

YOUNG TO OR 20 BIENNIAL CONFERENCE
4-6 APRIL 2017

ABSTRACT LISTING
(in stream order alphabetically)

A Young OR Guide to...



Organiser: Matthew Mildred

04/04/2017 : 11:45 : Room Kingswood	Code: YOR20A2963
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KEYNOTE: Delivering Analysis for Decision Making - Are We Ready?

Dr Kuangyi Liu (*Astra Zeneca UK Limited*)

As we all know it, ORMS, or in the general term 'analysis' as many of us would refer to their colleagues and friends, are powerful for structuring and rationalising problems, and bringing insights to support decision making. This said, looking back past projects and around in many organisations, challenges remain on the application side of analytical tools. What are the aspects of delivering a great piece of analysis to your stakeholders? Based on pharmaceutical industry, this talk will first give an overview of pharma in general, i.e. what do the pharma companies do? What makes it different from other industries such as retail and consumer? A couple of examples will be addressed in terms of using ORMS tools in pharma. Meanwhile, let's not forget about the challenges – What are they? How will they play a role in delivering the analysis and make an impact in your organisation? As an OR person/analyst, how are we 'equipped' to meet the challenges and sell OR to our non-analytical colleagues/managers? The session aims at sharing some of the own experiences with the audience. However, it is not set to be a monologue - Interactions and discussions from the audience are invited.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

04/04/2017 : 13:30 : Room Kingswood	Code: YOR20A2947
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Social Media Analysis in OR: More than Just Reading Trump's Tweets

Mr Callum Staff (*Department for Education*)

Social media has established itself both as a go to form of communication for many, and as an online embodiment of a person or organisation – 'online you' disseminates the characteristics and personality of 'offline you'. With this establishment within society, social media has provided us with a plethora of new data to analyse, but have we, as Operational Researchers

fully capitalised on what it can offer us? This talk will argue that whilst we have definitely not taken full advantage of the new datasets we can obtain, the types of data that social media offers us and the sorts of analysis that can be done on it sit well within the Operational Researcher's suite of capabilities. The talk will first explore what social media is (and the fact that it's more than just following your friends and favourite celebrities on Twitter, Facebook and Instagram), what sorts of data we can extract from it, and what techniques can be used to obtain this data (challenging what it means to be an Operational Researcher in a world of Big Data and Data Scientists along the way!). It will then explore which traditional OR techniques lend themselves to social media analysis, and which techniques we might need to add to our armoury to take advantage of what social media can offer. However, the reason we do OR is to inform real world decisions, and so the talk will conclude by talking about how social media analysis can be integrated in to our current methods for supporting decision making and the ethics of utilising it – using some successful (and not so successful!) projects to provide real world examples.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

04/04/2017 : 14:00 : Room Kingswood

Code: YOR20A2982

What do I know? A Practitioners Viewpoint from The End of Early Career.

Mr Colin Kendall (*AWE*)

What's the difference between OA and OR? ... I'm an engineer how did I end up doing OR? ... none of my friends have ever even heard of it ... how do I explain what it is? ... I'm presenting to who?! ... how much money rests on my analysis!?! ...If I get this wrong could people get hurt? ... how do I find out the 95th percentile boot size of a British soldier? ... what on earth is a mega-trend-diffusion grey forecasting model?... should I care? Starting a career in OR can be confusing and overwhelming. As I approach the end of what the society generously refers to as early career there are many things I know now that I wish I had known at the start. Whilst many organisations have very good mentoring schemes and many of us benefit from being surrounded by experienced peers, there are things which I was too embarrassed to ask for fear of looking stupid. As analysts we never stop learning, there is always a new method or technique, a new problem to be solved or a new domain to conquer, one of the greatest revelations of my early career is that being a good analyst is simply knowing enough to know what you don't know! This presentation takes the form of a conversation with my former self and those beginning their careers. Not focussing on any specific techniques, but tackling some of the assumptions, fears and stigma's which can affect analysts at the start of their careers.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

04/04/2017 : 14:30 : Room Kingswood

Code: YOR20A2986

A YoungOR Guide to Health Economics: Are You a Health Economist in the Making?

Mr Matthew Mildred (*Boehringer Ingelheim*)

Operational Researchers share many of the same core skills as Health Economists, both of whom use similar techniques and methods in their day to day lives. If Operational Research

(OR) is defined as using analytical methods to help make better decisions, then Health Economics may be thought of as using analytical methods to help make better healthcare decisions. The aim of this talk is to introduce the field of Health Economics to OR students, researchers and practitioners, drawing parallels between the two fields and the decision problems that exist such as allocating scarce resources and decision making under uncertainty. We will look at how analytics, spreadsheet modelling, Markov Chain Monte Carlo (MCMC), and cost-effectiveness analysis is used to inform healthcare decision making and prescribing of a hypothetical treatment, drug Z, in the general population. Attendees will gain an understanding of how traditional OR techniques can be applied to promote the health and wellbeing of others, and how they can apply existing knowledge to new fields.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

05/04/2017 : 14:30 : Room Kingswood	Code: YOR20A2962
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A Young O.R. Guide to Pro Bono O.R.: Using Your Skills to Help Good Causes

Mr Jamie Douglas (*DWP*) and **Mrs Felicity McLeister** (*The OR Society*)

'Using your skills to help a good cause' Pro Bono O.R. has thrived since being launched in 2013. With 69 completed projects and 32 currently underway it provides numerous benefits to both the organisations involved and the volunteers. We've worked with charities ranging from small volunteer led charities to large national charities like Diabetes UK and Big Issue Foundation. A charities perspective: 'We've benefited hugely from your support in all areas of the project. You've enabled us to take a hugely professional approach to increasing the efficiency of our charity.' A volunteer's perspective: 'I felt a sense of contributing to an organisation which does good work for the community. I also was able to up-skill by applying different skills I don't currently use in my employment and have the freedom to solve the problem in my own way.' This session will provide details about Pro Bono O.R., give an overview of the experience from both a volunteer and organisational perspective, provide an example case study and give you information about how to get involved. Skilled volunteering is on the rise and Pro Bono O.R. gives O.R. practitioners and academics the opportunity to put their skills to good use. It is a win win situation. Find out how you can use your skills to help a good cause.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/04/2017 : 10:45 : Room Mandela	Code: YOR20A3026
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A Young to OR Guide to Becoming a Chartered Scientist

Ms Hannah Kowszun (*Science Council*)

As The OR Society has recently become a licensed professional body of the Science Council, gaining licence to award the Chartered Scientist register, this session will help Young to OR Scientists understand what it means to be a Chartered Scientist and how you can achieve it.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

Making a Real Difference with the O.R. in Schools Programme**Mrs Louise Allison** (*The OR Society*)

You could refine and develop your repertoire of skills by sharing your experience within the classroom. This workshop provides insight into one of the OR Society's key strategic projects: O.R. in Schools (ORiS), which promotes Operational Research to young people and their teachers in a bid to fulfil the Society's vision that "every school child knows what O.R. is". Explore the vital role of an ORiS Volunteer, how they are supported by the OR Society, and the benefits they enjoy. Find out how operational researchers from all backgrounds of experience across the UK are currently enthusing, inspiring, and motivating young people with demonstrations of and discussions about the applications of maths skills to solve real world problems and by opening their eyes to an array of career opportunities within O.R. Enjoy hands-on tasters of the most popular, interactive ORiS sessions and perhaps discover whether you have what it takes to make an impact upon the future of young people.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

Analytics



Organiser: Michael Mortenson

06/04/2017 : 11:15 : Room Kingswood

Code: YOR20A2979

The Uniformed Patroller Problem

Mr Stamatios Katsikas and Prof Steve Alpern (*The University of Warwick*)

In the recently introduced network patrolling game, an Attacker carries out an attack on a node of his choice, for a given number m of consecutive periods. The critical parameter m indicates the difficulty of the attack, or infiltration, at a given node. To thwart such an attack, the Patroller adopts a walk on the network, hoping to be at the attacked node during one of the attack periods. If this occurs, the attack is intercepted and the Patroller wins; otherwise the Attacker wins. In the original setting, the Attacker has no knowledge of the Patroller's location at any time. Here, to model the important alternative where the Patroller can be identified when he is at the Attacker's node (e.g. the Patroller wears a uniform), we allow the Attacker to initiate her attack after waiting for a chosen number d of consecutive periods in which the Patroller has been away. We solve this version of the game that is more favourable to the Attacker, for various networks: star, line, circle and a mixture. We restrict the Patroller to Markovian strategies, which cover the whole network.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

