resulting in much greater exposure.

Financial institutions that can ease security fears, offer money-saving incentives and promote widespread acceptance of mobile wallets may see more customers embrace them.

Behavioural Analytics: Putting Fraud in Context

But where to begin? With a company's bottom line, brand reputation and customer loyalty on the line, how can institutions secure payments via mobile wallets? They need to really trust the user behind the device by verifying the user based on behavior. Deploying advanced user behavioral analytics will allow the organisation to detect genuine good users more accurately and improve the customer experience. Tracking behavioural patterns lets you learn who the real user is behind the wallet, from the kind of device they use to even detecting behavioural anomalies over time. When it comes to fraud attempts, banks can leverage that same information to quickly spot bad actors attempting to cycle stolen card details.

How does behavioural analytics work? Behavioural analytics focuses on observed characteristics of who the user is, not just who they tell you they are. It continuously profiles users and accounts through their entire lifecycle across multiple channels, including: desktop and mobile Web and native apps. Continuously profiling users' behaviour empowers two key capabilities. First, it enables risk managers to detect and respond to risk sooner, reducing the chance of financial loss. Second, when the user does reach a transaction point, fraud managers have full context of all their previous actions and behaviour to make a better decision on the transaction.

To collect all these observed characteristics, non-PII networks analyse billions of transactions, including user behaviours, to create a store of anonymous identities that are categorised as good users and riskier users. These identities remain completely anonymous and adhere to stringent privacy laws. With this collection of identities, a bank is provided an early warning system that is able to

alert them when a user is behaving 'badly,' even if it is the first time the user is approaching one of their sites.

User behaviour analytics can help answer bigger questions, such as:

- How did the user behave previously when they logged in? Are they behaving the same now? In other words, is this the real user accessing this account?
- When the user is inputting data, is it similar to how they've interacted on the same mobile device before, or is it completely different?
- Is this 'user' creating a fraudulent mobile wallet with stolen account information?
- Is their behaviour repeated? Repeated behaviour yields important information. If the behaviour is the same every time they visit, perhaps we can say it's a good user, acting the same as always. But if it's the same behaviour that 1,000 users are all repeating, it could indicate that this behaviour is part of a crime ring that is creating bogus accounts with stolen credit card data. This could be a distributed, low velocity attack – the kind of attack that exposes you to massive amounts of loss.

Observing user behaviour in detail enables the best chance of beating fraud.

Fighting Fraud with Behavioural Insight

There are at least 20 mobile wallet systems currently in use, according to a study from the Carlisle & Gallagher Group. This expands the threat landscape significantly. The fact that The Which? team was able to purchase goods online with card details stolen from an NFC transaction suggests that contactless cards are not a solution to risk in and of themselves. Of course, preventing data lost in the first place would be the ideal, but we have to be realistic. Having more accurate detection at the point of sale or at the login would protect consumers, merchants and banks from fraud no matter how the credentials were attained.

Relying on a single layer of defence at a single point in the transaction chain is always going to end badly. Profiling across multiple channels, using analysis from billions of transactions, provides the insight needed to more accurately detect mobile wallet fraud. Behavioural analytics offer banks the insight they need in order to protect themselves and their customers from fraudulent activity.

<OR>

SEASONS GREETINGS

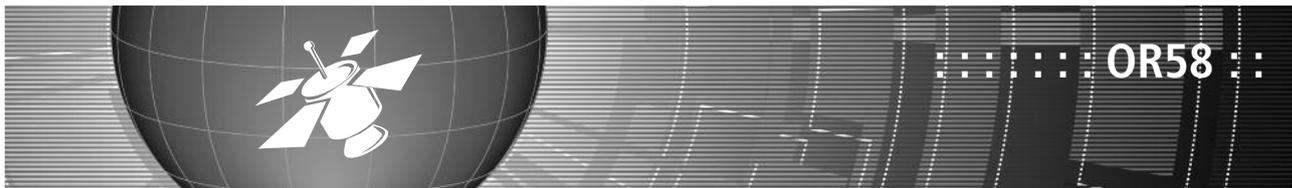
GAVIN BLACKETT, SECRETARY & GENERAL MANAGER

On behalf of the Staff and Officers of the Society, I'd like to wish all our members:

Merry Christmas & A Happy New Year



Please note that the office closes at noon on Thursday 24 December, and reopens at 8.30am on Monday 4 January 2016.



Diary Date

Here's a date for your new 2016 diary:

If you're an Academic, Practitioner, Researcher or Student with interests in any aspect of Operational Research, come and present your work at OR58.

OR58 Annual Conference

Tuesday 6 to Thursday 8

SEPTEMBER 2016

**At the University of Portsmouth, Winston Churchill Avenue,
Portsmouth. PO1 2UP**

Our OR58 Chairs, Djamila Ouelhadj (University of Portsmouth) and Alan Robinson (Dstl), and our OR58 committee, have already assembled an excellent number of streams and are awaiting your submissions!

All that's needed now is for you to go online and submit your title and abstract at www.theorsociety.com/OR58

OR58 ANNUAL CONFERENCE – Calling for Papers

University of Portsmouth, Winston Churchill Avenue. PO1 2UP
6 - 8 September 2016

Abstract Submission is OPEN at www.theorsociety.com/OR58

IN BRIEF - Planning for OR58 is underway and we now need to encourage a supply of interesting, informative and challenging papers. Academics, practitioners, researchers and students with interests in any aspect of Operational Research are invited to present their work at OR58. Prospective authors are welcome to discuss proposals for papers with the conference committee in advance of submission.

Each stream is encouraged to have a Keynote paper or an Extended Abstract. Such a paper is expected to present a state of the art review of an area and discuss future directions for research in the field. Keynote papers and Extended Abstracts will be highlighted in the Conference Programme. A full list of streams and further information and guidelines are available on the website.

Some Important Deadlines – which may be subject to change

30 May 2016	Deadline for submission of full Keynote Papers and Extended Abstracts.
20 June 2016	Notification of Acceptance to be sent re Keynote Papers and Extended Abstracts.
30 June 2016	Deadline for submission of Titles and Abstracts to appear in the programme.
30 June 2016	Deadline for submission of Keynote and Extended Abstract camera ready copy.
30 June 2016	Deadline for early reduced registration fee.

Meet the OR58 Conference Committee :

Djamila Ouelhadj, *Univ. of Portsmouth*

Alan Robinson, *Dstl*

Alessio Ishizaka, *Univ. of Portsmouth*

Toni Martinez-Sykora, *Univ. of Southampton*

James Bleach, *Dstl*

Banafsheh Khosravi, *Univ. of Portsmouth*

Tom Baldwin, *Polaris Consulting*

Hilary Wilkes, *The OR Society*

Conference Co-Chair

Conference Co-Chair

Programme Co-ordinator

Programme Co-ordinator

Keynote/Ext. Abstracts

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hilary.wilkes@theorsociety.com

We look forward to seeing you next September!

<OR>

EVENTS WORLDWIDE

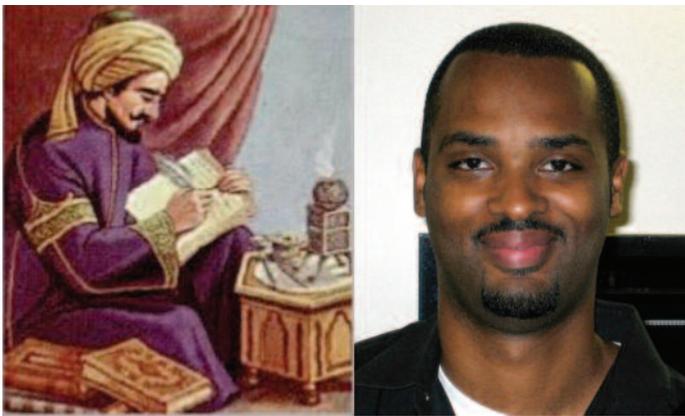
To see the full listing go to:

www.theorsociety.com/Pages/NonSociety/NSEvents.aspx

HOW SECURE IS YOUR DATA?

NIGEL CUMMINGS

In the ninth century, Baghdad was an important centre of the civilised world, and it was home to many talented scientists and mathematicians, the best of whom studied at Bayt al-Hikma, known in English as the House of Wisdom, a research academy that gathered manuscripts from around the world.



Al-Kindi and Seny Kamara

Many of these texts were in foreign languages, but some were also enciphered, so scholars working at Bayt al-Hikma had to decipher them. As a result they developed cryptanalytic techniques. An example of this was a man called al-Kindi, he was the first director of the Library and Translation Academy at the House of Wisdom, he is also credited as being the author of the oldest surviving document on cryptology.

His manuscript on Deciphering Cryptographic Messages carries within it many of the ideas that are still taught today in cryptography: the use of letter frequency statistics to unlock ciphers, for example. You count the number of times each letter/symbol appears in a cipher text and rank them. You do the same for a piece of text (of at least 500 words) written in the same language. In English, for instance, the most commonly used letter is E followed by T and A with Q and Z the least used. Using a combination of statistical information, intuition and informed guesses, it is usually possible to work out the original text.

Kamara along with co-researchers Muhammad Naveed from the University of Illinois and Charles Wright from Portland State University, have published a paper illustrating how they have extracted 'revealing medical information' from hospital databases using these 9th century techniques.

Searchable encrypted databases (EDBs) contain the medical records of individuals but stored in such a way that it should be impossible to identify those individuals without access to the encryption key. The data is made available to researchers to enable them to look for correlations and draw inferences, etc.

Seny Kamara has successfully employed al-Kindi's decryption techniques to files encrypted in the form of CryptDB, which was

created by MIT scientists in 2011. CryptDB, has been used to 'inform' the designers of some major initiatives, which include Google's Encrypted BigQuery and SAP's SEED database services.

Kamara and his fellow researchers started by downloading real patient data from 200 U.S. hospitals, taken from the National Inpatient Sample (NIS) database of the Healthcare Cost and Utilisation Project (HCUP), which anyone can acquire by paying out. They then set about determining if their 'inference attacks', where leaked data is combined with publicly available information to infer the plain text, would work against the kinds of encryption used by CryptDB.

They targeted two types of the 'property preserving elements' of CryptoDB. First was the order preserving encryption (OPE) scheme, which encrypts a set of messages in such a way that their ciphertexts reveal the order of the messages. Second was the deterministic encryption (DTE) scheme, which reveals whether scrambled data types are equal or not.

Comparing the NIS database with two freely-available auxiliary datasets, they were able to uncover the correct mortality risk and patient death attributes for 100% of patients in at least 99% of the 200 largest hospitals included in the HCUP data. They also recovered the disease severity for 100% of the patients for at least 51% of the same hospitals.

This suggests that the state-of-the-art encryption methods have advanced but very little in 1200 years.

More at:

<http://www.forbes.com/sites/thomasbrewster/2015/09/03/microsoft-dumb-attacks-cracks-next-gen-cryptography/>

<OR>

'Searchable encrypted databases (EDBs) contain the medical records of individuals but stored in such a way that it should be impossible to identify those individuals without access to the encryption key.'



MY FIRST PROJECTS

PROFESSOR JOHN STRINGER

I stumbled across O.R. in the course of my work on energy efficiency at the British Iron and Steel Research Association (BISRA) whose Director, Sir Charles Goodeve, was a keen proponent of extending O.R. beyond its wartime military origins¹.

So, when a job at London Transport was advertised at an attractive salary, I was one of the many who applied. Points in my favour were that I knew (roughly) what O.R. was, and I had the same Cambridge degree as a well-regarded senior officer, David McKenna. (The similarity ended there - *his* father had been Chancellor of the Exchequer!) I was appointed by the Chief Research and Development Officer, F A A (Fred) Menzler, a distinguished actuary who had joined in the mid-1930s to advise on financial aspects of the major expansions of the Underground system then being planned². Incidentally, he was more highly paid than the board members. His take on O.R. was that absence of the profit motive in a nationalised industry made it essential.