06/04/2017 : 11:45 : Room Kingswood

Code: YOR20A2994

KEYNOTE: THE BIG DATA GAME! A Simulated Exercise in Managerial Decision Making with Big Data

Mr Michael Mortenson, Ms Janet Law and Mr Christian Lerke (*University of Warwick*)

The challenges of Big Data have been studied extensively in respect to business uses, but less so (within the OR field at least) in respect to education and training. While many courses in "Analytics", "Data Science" and "Big Data" have been introduced, predominantly they focus on the technical skills required. As part of a new module in "Big Data Analytics & Visualisation", we have designed a novel simulation 'game' to be used which gives participants a rare opportunity to experience managerial decision making in the face of high velocity, varied, and volatile data streams. The talk explains the architecture of this software, as well as the novel approaches used, including a structural topic model correlated to sentiment analysis, geo-mapping visualisations and other analytical techniques.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/04/2017 : 13:30 : Room Kingswood

Code: YOR20A2981

How Do You Solve a Problem Like London? Complex Problem Simplification

Mr Mike Rowlands (*AWE*)

Modern cities are busy. Those built more recently, for example American cities, are often built with modern design in mind; neatly intersecting roads and simple cuboidal buildings are a dream for analysts, but how do you tackle a historic city like London? London has twisted streets, roads that skirt roman walls and buildings placed wherever they can fit. When faced with complicated problems analysts often need to simplify the problem in order to draw meaningful insight from complicated data. This presentation will discuss a novel analytical approach to problem simplification used by the presenter to simplify and analyse building data. The method reduces each building in the scene to a single shape factor, enabling even complex scenarios to be parameterised and graphed. Then a single meaningful graph may be used to quantitatively compare simple and complex geometries from which inferences can be made.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/04/2017 : 14:00 : Room Kingswood

Code: YOR20A2999

Net Benefits: Applications for Agent-Based Modelling in Ecommerce and Digital Marketing

Miss Athina Papayianni, and Mr Michael Mortenson (*University of Warwick*)

Agent-based models (ABM) has become an area of increasing growth and interest of recent years. However, to date, studies into its applications in the eCommerce and digital marketing domains has been an under-developed area. To help meet this gap, this talk will explore the potential uses of the technique. To illustrate this, a case study is presented of an application of ABM (as well as social network analysis and web mining techniques) to understand the spread of fashion trends through online blogs. Aside this, further areas of potential study are discussed.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Consultancy



Organisers: Thameesha Hipkin and Zoe Goodwin

04/04/2017 : 11:45 : Room Mandela

Code: YOR20A2988

Use of Operational Research Techniques to Improve A&E Performance

Miss Zoe Goodwin (*EY*) and Mrs Thameesha Hipkin (*EY*)

A&E performance is currently a critical issue in UK hospitals, with many hospitals reporting prolonged underperformance against the national NHS standards. With increasing financial pressures and levels of demand, it is important to make decisions based on reliable evidence. Data Analytics and Operational Research techniques can be used to aid these decisions and identify opportunities for improvement within A&E departments. This presentation focuses on projects for two NHS clients. A large London based Trust required support in developing a plan for reconfiguration of A&E services to improve patient experience and performance against the waiting time target of four hours. A tool was developed that used DES to simulate the flow of patients through the A&E department. The tool was built in a user-friendly manner and incorporated constraints such as:

- Physical capacity and staffing
- Flow of patients into inpatient wards
- Travel times within the A&E department

The tool allowed the client to test proposed reconfiguration options, such as staffing profiles and pathway changes, in a risk free environment. Evaluation and quantification of risks enabled the Trust to eliminate some of the plans and focus on those with the greatest improvement to four hour performance and patient experience. The second Trust was developing a programme of work across several areas, including urgent and emergency care. A dashboard was developed to allow them to quickly identify problem areas and bottlenecks in their A&E department. This helped investigate several key areas including:

- Key drivers of 4 hour performance trends
- Factors that differentiate a good and poor month for performance
- Trigger points which could predict a decline in performance
- Impact of pathway changes on performance
- Review of staffing rotas

Both techniques can be used in combination to help clients identify and subsequently improve existing problems in the performance of their A&E departments.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

04/04/2017 : 12:15 : Room Mandela

Code: YOR20A2945

A Mixed Optimisation and Simulation Approach to Increasing the Useful Life of Aging Aircraft Fleets

Mr Matthew Gibbon (*Aspire Consulting Limited*)

An aircraft platform may have multiple "Life Parameters" constraining their operational life, which are spent as the platform is operated. The tasking demanded of the platform may result in these life parameters being accrued at different rates, and so an aircraft can reach the end of its life in one parameter whilst excess life remains in other parameters. When considering a fleet of aircraft performing a range of duties it is therefore possible for the achieved utilisation across the fleet to significantly under-perform when compared against the expected life, and subsequently it may not be possible to achieve the desired tasking in late life. On the surface this can be considered as a fairly routine optimisation problem; however, when considering the complex feedback loops introduced by the reliability and maintainability characteristics of the aircraft, the performance of standard optimisation methods is limited. A mixed method approach, implementing optimisation routines into a simulation of fleet operation, maintenance and availability, has been developed by the Aspire team and applied to this case. This talk describes the optimisation approach, both as a generic algorithm and in its application to real-world aircraft fleets, along with expanding on potential applications, limitations, and future research questions.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

04/04/2017 : 13:30 : Room Mandela

Code: YOR20A2969

Benefit Tracking in IT Transformation Programmes – An Application for One of The World's Largest Banks.

Dr Huiling (Florence) Zhao (*Capgemini*)

In order to retain leadership position and remain competitive, a global bank implemented a 2-year world-wide IT transformation programme with multi-billion dollars' investment, a delivery team of over a thousand people, and overall impact on sixty thousand staff. There are three main areas of focus for IT transformation programme: Application Simplification, Resource Optimisation, and DevOps and Agile. The benefit tracking project was formed as part of the application simplification work-stream, a focus area that aims to simplify IT infrastructure by removing redundant applications, replacing out-dated applications, and optimising utilisation of retained applications. A great deal of resource and investment is required to deliver a project of this scale and thus tracking of benefits is critical, providing senior stakeholders with a clear view of return on investment at every level of granularity. A comprehensive financial model was built to predict and track the benefits of application simplification using a tailor made methodology designed to meet the specific requirements of the bank. Output and results from the model have been instrumental in allowing the global bank to understand weekly movements and forecasts in addition to quantifying the main risks and opportunities throughout the programme.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

04/04/2017 : 14:00 : Room Mandela

Code: YOR20A2993

New Methodologies to Exercise Government Emergency Response Plans

Dr Hu Barucki (*Dstl*)

The presentation describes a number of novel approaches which have been developed and used in Dstl to test the preparedness of response and communications plans in Government. These have involved simulating decision making and information flows, under pressure either in COBR (Cabinet Office Briefing Rooms) or in SAGE (the Scientific Advisory Group for Emergencies which provides science advice to support decision making in COBR) against a number of emergency scenarios. My talk will cover the design and application, some key insights from the exercise where they have been used, and the benefits and outcomes they have provided to wider Government customers and Stakeholders

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

04/04/2017 : 14:30 : Room Mandela

Code: YOR20A2984

KEYNOTE: Are Jobs Overrated? Disrupting the Future of Consulting

Mr Jan Chan (*EY*)

Media is talking about the automation of the work force and the impacts of AI. In this talk we will be looking to answer the following questions to help understand the future of OR consulting. • What impact will technology bring to the Labour market? • How will digital technologies transform companies? • How will this change the way consultants work? • Strategies in consultancies (e.g. more flexible employment, freelancer pools) • Where does this leave us?