I had no staff, but could borrow from the Statistics group, and could draw upon large numbers of inspectors to make observations. I reported to the Research and Development Committee, consisting of the mechanical, civil, and electrical Chief Engineers, chaired by Menzler. Problems for study came from them or from the operating managers.

In the early days these involved observations of the effect on passenger movement of design features of the several types of buses and trains then in service, work which contributed to the design of the Routemaster, for example. The new science of Ergonomics – design of work spaces - looked useful and at the invitation of Sir Frederick Bartlett, Professor of Psychology at Cambridge, I spent six weeks studying in his laboratory.

Energy consumption was another important subject. A T Wilford, the Chief Chemist, had made useful savings by the introduction of low-viscosity engine lubricants and studies were proposed of the widespread belief that a more relaxed driving style could save a lot. This led to a three-week programme of tests at the proving ground of the Motor Industry Research Association. Four buses were driven round the circuit, stopping at given intervals and the fuel consumption measured. The conclusion was that with frequent stops it is better to accelerate rapidly to a modest speed than to accelerate more slowly and have to reach a higher maximum to meet the schedule. The data from these experiments, along with data about the frequency of stops for traffic hold-ups, enabled a calculation that the actual fuel consumption of the fleet was within 2 per cent of the minimum possible.

Electricity consumption of trains was also studied when it was proposed to revert to the pre-war practice of running shorter trains in the off-peak hours in expectation of an energy saving proportional to the reduction in car-miles. An experiment showed this was not the case. The reason, of course, is that a tube train in a tunnel is like a piston in a cylinder so that the same amount of air has to be displaced whatever the length of the train.

The signalling system implicitly assumes that, if a train is present in a block, it is stationary, and that the succeeding train would have to brake from full speed. A proposal was made to develop speed-controlled signalling in which, as with road traffic, the safe distance between successive vehicles depends on how fast they are going. According to the signal engineer's calculations this would increase the line capacity from 40 trains per hour (tph) to 42. However the most ever achieved in practice was 34 tph. An experiment was run on the Bakerloo in which station stops were held at 30 seconds, as the calculations assumed, and 20 trains were fed in from each of the two branches merging at Baker Street. Only 34 trains arrived in the hour at Elephant & Castle, and a queue built up. Further observation showed that this was because drivers tend to slow down some distance from the end of the platform and creep forward carefully to arrive at the stop. This observation led to the new Victoria line's trains being equipped with automated braking and acceleration.

'Why do buses come in bunches, and what can be done about it?' was another issue. A typical observation found a bunch of two in early morning had grown to 14 by the end of the morning. Obviously the bus at the head of a bunch spends more time boarding and loading than those behind, and they do not overtake. Also, the closer the buses are, the more likely they are to meet the same traffic delays. Inspectors tried to deal with it by holding back buses running ahead of schedule, but this was about *punctuality* and the problem was *regularity*. The solution was to use the average time a passenger at a bus stop would have to wait for the next bus to arrive (AWT) as the measure of regularity :-

$AWT = \frac{\sum h^2}{2 \sum h}$ where h is the headway between successive buses³

HUGH MURRAY 1919-2015: AN APPRECIATION

JOHN FRIEND NOVEMBER 2015

Not many people in today's O.R. world will recognise the name of Hugh Murray, who died on 9th October 2015 at the grand age of 96. Yet over a long career he introduced into the practice of O.R. in the UK many insights from the social sciences, and from social psychology in particular.

Hugh was a founder member of the Association which set up in London the Tavistock Institute of Human Relations in 1948. He went on to serve as a member of its scientific staff continuously from 1955 until his retirement in 1989. Born in County Durham in 1919, his professional career began before the Second World War, when he gained an eclectic BSc from Sheffield University in geography, chemistry and educational psychology. During that period he also developed a passion for rock climbing on the nearby crags of Stanage Edge. On the outbreak of war, he was commissioned as a psychologist in the rank of Major and carried out research and development in personnel selection, training and civil resettlement. There followed a spell in the civil service from 1952 to 1955, as a senior psychologist in the Army Operational Research Group, on which he drew for his London university doctorate on *An operational research study of a military training system*.

During his long career in the Tavistock, Hugh made a range of contributions to the Institute's applied research programmes, starting with his involvement alongside Eric Trist and others in the team which carried out a pioneering socio-technical analysis of self-organising systems in the Yorkshire coal mines. Their seminal study of the longwall method resulted in an influential book *Organizational Choice*¹, co-written by Hugh with Eric Trist, Gurth Higgin and Alec Pollock. As a leading member of the Institute's Human Resources Committee, he provided close support to Eric Trist and Neil Jessop of the UK's OR Society in the negotiations that resulted in 1963 in the formation within the Tavistock matrix of an *Institute for Operational Research [IOR]*, dedicated to the joint application of O.R. and social science methods to important fields of public policy.

Hugh was the first member of staff to welcome me when I arrived in Coventry in 1964 as a young operational researcher to work on a four-year Nuffield Foundation project on *Policy Research for Local Government*, which was later to provide a foundation for IOR's wider programme of action research on public planning processes. Before my arrival, Hugh's social skills had already enabled him to learn much about the power structures of the city council through informal chats with leading elected members and officers; and this paved the way for the unique access to the Council's informal decision processes that was offered to me and my anthropologist colleague, Paul Spencer. Soon after that, Hugh became drawn into an influential programme of IOR work on the regional dispersal of civil service policy divisions, in partnership with the government's then embryonic O.R. service.

'... knowingly or otherwise, many of us in O.R. continue to benefit from our exposure to Hugh's wisdom, warmth and wit over the course of his long and quietly influential career.'

Hugh then played a leading role in an internal merger in 1973 between IOR and a group of senior staff of the Tavi's Human Resource Centre. Twelve years later, after a long period of retrenchment in government research funding, he became the doyen of our small group of remaining staff who agreed to a dissolution of this unit within a smaller and more integrated Tavistock management structure. By this time, many of our younger recruits had migrated either to academia or to more conventional consulting groups – several of them continuing to spread IOR's innovations in practice and theory in other parts of the world.

When Eric Trist's declining health led him to seek a collaborator to help him in editing his magisterial Tavistock Anthology entitled *The Social Engagement of Social Science*, it was to Hugh Murray that he turned². Hugh's surviving son Alan has reported that his father's final years were overshadowed by the onset of Alzheimer's. Yet, knowingly or otherwise, many of us in O.R. continue to benefit from our exposure to Hugh's wisdom, warmth and wit over the course of his long and quietly influential career.

¹ Trist EL, Higgin GW, Murray H and Pollock AB: *Organizational Choice: capabilities of groups at the coal face under changing technologies: the loss, rediscovery and transformation of a work tradition*. London: Tavistock Publication 1963. Reissued 1987 New York: Garland.

² Trist EL and Murray H (eds.). *The Social Engagement of Social Science: a Tavistock Anthology. Volume I: the socio-psychological perspective (1990); Volume II: the socio-technical perspective (1993); Volume III: the socio ecological perspective (1997)*. Philadelphia: the University of Pennsylvania Press.

OBITUARY – CATHERINE BENFIELD, 1963-2015

NIGEL CUMMINGS

We are sorry to announce the death of Catherine Benfield, who was noted as a key figure in our modern day education information landscape.



Catherine Benfield was born in Walsall on 16th August 1963 and educated at Queen Mary's High School. She went on to attain a BSc in combined studies at Nene College in Northampton (1981-84) and then an MSc in Management Science and Operational Research at the University of Warwick (1984-85).

Catherine began her working life as a scientific officer for the Department of the Environment (1985-86) and the Department of Education and Science (1986-90) before joining London Electricity as a senior project analyst (1990-91).

Following on from the London Electricity appointment Catherine moved into the higher education sector to run a small statistics team at the Committee of Vice-Chancellors and Principals (1991-97). She formed part of a group that lobbied for the creation of an organisation that would bring greater coherence to higher education statistics across the divide between universities and polytechnics.

When the divide was abolished the Higher Education Statistics Agency was established in 1993 as the central source for the collection and dissemination of statistics about publically funded UK higher education. Catherine became its first company secretary before taking up a full-time position as Head of Research and Development in 1997 and Head of Business Development in 2011 before retiring in 2014. During this time, she also took a year's sabbatical to work with government and schools in Uganda on collection and utilisation of data.

Her roles at HESA made full use of her skills in diplomacy, since she was caught between an ever-increasing demand for complex and detailed data and the pressures that this placed on universities. According to Andy Youell, Director of the Higher Education Data and Information Improvement Programme, Ms Benfield 'worked on a very human level, both in terms of the way she managed complex, technical negotiations and her passion for developing the people who worked with her'.

Diagnosed with a brain tumour shortly after she left HESA to go freelance in 2014, Catherine Benfield died on 13 August 2015. A keen hill walker and gardener, she was also an Archers aficionado - the theme tune was played at her funeral during the final committal of her coffin.

Catherine Benfield, 1963-2015

<OR>

REGIONAL SOCIETIES

Contact details for all regional societies and meetings past and present are listed at:

<http://www.theorsociety.com/Pages/Regional/RegionalList.aspx>

REGIONAL SOCIETIES

LONDON & SOUTH EAST (LASE OR S)

CONTACT:

Sandra Weddell

TEL: 020 7918 4591,

EMAIL: Sandra.Weddell@tube.tfl.gov.uk

or Martin Caunt

TEL: 020 7215 3317,

EMAIL: Martin.Caunt@dti.gsi.gov.uk

Christmas Quiz upstairs at the Watling

Date/Time: Monday 7th December, 6.00pm (for 7pm start)

LASEORS popular annual quiz night is back please sign up early, for this year's festive event. All profits from the event will go to charity. Teams should comprise 3 - 5 people. As last year's winners will be able to tell you there will be lots of exciting prizes etc.

There is limited space, so entries will be accepted until capacity is reached. The entry fee is still £40 per team this will include a buffet. Please send cheques payable to LASEORS, the team name, a contact phone number, email and name along with the expected number in your team, before 30th November to ensure a place. Post to Sandra Weddell, Transport for London, 5G7, 5th Flr, Palestra, 197 Blackfriars Road, London, SE1H 8NJ

Location (unless otherwise specified): In the upstairs bar of Ye Olde Watling, on the Corner of Bow Lane and Watling Street nearest stations are Mansion House (Bow Lane exit) and Bank (exit 8) for tube, or Cannon Street and City Thameslink for rail. The event is open to all and with a free buffet of sandwiches available afterwards.

For further details contact:

Sandra Weddell Tel: 020 3054 8693,

Email: Sandra.Weddell@tube.tfl.gov.uk

MIDLAND (MORS)

CONTACT: Jen East (Secretary)

EMAIL: MidlandsORSociety@live.co.uk

O.R. on the NHS front line – experience of being embedded with Great Ormond Street intensive care units

Date/Time: Wednesday, 16 December 2015 18.00-19.00

Venue: G8, Main Building, Aston University, Aston Triangle, B4 7ET

Speakers: Christina Pagel, UCL

Non-members welcome, no charge is made. After the talk, you are welcome to join us and the speaker for a meal. For further information please contact MidlandsORSociety@live.co.uk

Refreshments will be available from 5:30pm.

Directions: Aston is a short, flat 15 minutes walk away from New Street Station, through the main shopping areas of the city along Corporation Street. Directions to Aston can be found

at <http://www1.aston.ac.uk/about/directions/> go to entrance marked E In the campus map (<http://www.aston.ac.uk/about/directions/>) and follow the signs.

Abstract to follow

SOUTH WALES (SWORDS)

CONTACT: Julie Vile (Chair)

EMAIL: julievile1@gmail.com

From control rooms to common rooms: how O.R. found its way into Universities

Date/Time: Wednesday November 25th 17:30-19:00

Venue: School of Mathematics, Cardiff University

Speaker: Dr Graham Rand (Lancaster University)

This talk will trace aspects of the history of O.R. from the control rooms of WWII to common rooms of Universities. The focus will be on the UK, with a particular emphasis on the setting up of the first Department of O.R. at Lancaster and what happened in Wales. In addition, interesting contrasts with the developments in the States, both as to timing and the nature of the curricula will be noted. It is expected that the talk will be illustrated with audio-visual material, including extracts from prime-time BBC TV in the early 1960s.