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

Defence

Organiser: Fiona McCann

05/04/2017 : 14:30 : Room Mandela

Code: YOR20A2977

How Good is 'Good Enough': Complicating Factors of Expert Judgement Elicitation

Mr Colin Kendall (*AWE*)

Across all domains, operational analysts and researchers rely on the judgement of subject matter experts (SME) to validate assumptions, gather qualitative information and provide important insights and context to studies. This is particularly important in the defence and security domain, where it is uncommon for analysts to have first-hand experience of military operations or conflict. With limited analogies in the civilian world, effective elicitation of SME judgement is crucial, as is having an understanding of the reliability and accuracy of the information collected. In military or defence environments, SMEs may be wary of revealing or acknowledging weaknesses or shortfalls due to security fears, or fear of damaging their service's reputation. The pragmatic and resourceful nature of the military and defence community (where 'soldiering on' is common place), makes accurately assessing equipment and capability more complicated as "good enough" or "we make do" are common responses. Alongside these defence specific factors, other common pitfalls and complications in judgement elicitation such as unconscious bias, mistrust and SME opinion vs experience are discussed. This presentation will conclude with a number of methods and suggestions to overcome these common issues, to enable effective information gathering.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

05/04/2017 : 15:00 : Room Mandela

Code: YOR20A2978

Dyrect To The Future - Using a Demand and Supply Model to Inform the UK Defence Force Structure

Mr Tomas Westlake (*Dstl*)

The Defence Science and Technology Laboratory (Dstl) Force Structure Analysis (FSA) team provides evidence-based analysis and advice to support MOD senior decision-makers. The team utilises a range of OR tools and techniques to explore and refine the required size and shape of the UK Armed Forces needed to meet UK Defence Policy. FSA have developed a suite of tools to support MOD which includes a linear programme, cost analysis, and supply and demand models. This presentation will focus on the newest addition to that tool suite – the Dynamic Readiness and Concurrency Tool (Dyrect). Dyrect is a supply and demand model that creates a timeline of operations (demand) and models the ability of provided forces (supply) to meet those operations over time. The tool stochastically generates a user defined number of operations timelines (demand set) and assesses the capacity of a defined UK Armed Forces Structure to meet demands. This provides the ability to analyse the UK Armed Forces required to satisfy different UK Defence Policy ambitions. The presentation will cover: - An introduction to Dstl and the FSA team. - An overview of the FSA tool suite. - A review of the model Dyrect as follows: o The generation of demand sets to reflect UK Defence Policy; o The method for assigning the force structure to these demands; o Typical outputs from the model; and o The

use of bespoke R post processors to meet the challenges of analysing the large amount of output data.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/04/2017 : 10:45 : Room Kingswood

Code: YOR20A2992

When 2+2+2 is not 6: Modelling Aggregated Project Portfolio Risks in Defence

Mr Nick Rose (*Polaris Consulting*)

UK MOD has a strong requirement to use risk management across its enterprise. Risks to operational delivery, force generation, reputation, finances, and others are captured and managed at tactical and strategic levels. The strongest area of quantitative risk analysis is in DE&S, assessing and forecasting risk to acquisition projects. There is currently £11bn of risk costed into these projects over the next 10 years. But is that the same as saying DE&S is exposed to £11bn of risk? No, it isn't. I'll discuss the difference between risks at a project perspective, and the aggregation of those risks into programme and portfolio perspectives. I'll then suggest where, in alignment to the current and expected future Defence risk management processes, analysts can provide improved risk analysis products. I will compare improved methods for aggregating risk, and discuss heuristics for what risks should be considered in the scope of analysis at a portfolio level that were not at a project level (and vice versa).

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Energy and Water



Organiser: Ibrahim Tamimi

04/04/2017 : 14:00 : Room Maathai

Code: YOR20A2961

Quantifying The Benefits of Investment Portfolio Optimisation Versus Prioritisation for Asset Intensive Organisations

Mr Ibrahim Tamimi (*Copperleaf*)

Objectives Historically, many organisations have made investment decisions using a conventional ranking and prioritisation process. When prioritising, a fixed score is determined for each investment. This can be a measure of the investment's financial return (e.g. Net Present Value), or possibly a measure of the risk that the investment will mitigate (risk score). During prioritisation, the portfolio of investments is ranked by that fixed score, and then those investments that can be executed within the budgetary constraints are selected. Mathematical Optimisation using linear programming can improve on prioritisation results and achieve higher value outcomes whilst honouring multiple constraints (e.g. financial, resources, timing, inter-project dependencies, risk tolerances). This study seeks to quantify the difference in value obtained by using advanced optimisation techniques for asset investments planning. **Methods** The University of Southampton performed this study as a Student Project. Guidance and practical context is provided by Copperleaf. Actual investment data provided by various asset intensive organisations is used for this analysis. The researcher first constructed a methodology to generate representative portfolios of investments and simulate a traditional prioritisation scheme. These portfolios are then optimised using the Copperleaf C55 Asset Investment Planning and Management solution. Repeating the previous process, the obtained results is effectively a Monte Carlo simulation which is analysed to obtain generalised results on the difference between the various techniques. The study also considers various portfolio characteristics and their impact on the value, such as: - Number of investments within the portfolio - Using static scores or considering time-based risk and value - Allowing investments to have multiple alternatives (e.g. refurbish, replace) **Outcomes** Quantify the potential benefits of optimising asset investment planning for asset-intensive organisations. **Conclusions** Optimisation yields 6% to 20 % higher value than prioritisation depending on the level of complexity in the portfolio.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

Cross-Asset Optimisation Modelling of Risk of Large Asset Portfolios at Northern Powergrid
Mr Panagiotis Samartzis (*decisionLab Ltd*)

Northern Powergrid (NPg) is an electrical distribution company for the northeast part of the UK. Planning the maintenance of NPg's portfolio, which has more than 500k assets, has proven over the years to be quite challenging due to the dynamic and complex nature of their health condition, as well as their volume. In order to assist this process, NPg has collaborated with decisionLab to develop an innovative decision-support tool – the Asset Risk Model (ARM). ARM employs a number of OR techniques that assists NPg's asset managers to make optimised intervention decisions in order to reduce the risk associated with their asset portfolio. At the heart of the model, the health deterioration of the assets is calculated employing probability distributions. Then a mixture of flexible multiple threshold criteria as well as operational-based decision processing (termed “decision maps”) is implemented in order to identify the optimum interventions. The analysis is carried out for four different budgetary scenarios, providing increased flexibility to the user. The optimal plan is subsequently allocated to a year in the planning period. Furthermore, ARM enables the identification and allocation of interventions across multiple asset categories, even across the whole portfolio, in a consistent, robust yet computationally inexpensive way. Moreover, numerous features have been incorporated into ARM that greatly enhance the decision-making process. In particular, interventions can be planned on specific dates, the geographical proximity of intervention sites is taken into account and constraints are imposed on the allowed number of interventions per year to name but a few. Finally, a variety of output pages and regulatory reports in order to visualise the results of all investment strategies is produced by ARM. Hence, the monitoring of the process is ensured as well as the running of multiple what-if scenarios is facilitated, making it an iterative procedure.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Monetised Risk Trading in an Asset-Heavy Organisation**Mr Dougie Mackenzie** (*Capgemini Consulting*)

A monetised risk trading methodology helps asset-heavy organisations to understand their riskiest assets, and enables them to articulate this risk in a purely financial and equitable value. Gaining a holistic understanding of the risks to your assets we can enable organisations to make more informed and intelligent investment decisions. The Analytics team within Capgemini Consulting recently partnered with a specialist Asset Investment Planning consultancy firm called ICS Consulting to develop this methodology. We are creating models to enable us to quantify the risk on the network by considering the cost of repairing or replacing assets, the cost of a loss of gas supply to the network, the cost of potential regulatory fines, reputational damage, loss of life etc. – all combined with associated probability models and then compare it to the cost of reducing this risk by doing work. This will ultimately allow the client to choose between asset investment decisions where they could, for example, decide between reducing the risk by £2million at a cost of £500K against reducing the risk by £3million at a cost of £2million. A more informed decision can be made on this basis. The project

delivered a fully written-up methodology which we will submit to the regulator. We will also briefly talk about what it is like to work in the Business Analytics team at Capgemini Consulting.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

Guest Speakers

05/04/2017 : 15:45 : Room John Wesley LT

Code: YOR20A3017

Working with Clients – The Key Consultancy Skills?

Lawrence Phillips, *Emeritus Professor of Decision Sciences, Department of Management, LSE*

This session explains the three approaches to consultancy, explores Edgar Schein's 10 principles of process consultancy as applied to Operational Research and Decision Science, and presents the different forms of enquiry in working with a client. The session will provide opportunities for participants to apply these features of good consultancy practice.

06/04/2017 : 09:30 : Room

Code: YOR20A3015

Robust Optimization: Solving Practical Optimization Problems with Uncertain Data

Pietro Belotti, *(FICO)*

Practical optimization problems often come with uncertainty in their parameters. The uncertainty is due in some cases to inaccurate measurements, in other cases some parameters are unknown at the time of optimization. Often, this uncertainty can be limited to a well-specified uncertainty set. Robust optimization aims at solving these problems by ensuring that all scenarios in the uncertainty set are accounted for, and provides a solution that is proven to be feasible for any realization of the uncertain parameters.

This talk will introduce the robust optimization paradigm and shows the main algorithmic tools to solve a problem under uncertainty. It will then describe two real-world industrial applications where data is uncertain and show how robust optimization offered a practical solution in both cases. The first application is in Network design, where traffic demands are never known accurately. The second use case is in production planning at a major factory where power supply can be interrupted with short notice.

06/04/2017 : 09:30 : Room

Code: YOR20A3016

The power of nodes and arcs: How Bayesian Belief Networks can help you reason, predict and explain.

Sophie Carr, *(Bays Consulting Ltd)*

You may have heard of Bayes Theorem, but have you ever built a Bayesian Network? If not, come and learn about how Bayesian networks are being applied in areas from bioinformatics, analytics, sports science, insurance and marketing and how they could help you to in you explaining and predicting results. You don't need to code, nor have any knowledge of statistics. All that is needed is a spark of interest, a willingness to join in and a pencil to draw graphs. This practical one hour workshop will introduce you to the basic concepts involved in

building a Bayesian network with case studies from across the field of operational research. From the outset you'll be working with Bayes theorem, building your own network and through group exercises start to investigate the power of a Bayesian network to provide clear audit trails of decisions taken, update results as information arrives and explain results obtained.

Healthcare



Organiser: Thomas Stephenson

04/04/2017 : 11:45 : Room Luther

Code: YOR20A2967

Modelling Access to Primary Healthcare in the Australian Outback

Dr Lauren Petrie (*ORH*)

Operational Research in Health (ORH) is a management consultancy that supports resource planning in the public sector through use of quantitative OR techniques. ORH helps clients optimise performance and deploy resources in the most effective and efficient way. In Australia, where nearly 90% of the population is distributed over less than 4% of the land area, it is challenging to provide health care for the widely-spread remaining 10% of Australians. For the past three years, ORH has been providing consultancy services to The Royal Flying Doctor Service (RFDS) – an organisation supplying aeromedical services across rural and remote Australia. Most recently, ORH has developed a decision support model for RFDS strategic planning. This model enables visualisation of populations (including those demographics with the highest healthcare needs) within the “Remote” and “Very Remote” areas of Australia, and quantifies their coverage by clinics and other healthcare facilities. The model highlights gaps in provision of primary health care and suggests optimal locations for new facilities. A description of the model and a review of the project will be presented, along with an explanation of the complications that arose and how they were solved.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

04/04/2017 : 12:15 : Room Luther

Code: YOR20A2987

How Ethical is the Use of WTP in Developing Countries and What Alternatives Are There?

Miss Dagmar Andersen (*Strathclyde Business School*)

The survey technique Willingness to Pay (WTP), or Contingent Valuation (CV), has become increasingly utilised in developing countries, not least in the health field, but also in relation to energy, education and water. This method is employed in order to set prices, potentially to inform decisions about provision of services and to determine, for example, whether a product or service should be subsidised by the public sector. The literature identifies a number of ethical concerns which can arise in this context, such as: governing bodies being less strict, making it easier to gain ethical approval than in Europe and the US; issues relating to cross-cultural communication; and the risk of spreading confusion and misinformation. It can therefore be considered questionable to utilise the method in developing countries. Key questions are: is it appropriate to use the approach without adapting it to take account of these issues and, if not,

how can it be adapted? This presentation will provide an overview of these issues and outline my research which aims to investigate a feasible alternative approach which is more meaningful, accessible, and ethical. Multi-criteria Decision Analysis (MDCA) will be explored as a potential solution, along with other methods. The presentation will be a mix of theory and practice, mainly discussing what has been identified so far in the literature but also the planned practical application.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

04/04/2017 : 13:30 : Room Luther

Code: YOR20A2980

The Drivers Behind the Assessment of Health Technologies in the UK & Ireland; A Binary Decision Analysis

Miss Eleonora Skentzou (*Boehringer Ingelheim*)

Background: Health Technology Assessment (HTA) is the process through which national bodies evaluate drugs and other health technologies in terms of their clinical- and cost-effectiveness, in order to decide whether a particular technology should be available to patients. Pharmaceutical companies are required to submit clinical and cost data to show the value of their products. However, factors influencing this process are not always clear to manufacturers. Objectives: The aim of this project was to understand which factors, if any, affect the outcome of the HTA decision making process, by looking at a variety of diabetes drugs and the way these were evaluated by the four national bodies that exist in the UK & Ireland (i.e. NICE, SMC, AWMMSG and NCPE). Methods: A binary decision analysis using a logistic regression model was conducted to investigate decisions. The dependent variable was modelled as a decision that a particular drug should be made available in the NHS vs. a decision that it should not be made available. Independent variables included issues with the manufacturers' economic analyses, the impact of the health technology on the healthcare budget, data on side-effects, the internal validity of the clinical data, time analysis, the availability of a patient group submission and the price of each drug. Sensitivity analysis was also carried out to confirm the robustness of the results. Results: Fifty-six submissions, dated between 2002 and 2016, were investigated. The results showed that health technologies which have issues with their economic analyses and those that result in a higher budget impact have lower chances of being recommended for use in the NHS. Sensitivity analyses confirmed these results. Conclusion: Findings can potentially increase transparency over what is thought to be important by decision makers, and also reduce future delays, which could mean faster access to treatments for patients.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

04/04/2017 : 14:00 : Room Luther

Code: YOR20A2997

Exploring Data Visualisation Methods Using Large Anonymised Electronic Health Records: A Case Study Mapping Regional Prescribing Habits using SAS GMAP

Miss Alicia Gayle (*Boehringer Ingelheim*)

Aim: Disparities in prescribing patterns across communities are a central concern in public health and pharmacoepidemiology. Choropleth maps of area level prescribing trends can show the geographical distribution of variation in clinical practice. This study investigated and visualised predictors of prescribing one drug class over another among patients with Chronic Obstructive Pulmonary Disease (COPD) in the UK. Method: The approach uses SAS GMAP to highlight the difference in odds of prescribing one drug class over another. This retrospective descriptive cross-sectional study using data obtained from one of the largest providers of electronic health data, the Clinical Practice Research Datalink (CPRD), and described prescriptions for just approximately 30,000 patients with a new diagnosis of COPD between June 2005 and June 2015. A linear regression model was used to identify whether geographical differences were apparent, and then differences in prescribing habits were plotted by region. Results: After controlling for other factors geographical region and GP practice were confirmed as significant drivers in prescribing habits in our predictive model ($p < 0.0001$). Graphing the likelihood of drug prescribing visualised the disparities in clinical practice across the UK and highlighted areas in which clustering of similar behaviour may happen. Conclusions: While traditional use of SAS graphics in epidemiology are static and lacking real-time components, they illuminate the context of disease through graphing health inequalities and the relationship between where you live and the care you receive.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

05/04/2017 : 14:30 : Room Luther

Code: YOR20A2966

Health InequORlities and Innovative Medicines: Using the Same Analytical Techniques for Two very Different Areas

Miss Cat Prowse (*NHS England*)

The effective use of data is frequently identified as a vital key to success in the NHS. Data can be analysed across the breadth of the health service and often this is done using the same or similar techniques despite the data being for very different areas. This talk will explain the data analysis process for projects on both innovative medicines and tackling health inequalities, demonstrating what goes on behind the scenes at NHS England to help inform decision makers in the NHS. I will introduce some of the statistical concepts used as well as showing the final products and discussing what it actually means for those on the frontline of the health service. As a Student Analyst, I have also been using data to improve the recruitment process for student analytical placements in the Department of Health and NHS England so will touch on the data collection and subsequent analysis used here – this work is not the same as the techniques used above!