Drinks will be available from 5.30pm with the seminar starting at 5.45pm in room M/0.40. For details or directions please contact Jonathan Thompson (thompsonjm1@cardiff.ac.uk)

'Flying Tonight?' - Christmas Seminar and Quiz

Date/Time: Tuesday, 08 December 2015 17.45-19.00

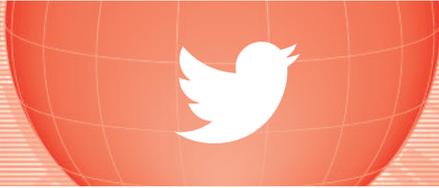
Venue: Cardiff University School of Mathematics

Speaker: John Crocker

The Christmas seminar this year will be given by John Crocker. Following this we will share a meal together while enjoying the annual quiz.

'Flying Tonight?'

In 2009 I was asked to look at the problems a certain low cost carrier (airline) was having in achieving its timetable. The airline operated 178 aircraft - A320s and B737s - out of 108 airports. There was typically 1040 scheduled flights per day with flight times ranging from half an hour to over five hours. The main problem was that the airline was failing to meet its targets of number of flights on time and numbers of flights flown - too many flights were taking off late and too many were being cancelled. What they were looking for was a dynamic rescheduling system which would switch aircraft between routes to reduce the overall number of delayed flights subject to numerous restrictions and regulations.



SOCIAL MEDIA MONTHLY FAVOURITES



What's hot on Twitter from @TheORSociety community of 1,755 followers...

<p>Social&HumanSciences @UoS_FSHS Congrats Maths MSc Operational Research graduate on @TheORSociety award for @RNLI lifeboat efficiency dissertation socsi.in/FZxcd?</p>	<p>Miles Weaver @Weavermiles @TheORSociety "O wad some power the giftie gie us, To see oursels as ithers see us!" (Robert Burns). #ThisisOR #SSM wp.me/p5rDO4-1m</p>	<p>Andy Harrison @baldie_andy I had a fantastic day yesterday, at Emmaus Mossley, thanks to Don and Ali. The start of a Pro Bono project. @TheORSociety @EmmausUK</p>
<p>Amy Shackleton @quartzbrained @TheORSociety JORS editors have hand picked these articles for #informs2015 delegates - read them for FREE: palgrave-journals.com/jors/collectio... @INFORMS</p>		<p>YHORG @ORS_YHORG Next Meeting. Tue 24 Nov 2015 17:30. Leeds. Panel discussion + talk on Systems Thinking by David Lane. @TheORSociety ow.ly/U0SbI</p>
<p>Felicity McLeister @FMcLeister New blog 'Where are the O.R. professionals hiding?' ow.ly/TcKet #ORblog @TheORSociety</p>	<p>Avnet TS-Global @AvnetTSGlobal #BigData infrastructure spending will grow at a 21.7% CAGR over the next five years via @IDC ow.ly/UG9fo</p>	<p>Jez Cope @jezcope .@drvinceknight bringing software sustainability to Operational Research, a field which gave us the Duckworth-Lewis method. #SSIBattleRoyale</p>

Who the OR Society is following on twitter:

 <p>Jennie Phelps @Jenster2008 I work @TheORSociety as a Senior Accounts Administrator and Training Co-ordinator views expressed are my own.</p>	 <p>Miles Weaver @Weavermiles Lecturer in #SCM & #RespBiz Convenor of award-winning #GetonBoard initiative #KTP: Connecting & aligning #CSR & societal goals in Scotland</p>
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The OR Society on LinkedIn: join the 3,573 members who do so ...

 <p>Jane Parkin Associate Faculty at Leeds University Business School Jane notes a "Great YHORG meeting on Simulation in healthcare". Already receiving six likes from Louise, James, Aritad, Frances, Louise & Erfan. Led by Claire Cordeaux, Director for Health and Social Care at Simul8. You can see Claire slides together with a model of long-term conditions at: http://www.simul8healthcare.com/YHORG. Jane suggests you should have a look and play with it!</p>
 <p>Afshin Mansouri Reader in Operations and Supply Chain Management at Brunel University Afshin posts his recent work. <i>He would be delighted to obtain your feedback on LinkedIn?</i></p>
<p>Green Scheduling of Manufacturing Operations (EJOR): http://www.sciencedirect.com/science/article/pii/S0377221715008206 & Humanitarian Logistics Network Design in Preparation for Earthquake (EJOR) including a real case study in Tehran: http://www.sciencedirect.com/science/article/pii/S0377221715008152</p>

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4 December 2015
 Rolls Royce, Derby

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CHRISTMAS 2015

LOUISE MAYNARD-ATEM, CORDA

I'm not quite sure where 2015 has disappeared to but by the time you read this we'll be in, or very close to, December. It's been a very eventful year in lots of aspects, and in terms of these articles, I've covered a range of topics ranging from the May General Election, to social media analytics, to examples of using survival analysis.

This month I thought I'd try and give the article a little festive cheer; I'll be looking at how we can measure the impact and value of Christmas advertising campaigns.

Please don't hesitate to get in touch with me if you have any thoughts on this month's article or if you have any thoughts on what you'd like to see in this section in the coming months; I'm available on the usual email address (lmaynardatem@live.co.uk) or you can tweet me @LMAtem.

Christmas Advertising – What's the impact & where's the value?

I don't know about you, but my countdown to Christmas begins when two things have happened:

- The Christmas lights have been switched on in London
- TV is filled with various Christmas adverts, I mean you all know which soft drink brand I'm referring to when I say 'Holidays are coming'.

It's currently November 6th and this morning saw the release of the much anticipated John Lewis Christmas advert. I've just had a quick look on Twitter; #ManOnTheMoon is already trending, and there have been over 22,000 tweets about the trend already (the advert was only released five hours). A quick Google search tells me that the advert cost £1million to produce, with a further £6million spent on buying slots on television, the internet and in the press.

Every year, brands go to great lengths (and spend huge amounts) to create Christmas content that will engage with customers and encourage them to spend either in store or online; what I'm interested to understand is how the impact of the ads are measured and how that correlates to revenue.

Measuring Impact

We won't know the effect of this year's crop of festive ads until after all the Christmas mayhem has subsided, so this article will focus primarily on previous Christmas campaigns from John Lewis, Sainsbury's, and a number of other high street retailers.

Market research organisations such as TNS UK have used a number of different approaches to understand both the short and long term campaign effects including facial analysis, emotional analytics

software and surveys of members of the public. Figure 1 shows the results of public poll, who were each asked to name their favourite 2014 Christmas advert; as was the case in the previous year, John Lewis' Monty The Penguin ad was the favourite, followed by Sainsbury's remake of the WW1 Christmas Day truce.

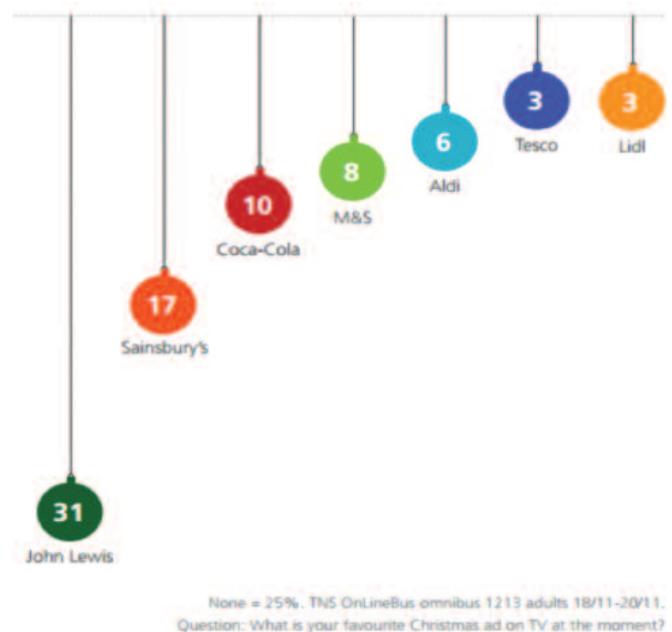


Figure 1: The UK's favourite Christmas Advert 2014 according to TNS UK, based on a sample size of 1213 adults¹.

YouGov carried out similar research, surveying a nationally representative group of adults on how likely they would be to shop at any of the mentioned retailers over the Christmas period, the results of which are shown in Figure 2. Overall, the findings of the YouGov surveys place the Sainsbury's Christmas advert at the top of the pile rather than John Lewis (both were liked in equal measure but when asked to pick a favourite, people tended to choose Sainsbury's), both in terms of popularity and likelihood to visit the store, however there were some very interesting insights including:

- The Waitrose advert was more effective in the South East of the UK.

- Those that liked the Marks & Spencer 'Magic & Sparkle' campaign and were likely to shop there over Christmas were more likely to be aged 35-54.
- The Debenhams advert was well targeted; those that liked the advert and were likely to shop there over Christmas were more likely to have children in their household.

So...is it worth it?

The performance of a brand at Christmas is linked to a large number of factors, and looking at sales over the Christmas quarter (and how they change year-on-year), does not necessarily tell us the full picture, however I certainly feel that Christmas advertising campaigns do contribute to this. Adverts are particularly effective in

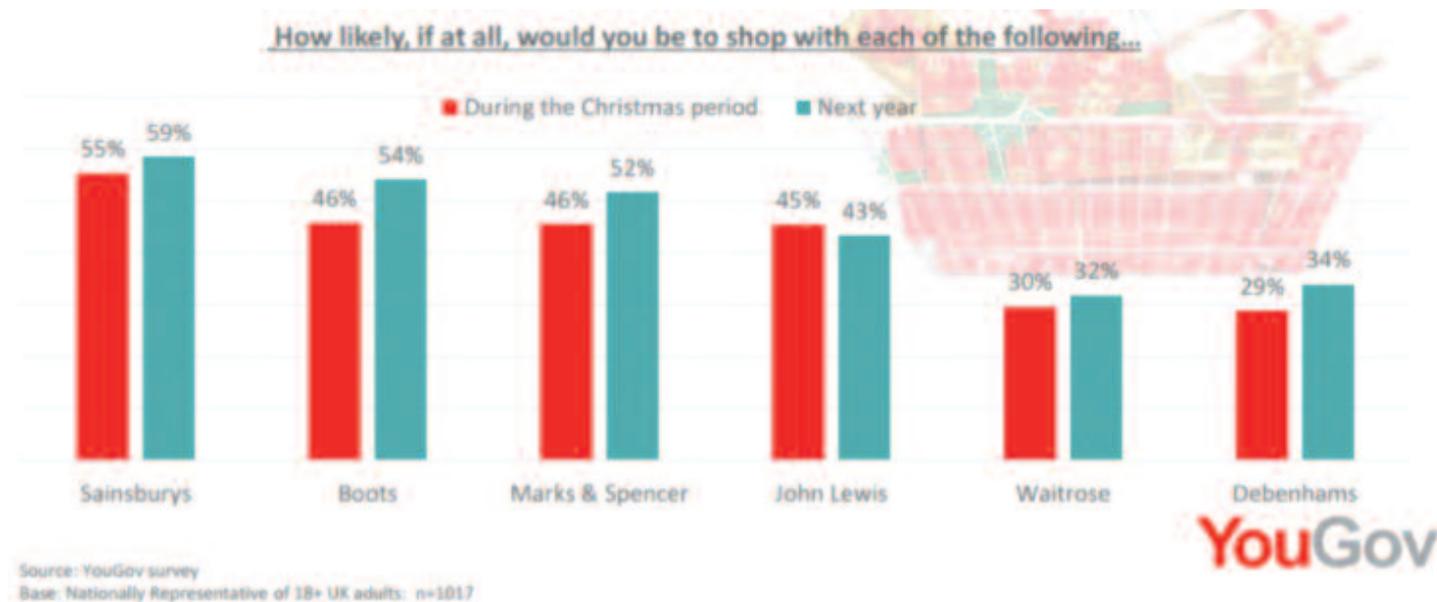


Figure 2: From the responses of those surveyed, Sainsburys was most likely to see the most shoppers through the door during the 2014 Christmas period².

Measuring Value

Return on investment (ROI) is probably the most appropriate quantitative measure for understanding the value that an advertising campaign can add as it is the ratio of net profits to costs. There are a number of ways to measure ROI depending on the goal of the campaign, Table 1 shows the ad spend for a number of 2014 Christmas campaigns alongside sales from the Christmas quarter 2014. It's interesting to note that John Lewis had the lowest ad spend and showed the only increase in sales compared to the same period in the previous year.

encouraging consumers to talk about their content, and consequently the brand, on social media; John Lewis are the perfect example of this, given they do minimal visual advertising throughout the rest of the year.

As well as sales and consumer engagement, the charitable aspects of Christmas advertising campaigns should not be forgotten. Last year the Sainsburys advert was produced in partnership with the Royal British Legion, and helped to raise funds for the organisation. This year, John Lewis are working to raise awareness of Age UK by encouraging staff and customers to join up with their local branch of the charity to care for elderly people who might otherwise be alone over the holidays, and profits from three products related to the ad campaign will go directly to the charity.

	Ad Spend (£million)	Comparison of like-for-like Sales, Christmas Quarter (%)
John Lewis	6.9	+4.8
Marks & Spencer	17.7	-2.7
Sainsburys	20.5	-1.7
Tesco	22.2	-4.2

Table 1: Christmas Ad Spend & Christmas Quarter Sales 2014

OR-30

December 1985

Most of the December issue of *JORS* was taken up with the proceedings of the 1985 Conference held in Durham. Although I attended this conference, all I can really remember about it was rowing on the Wear in glorious sunshine under the gaze of the magnificent cathedral.

Looking through the papers, there were four from my colleagues at Rolls-Royce Ltd (three from Derby and one from Bristol). David Templeman from Bristol talked about the directions for industrial O.R. groups. Unfortunately, it was not many years after this that Rolls-Royce (along with many other large organisations in the UK) decided it no longer needed in-house O.R. groups.

It is interesting to note the names of some of the companies represented at this conference (in no particular order): Cadbury Schweppes, Rowntree Mackintosh, Nestlé, Scicon, Reckitt and Colman, British Steel Corporation, British Gas, British Rail, National Coal Board, Thorn EMI, Lever Brothers, Unilever, ICI, British Airways, Rank Xerox, Arthur Anderson, Yard, Shell, National Westminster Bank. The conference was particularly well attended with 450 registered (around twice the usual number). There were also some very well-known names in the O.R. world: John Ranyard, Frank Lyness, Robert Dyson, Ruth Davies, Bob Miles, Richard Eglese, Nigel Meade, Graham Rand, Andrew Jardine, Alan Clementson, Chris Chapman, Colin Eden, Colin New, Bob O'Keefe, Ray Paul, Val Belton and Jim Bryant (apologies to those I have omitted).

One of the plenary speakers was the Bishop of Durham, who was, at that time, David Jenkins, a particularly outspoken and controversial member of the Anglican faith. One suspects that his presence was a major contributory factor in achieving such a high attendance.

There were twelve streams and 130 papers split almost exactly between practitioners and academics. Flexible manufacturing systems had recently become available and were providing O.R. groups with a fair amount of work. Another developing area was that of expert systems and artificial intelligence which was creating much excitement and, one has to say, hyperbole – many of the expectations of the time have still yet to be achieved.

Looking back over the year, 1985 was an exciting time to be in O.R. The advent of the affordable personal computer meant that for the first time O.R. groups and, indeed, many O.R. individuals had access to their own computers without having to rely on the often tyrannical computing departments. Models could be developed quickly and often run in front of the client displaying the results on the screen allowing for a much closer and more dynamic relationship to develop between analyst and client. It also heralded an era when the managers could start to do much of the analytical work for themselves sometimes using models built for them but often building their own.

<OR>

OR-20

December 1995

DEBATE

Manifesto for exciting O.R. or Not the Survival of O.R. Report

The O.R. profession has never faced so many exciting and challenging opportunities for contributing to improved decision making in society. To success all we have to do is harness the energies of our youthful membership in a broad programme of activities. We have new tools and techniques we can exploit, we have new problems to solve and we can pioneer the adoption of new information technologies. Underpinning these opportunities is an urgent need to better understand how decision making works in practice.

How decision making works in practice

OR Insight should invite contributions from experts in a broad range

of disciplines giving insights on how decision making works in practice. We should commission more research on decision making processes. We should educate graduates in O.R. on the work of key analysts of decision making. In British Airways over the years we have been particularly influenced by the work of Cyert & March in the 1960's (*A Behavioural Theory of the Firm*) by Daniel Isenberg in the *Harvard Business Review* in 1984 (*How Senior Managers Think*) and most recently the ideas of constructive conflict developed by Andreas Reinhold (LSE 1995).

Fantastic Opportunities & Challenges

On the tools and techniques front, IT processing power and the mountains of data we all have provide fantastic opportunities and challenges to present our data better. Animation and virtual reality need to become routine tools in the O.R. kit bag. I will give a prize for the best presented data in an O.R. paper published in 1996. By 'best' I mean most persuasive, innovative and imaginative. Let us resolve to go beyond mere line diagrams and bar charts. The O.R. Society should pioneer the use of groupware, video conferencing

and other techniques for improving communications. It should network its practitioners together and set up added value services. We should monitor parallel disciplines for emerging techniques. Case based reasoning in AI, for example, brilliantly maps on to Isenberg's ideas of decision making. It has to be one of the really exciting emerging techniques for O.R. to adopt. Others are constraint logic, formal creativity techniques, conflict resolution techniques and so on. The field of emerging tools and techniques has never been richer.

Modern society is also giving us major new challenges where O.R. can contribute and ought to be contributing. The ORS pioneered the brave step of setting up its community O.R. initiative and was richly rewarded. It now needs to turn its attention to the structural issues of society and the environment, to pollution, congestion,

competition for resources, conflict resolution, unemployment, leisure. And how about the challenges of an ageing population! The only choice is where to begin.

And then there is the revolution in IT O.R. has a great track record in being early adopters of new technologies and the world of IT offers many fantastic opportunities both now and for the foreseeable future.

The world has never been so exciting! Just put the sparkle back in O.R.!

By Keith Rapley, British Airways

<OR>

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On behalf of both external consulting and in-house analytics teams, we seek talented professionals at both junior and senior levels. These represent enviable opportunities for motivated achievers able to offer impressive academic credentials with proven data science success in sectors such as Consumer Products/Retail, Utilities, Financial Services, Transport or Government. Previous experience should include data exploration, data visualisation and data mining using such tools as SAS, SPSS, R, SQL, Python. **Central London**

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£35,000 - £50,000 + Bonus

Enviably opportunity to join the well established consultancy team within this leading logistics company which serves the fast moving consumer goods, industrial goods and retailing sectors. Working with major UK and international companies, you can expect involvement in activities such as transport analysis, supply chain mapping, network strategy and performance modelling. Whilst previous exposure to supply chain/logistics will be advantageous, the prime requirement is proven modelling and analytical problem solving skills. **M23 Corridor – Surrey/Berks/Hants**

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To c£40,000 + Bonus

Our client is an established boutique consultancy, offering particular expertise in data analysis, process mapping, forecasting, optimisation, simulation and related techniques, utilising tools such as Excel, VBA, Access, Tableau, Witness and Simul8. Significant growth in demand for their high calibre team of analytical professionals, is prompting the need for an additional consultant to take up a newly created role, representing a significant opportunity for a calibre individual, probably looking for their first or second career move. **West Midlands**

GRAD STARTER or EXPERIENCED
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Opportunities for talented achievers able to combine impressive academic credentials (to MSc or PhD level), with proven modelling/data science experience or potential, plus an aptitude for activities such as optimisation, forecasting, pricing analytics and revenue management. Specific experience of advanced statistical activities (Bayesian analysis), data visualisation (Tableau) and some/all of Matlab, R, Python and SQL or similar tools, would be highly advantageous. Excellent social integration skills and genuine commercial acumen are essential. **Central London**

eCOMMERCE INSIGHT MANAGER
To £48,000 + Benefits

Europe's largest specialist electrical and mobile communications retailer, focused on assisting customers to navigate technology purchasing, is looking to recruit a highly analytical manager on a Fixed Term 12 month contract basis to drive insight delivery; provide deep dive analysis and create robust statistical models; focused on web/traffic analytics, price/promotions and their customers' journey. Advanced numerical skills, insight provision and strong commercial retailing experience is required. **West London**

SIMULATION ANALYST
c£35,000 + Benefits

Due to a growing workload, our client, a specialist Plant and Manufacturing Simulation organisation, is looking to hire an OR professional with experience in applying Discrete Event Simulation to analyse and improve operations. The ideal candidate will have a first or second degree with an OR focus, 1-3 years' commercial experience and well developed communication skills. Knowledge of manufacturing or logistics would be desirable, but not essential. **Manchester**

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- Simulation
- Customer Relationship Management
- Revenue/Yield Management
- Marketing Analysis

SQL ANALYST
c£32,000 + Benefits

Our client has an established analytical team adept at extracting insight and opportunities from very large data sets (Big Data). Their clients are UK and internationally based and span many industries. Following significant successes, this team is growing rapidly and, accordingly, they have an opening for an OR Analyst. Key selection criteria would encompass: strong OR academics; demonstrable insight provision; 1-2 years' SQL ability plus and tangible experience of GIS. **London EC1**

OR ANALYST – WEB ANALYTICS
c£35,000

Very exciting opportunity to join a small, but thriving Web Analytics team of a well-established High Street brand. This newly created role requires an OR professional with 1-2 years' post-graduation data analytical ability from within a commercial context. Demonstrable knowledge of some or all of the following software (either from studies or industry) will be pre-requisites: SQL; Excel; Google Analytics; Adobe Site Catalyst (Omniure); R; Bing etc. **London W3**

INTERNAL ANALYTICS CONSULTANT
To c£65,000 DOE + Benefits

Exceptional opportunity to join new Internal Analytics Team providing best in class, in-house consultancy for a leading communications service company. You will play a key part in shaping this new division and have a potentially huge opportunity for personal development and business influence using your analytical expertise. Applicants are expected to be high achievers and offer between 2 – 8 years proven industry experience gained either in a management consultancy, niche consultancy or internal consultancy capacity. **City of London**

PRICING BUSINESS ANALYST
To £40,000 + Benefits

Europe's largest independently owned and highly respected Insurance intermediary have a strong actuarial team and are looking to complement it with the addition of more 'Business focused' Pricing Analysts. Successful candidates will have strong mathematical and statistical analysis skills, and thrive on more complex analytical challenges and are comfortable with ambiguity. Advanced Excel skills, exposure to SAS or a similar statistical package and a confidence in handling large volumes of data required. **City of London**

DEMAND PLANNER – SAS
To £37,000 + Benefits

Excellent opportunity for a Demand Planner/Analyst who is looking to broaden their skill set in a role that offers development and progression, and to make their mark in an established global company. The successful candidate will be of graduate calibre with proven experience in supply chain analysis, forecasting, demand planning, operational research or management science whilst having a solid understanding of statistical analysis. Prior knowledge of SAS would be preferable. **Gatwick**

BUSINESS MODELLER
To £42,000 DOE + Benefits

Our client is a leader in its field with an established history of applying Operational Research expertise to operational, tactical and strategic issues. As a consequence of continued significant project demands, there is an immediate need for a high calibre, experienced Business Modeller to provide commercial, analytical and problem solving expertise to the business, and maintain a complex suit of models to support business decision making. **Central London**

For an informal discussion in total confidence on any of these positions or the market in general, please contact: Teresa Cheeseman, Kate Fuller or Mark Chapman. Alternatively visit our website to view our current vacancies.