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

Supporting the Design of Radiotherapy Treatment Planning using Data Envelopment Analysis and Robust Optimisation

Miss Emma Stubington, Prof Matthias Ehrgott (*Lancaster University*) and **Prof Omid Nohadani** (*Northwestern University*)

Radiotherapy is a common treatment for cancer. Ionising radiation is used to control or kill cancerous cells. Although there has been rapid development in radiotherapy equipment in the past decades it has come at the cost of increased complexity in radiotherapy treatment plan design. Treatment planning involves interlinked optimisation problems to determine the optimal beam direction, radiation intensities, machine parameters etc. Complication arises from conflicting objectives; an ideal plan would maximise the radiation to the tumour whilst minimising radiation to healthy cells. However, minimising would result in no radiation and maximising would result in the death of healthy cells. Therefore, a compromise must be found. Currently this is done by comparing a plan to a set of clinical criteria. If a plan does not meet the criteria it must be re-optimised using trial and error. Here Data Envelopment analysis (DEA), a tool used to extract information about a population of observations, is used to assess the quality of individual plans. Each plan is compared against a database of existing achievable plans to determine those that could realistically be improved. In radiotherapy uncertainty can arise in many different ways such as patient alignment, algorithm limitations and measurement uncertainty. Robust Optimisation, simulation and expected Dose Volume Histograms are used to investigate the effects of treatment planning under the presence of uncertainty. Treatment plan metrics are obtained from patients from Preston Hospital. Initially prostate cancer patients' plans are used as it tends to be more straightforward than other cancer types due to the frequency and relative conformity in shape and location of the tumour. It is hoped that these methods can ultimately be expanded to all cancer types.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

Logistics and Transport



Organiser: Djamila Ouelhadj

05/04/2017 : 15:00 : Room Maathai

Code: YOR20A2964

Case study: Optimisation and Simulation for Monthly Transport and Production Design in the Dairy Industry

Miss Victoria Forman (*Llamasoft*)

Dairy products have a short shelf life and in a country as large as Russia understanding the impact of production and transportation decisions on lead time and the potential for wastage is very important. You don't want to be in a situation that you move production to another plant and as a result increase wastage in the network and potentially impact the customer service level. We used a combination of optimisation and simulation to help us answer this question and understand these relationships. Firstly, using optimisation to define the optimal production location and frequency and the transportation method and frequency to the customer distribution centre. Then using simulation to test the new network under real world conditions to understand the potential impacts on waste and customer service. I will take you through the challenges we faced during the project along with the solutions and the outcomes.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

Operations Research for Sustainable Development



Organisers: Masoud Fakhimi and Anastasia Anagnostou

04/04/2017 : 11:45 : Room Maathai

Code: YOR20A2944

Optimisation of Agri-Food Supply Chain

Prof Silviya Vlah Jerić (*Faculty of Economics and Business Zagreb*) and **Dr Kristina Šorić** (*Zagreb School of Economics and Management*)

Sustainable agriculture implies efficient and humane use of inputs, among other things. Consumers play a critical role in creating a sustainable agri-food system, especially considering the fact that today they are getting more and more sensitive to nutritional quality of the food and also its origin, what reflects to their demand and consequently to the price variability. On the other hand, sustainable agriculture also entails consideration of farmers' goals and lifestyle choices. Farmers and producers have to realize the full benefits of the productivity gains made possible through alternative practices. Sustainable agriculture means also encouraging a diverse and decentralized system of family farms rather than corporate concentration. The challenge is to find a way to organize coalitions improving the food system. Supply chain models used in the management of fresh farming products tend to be more complicated than supply chain models applied with non-perishable products. To incorporate increased production standards for perishable food, producers need to review their use of inventory and move towards more integrated approaches. The case study that inspired this work originates from Istria, a Croatian region with 25 olive oil producers and about 5,000 mostly small farmers growing and harvesting olives. Much effort is being put into organizing and educating the local suppliers and producers to be more competitive and to keep their local originality. However, additional efforts should be made, especially at the operational level. To account for all the objectives of all of the agri-food supply chain participants, this work aims to set up a model for the integrated optimisation problem arising from the olive oil production in Croatia, give its mathematical formulation and suggest methods for solving the problem.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

A Dynamic Multi-Level Approach for Sustainable Development Analysis'

Dr Masoud Fakhimi (*University of Surrey*), **Dr Navonil Mustafee** (*University of Exeter*) and **Prof Lampros Stergioulas** (*University of Surrey*)

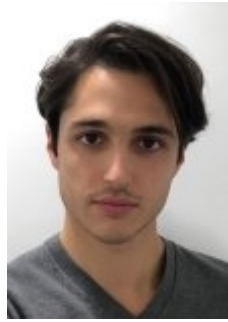
The policy demand for sustainable development (SDEV) is of rising importance in most spheres of public life and businesses, in particular, are in need of a systematic approach for its management and analysis. This may necessitate changes not only to processes integral to the business functions but also to organisational culture. The triple-bottom line (TBL) approach stresses the importance of achieving a balance between economic, environmental and social impact, and to this end computer modelling & simulation (M&S) enables us to evaluate these three, often competing, metrics. TBL-systems being complex, inter-dependent and having multiple system outputs, demand in their representation a combined modelling approach that leverages the precision of discrete event simulation (DES) models and the ability of holistic modeling methods such as Systems Dynamics (SD) to capture multiple perspectives and the effect of unquantifiable variables on the underlying system in the long term. The methodological contribution of the research is proposing a dynamic multi-level modelling approach for sustainable development analysis. The work contributes to original research in SDEV through its identification of a mixed method approach for modelling systems with competing goals.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Optimisation



Organisers: Kevis Pachos

06/04/2017 : 10:45 : Room Maathai

Code: YOR20A2950

A Heuristic Procedure to Solve the Integrated Personnel Staffing Problem and Multi-Mode Project Scheduling Problem

Mr Mick Van Den Eeckhout, Prof Broos Maenhout and Prof Mario Vanhoucke (*Ghent University*)

When scheduling projects under resource constraints, assumptions are typically made with respect to the resource availability and activities are planned each with its own duration and resource requirements. In resource scheduling important assumptions are made with respect to the staffing requirements. Both problems are typically solved in a sequential manner leading to a suboptimal outcome. We integrate these two interrelated scheduling problems to determine the optimal personnel budget that minimises the overall costs. In addition, resource demand flexibility is considered since an activity can be performed in multiple modes. An iterative meta-heuristic solution procedure was developed to solve this integrated multi-mode project scheduling and personnel staffing problem. This solution procedure combines a heuristic framework with optimal solution procedures. Furthermore dedicated iterative and global improvement heuristics are developed which are based on decomposition principles. Besides the decomposition rules used in the literature, new rules were developed that explicitly take the integrated problem definition into account. The algorithm is tested on data instances from a well know project scheduling library, the Project Scheduling Problem Library (PSPLIB). This research thus start from a theoretical point of view, but can also be applied in more practical environments. Most organisations and industries deal with projects where a set of activities or tasks need to be scheduled, which are carried out by a limited number of resources. Furthermore it is possible to incorporate company specific personnel staffing and scheduling policies. Using the instances of PSPLIB, our solution procedure was benchmarked against an optimal procedure, namely a branch-and-price. The results revealed that our newly developed procedure leads to fast, significant cost improvements.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Relevant

In Pursuit of More Accurate Project Forecasts: Integration of Earned Value Management with Exponential Smoothing and Reference Class Forecasting**Mr Jordy Batselier and Prof Mario Vanhoucke** (*Ghent University*)

Being able to accurately forecast costs and durations is essential for good decision-making in a project management context. Therefore, the methods for obtaining these forecasts should continuously be improved. The current study pursues this goal by extending the traditional earned value management (EVM) project control and forecasting methodology through integration of the exponential smoothing technique. This allows forecasts to be more strongly based on the more recent project performance, which often increases representativeness. A clear correspondence between the traditional approaches and the newly introduced method - called the XSM - is identified, which will facilitate future implementation. More specifically, only one smoothing parameter is needed to calculate the enhanced EVM performance factor. Moreover, this parameter can be dynamically adjusted during project progress based on information of past performance and/or anticipated management actions. Additionally, the reference class forecasting (RCF) technique can be incorporated into the XSM. RCF relies on the principle of deriving cost and time forecasts for a certain project from the actual performances of earlier similar projects that constitute a so-called reference class. The rationale behind this technique has been supported in previous work. Besides the theoretical contribution, this study also has an important practical value. More specifically, the novel methodology is assessed on an elaborate and qualitative database of real-life projects. Results from 23 of these projects show that, for both time and cost forecasting, the XSM exhibits a considerable overall performance improvement with respect to the most accurate project forecasting methods identified by earlier research, especially when incorporating the RCF concept.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Managing Options in Project Scheduling: Integrating the Temporal and Resource Analysis**Mr Jeroen Burgelman and Prof Mario Vanhoucke** (*Ghent University*)

Selecting the best activity execution mode from a selection of options that are available is of paramount importance in a multi-mode project scheduling environment. This decision only gains in importance if uncertainty about the best execution modes exists at the start of the project planning phase. Therefore, the methods that are used to obtain suitable options should be considered carefully. In this study we extend the multi-mode scheduling problem to allow multiple options for activity execution modes to be incorporated during the baseline schedule construction. We introduce an integrated approach that incorporates both the temporal and resource aspects of considering multiple options for the project activities. Contrary to existing approaches in the literature, we explicitly take the project deadline and limitations on renewable resource usage into account. This approach is implemented and evaluated using several state-of-art mathematical problem formulations. The benefits of this integrated approach are quantified based on the schedule quality of the obtained baseline schedule and the modelling efficiency that was achieved. Furthermore, our integrated approach can easily be adapted to incorporate novel information regarding the activity options during the project execution phase.

In addition to the methodological aspects of the study, managerial insights in the benefit of considering multiple options at the baseline schedule construction phase are derived. We apply the novel methodology on a large dataset available in the project scheduling literature. Results indicate that even with tight project deadlines and strict resource limits, the incorporation of multiple alternative options for key activities in the project schedule can increase the robustness of the baseline schedule and enhance the project execution subject to uncertainty when compared to existing approaches in the literature.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Somewhat

06/04/2017 : 12:15 : Room Maathai

Code: YOR20A2948

Setting Buffer Consumption Thresholds for Project Control

Ms Annelies Martens and Prof Mario Vanhoucke (*Ghent University*)

In this study, we propose a new approach to set threshold values for buffer consumption during project execution. Since Earned Value Management (EVM) is a widespread project monitoring methodology, the buffer consumption thresholds are translated into EVM schedule performance metrics. During project execution, the buffer consumption thresholds will generate early warning signals when the project deadline is expected to be exceeded. Hence, these threshold values aid the project manager in deciding whether corrective actions are required to get the project back on track. Traditionally, buffer consumption thresholds are either based on rules of thumb, or on more statistically advanced techniques. While the rule-of-thumb thresholds are easy to implement, they do not incorporate valuable information on the project characteristics. Accordingly, they are inadequately able to distinguish late projects from projects which finish on time. Further, statistical thresholds include information from historical data, which is not always sufficiently available due to the uniqueness of projects, or Monte Carlo simulations, which require that assumptions on the variability of activity durations should be made. Therefore, we propose to set threshold values which close the gap between these rule-of-thumb and statistical thresholds, by including project-specific information (which is available before execution) into the construction of the thresholds. In order to assess the performance of the proposed thresholds, an extensive simulation study on a large and diverse set of fictitious project networks is executed. Results of this simulation study have shown that the proposed buffer consumption thresholds substantially improve the rule-of-thumb thresholds and approximate the performance of the statistical thresholds. Moreover, the proposed thresholds are less prone to over- or underestimations of assumptions made prior to the project execution than the statistical limits.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

Search and Pursuit in Predator-Prey Games Where Hiding Locations are Heterogeneous with Respect to Both**Mr Viciano Lee and Prof Steve Alpern** (*The University of Warwick*)

We consider a game of search-and-pursuit between 2 players, namely the predator and the prey. The predator (searcher) must find the prey (hider) at one of n locations and then attempt to capture it, within a given time s . For example, the Searcher might be a day-hunter and s might represent the number of daylight-hours remaining. The locations $i \in N = \{1, 2, \dots, n\}$ are heterogeneous in their difficulty with respect to search and with respect to pursuit. The search difficulty is denoted by a vector t , where t_i denotes the time required to search location i . On the other hand, the pursuit difficulty is represented by a vector p , where p_i is the probability that a prey found at location i will be successfully captured. The predator wins the game if he captures the prey (payoff = 1); otherwise the prey wins (payoff = 0). We can say that this game, which we denote as $\Gamma_{p,t}(s)$ is a zero sum game where the value $v(s)$ is the probability that the predator wins at a given s . More formally, we can say the pure strategy for the prey is h_i - where he/she simply picks a location $i \in N$ at which to hide. On the other hand, a pure strategy for the predator is a set $A \in A(s)$, where the predator chooses one of the attack sets of a predator which contains the location sets which take time not exceeding s to search. An important case has been solved by S.Gal and J.Casas (2014), where the locations were assumed to be equally easy to search, that is, when t_i was a constant number equal to 1. In this case, the problem for the searcher was how to choose k locations to inspect.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

How to Leverage Flexible Project Structures to Tackle Uncertainty in Project Scheduling?**Mr Tom Servranckx and Prof Mario Vanhoucke** (*Ghent University*)

Project scheduling is crucial to project success as it facilitates accurate resource management and better communication with subcontractors. However, the traditional project scheduling approaches assume a deterministic project structure, while most projects in real-world situations are characterised by an ever-increasing need for flexibility. In recent years, novel approaches have therefore been designed to incorporate alternative, substitutable ways to execute work packages in a project. This implies that the resulting scheduling problem consists of two sub problems: a decision and a scheduling sub problem. In our research, we propose to classify different types of alternative project structures in a comprehensive theoretical framework. Moreover, we present a metaheuristic solution approach based on this framework to support more realistic and practical variants of the project scheduling problem. In literature, a limited number of approaches have been developed to solve this complex combinatorial optimisation problem. However, the search continues for an extensive solution approach that challenges both the efficiency and effectiveness of the existing heuristic methods. Therefore, we propose a state-of-the-art tabu search algorithm that is designed to solve more general problem variants of the project scheduling problem with alternatives. This algorithm is further extended with a dynamic procedure to guide the search process. For that reason, the building blocks of the procedure are tailored to leverage the specific characteristics of the alternative project structures of problem instances. Our approach is evaluated from a theoretical and

experimental point of view. In order to achieve the latter, the procedure is tested on a generated dataset that covers a wide diversity of problem variants. The preliminary results indicate that a focus on the decision sub problem early on in the project progress highly impacts the solution quality, while latter on in the project progress the focus should shift towards the scheduling sub problem given a rigid set of decisions.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

OR and Public Policy

Organisers: Katharine Etheridge

06/04/2017 : 12:15 : Room Mandela

Code: YOR20A2975

Reasoning in Problem Solving

Mrs Polly Lambert and **Dr Gareth Conway** (*Defence Science and Technology Laboratory*)

A presentation has been developed and is frequently delivered at the MOD Policy, Strategy, and Parliamentary (PSP) Professions Base Camp – a one week training course held at RCDS in London for MOD Band B and C delegates to ensure they understand why and how to improve their use of evidence in policy-making. Part of this training material provides delegates with information on how people think and problem-solve, or reasoning, on a day to day basis and how this can lead to errors in decision-making. Policy-making often requires making judgements or inferences in areas where there is a lot of uncertainty and where robust or relevant evidence can be lacking. This presentation will therefore provide delegates with a basic understanding of how humans ‘cope’ with this uncertainty in order to make decisions, and highlight how our mental processing of information can create barriers to correct reasoning. The presentation will cover: • How people think on a day to day basis – with the rapid development and application of ‘mental models’ or heuristics based on previous experience and knowledge. • How we apply our thinking to problems – outlining three different types of reasoning (Inductive, Deduction and Abductive reasoning) and how these used to make judgements in different situations. • How and why this might go wrong sometimes – explaining the ‘pitfalls’ that can occur, and weaknesses associated with each type of reasoning. • How to overcome these barriers – with the use of critical thinking, other structured methods and when to trust your intuition. The objective of the presentation is to highlight to delegates some innate weaknesses in human reasoning, and how taking these into account and taking step to ‘protect’ against them can result in a better decision making or problem solving process.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/04/2017 : 13:30 : Room Mandela

Code: YOR20A2989

The Safe & Speedy Balance – Modelling Transport Security to Maximise Throughput and Security

Miss Rebecca Fox and **Mrs Sarah Lodge** (*Dstl*)

There is an ever-greater need for secure transport systems across the land, aviation and maritime domains. This need has an associated trade-off – how do we maximise the safety and security of passengers whilst getting them on their journey as quickly and effortlessly as possible? Dstl has been working with the Department for Transport, Home Office and other Government departments for over a decade to optimise this balance for an array of transport hubs, as well as large events with aviation-style security such as the Olympics. Our methods have become more sophisticated over time, and we now use a combination of discrete event simulation, crowd flow modelling and Excel-based tools to tackle these problems. This is then often complimented with soft OR approaches such as subject matter expert workshops, informed by credible scenarios. This presentation will provide an overview of the kinds of

studies we have been involved in, and how we've used our suite of OR tools and techniques to aid our customers in reaching the best possible decisions

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/04/2017 : 14:00 : Room Mandela

Code: YOR20A2998

Monitoring and Evaluation of Third Party Projects: A Case Study.

Miss Sarah Esler (*DSTL*)

This talk will use a case study to discuss the author's experience of undertaking monitoring and evaluation of projects, run by a third party, on behalf of a Government Department. The main challenges associated with the case study were as follows: - The projects were delivered in a dangerous environment; - Monitoring was largely reliant on third party reporting, which was difficult to verify; - Stakeholders were busy and 'hands off' - but still wanted and needed the results of the monitoring and evaluation work! The talk will discuss how the study approach addressed these specific challenges, while also discussing more general principles of both monitoring and evaluation and stakeholder engagement.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

Simulation



Organisers: Naoum Tsiptsias

06/04/2017 : 10:45 : Room Luther

Code: YOR20A2942

KEYNOTE: Improving Airport Queues: A Live Demo Showing the Benefits of Optimising Border Force Officer Deployment at Passport Control Points

Miss Fiona Baldwin (*Home Office*), **Miss Olivia Lewis** and **Mr Sameer Sheorey** (*Government Operational Research Service*)

This practical demonstration uses audience participation to simulate airport arrivals being processed by Border Force Officers at the Passport Control Point. The 'passengers' (audience members) will land in our immigration hall according to an arrivals schedule which mimics flight arrivals. Using live queuing data generated by the demonstration, we will review the impact of Passport Control Point desk staffing on passenger waiting times and show how OR plays a part in workforce planning for Border Force. Within the Home Office, Border Force Analysis have built a Dynamic Resourcing Tool (DRT) which recommends the optimal desk configuration for a given arrivals pattern and is already being used for desk allocation at the UK's largest airports and for future staff resourcing. After reviewing the results of the demonstration, we will also look at the OR behind this tool.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/04/2017 : 11:45 : Room Luther

Code: YOR20A2968

What and How Can We Learn from Wrong Models?

Mr Naoum Tsiptsias, **Prof Stewart Robinson** and **Dr Antuela Tako** (*Loughborough University*)

Interacting with simulation models in facilitated workshops can provide learning opportunities for stakeholders involved. However, using complex and detailed models to drive conversations in a workshop environment may not be practical. Hence simple models are suggested as more appropriate. This however could affect the participants' perception of model validity and may consequently lead to the model being considered inadequate or plainly wrong. This paper aims to understand whether users can learn from interacting with wrong simulation models. We investigate the differences in learning as a result of using simple versus more complex structures of the same models. This study uses a laboratory experiment with undergraduate students using simulation models of different fidelity levels in order to measure participants' understanding and learning achieved. A case study of a hospital-setting is used, where the students are asked to solve a resource utilization task. The aim is to investigate whether biases can be altered by solving the case study using the wrong model compared to using the

adequate or no model at all. The simulation study process is used as the treatment variable, where students are randomly split in groups and asked to make use of different settings to solve the task: a relatively complete simulation model, a wrong (oversimplified) model, and use no model at all (control group). A pre-test questionnaire will be used to understand participants' attitudes towards the solution of the problem. A post-test questionnaire will then be used to compare whether learning has been achieved based on whether participants attitude towards the solution has changed. The results are expected to contribute to our knowledge of whether and to what extent a "wrong" model can be used to support debate and decision making. Additionally, we aim to develop a framework that can guide interaction with wrong models in facilitated settings.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

06/04/2017 : 12:15 : Room Luther

Code: YOR20A2952

The SIMTEGR8 Project Phase 2: Using Facilitated Simulation Modelling for Improving Health and Social Care for the Elderly

Dr Anastasia Gogi, Prof Zoe Radnor, Prof Stewart Robinson and Dr Antuela Tako

(Loughborough University)

This paper reviews the effectiveness of using facilitated simulation modelling to promote debate and make changes to patient pathways. This is based on the work carried out as part of the second phase of the SIMTEGR8 project. The SIMTEGR8 project is a research collaboration between Loughborough University, Leicestershire County Council (LCC), Healthwatch Leicestershire and SIMUL8 Corp. Facilitated simulation modelling is used to evaluate and support the development of four patient centric integrated services aimed at reducing emergency hospital admissions and improving the user experience. The assessment process involves three workshops, two held with project leads (health and social care professionals) and one held with service users (i.e. patients and carers), for each intervention. Simulation models are developed after agreeing pathways with relevant stakeholders in a facilitated workshop. Models are then used in subsequent workshops to generate understanding and discussion around the effectiveness of the services and to identify potential improvements. This paper presents a brief overview of the interventions and how these were run comparing the difference in settings and the outcomes. Overall, the concept of using facilitated simulation modelling as a means of communication and reflection, introducing changes and service improvement in a workshop environment, has been effective. Lessons learnt and considerations for future studies on facilitated simulation modelling are put forward.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

06/04/2017 : 13:30 : Room Luther

Code: YOR20A2985

KEYNOTE: Towards a Future Mode of Discrete Event Simulation (DES)

Dr Kathy Kotiadis *(Canterbury Christ Church University)*

Systems that benefit from the ongoing use of simulation, often require considerable input by the modeller(s) to update and maintain the models. This paper proposes automating the

evolution of the modelling process for discrete event simulation (DES) and therefore limiting the majority of the human modeller's input to the development of the model. This mode of practice could be named Self-Adaptive Discrete Event Simulation (SADES). The research is driven from ideas emerging from simulation model reuse, automations in the modelling process, real time simulation, dynamic data driven application systems, autonomic computing and self-adaptive software systems. This paper explores some of the areas that could inform the development of SADES and proposes a modified version of the MAPE-K feedback control loop as a potential process. The expected outcome from developing SADES would be a simulation environment that is self-managing and more responsive to the analytical needs of real systems.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Team Challenge

05/04/2017 : 16:30 : Room John Wesley LT

Code: YOR20A3019

Practical Solutions to Complex Problems (sponsored by Polaris Consulting)

PLUS a Team Challenge (with a prize!)

Nick Rose, Senior *Consultant at Polaris Consulting*

This session is designed to encourage inter-disciplinary networking and problem solving from within the YOR community by presenting a real-life complex problem challenge to be solved by the practical application of OR methods. After an initial briefing from the customer, delegates will be asked to form teams of 4-5 people to develop innovative yet practical proposals or solutions to the problem. Towards the end of the session, each team will be invited to give a brief pitch of their proposal to the customer and fellow teams. These will be judged by the customer and prizes awarded for the best proposals. By the end of this session we hope you will have broadened your networks, learnt about new OR approaches and developed your consultancy skills.

Technique Tasters

04/04/2017 : 16:00 : Room Kingswood

Code: YOR20A2983

Learn How To Build a Quantitative Risk Register using @RISK

Mr Doug Oldfield (*Palisade*)

Palisade's @RISK software has many applications ranging from cost estimation and demand forecasting through to schedule risk analysis and mineral reserves estimations. One of the most common applications of the tool is in the building of quantitative risk registers which use Monte Carlo simulation to show all possible scenarios. In this session, Palisade will give a run-through of the capabilities of the tool in a risk register context including tornado graphs for sensitivity analysis, modelling mitigation efficacy and then finally looking at optimising mitigation spend. Attendees will then be given a training session to show how quick it is to build up a simple risk register using the tool. Using @Risk at the workshop Attendees will need to have a trial version of @RISK installed on their laptops for this workshop, with free trials being available at www.palisade.com. Please note that free trials are only valid for 15 days so it is advisable to install trials a few days before the workshop. In the event delegates have expired trials or experience any other issues, please contact Dana on danak@palisade.com and CC in Doug Oldfield at doldfield@palisade.com

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

05/04/2017 : 10:45 : Room Kingswood

Code: YOR20A3014

Exploring AnyLogic and Real-World Simulation Best-Practice

Mr Stuart Rossiter (*Decision Lab*)

This workshop aims to introduce you to the capabilities of the AnyLogic simulation tool (particularly agent-based simulation) and to discuss some of the realities of what makes

simulation projects successful or not in both commercial and academic contexts. AnyLogic's main selling point is that it allows you to seamlessly combine discrete-event, system dynamics and agent-based approaches. Since agent-based approaches are likely to be the most unfamiliar to most of you, we will put a little bit more focus on that. In particular, the upcoming AnyLogic 8 adds capabilities to 'natively' run your simulations in the cloud. This is *not* a slick marketing presentation or dry demonstration, and is informed by lots of in-the-trenches experience. You will be hands-on with AnyLogic and we'll include lots of interactive, open-ended discussion around 'big questions' i.e.: * Why should I use AnyLogic over other simulation tools? Where are the pain points and do they differ from those in other tools? * How is it even possible to combine the three modelling approaches 'seamlessly' in AnyLogic and when does that help me? * How is agent-based simulation different to discrete-event and system dynamics? Is it really a more 'general' paradigm as many people claim? Does it make the others obsolete? * What are the main success factors for simulation projects, and how can I use AnyLogic to help me here. How do these change for longer-term simulation projects, if at all? * Can software engineering teach me any lessons about running simulation projects and designing AnyLogic models? Is AnyLogic particularly suited for applying some of these?

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Using @Risk

04/04/2017 : 15:00 : Room Kingswood

Code: YOR20A3025

Making Better Decisions: Monte Carlo Simulation and the Power of Quantitative Risk Analysis **Mr Doug Oldfield** (*Palisade*)

Monte Carlo simulation has many applications ranging from cost estimation and demand forecasting through to schedule risk analysis and mineral reserves estimations. One of the most common applications of the tool is in the building of quantitative risk registers which use Monte Carlo simulation to show all possible scenarios. In this session, Doug will build up an example of a stochastic risk register and will then run through some of the insights this process generates. After that, he'll show how it's possible to then use the technique for modelling mitigation efficacy and then finally how you might consider optimising mitigation spend.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

WORKSHOPS

04/04/2017 : 16:00 : Room Maathai

Code: YOR20A2973

Working with Uncertainty: Workshop on How to Identify and Communicate Uncertainty in Analysis

Mr William Miller (*Home Office*)

Join us for a rollercoaster ride of a workshop! Using the collaborative brain power of the OR community we will explore the inherent uncertainties we all face in analysis, using the problems faced by a Theme Park named AdventORe Land! We will use a range of problem archetypes, from day-to-day crisis management to longer-term strategic modelling projects. We will work through the steps of identifying and understanding the sources of uncertainty, discussing how we work with these, and how we communicate the outcomes effectively to decision makers. Because no one wants to be stuck in a long queue for a broken ride, in a park that's run out of ice cream...

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

04/04/2017 : 16:00 : Room Luther

Code: YOR20A3013

Make Your Voice Heard: a Workshop to Explore What Early Careers OR People Want from The OR Society.

Ms Ruth Kaufman (*Independent Consultant*)

A workshop to explore what early careers OR people want from the OR Society, and how they can make it happen. At a rough count, the OR Society offers around 25 different services - journals, events, on-line resources, awards, accreditation and a score more. But very little is specifically aimed at Early Careers professionals. This workshop will invite participants to explore whether there is more that the ORS could or should do, either in developing specific initiatives to support Early Careers professionals, or to ensure that existing initiatives are adequately communicated and designed to include Early Careers people; and to identify what they or their colleagues can do to contribute to this.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

04/04/2017 : 17:00 : Room Luther

Code: YOR20A3027

Make Your Voice Heard: a Workshop to Explore What Early Careers OR People Want from The OR Society.

Ms Ruth Kaufman (*The OR Society*)

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initiatives to support Early Careers professionals, or to ensure that existing initiatives are adequately communicated and designed to include Early Careers people; and to identify what they or their colleagues can do to contribute to this.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

05/04/2017 : 10:45 : Room Maathai

Code: YOR20A2991

Understanding Research & Publishing

Mr Ian Challand (*Taylor & Francis*)

Taylor & Francis, a leading academic publisher, are pleased to present a workshop which outlines the practicalities of journals publishing, from deciding what to submit, through the peer review process, and to an overview of post-publication options. Presented by Ian Challand, an experienced Managing Editor, there will also be an opportunity to ask questions at the end of the session. The workshop would be suitable for researchers in academia and those in practice who are interested in maximising their understanding of academic publishing, and to all those interested in maximising the impact of their research.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Somewhat

05/04/2017 : 10:45 : Room Luther

Code: YOR20A2996

Social Return on Investment, or, How to Analyse Effectiveness with Very Little Data

Dr Jamie Douglas, Mr Matthew Miller, Dr Yasmine Ammar, (*Department of Work and Pensions*), **Dr Kayleigh Ellis** (*Scottish Government*), **Dr Claire Murray** (*Department for Work and Pensions*) and **Dr Ian Thomas** (*Department for Environment, Food and Rural Affairs*)

How can we, as operational researchers, use our professional skills to help worthy charitable causes? We were presented with that exact question when we applied to help a local community centre through the ORS pro-bono OR scheme. By adopting a framework that enabled us to calculate the social value of the charity's work, we were able to provide a quantitative analysis of their social return on investment which they can use to secure future funding. We learned a lot on this journey, and we've developed a workshop based on our experience to help you consider how to manage stakeholders, make data work harder, think creatively but analytically, and apply frameworks as problem-structuring techniques.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

05/04/2017 : 10:45 : Room Mandela

Code: YOR20A3018

Mindful OR Practice: Being Open, Kind and Still

Dr Jose-Rodrigo Cordoba-Pachon (*Royal Holloway, University of London*)

In today's world many people (including OR practitioners) often adopt an automatic pilot mode to deal with their activities and practice. This often leads to respond automatically to situations by focusing on using the past as an anchor or foreseeing a future (focusing on outcomes).

Ideas of mindfulness and creativity are used in this workshop to encourage OR practitioners to better understand themselves in their practice. Mindfulness brings the important of being in the present and developing awareness about one's own thoughts and body sensations. Some mindfulness and creative improvisation techniques are practised in the workshop to help us generate more and adequate, meaningful choices for thinking, acting and living our OR practice. Please note that one of the intentions of the workshop is to generate a collection of thoughts and feelings experienced by participants in order to reflect on them and inform future OR practice. The facilitator is currently writing a book on creativity and systems thinking and would very much like your input for possible and anonymous inclusion in the book provided you agree to it.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

05/04/2017 : 11:45 : Room Luther	Code: YOR20A3028
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Social Return on Investment, or, How to Analyse Effectiveness with Very Little Data

Dr Jamie Douglas, Mr Matthew Miller, Dr Yasmine Ammar, (*Department of Work and Pensions*), **Dr Kayleigh Ellis** (*Scottish Government*), **Dr Claire Murray** (*Department for Work and Pensions*) and **Dr Ian Thomas** (*Department for Environment, Food and Rural Affairs*)

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What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

05/04/2017 : 11:45 : Room Maathai	Code: YOR20A3029
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Understanding Research & Publishing

Mr Ian Challand (*Taylor & Francis*)

Taylor & Francis, a leading academic publisher, are pleased to present a workshop which outlines the practicalities of journals publishing, from deciding what to submit, through the peer review process, and to an overview of post-publication options. Presented by Ian Challand, an experienced Managing Editor, there will also be an opportunity to ask questions at the end of the session. The workshop would be suitable for researchers in academia and those in practice who are interested in maximising their understanding of academic publishing, and to all those interested in maximising the impact of their research.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Mindful OR Practice: Being Open, Kind and Still

Dr Jose-Rodrigo Cordoba-Pachon (*Royal Holloway, University of London*)

In today's world many people (including OR practitioners) often adopt an automatic pilot mode to deal with their activities and practice. This often leads to respond automatically to situations by focusing on using the past as an anchor or foreseeing a future (focusing on outcomes). Ideas of mindfulness and creativity are used in this workshop to encourage OR practitioners to better understand themselves in their practice. Mindfulness brings the important of being in the present and developing awareness about one's own thoughts and body sensations. Some mindfulness and creative improvisation techniques are practised in the workshop to help us generate more and adequate, meaningful choices for thinking, acting and living our OR practice. Please note that one of the intentions of the workshop is to generate a collection of thoughts and feelings experienced by participants in order to reflect on them and inform future OR practice. The facilitator is currently writing a book on creativity and systems thinking and would very much like your input for possible and anonymous inclusion in the book provided you agree to it.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant