IFORS NEWS

International Federation of Operational Research Societies

From the President

Let's Look Ahead And Be Creative

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Our community, as any other community, is still living difficult times. Our lives remain constrained in many ways. More importantly, many of our families and friends have been hit by the coronavirus, and I wish to express my closeness to all of us who have experienced or are experiencing worrying or painful situations.

The technology still helps to keep contacts and to work. We use it to hold and record lectures, to participate to meetings and webinars, to interact with colleagues about research projects. Also to talk to families and friends. More than ever our personal lives are intertwined with our professional lives because of the lack of a physical division of personal and working space. We live and work at home, most of the time. We have more time for the family and do not need to waste time commuting but also realize how good a cup of coffee or a chat in person with colleagues is.

We have broken old customs, and now know that it is possible to do things in a different way, that lectures and exams and meetings can be successfully organized in a remote setting with all the related savings. And also know that not all lectures and exams and meetings should be organized remotely, that there is a value in the physical contact. At present we are not free to choose how to behave and how to organize our lives and our work but time will come when we will again. Now it is the time to think and reflect, to get ourselves ready to do everything in a different way with respect to the pre-coronavirus situation. We should find the optimal trade-off between saving of time and personal well-being, between money saving and action effectiveness. We should try to understand when it is better to do things remotely and when to do things in person. This is not a formal optimization research problem but it requires a systemic view which belongs to us.

Given that our community is spread over the entire planet, physical meetings of the IFORS officers with the officers of the national societies - which are the members of IFORS - cannot be held frequently and, at the official meetings organized during our triennial conferences, several societies have not been represented because of other commitments of the officers or because of the cost of traveling and attending the conferences. In June we, that is myself and the other members of the IFORS Administrative Committee, had a remote meeting with the Presidents and the Representatives of the national societies. This kind of event had never been organized before and it was considered by the participants very valuable. We have agreed to hold a couple of meetings a year. In the next one which will take place in December I will inform our community, through their officers, of some interesting and important, I hope for us all, new initiatives. The meeting will also be an opportunity for exchanging experiences and ideas. I look forward to the next one! 🌍

What's Inside

Editorial

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We are now at the end of the year 2020. The world faced too many ups and downs during the period and IFORS and the whole OR community coped with whatever came on its way. The COVID-19 era seems to get through as vaccines in a few countries are getting ready to serve people. During this period OR scientists applied various OR tools to analyze the situation of corona and come up with suggestions to overcome the trauma. The major change in the academic lifestyles experienced in past months is the virtual meetings and webinars that actually did not stop OR scientists and all from their work and research.

All the permanent sections of the Newsletter are here in the December issue. John Ranyard has the OR Impact section in special way where the article include three research works stimulated by the pandemic. The article on tutorial section is on Mathematical programming and Computational Game Theory. The conference section is more exciting with number of virtual webinars happening around the world on OR theories and its applications.

As promised this issue covers two more articles on the IFORS Award 2020 for OR in Development among six finalists. Hans Ittman has written the Book Review on the edited book "Behavioral Operational Research – A Capabilities Approach by Leroy White, Martin Kunc, Katharina Burger and Jonathan Malpass". We lost an OR scientist Prof. Duan Li this year. IFORS shares his obituary in this issue.

The IFORS Global Webinar series organized its second webinar from Asia pacific region (APORS) on September 30, 2020 with a theme of "OR in APORS: Trends and Practices. Also the 3rd IFORS Global webinar was organized in November 30, 2020. The report of 2nd IFORS global webinar from APORS and the 3rd global webinar from EURO is presented in this issue.

Whole world is looking at the scientists for the vaccine for COVID-19 and we are hopeful to have better and normal life ahead. 🌍

OR Impact

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Supporting Organisational Responses to the COVID-19 Pandemic in the UK

John Ranyard <jranyard@cix.co.uk>

Introduction

The Heads of OR and Analytics Forum (HORAF) is a network of leaders of OR, Analytics and Data Science groups in industry, commerce, consultancy and the public sector in the UK. The Forum meets quarterly and enables members to network with peers; to improve their own effectiveness and impact; and influence the wider OR, Analytic and Data Science landscape.

Unsurprisingly, recent meetings have been virtual, with members discussing how their groups have helped their organisations to respond to the COVID-19 pandemic, under extreme time pressures and with most of their staff home-based! The pandemic has caused a major disruption in many data streams, for example, in the demand for and distribution of products, such that models relying on historical trends were no longer reliable. The immediate focus was on finding data representative of the new situation, such as from mobile phones and via number plate recognition for changing population movements etc. Automated forecasting and machine learning systems have had to be adjusted manually to enable them to represent the new normal as quickly as possible. Existing models which have previously given reliable results may now have to be used outside their designed range, necessitating much care in interpreting their results. Reliable analytical support has never been in such high demand and all groups reported that their staff were working flat out, now for several months with no let-up in sight!

In this article we focus on typical projects at three HORAF organisations that have been stimulated by the pandemic: designing an efficient virus testing regime for front line staff at Ocado; providing guidance for ensuring social distancing at a major station by the organisations Connected Places Catapult and Open Space; and Intensive Care Unit planning at Simul8. 🌍

How Ocado Technology Applied Constraint Programming to Build an Automated COVID-19 Test Schedule

Anna Moss <anna.moss@ocado.com>

Ocado Group is a UK based technology company that provides end-to-end online grocery fulfilment solutions to some of the world's largest grocery retailers and holds a 50% of Ocado Retail Ltd in the UK in a Joint Venture with Marks & Spencer. Ocado has spent two decades innovating for grocery online, investing in a wide technology estate that includes robotics, AI & machine learning, simulation, forecasting, and edge intelligence.
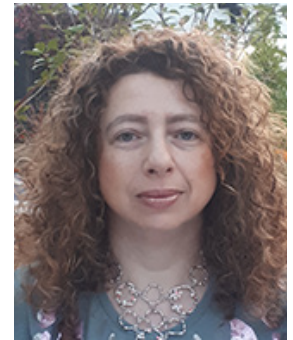

▲ Figure 1: An Ocado automated warehouse

Ocado Retail Ltd is the world's biggest online-only grocery retail business. It offers a range of over 50,000 products and serves over 639,000 active customers across the UK, shipping 325,000 orders per week. Its fulfilment is based on Customer Fulfilment Centers (CFCs), highly automated warehouses powered by cutting edge technology.

Ocado Group employs over 15,000 people, many of whom perform frontline roles such as picking and packing in CFCs, order deliveries to customer homes, providing customer service in the call centres etc.

The Problem: At the beginning of the COVID-19 lockdown, Ocado Group took a decision to test all frontline employees on a weekly basis in order to protect the health of the staff. This task presented the business planning team with the large scale logistical problem of scheduling these employees at each site to available test slots determined by room and testers availability, subject to various operational constraints. These constraints included, for example, that: each employee should be scheduled for a test within their working shift; the spacing between tests performed on the same employee should be within given bounds; only a limited share of employees from the same work area should be scheduled for a test on the same day etc.
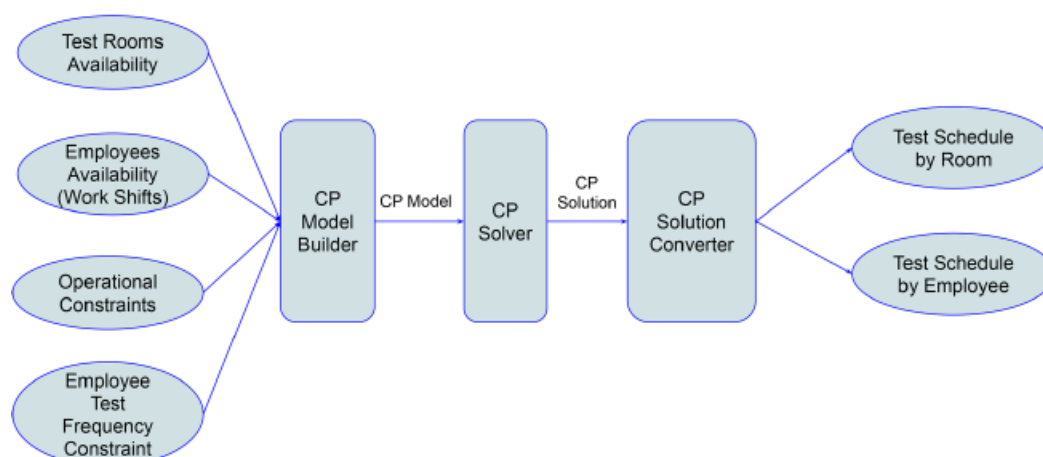
The problem proved too difficult to be solved manually, and the Data Science team was approached for help, with extremely tight time limitations. The team were able to leverage their prior experience with constraint *optimisation* problems, e.g. staff rostering. The COVID-19 test scheduling problem was solved by creating an efficient constraint model of the problem and feeding it to a constraint solver. Good design practices allowed partial reuse of an existing code base and enabled completion of the project in less than two weeks.

▲ Figure 2: An Automated Warehouse Collection Point

The Outcome: the business planning team was able to automatically create test schedules for different Ocado sites, complying with the specified constraints. The tool has been used to automate a substantial share of the test scheduling tasks in different business areas producing schedules for up to 3500 employees across 4 sites. This automated test scheduling tool has become a significant part and an enabler of the COVID-19 testing process in Ocado. 🌍

▲ Figure 3: Automated COVID-19 Test Scheduling: Process Overview

Modelling Social Distancing at Kings Cross/St Pancras Station, London

Abby Miller; Louise Fildes; Nicholas Le Glatin

The **Connected Places Catapult** is one of a network of world-leading technology and innovation centres established by Innovate UK with the goal of accelerating smarter living and travelling in and between the places of tomorrow. For over two years we have been on a journey assisting OpenSpace Group from being a small consultancy specialising in people movement in transport hubs, to becoming a technology platform provider that now offers railway station operators a new generation of data-driven, real-time decision making tools that they believe could revolutionise the way that stations are managed.
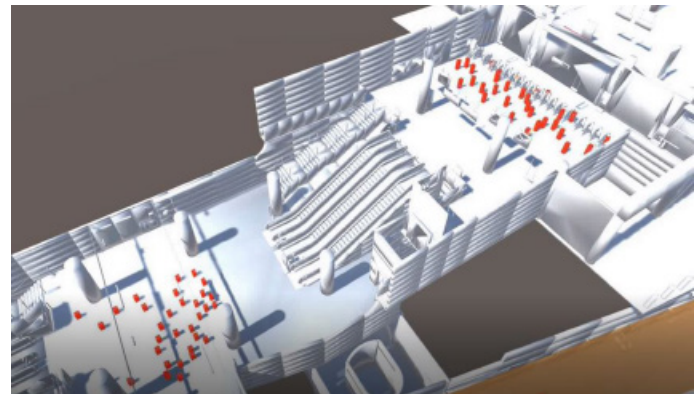

▲ Figure 1: Crowding at Kings Cross/St Pancras station

Together with **OpenSpace**, we have supported the trialling and validation of their operational cognitive digital twin of Kings Cross St. Pancras Thameslink station under real-world COVID-19 conditions. In particular we have helped them to develop specialised analytics to support decision making around *social distancing* at the station as required by legislation. OpenSpace's technology fuses real-time data from pedestrian-tracking sensors and operational data feeds (such as train timetables and self-calibrating pedestrian microsimulations) to provide insight into the causes and impacts of observed incidents. It also provides verifiable data to support decision making and the ability to carry out predictive analytics in ways that have not been feasible until now.

Before the start of the COVID-19 pandemic, the station was serving approximately 150,000 commuters and other travellers every day. Our analytical insights provided to the station management team in near real-time about the actual movement of pedestrians within the station and the utilisation of available space has allowed them to more effectively mitigate situations where social distancing is not being adhered to or other disruptions are occurring.

Outcome: The collaboration between OpenSpace Group and the Connected Places Catapult has allowed all of the relevant data analysis to generate metrics such as social distancing, passenger density, passenger speeds and space utilisation either on-demand or in a fully automated manner. These aggregated metrics are then presented to users as a combination of heat maps projected into the 3D model of the digital twin plus more traditional graphs. The metrics, typically aggregated over a 15 minute period, can also be

viewed alongside near real-time, anonymised observations of individuals moving through the station, which assists with understanding whether interventions being made by the station management team are resulting in positive behavioural change.

This work has enabled station management to control pedestrian movement more efficiently and safely, under the current challenging conditions, than would have previously been possible. 🌐

▲ Figure 2: Open Space Monitoring

▲ Figure 3: Open Space Ped SIM

▲ Figure 4: Open Space Social Distancing Map

How Simul8 has helped organisations plan an effective response to Covid-19

Tom Stephenson

The past few months have been full of uncertainty for individuals and organizations alike. When COVID-19 hit, none of us knew what the implications would be now or in the future and so scenario planning began at speed. Decisions needed to be made quickly, but when lives are at risk no one really wants to be guessing.

That's why simulation and other ORMS techniques have become so critical in COVID-19 planning, because multiple scenarios can be tested risk free before implementation and be continually be re-evaluated as more information becomes available.

At **Simul8 Corporation** we create simulation software that helps organisations worldwide transform the way they make decisions. Simul8, our flagship product is designed to be accessible to everyone with intuitive features, and the ability to build, run and share simulations anywhere - making it great for collaboration, especially in times of remote working.

Response to COVID-19

We knew our software could benefit organisations trying to plan for the impact of COVID-19. Over the last 7 months we've created a number of free simulations that anyone can use on key COVID-19 issues. We've also provided 50+ pro bono licenses to allow those without access to the software the ability to use these simulations, and given our users and universities online access so they can work remotely and continue to make decisions with confidence.

Over the past few months we've heard some amazing stories of people building simulations to support organisations through COVID-19 including; predicting, at very short notices, the critical care resources that NHS Lanarkshire would require in the early weeks and months of the pandemic; planning bed capacity in hospitals generally; planning for drive-through testing centres; and reconfiguring manufacturing lines to produce much needed resources, such as hand sanitizer and ventilators. The following describes a typical application.

▲ Figure 1: A typical Intensive Care Unit

Intensive Care Unit (ICU) planning: ICUs are playing an essential role in the fight against COVID-19. These specialist facilities provide treatment for seriously ill patients using equipment such as bedside machines to monitor heart rate and ventilators to assist breathing. But with often limited resources, how can hospitals understand whether they will be able to meet demand throughout the pandemic?

One of the key factors affecting the mortality rate of COVID-19 is the availability of ICU beds that use equipment, such as bedside machines to monitor a patient's heart rate and ventilators to help them breathe. With the disease stretching healthcare systems across the world, many countries, including the UK, had to cancel non-urgent surgical operations and stop services to open more of these ICU beds for critically ill COVID-19 patients.

To help hospitals facing this unprecedented demand for these beds, the Simulation Excellence team at Simul8 developed a free simulation model to help assess how many ICU beds and how much surge capacity would be needed to meet demand. This simulation can tell you how many ICU beds will be utilised as well as how many temporary surge beds will be

▲ Fig 2 Structure of a Typical ICU Simulation (icu-sim-high-res)

needed to meet demand. There's also a facility to change the mortality rates so users can estimate the impact of having the appropriate types of bed on survival rates.

▲ Figure 3: Typical Output from a Simul8 Application

Other Applications and Further Developments

The software has been used successfully by healthcare organisations worldwide to help them to improve capacity planning, including as a starting point for planning some of the rapidly constructed overflow hospitals being set up in major cities, and has been used to understand the knock-on impact to other healthcare services.

Since the initial version of the simulation was made available, many users have provided positive feedback and suggestions, allowing it to be further developed for use in a wider range of scenarios. Additional simulations have also been built to help with planning for drive-through COVID-19 testing and managing supply chains during the pandemic.

The COVID-19 pandemic will no doubt continue to impact on health services and many other industries for the foreseeable future. But, as organisations across the world work to ready themselves for multiple different possibilities – as well as their ordinary, and enormous, workload – simulation will be an invaluable tool in helping deploy available resources in the most-effective way possible.

Reference
This link gives a typical healthcare investigation using Simul8, with full technical detail.
https://link.springer.com/article/10.1007/s10729-017-9401-y 🌎

OR Tutorial   Section Editor: **Javier Marenco**

Mathematical programming and Computational Game Theory

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1 Decision making
Mathematical programs (MP) which are problems of the form min $x \in X f(x)$, are of interest for a long time in research and application. Such problems could be interpreted as decision problems with a single decision-making agent. A natural extension to this is a game, where there are multiple decision makers, otherwise known as *players.*

A game can be further divided into two classes, one where all the players decide simultaneously and one where they decide sequentially. The former is called a *Nash game* and the latter a *multi-level game.*

Using the standard notation in the context of games where x^i is the decision variable of the *i*-th player, and x^{-i} is the vector of decision variables of all players except the *i*-th player, we define the following.

Definition 1 (Nash game). *A Nash game is a tuple* (P^1 , . . . , P^n) *of mathematical programs such that P^1 is of the form:*

$$\min_{x \in \mathcal{X}^i} f^i(x^i, x^{-i})$$

In other words, one player's decisions affect the objective function of other players leading to a form of coupled optimization problems. A generalization of this concept is a Generalized Nash game, where a player's decisions affect not only the objective function of others but also the feasible set. However, we will restrict ourselves to Nash games for time being.

Nash games admit a wide range of solution concepts, but the most popular among them is a Pure-strategy Nash equilibrium (PNE) and then the Mixed-strategy Nash equilibrium (MNE).

Definition 2 (Pure and Mixed-strategy Nash equilibrium). *Let $v = (v^1, . . . , v^n)$ where v^i is a Borel probability distribution on X^i with finite support. Then, v is a Mixed-strategy Nash Equilibrium (MNE) if for all i and $x \in x^i$, then* E $f(v^i; v^{-i}) \leq$ E $f(x^{-i}; v^{-i})$. *If all the distributions have a* singleton *support, then the set of strategies is referred to as Pure-strategy Nash Equilibrium (PNE).*

More informally, a PNE provides a strategy x^{i*} for each player such that for all $x^i \in x^i$, f^i $(x^{i*}, x^{-i*}) \leq f^i (x^{i*}, x^{-i*})$. Instead for an MNE, each player has a probability distribution among finitely many such strategies such that no player cannot do better in expectation, by deviating from this strategy. In either definitions, an individual player cannot unilaterally deviate to improve their utility.

Definition 3 (Multi-level games). *A 1-level game is an MP. Now, a k-level game is a problem of the form:*

$$\min_{x \in \mathcal{X}^1} : f^1(x^1; x^2, x^3, \ldots, x^k) \qquad s.t.$$
$$(x^2, \ldots, x^k) \in S^{k-1}(x^1)$$

where $S^{k-1}(x^1)$ is the solution set of a $k-1$-level game parameterized in x^1. Further the problem is a linear k-level game, if each f^i is a linear function of x and x^1 is of the form $A^{ix} \geq b^i$ for each i = 1,...,k.

In other words, in a multi-level game, among *k* players, the *i*-th player decides after observing the decisions of the first *i* − 1 players and anticipating the behavior of the last *k* − *i* players. Like MPs, *k*-level games admit an *optimal solution x^{i*}*, . . . , x^{k*} such that x^{i*} is optimal to the *i*-th player given x^{i*}, . . . , $x^{(i-1)*}$ and in anticipation of the remaining players's behaviour.

Normal-form games. A normal-form game is a Nash game where each X^i is a small finite set and $f^i(x)$ is given point-wise for each $x \in X^i \times ... \times X^n$. PNEs are strong solution excepts, which don't necessarily exist for even normal-form games, but the seminal paper by John Nash proved the existence of an MNE for such games (Nash, 1950).

2 Solving games with a linear-convex quadratic structure
A recurring assumption in the field of mathematical programming is that of convexity. Despite corner cases that are hard, convex MPs are considered synonymous with MPs that are solved easily. >>

>> Further, even with convexity, a particular class of MPs that are easy to solve are convex quadratic MPs with affine constraints. The Karush-Kuhn-Tucker (KKT) conditions are known to be necessary and sufficient for proving optimality in these problems. A point x solves the MP given by $\min_x \left\{ \frac{1}{2} x^\top Q x + c^\top x : A x \geq b; x \geq 0 \right\}$ if and only if there exists λ such that $0 \leq Q x + c - A^\top \lambda \perp x \geq 0$ and $0 \leq \lambda \perp A x - b \geq 0$ where $p \perp q$ refers to the constraint that $p^\top q = 0$.
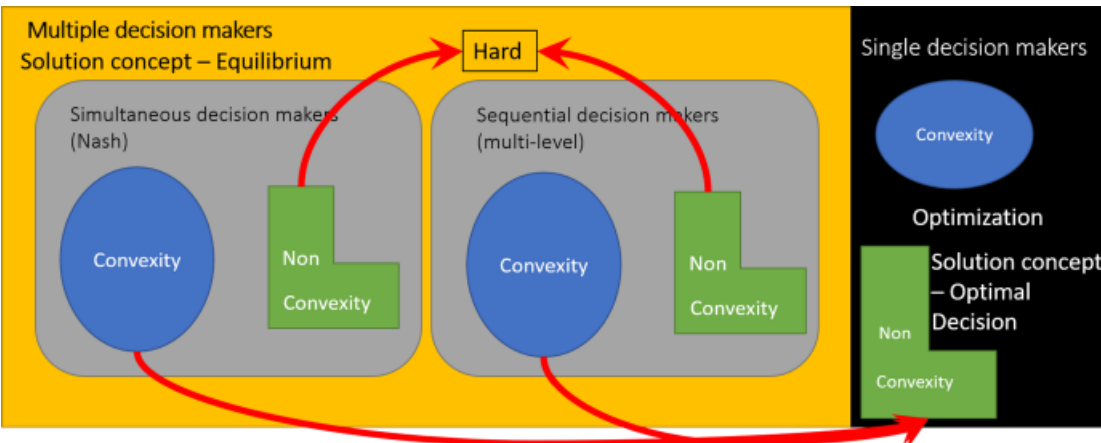
Now consider a Nash game where each player's optimization problem P^i is a convex quadratic optimization problem with affine constraints. Unlike normal-form games, these games don't necessarily have an MNE. But if they have an MNE, they also have a PNE.

Theorem 4. *Let $(P^1,...,P^n)$ be a Nash game. If each x^i is a polyhedron and if each $f^i(x)$ is of the form $\frac{1}{2} x^{i\top} Q^i x^i + c^{i\top} x + (C^i x^{-i})^\top x^i$ for some positive semi definite Q^i, then existence of an 2 MNE implies existence of a PNE. Moreover, if each X^i is bounded, then a PNE always exists.*

Such a PNE can be identified using the KKT conditions associated with each player's problem.

Given $\mathcal{X}^i = \{ x^i : A^i x^i \geq b^i; x^i \geq 0 \}$, and each f^i is a convex quadratic function of the form $f^i(x^i; x^{-i}) = \frac{1}{2} x^{i\top} Q^i x^i + c^{i\top} x + (C^i x^{-i})^\top x^i$ the Nash game can be reformulated as a *linear complementarity problem (LCP)* shown in (1) which can be solved efficiently using dedicated solvers like PATH (Dirkse and Ferris, 1995) or Constraint programming or integer programming solvers.

$$0 \leq x^i \perp Q^i x^i + C^i x^{-i} + c^i - A^{i\top} \lambda^i \geq 0 \qquad \forall j = 1,\ldots,m_i; \ \forall i = 1,\ldots,n \qquad (1a)$$

▲ Figure 1: Decision-making problems

$$0 \leq \lambda^i_j \perp A^i x^i - b^i \geq 0 \qquad \forall j = 1,\ldots,m_i; \ \forall i = 1,\ldots,n. \qquad (1b)$$

Similarly, consider the following bilevel program where A^2_1 and A^2_2 refers to restriction of A^2 only to the columns corresponding to x^1 and x^2 respectively.

$$
\begin{aligned}
\min_x \ &: \ c^{1\top} x & \text{s.t.} & \quad (2a)\\
A^1 x \ &\geq \ b^1 & & \quad (2b)\\
x^1 \ &\geq \ 0 & & \quad (2c)\\
x^2 \ &\in \ \arg\min_{x^2} \left\{ c^{2\top} x^2 : A^2_2 x^2 \geq b^2 - A^2_1 x^1; x^2 \geq 0 \right\} & & \quad (2d)
\end{aligned}
$$

The follower optimality condition in (2d) can be replaced by equivalent KKT conditions for the lower level and be written using complementarity constraints as follows:

$$
\begin{aligned}
\min_{x,\lambda} \ &: \ c^{1\top} x & \text{s.t.} & \quad (3a)\\
A^1 x \ &\geq \ b^1 & & \quad (3b)\\
x^1 \ &\geq \ 0 & & \quad (3c)\\
0 \leq x^2 \ &\perp \ c^2 + A^{2\top}_2 \lambda \geq 0 & & \quad (3d)\\
0 \leq \lambda \ &\perp \ A^2 x - b^2 \geq 0 & & \quad (3e)
\end{aligned}
$$

Be it the set of conditions defining (1) or the constraints in (3d) and (3e), they can be reformulated into logical constraints supported by standard integer programming solvers. For example, the condition that $0 \leq x \perp c^\top x + d \geq 0$ can be linearized using indicator constraints and a binary variable b as $b = 1 \implies x = 0$ and $b = 0 \implies c^\top x + d = 0$, along with the linear constraints $x \geq 0$ and $c^\top x + d \geq 0$. Alternatively, one could use a *sufficiently large value, M,* notoriously known as the big-M, to rewrite the same condition with a binary variable b as $x \leq Mb, c^\top x + d \leq M(1-b)$ along with the linear constraints mentioned earlier. Given that these methods are inherently slow and poor choices of M could lead to an incorrect formulation, algorithms to solve (2) is an active area of research.

Further, the above LCP-motivated reformulations are valid only if each player's MP is convex. If the game is between players solving nonconvex MPs, obtaining solutions could be much harder. The idea is captured in Figure 1 where our capability to reformulate convex games as nonconvex MPs while the much harder class of nonconvex games might require a special framework of algorithms.

3 Complexity of solving games

In this section, we discuss the complexity of solving Nash and multi-level games.

Nash games. Complexity classes P, NP, etc. are defined for decision problems with a YES or NO answer. In case of normal-form games, the celebrated theorem from Nash (1950) provides a non-constructive proof that an MNE always exists.

So, the decision problem asking *whether this game has a Nash equilibrium?* can always be answered YES trivially. Nevertheless, finding such a Nash equilibrium could be hard. This warrants a new complexity class defined in Papadimitriou (1994) — Polynomial Parity arguments on Directed graph (PPAD) — where nonconstructive arguments trivially solve the decision problem, but a constructive proof is hard to find. The problem of finding an MNE is known to PPAD-complete, making it unlikely that a polynomial-time algorithm to determine an MNE of a normal-form exist.

Convex-quadratic Nash games with affine constraints reformulated in (1) are also PPAD- complete if each player's feasible set is known to be bounded. This follows from the fact that an equilibrium exists in that case and that a normal-form game can be rewritten in the same form. However, the complexity class is unknown if at least one player's feasible set is unbounded.

The polynomial hierarchy for complexity is defined using a sequence of classes Σ_k^p, which refers to decision problems whose YES instances have a proof of correctness that can be checked using polynomially many calls to an oracle that can solve Σ_{k-1}^p -complete problems, and Σ_1^p refers to the class NP.

For Nash games where each player's MP is a linear integer program, or linear bilevel program the problem of determining if an MNE exists is Σ_2^p - complete. However, in both the cases, if every player's feasible set is bounded, an MNE is guaranteed to exist. On the other hand, the problem of determining if a PNE exists is Σ_2^p -complete even if every player's feasible set is bounded (Carvalho, 2019, Carvalho et al., 2019). All the complexity results mentioned here hold for even two player Nash games, and the results continue to hold for generalizing the game to n players.

Multi-level games. Unlike certain Nash games where a solution exists, existence of a solution for multi-level games is not guaranteed even under boundedness or compactness assumptions. Thus, traditional polynomial hierarchy are typically applicable in the context of multi-level games.

One of the seminal results in this area is due to Jeroslow (1985) who showed that linear k-level game is Σ_{k-1}^p -complete. This is in contrast to Nash games, as the complexity of the multi-level game goes one step up the polynomial hierarchy for every additional player in the game. A trivial corollary of the result is that the linear bilevel game is *NP-complete*.

References

Margarida Carvalho. A note on the complexity of integer programming games. *arXiv preprint arXiv:1907.11338, 2019.*

Margarida Carvalho, Gabriele Dragotto, Felipe Feijoo, Andrea Lodi, and Sriram Sankaranarayanan. When Nash Meets Stackelberg. *arXiv preprint arXiv:1910.06452, 2019.*

Steven P Dirkse and Michael C Ferris. The PATH solver: a nonmonotone stabilization scheme for mixed complementarity problems. *Optimization methods and software,* 5(2):123–156, 1995.

Robert G Jeroslow. The polynomial hierarchy and a simple model for competitive analysis. *Mathematical programming,* 32(2):146–164, 1985.

John F Nash. Equilibrium Points in N-Person Games. *Proceedings of the National Academy of Sciences of the United States of America,* 36(1):48–9, January 1950. ISSN 0027-8424. doi: 10.1073/pnas.36.1.48.

Christos H Papadimitriou. On the complexity of the parity argument and other inefficient proofs of existence. *Journal of Computer and system Sciences,* 48(3):498–532, 1994 🌍

IFORS Prize for OR in Development 2020

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School Choice in Chile

José Correa; Rafael Epstein; Juan Escobar; Ignacio Rios ; Bastián Bahamondes; Carlos Bonet ; Natalie Epstein; Nicolás Aramayo; Martin Castillo; Andres Cristi; Boris Epstein; Felipe Subiabre

According to the Duncan Index of segregation, Chilean schools are extremely socially segregated (Bellei, 2013; Valenzuela et al., 2014). While the drivers of school segregation include societal aspects well beyond school choice, social movements and politicians were probably right at blaming features of the admission system.

The School Inclusion Law marks a breaking point in the organization and functioning of the school system. The Law, promulgated in 2015, drastically changed the old admission process by (i) eliminating co-payments in publicly subsidized schools; (ii) forbidding publicly subsidized schools from selecting their students based on social, religious, economic, or academic criteria; and (iii) defining priorities that must be used to assign students to schools. The Law also radically changed the way in which families apply and are assigned to schools, which made the transmission of information essential to the implementation. In the new system families can apply online with no need to visit the schools, so having accurate and complete information in the application platform was crucial for families to build their preferences.

In this work we report the results of an ongoing collaboration with the Chilean Ministry of Education (MINEDUC) addressing the practical challenges of implementing the School Inclusion Law. To this end, we designed and implemented a centralized system that (i) provides information about schools to help parents and students in building their preferences; (ii) collects families' preferences through an online platform, reducing the time and cost that visiting each school involved in the past; and (iii) assigns students to schools using a transparent, fair and efficient procedure.

Solution Approach

As part of the new system, students and families can access a platform where they can collect information—number of open seats, number of students per classroom and level, educational project, rules and values, co-payments required, among others—to build their preferences, and later they can use it to apply to as many schools as they want by submitting a strict order of preferences.

At the core of the system is the assignment algorithm, which collects all applications and adapts the celebrated Deferred Acceptance (DA) algorithm—introduced in the seminal paper by Gale and Shapley (1962)—to incorporate all the elements required by law and by MINEDUC. In particular, if the number of applicants is less than the number of open seats, the law requires that all students applying to that school are admitted, unless they can be allocated in a school they prefer over it. On the other hand, for schools that are over-demanded, the law defines a set of priority groups that are used to order students. In particular, there are three priority groups, which are processed in strict order of priority: (1) *Siblings*, for students that have a sibling already enrolled at the school; (2) *Working parent*, for students that have a parent working at the school; and (3) *Former students*, for students that were enrolled at the school in the past and were not expelled from it. Within each priority group students are randomly ordered, and each school uses a different random tie-breaker. In addition to these priorities, the law specifies three different types of quotas: (1) *Special needs*, for students with disabilities; (2) *High-achieving*, for students with high academic performance; and (3) *Disadvantaged*, for vulnerable students (bottom third in terms of income according to the Social Registry of Homes). Finally, another distinctive feature of the new school choice system is its broadness, as it runs nationwide and throughout all school levels. Being nationwide, the system accommodates the needs of both urban and rural families, and since it runs throughout all levels, it must dynamically update priorities to maximize the probability that siblings are assigned in the same school.

Results

Our results for the academic year 2019 consider 274,990 students and 6,421 schools in the main round (which includes all regions, except the Metropolitan area of Santiago). Students applied to 3.4 schools on average, and 59.2% of students were assigned to their top preference. Moreover, 82.5% of students were assigned to one of the schools in their application list, 8.6% were assigned by secured enrollment to their current schools, and only 8.9% resulted unassigned. In addition, there were 10,301 family applications involving 21,424 students and 65.3% of these were successful, i.e., siblings got assigned to the same school, while 3% were partially successful, i.e., only a subset of siblings got assigned together..

Conclusion

Designing, implementing and improving the Chilean school choice system has resulted in many lessons that could be useful for other practitioners designing large-scale clearinghouses. From a theoretical standpoint, we contribute to the existing literature by introducing the notion of family applications. We show that a stable matching may not exist, and we provide heuristics that are successful at increasing the fraction of siblings assigned to the same school. Finally, our results show that having lotteries over families significantly increases the fraction of siblings assigned to the same school. As centralized procedures to assign students to schools are becoming the norm in many countries, we expect that the lessons and solutions offered in this work are deemed useful in other implementations.

References

Bellei C (2013) El estudio de la segregación socioeconómica y académica de la educación chilena. *Estudios pedagógicos* 39(1):325–345.

Gale D, Shapley LS (1962) College admissions and the stability of marriage. *The American Mathematical Monthly* 69(1):9–15.

Valenzuela JP, Bellei C, De los Ríos D (2014) Socioeconomic school segregation in a market-oriented educational system. The case of Chile. *Journal of Education Policy* 29(2):217–241.

A Light-Touch Tool for Optimal Vaccine Distribution in Mozambique

Larissa P.G. Petroianu; Zelda B. Zabinsky; Mariam Zameer; Yi Chu; Mamiza M. Muteia; Mauricio G.C. Resende; Aida L. Cohelo; Jiarui Wei; Turam Purty; Abel Draiva; Alvaro Lopes

Distribution of vaccines in rural and impoverished urban communities faces many challenges due to inadequate vehicles, limited cold storage, road availability, and weather conditions. Moreover, different from most routing problems, cost reduction is not the sole or main objective. Maximization of the accessibility of medicines delivered within time constraints and constrained resources is the primary objective. Government and non-governmental organizations require tools for planning and scheduling distribution that are easy to use and update when circumstances change. VillageReach is a nonprofit organization focused on "strengthening the 'last mile' of healthcare delivery, where healthcare is administered, often the most rural and remote communities"[1]. VillageReach and the University of Washington, Department of Industrial & Systems Engineering, are working with the Mozambican Ministry of Health to develop and test a user-friendly, Excel spreadsheet-based optimization tool for routing and scheduling to effectively distribute vaccines and other medical commodities to health centers across the country.

Different from existing tools, the optimization model is easily updated and executed, considering the availability of routes, new products to distribute, or new health centers. The experience of VillageReach and the Mozambican government with current optimization tools is that the user interface is complicated to update data, and the constraints and objectives are difficult to modify without specialized technical expertise. As a result, existing tools are not typically used by the Mozambican Ministry of Health to plan distribution of medical supplies. As discussed by Van Wassenhove [2], there is an existing gap between supply chain tools for humanitarian organizations and those used in the private sector. Prior work in Nigeria showed that the use of supply-chain practices from the private sector resulted in an increase of immunization coverage by about 30%, and a cost reduction of about 15% [3]. Our goal is to improve vaccine distribution with a light-touch routing tool, suggesting routes that are optimal or near-optimal, according to Mozambique's constrained resources and uncertain environment. The tool can be used in routine operations or in emergency situations. The goal is to easily modify the data, allow multiple objectives, and update resource constraints easily. All of the input data is consolidated into one Excel spreadsheet file, in which each tab represents one type of input, including, demand, health center capacities, distances, road availability, vehicles with their capacities and costs, and penalties for unreliable vehicles and roads. The spreadsheets are designed to be similar to the documents that are used by the government. In addition, the output results are also consolidated in another Excel file for easy understanding. The team includes a design intern from VillageReach to improve the usability of the light-touch routing tool. The optimization model incorporates a consideration of variable conditions and their potential impact on the viability of the vaccines. For example, the accessibility of roads depends on weather conditions, and certain roads may not be passable in certain conditions. In addition, the condition of the vehicle is taken into account. If a vehicle cannot complete its route in the time allotted, perhaps it gets stuck in the mud or maybe the engine breaks down, the time to maintain cold storage of the vaccines could be exceeded and jeopardize the quality of the vaccines. These considerations are incorporated with the use of penalty parameters, and lead to one objective of the optimization model; minimize the sum of the penalties on roads and vehicles used in the route.

The second objective function is to minimize the total transit time to distribute the vaccines to the rural areas. The light-touch tool allows the users to select either objective function, or to minimize a weighted sum of the two objective functions. As is typical with vehicle routing optimization models, the computer time to determine an optimal solution can take hours or even days, depending on the details, which is impractical for government users. It was determined from interviews that a light-touch tool must return a solution quickly to be useful for operational decisions. In order to obtain a feasible solution quickly, a Vehicle Routing and Scheduling Algorithm (VeRSA) [4] was tailored to fit the considerations of vaccine distribution. VeRSA uses an indexing method to determine near-optimal feasible solutions promptly, and is embedded into a branch and bound framework to obtain an optimality gap for intermediate solutions and eventually obtain an optimal solution. It is coded in Python and reads and outputs Excel spreadsheets. For comparison purposes, the mixed-integer programming model was also implemented using GLPK, which is a publicly available free solver that can be accessed from Python. The performance of VeRSA finds a better solution faster than GLPK, and both arrive at the optimal solution when allowed to run to optimality.

The distribution and routing tool, named Route Optimization Tool (RoOT), is available on GitHub in English and Portuguese [5,6] as open-source for all users, especially those from NGOs, government, and academia. The tool was delivered to the VillageReach team in Mozambique in June 2019 for testing. Users from the Mozambican Ministry of Health were trained to use the tool in January and February 2020, and the feedback received was favorable. However, full deployment has been interrupted due to the new coronavirus pandemic.

References

[1] VillageReach website, https://www.villagereach.org/about/, last accessed September 23, 2019.
[2] Van Wassenhove, L.N., 2006. Humanitarian aid logistics: supply chain management in high gear. *Journal of the Operational Research Society* 57, 475–489.
[3] Sarley, D., Mahmud, M., Idris, J., Osunkiyesi, M., Dibosa-osadolor, O., Okebukola, P., Wiwa, O., 2017. Transforming vaccines supply chains in Nigeria. *Vaccine* 35, 2167–2174.
[4] Zabinsky, Z.B., Dulyakupt, P., Zangeneh-Khamooshi, S., Xiao, C., Zhang, P., Kiatsupaibul, S., and Heim, J.A., "Optimal Collection of Medical Specimens and Delivery to Central Laboratory." *Annals of Operations Research*, 287:537–564, 2020. DOI: https://doi.org/10.1007/s10479-019-03260-9 On-line version at: https://rdcu.be/bEOUC.
[5] Petroianu, L.P.G., 2019a. RoOT dataset and user guide in English. https://github.com/lpetroia/RoOT
[6] Petroianu, L.P.G., 2019b. RoOT dataset and user guide in Portuguese. https://github.com/lpetroia/RoOT-portugues

New IFORS Journal with Elsevier – Sustainability Analytics and Modeling (SAM)

Stefan Nickel <stefan.nickel@kit.edu>

IFORS is proud and happy to announce that a contract was signed with Elsevier to launch a new journal: Sustainability Analytics and Modeling (SAM). A search committee was formed to find as soon as possible the inaugural editor-in-chief for SAM.

The members of the search committee are
– Rosiane de Freitas, VP representing ALIO, Federal University of Amazonas
– Karla Hoffman, VP representing NORAM, George Mason University
– Stefan Nickel, VP representing EURO, Karlsruhe Institute of Technology (chair)
– Sunity Shrestha Hada, VP representing APORS, Tribhuvan University

We are confident to start the journal in January 2021. If you work in that area and you already want to prepare papers for submission, here is the preliminary aims and scope of SAM.

Aims and Scope
Sustainability Analytics and Modeling is an international journal looking at quantitative challenges in sustainability from an Operations Research and Analytics point of view.

A special emphasis will be given to the 17 sustainable development goals (SDGs) stated by the UN (https://www.un.org/development/desa/disabilities/envision2030.html): No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequality, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace and Justice Strong Institutions, Partnerships to achieve the Goal.

SAM publishes high-quality operations research and/or analytics approaches to challenges in sustainability from researchers and practitioners. Also, interdisciplinary submissions with a quantitative focus are welcome.

Typical methods include (but are not restricted to): Mathematical Programming, Heuristics, Multi-Criteria-Decision-Making, Simulation, Forecasting, Statistical Analysis, Machine Learning, …

We are all very excited and hope that SAM will attract many interesting papers from all over the world and we are sure that this new journal represents the very heart of the idea of IFORS as a world-wide umbrella organization for Operations Research. SAM will complement ITOR (our flagship journal). 🌐

IFORS Global Webinar
The 2nd IFORS Global Webinar -APORS Region
O.R. in the Asia Pacific: Recent Trends and Practices
September 30, 2020

Sunity Shrestha Hada <sunity.shresthahada7@gmail.com>

Continuing the IFORS Global Webinar series, the 2nd IFORS Global Webinar was organized by APORS on September 30, 2020. The COVID-19 is still prevailed its impact on the whole world in terms of health, education, over all social lives of people and the economy as a whole. The series of lock down and inability of physical movement has brought people around the world closer through technology. Number of pre-scheduled conferences have been postponed but has opened a new venue to meet through virtual meetings. Actually speaking, the virtual meetings have made the globe more small and beautiful irrespective of numerous difficulties.

The triennial IFORS conference has been re-scheduled for August 22-27, 2021 and the triennial APORS conference is rescheduled for 2022 at Philippines. We hope the situation on traveling and other factors will be improved by then and all the activities around the world will be as per the schedule and the life will be normal in nearest future.

The Association of Asia Pacific Operational Research Societies (APORS) has 12 member countries as below.

The 2nd IFORS Global Webinar was organized on September 30, 2020 with the theme of **OR in Asia Pacific: Recent Trends and Practices**. The host team of the webinar were **Grazia Speranza**, Italy (President of IFORS), **Francis Miranda**, Philippines (President of APORS) and **Sunity Shrestha Hada**, Nepal (IFORS Vice President representing APORS). The program took place at 9:00 AM Washington DC time for 90 minutes.

The Hosts: 2nd IFORS Global Webinar Series-APORS
Grazia Speranza (IFORS President, ITALY), Francis Miranda (APORS President, Philippines), Sunity Shrestha Hada (IFORS Vice-President representing APORS) the moderator.

▲ Figure 1: Member countries of APORS

The Participants
A total of 111 participants joined the webinar from 27 countries of five continents (Figure 4 & 5). Ten countries from Europe, six countries from Asia and six from Latin America, three countries from Africa, and from NORAM (USA and Canada) participated in the webinar. There were 65 participants joined from Asia, 17 from each Europe and Latin America, 8 from NORAM and 4 participants from Africa.

The Invited Speakers
Three panelists from Nepal, India and China presented their research papers.

First panelist Tanka Nath Dhamala is Professor at Central Department of Mathematics, Tribhuvan University of Nepal (amb.dhamala@daadindia.org). He presented the research paper entitled **Impact of Dynamic Network Reconfiguration on Optimal Evacuation Planning.**

Abstract
A large number of disasters have been a big challenge to protect the people and property. Many researchers from different aspects of sciences have focused these issues. The evacuation planning problems are modeled with network flows and mathematical programming. The OR models and algorithms that compromise the solution quality of real-scenarios at computational cost are the main points of research for acceptable evacuation plans. There exist many mathematical models and solution strategies, but still lacking a universally acceptable one. We discuss network flow models that vary on the means of transportation, commodity and network parameters, and present algorithms that optimize the network reconfigurations. Our algorithms are applicable to suggest optimal emergency facilities and movement of logistic vehicles. We present efficient algorithms, although most of the problems in this domain are computationally hard

Second panelist Gokulanand Patel is from Birla Institute of Management Technology (BIMTECH), India (gn.patel@bimtech.ac.in). He presented research paper entitled **Application of DEA Tool in analyzing COVID-19.**

Abstract
There have been several major outbreaks globally during the past decades, with the latest being the COVID-19 pandemic. So far it has infected millions of people and killed hundreds of thousands in the world. Performance of seriously affected countries regarding contagion control and medical treatment of COVID-19 have been evaluated using Data Envelopment Analysis tool in two steps. Undesirable inputs like population, population density, undesirable outputs like number of affected and death cases, along with inputs like medical facilities, recovered cases are considered. The analysis can help worst effected countries to follow the way those who are managing well. Since the COVID-19 hits the poor hardest, government can suggest guidelines for them. Also, it can help with support packages to business and economies afloat, providing critical medical and safety equipment including masks with minimum price.
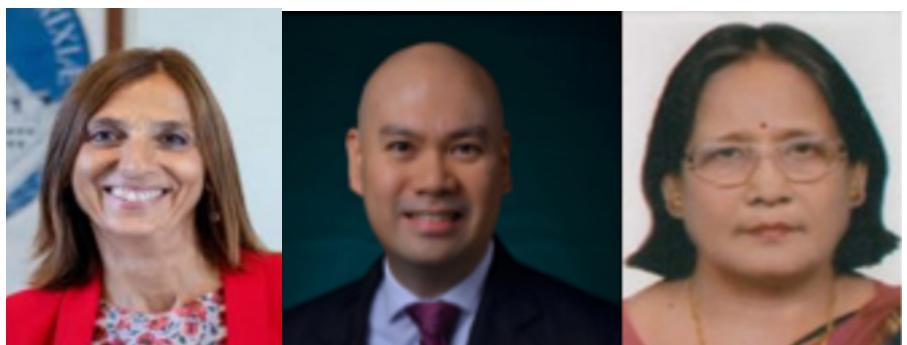
The **third panelist, Dongdong Ge** is from Shanghai University of Finance and Economics, China (ge.dongdong@mail.shufe.edu.cn). He presented his research paper entitled **Supply Chain Network Management in Mitigation of Covid-19.**

▲ Figure 2: The 2nd IFORS Global Webinar Series: APORS Poster

Abstract
Covid-19 has stuck at the core of the global value chain hub regions and has disrupted supply chains around the world with a series of problems: reduced demands, higher uncertainty, longer transfer cycle time, facility relocation, shortage in labor and critical materials. These challenges certainly urge a more robust, more flexible and more effective supply chain network management (SCNM) system. In this talk, we present several ad-hoc smart SCNM solutions for some Asian companies in mitigation of the pandemic. These data-driven smart solutions integrate multiple tools in machine learning, robust optimization, and operations management and perform well in the face of the challenges of Covid-19.
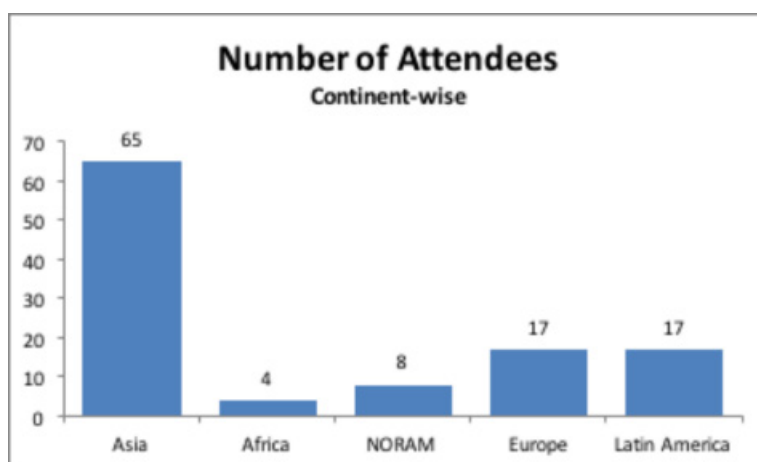
▲ Figure 3: The Hosts

▲ Figure 4: Participants by continents and countries

Concluding Remarks

All the three papers were related to impact of COVID-19 and the disaster management that are the burning issues of the current pandemic period. Therefore, the presentation and discussion were very lively. The 90 minutes webinar including all the formal official procedures, three paper presentations and the floor discussion were efficiently managed. The office supporters- the housekeeping part was excellent. The queries raised from participants during the webinar were duly responded by the respective speakers.

The successful completion of the two webinars (ALIO and APORS) of IFORS Global Webinar series encourages the need of its continuation. It provides a reason for OR-personnel to meet at each two months in the virtual venue of webinar series in IFORS platform and share the research findings.

IFORS Global Webinar series offers free webinars in various

▲ Figure 5: The number of participants in the webinar (Continent-wise)

topics from its regional societies throughout the years starting from ALIO, APORS, EURO and NORAM in continuous cycle. 🌍

▲ Figure 6: The Invited Speakers

Report on the 3rd IFORS Global Webinar – EURO O.R. in Europe: Topics that Matter

Stefan Nickel (IFORS Vice President, Germany)

▲ Figure 1- Poster of the 3rd IFORS global Webinar

The IFORS Global Webinar series aims at facilitating the exchange within the global O.R. community. With conventional conferences, such as the triennial IFORS conference, made impossible by the on-going COVID-19 pandemic, this Webinar series leverages the opportunities of the virtual world by providing a free and easy-to-access platform for the international O.R. community.

The 3rd IFORS Global Webinar was organized by EURO (Association of European Operational Research Societies) and took place on November 30th at 15:00 CET, having as hosts Grazia Speranza (IFORS President, from UNIBS, Italy), Immanuel Bomze (EURO President, from UNIVIE, Austria), and Stefan Nickel (EURO Vice-President representing EURO, from KIT, Germany), who served as moderator (Figures 1-2).
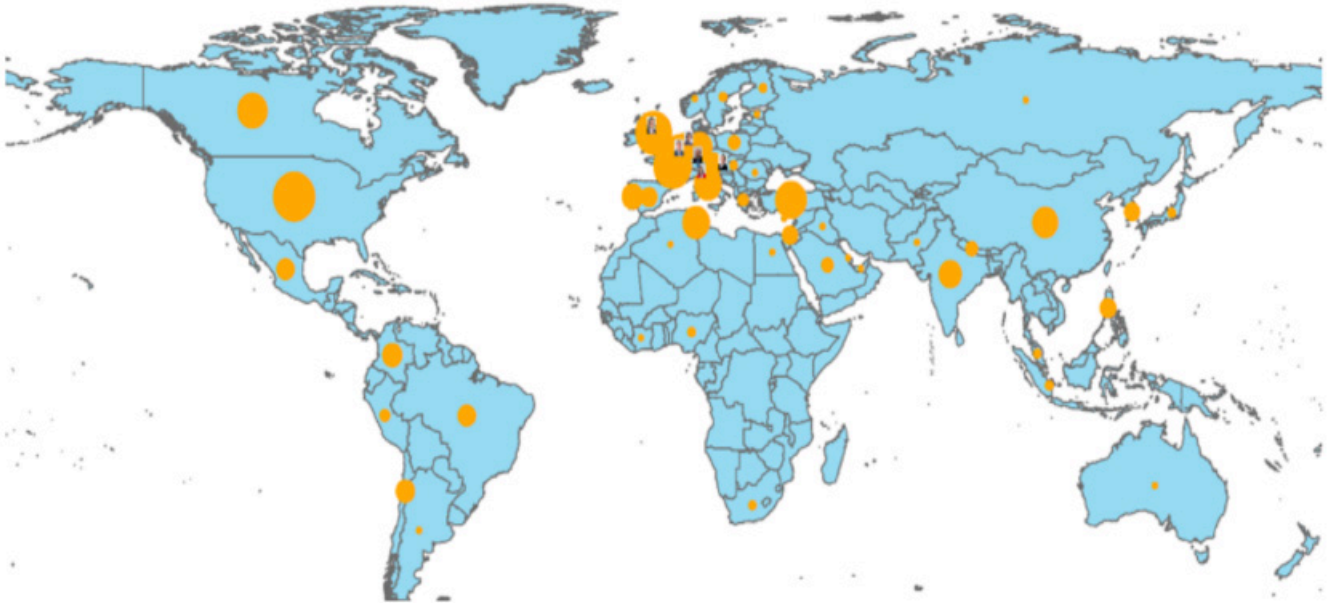
There was a great deal of interest in the Webinar resulting in the pre-registration of more than 350 interested people from all around the world, as can be seen in Figure 3 and Table 1. This shows the relevance of the invited talks and the need for such a platform to enable the worldwide exchange within the O.R. community. Of the registered people, over 200 from many countries participated effectively in the Webinar, covering all populated continents and the major IFORS scientific societies.

The Webinar had a duration of one and a half hours and consisted of talks from three invited speakers from three countries - Scotland, Belgium, and the Netherlands - presenting recent developments in theoretical and applied O.R. to face current global challenges.

▲ Figure 2 – The Hosts of the 3rd IFORS Global Webinar: Grazia Speranza (IFORS President, Italy), Immanuel Bomze (EURO President, Austria), and Stefan Nickel (IFORS Vice President representing EURO, Germany).

▲ Figure 3 - World map of 3rd IFORS Global Webinar (EURO) participants, hosts, and invited speakers.

The first talk, "*Increasing electric vehicle adoption via optimal deployment of charging stations*", was given by Miguel F. Anjos from UE, Edinburgh, Scotland, and presented a model whose objective is to increase the usage of electric vehicles by the optimal placement of charging infrastructure. The second talk, titled " A Transdisciplinary, System-based OR Approach to Covid-19 Challenges " was given by Nico Vandaele from KU Leuven, Belgium, focusing on human-centered, system-based and design thinking principles to design Covid-19 vaccine (sub)systems. Richard Boucherie from UT, Twente, Netherlands, held the third talk and presented a forecast model for the number of COVID-19 patients admitted to the ward and the Intensive Care Unit (ICU) of hospitals, entitled "Healthcare operations management challenges due to COVID-19". The abstracts of the talks are given below.

Abstract:
Electrifying transportation is critical to meaningfully curtail the use of fossil fuels. Electric vehicles (EVs) have the potential to considerably reduce the emissions produced by road transportation, and various countries have adopted ambitious targets for EV adoption. We present a new strategic multi-period mixed-integer linear optimization approach for locating EV charging stations. This is the first time that node-based modelling for urban or suburban settings has been combined with flow-based modelling for long-distance trips. Another novelty of our approach is that EV adoption over time is influenced by both the availability of charging opportunities and the local level of enthusiasm for EVs. We apply our approach to realistic large-scale instances based on the Canadian province of Quebec and the American state of California.
(This is a joint work with Martim Joyce-Moniz and Bernard Gendron.)

Talk 2: *A Transdisciplinary, System-based OR Approach to Covid-19 Challenges.*
Nico Vandaele - Access-To-Medicines Research Center – KU Leuven - Belgium

Abstract:
Touching the current Covid-19 pandemic, we review several decision support problems which call for a transdisciplinary approach. We build upon human-centered, system-based and design thinking principles to design Covid-19 vaccine (sub) systems such as the vaccine supply network design, the fair and equitable allocation of vaccines, the in-country supply system as well as the overall vaccine eco-system. We showcase the particular challenges encountered and conclude with some generic insights useful for other complex OR design problems and the OR community at large.

▲ Figure 4 – The Invited Speakers for the 3rd IFORS Global Webinar: Miguel F. Anjos (UE, SCOTLAND), Nico Vandaele (KU Leuven, BELGIUM), Richard Boucherie (UT, NETHERLANDS), respectively.

Talk 3: *Healthcare operations management challenges due to COVID-19*

Richard Boucherie – Mathematics of Operations Research (MOR), Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS), University of Twente – UT, Twente - Netherlands

Abstract:

We present a mathematical model that provides a real-time forecast of the number of COVID-19 patients admitted to the ward and the Intensive Care Unit (ICU) of a hospital based on the predicted inflow of patients, their Length of Stay (LoS) in both the ward and the ICU as well as transfer of patients between the ward and the ICU within the hospital and between hospitals. The data required for this forecast is obtained directly from the hospital's data warehouse. The resulting algorithm is tested on data from the first COVID-19 peak in the Netherlands, showing that the prediction is very accurate. The forecast may be visualised in real-time in the hospital's control centre and is used in several Dutch hospitals during the second COVID-19 peak.

(This is a joint work with Stef Baas, Sander Dijkstra, Aleida Braaksma, Plom van Rooij, Fieke J. Snijders ans Lars Tiemessen.)

Concluding Remarks

Three contributions of the O.R. community for supporting decision makers in facing current global challenges - Climate, Mobilty, and Health - were shared in very interesting talks. Concrete models were shown that can be applied worldwide, demonstrating how IFORS facilitates the global transfer of knowledge in O.R.
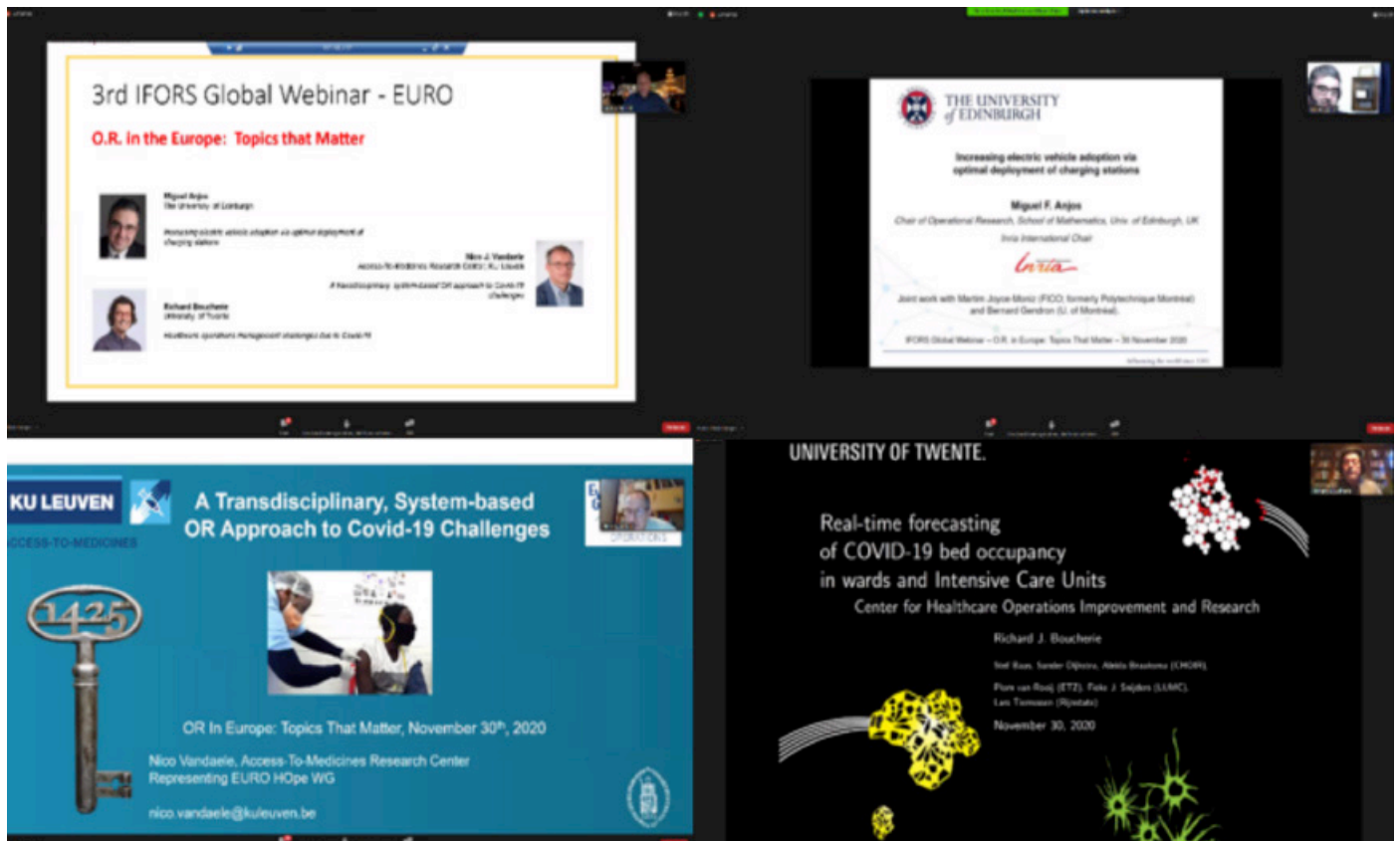
The Webinar as a whole went smoothly and had no disruptions or technical issues. The Q&A functionality of Zoom was used actively and substituted the planned live Q&A session with the result that the Webinar finished (almost) on time. The more active use of the Q&A window and possibly

CONTINENT	NUMBER OF PARTIPANTS
Africa	25
Asia	68 (10 Middle East)
Australia	1
Europe	183 - 24 Turkey (Europe/Asia)
North America	70
South America	31

▲ Table 1 - Number of registered participants by region of the world (continents).

even the substitution of the longer live Q&A session by this functionality can be considered in the future development of the Webinar format. The general feedback was very positive with participants suggesting to keep the Webinar series going even after the pandemic is over and face-to-face meetings would possible again. In this context it may be worthwhile to look into hybrid formats.

The IFORS Global Webinar series once again proved to be an adequate instrument for getting together and exchanging ideas between the different regions of our world and we look forward to the upcoming IFORS Global Webinar hosted by NORAM in January 2021. 🌎

▲ Figure 5 – Screenshots from the 3rd IFORS Global Webinar – EURO.

Experiencing Turkish culture with Data Science and Engineering, Turkey (May 2-3, 2019)

Sadia Samar Ali <ssaali@kau.edu.sa>; **Rajbir Kaur** <Rajbir00@gmail.com >

Modern economy, society, business, education, and even daily activities are data-dependent now and evolving social, corporate workplaces require employees that are capable of data synthesis, presentations, and other data-science applications. Growing trends of data analytics, smart systems designs, and development require technical education to adopt the transitions happening in the diverse fields of science, engineering, and technology. Academic platforms must train the future analysts and data developers with hand-on practices to strengthen their conceptual knowledge and applied foundations of the subjects. Considering the importance of such opportunities for future data professional and scientist, the *Academy of Science and Arts* at *Karabük University,* Karabük (www.karabuk.edu.tr) organized their *1st International Data Science and Engineering Symposium (IDSES 2019)* on May 2-3, 2019, at *Safranbolu,* Karabük, Turkey (www.idses.org). The city of Safranbolu is an Ottoman city, with typical buildings and streets, and played a key role in the *caravan trade* over many centuries. Safranbolu town, known for its uniquely preserved traditional Ottoman Turkish architecture, was inscribed on the *UNESCO World Heritage List* in 1994 on cultural criteria (https://whc.unesco.org/en/list/614/). Spanned over two days in this world heritage's town, the symposium witnessed exchange of ideas through interactive discussions, practical workshops and lab sessions focusing on data for cross industry erudition and associations. The event was attended by established national and international education representatives, academicians, data scientist, data engineers, and researchers.

The symposium was coordinated by *Prof. Dr. Sadettin Ökten* and *Prof. Dr. Fuat Sezgin* under the guidance of President of University, *Prof. Dr. Refik Polat*. The event was organized at the main campus of the Karabük University by *Prof. Dr. Filiz Ersöz,* Karabük University (https://muh.karabuk.edu.tr/?page=detail&no=127). For closer details and impressions we refer to https://kulliye.karabuk.edu.tr/kbude-konferans-salonuna-prof-dr-sadettin-oktenin-adi-verildi/ andhttp://www.fuatsezginsempozyumu.org/en/prof-dr-fuat-sezgin-biography/.

The symposium was based on the theme of data exploration and analysis for decision making and future challenges. The objectives of the symposium were to provide exposure to the budding scientist and engineers about latest trends in ICT applications, data management and applications, data mining and engineering. The symposium also aimed to facilitate the students for improving their efficiencies in data synthesis and presentations and making sensible choices using data. As data have become new norms for this young generation, it would seem sensible to focus the attention of education on intervention that provide the necessary exposure and good grasp of requisite knowledge.

The symposium started on May 2nd, 2019, with its opening

▲ Dr. Noor from Jorden and Sadia Samar Ali (from left to right).

ceremony by the President of the university *Prof. Dr. Refik Polat,* followed by keynote speeches by *Prof. Dr. Filiz Ersöz,* Karabük University, and *Prof. Dr. Necmi Gürsakal,* Fenerbahçe University, Turkey. A coffee break was followed by the keynote speech of *Prof. Dr. Sadia Samar Ali,* King Abdulaziz University, Saudi Arabia, and by the speeches of other invited speakers. Lunch was preceded by parallel sessions of *"Machine leaning and Artificial intelligence"* conducted by *(Prof. Dr. Necmi Gürsakal)* and *"Big Data Analytics and Metrics"* (Prof. Dr. Sadia Samar Ali) and *"Data Mining and Knowledge Discovery"* (Prof. Dr. Filiz Ersöz). Remaining sessions were conducted after coffee break where *Sadia Samar Ali,* chaired a session on *"Big Data and Green Practices for Carbon Performance"* and day ended with the closing speech. This was followed by a social event organized at *Safranbolu Çelik Palas Hotel* by the university for invited dignitaries.

Highlights of the discussions: The discussion, and sessions of the first day mainly focused on the following topics: *Artificial Neural Networks Based Genetic Algorithm; Smart and Green Supply Chain Applications in Enterprises; Adopting Machine Learning Algorithms for Cloud-Based Application Categorization; Building Digital Assistant (ChatBot) with SAP Conversational Artificial Intelligence; Smart Agriculture Applications with IoT; Assessment the Use of Aircraft Maintenance Manuals in Terms of Human-Machine Interaction; Connected Employee Platform; Factors Affecting the Adoption of Social Networks for Academic Purpose; >>*

Methodology for Building A Security System for Banking Information Resources; Facebook Games Applications; Data Science Meets Optimization; CO2 Emission and Energy Consumption and Building; Analysis of Earthquake Awareness in Education by Data Mining; Application and Comparison of Bi-clustering Methods in Detecting Crime Regions; Determination of Socio-Economic Factors Affecting Forest Fires; Data Analytics and its Importance in Health Sector; Detection of Manufacturing Defects in Iron and Steel Industry by Data Mining; Covering-Based Generalized IF-Rough Set Models for Selecting a HVAC System; Stochastic Approach to a Buffer Stock Problem; Multi-Objective Optimization of Hard Turning: Non-Dominated Sorting Genetic Algorithm-II Approach; Survey on Dynamic Bayesian Network Software Tools; Analysis of Non-Risked Provinces; Unemployment and Traffic Accidents.

The second day started with parallel sessions on *Data Science and Engineering* by invited speakers. The themes of the topics

▲ Filiz Ersoz, Sadia Samar Ali, wife of Prof. Ahmet, and Prof. Dr. Ahmet (from left to right).

were like the discussion on day one. The technical sessions were followed by poster-making competitions and video sessions by the participants. The sessions were followed by tour of Safranbolu for sight-seeing and social networking. The two-day event ended with a closing speech by the president of the university, *Prof. Dr. Refik Polat.*

First Caribbean & Central American Workshop on Statistical Literacy (December 3, 2019)   James J Cochran <jcochran@cba.ua.edu>

▲ Attendees of the First Caribbean & Central American Workshop on Teaching Introductory Statistics.

The *"1st Caribbean & Central American Workshop on Statistical Literacy for High School Students"* opened on December 3, 2019, with a welcome from *Halim Brizan,* Grenada Ministry of Finance's Director of Statistics. Throughout the three-day workshop, twenty-five colleagues (high school teachers along and few college instructors and government analysts and officials) participated. The participants were extremely engaged and enthusiastic, and they gave the workshop outstanding reviews.

The development of this workshop began with an email I received in May 2019 from *Yu Tian* and *Millicent Gay Tejada of the Partnership in Statistics for Development in the 21st Century (PARIS21,* https://paris21.org/about-paris21). *Mr. Tian,* a Policy Analyst who monitors global support for statistics and global statistical literacy, and *Ms. Tejada,* the Project Officer for Asia and the Pacific, made an interesting proposition. >>
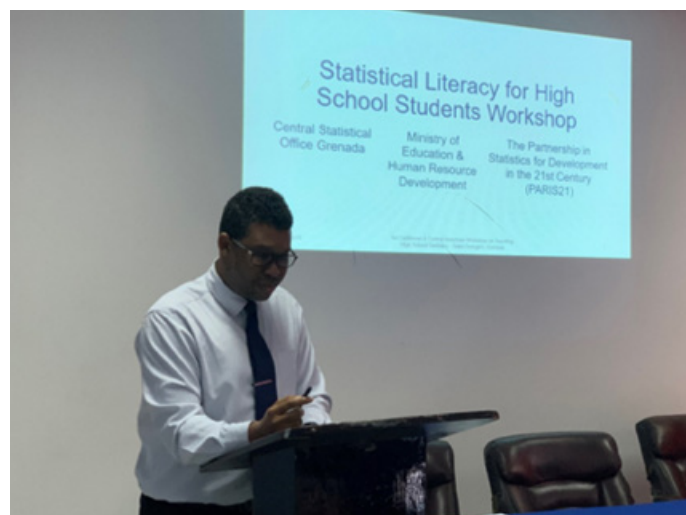
>> They had learned of a workshop on teaching statistics and operations research that US colleagues and I organized on the University of Alabama campus for a group of colleagues from Mongolia in May 2017[1,2]. After returning to Mongolia, the participants worked with the National Statistics Office of Mongolia to create the *Handbook on Statistical Methodology,* which provides the basis of the new statistics courses that all students in Mongolia's secondary schools now take. *Mr. Tian* and *Ms. Tejada* believed that this approach to improving statistical literacy and growing statistical capacity could be effective in Caribbean countries, and they invited me to work with them on this initiative. The *International Monetary Fund,* the *World Bank,* the *United Nations,* the *European Commission,* and the *Organisation for Economic Co-operation and Development established PARIS21* in 1999 by to promote better use and production of statistics in the developing world. Over the past twenty years, *PARIS21* has developed an extensive worldwide network of statisticians, analysts, policy makers, and development practitioners committed to evidence-based decision making. The organization works with this network to achieve national and international development goals, reduce poverty in low and middle-income countries, and develop a culture of *Management for Development Results.*

I have worked with colleagues on statistics/operations research/analytics literacy and capacity building projects in several other nations[3-19] (Uruguay, South Africa, Colombia, India, Kenya, Argentina, Nepal, Cameroon, Tanzania, Fiji, Uganda, Croatia, Estonia, Cuba, Moldova, Tunisia, Bulgaria, Namibia, and Mongolia), and I was impressed with PARIS21's organization and network, so I was eager to work with these colleagues. After deciding that our first efforts would focus on Grenada, *Mr. Tian* and *Ms. Tejada* proposed a three-day workshop on effective instruction of introductory statistics to the Grenadian government. The *National Statistics Office and Ministry of Education* of Grenada quickly indicated eagerness to work with us and the committed to hosting the workshop.

▲ Dr. Nathan Tintle discusses a Concept in Experimental Design.

then recruited a team of renowned statistics instructors to create and teach in the workshops. The team includes *Anna Bargagliotti,* Loyola Marymount University; *Beth Chance,* Cal Poly San Luis Obispo; *Christine Franklin,* University of Georgia; *Kaycie Maddox,* Northeast Georgia Regional Educational Service Agency; *Roxy Peck,* Cal Poly San Luis Obispo; *Lynne Steuerle Schofield,* Swarthmore College; and *Nathan Tintle,* Dordt University. The team developed modules of high school level material on data visualization and descriptive statistics;

▲ Mr. Halim Brizan, Director of Statistics with Grenada's Ministry of Finance, Welcoming the Workshop Participants.

probability for statistics; statistical inference; regression analysis; and experimental design and sampling. The material focused on motivation (why teach/study the material in this module?); organization and flow (how can/should coverage of the key concepts be organized?); key concepts (how can each key concept and term in this module be effectively covered?); examples (how can this be applied to real problems?); and helpful hints (what else can we suggest for this module?).

We decided that *Dr. Chance, Dr. Tintle,* and I would deliver the inaugural workshop for this initiative in Saint George's in early December.

In addition to the participants' enthusiastic reaction, *Ministry of Education* of Grenada and Grenadian *National Statistics Office* officials were extremely pleased with the workshop. The Grenada Broadcast Network reported nationally on the workshop (https://www.facebook.com/watch/?v=2736786999675140), and Ambassador *Didier Chassot (Head of Mission of Switzerland* to Venezuela and several other *Swiss diplomatic missions* in the Caribbean) praised the event.

We are working to establish workshops across the region, organize the participants into workgroups that develop a regional *Handbook on Statistical Methodology,* and establish a recurring Caribbean and Central American conference on teaching statistics. We also want to extend this program to other regions and replicate it for *Operational Research.* The coronavirus pandemic is slowing our progress, but we will accelerate once the pandemic has been controlled.

Please contact me at jcochran@cba.ua.edu to discuss organizing a similar event for colleagues in your nation or suggest a nation we could consider for a future workshop.

1   Mendsaikhan Sonomtseren, Altantsetseg Sodnomtseren, and Khuslen Zorigt (2016). O.R. without borders: Introducing O.R. in Mongolian Schools INFORMS leaders join Mongolia's strategic efforts to emphasize analytics in its education system, *ORMS Today,* 43(4).
2   James J. Cochran (2018). Ambassadors and O.R. Education, *ORMS Today,* 45(4).
3   James J. Cochran (2013). How do you find and Prepare for Opportunities to work in Developing Nations? *AMSTAT News,* June.

4 James J. Cochran (2015). An O.R. Perspective on U.S./Cuba Relations, *ORMS Today,* 42(2).

5 James J. Cochran (2018) Mongolia Outreach Leads to Nationwide High School Statistics Education, The International Statistical Literacy Project (ISLP) Newsletter, September 2019.

6 James J. Cochran (2020). Teaching Effectiveness Colloquium (TEC) for Statistics Educators in Mongolia, ISLP Newsletter: *Newsletter of the International Statistical Literacy Project,* 1 (12).

7 James J. Cochran (2006). Workshop on O.R. Education Set for Uruguay, *ORMS Today,* 33(5).

8 James J. Cochran (2007). The first ALIO/INFORMS Workshop on OR Education - A Great Success in Montevideo… and now on to Cape Town! *IFORS Newsletter,* 15(1).

9 James J. Cochran and Hector Cancela (2007). The first ALIO/INFORMS Workshop on OR Education - A Great Success in Montevideo! *ORMS Today,* 34(2).

10 James J. Cochran (2007). Workshop on O.R. Education to be held in Cape Town, *ORMS Today,* 34(3).

11 James J. Cochran (2008). O.R. in Africa Conference … in D.C., *ORMS Today,* 35(2).

12 James J. Cochran (2009). Progress in the Use of Operations Research in Eastern Africa and the 5th International Operations Research Society of Eastern Africa Conference, *IFORS Newsletter,* 3(4).

13 James J. Cochran (2010). International Teaching Effectiveness Colloquium Continues to Reap Benefits, *IFORS News,* 4(4).

14 James J. Cochran (2010). An Update on the INFORMS/IFORS International Teaching Effectiveness Colloquium Series, *IFORS News,* 4(4).

15 Nkem A. Khumbah and James J. Cochran (2013). IFORS Introductory Operations Research Colloquium held in Cameroon! *IFORS News,* 7(2).

16 Nkem A. Khumbah and James J. Cochran (2013). O.R. goes to Cameroon, *ORMS Today,* 40(3).

17 James J. Cochran (2013). How do you find and Prepare for Opportunities to work in Developing Nations? *AMSTAT News,* June.

18 James J. Cochran (2015). An O.R. Perspective on U.S./Cuba Relations, *ORMS Today,* 42(2).

19 James J. Cochran (2020). Teaching Effectiveness Colloquium (TEC) for Statistics Educators in Mongolia, *ISLP Newsletter: Newsletter of the International Statistical Literacy Project,* 1(12). 🌐

Autumn School on Bilevel Optimization, Germany (Online October 12-14, 2020)
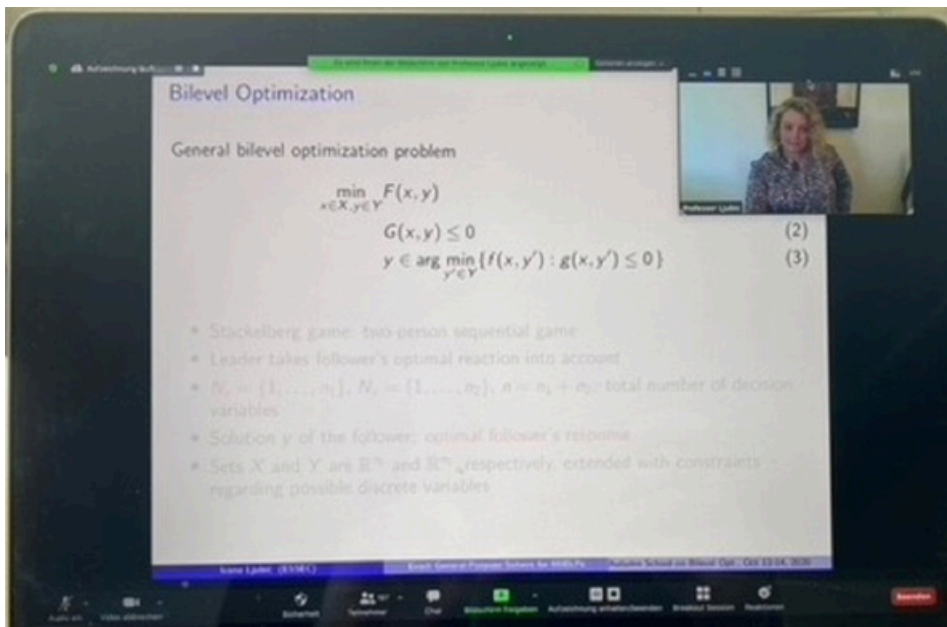
Burcu Gürbüz <burcugrbz@gmail.com>

▲ ALOP 2020: Prof. Dr. Martine Labbé presents her "Introduction to Bilevel Optimization, Linear Bilevel Problems, and Maybe Beyond".

The *ALOP - RTG (Research Training Group on Algorithmic Optimization)* at *Trier University* is a research center and funded by the *German Research Foundation (DFG)*. The research center hosts many scientific events such as conferences, colloquiums, autumn schools, workshops, etc. This is one of the reasons that the *ALOP - RTG* is regarded as an attractive research center for scientists, experts and scholars who work on optimization and related fields. Since 2016, *ALOP - RTG* has offered annual *Autumn Schools* with the following topics: Algorithmic Optimization (2016), Optimization in Machine Learning and Data Science (2017), Mixed Integer Non Linear Programming (2018) and Optimal Control and Optimization with PDEs (2019), respectively.

This year, hosts and guests celebrated *ALOP - Autumn School on Bilevel Optimization 2020.* This event was held online during October 12-14, 2020. The autumn school was organized by *Prof. Dr. Marina Leal Palazón* (Miguel Hernández University, Elche, Spain) and *Prof. Dr. Martin Schmidt* (Trier University, Germany) together with *Martina Shaw* (Administrative Coordinator; Trier University, Germany). This important scientific organization was hosted by *ALOP - RTG* at Trier University (https://alop.uni-trier.de/event/autumn-school-on-bilevel-optimization). The autumn school received around 226 participants from all over the world. Actually, they attended the online meetings at various times. The event hosted many young researchers at the beginning of their careers, and three distinguished professors and well-known experts from the topics of *"Bilevel Optimization".* They gave detailed talks with respect to those subjects, which were scheduled for three different days, with morning and afternoon sessions.

▲ ALOP 2020: Prof. Dr. Ivana Ljubic lectures on "Mixed-Integer Bilevel Linear Programs".

resulted in productive beneficial discussions and in some new ideas by with the participants and specifically the young researchers at the online platform of the event.
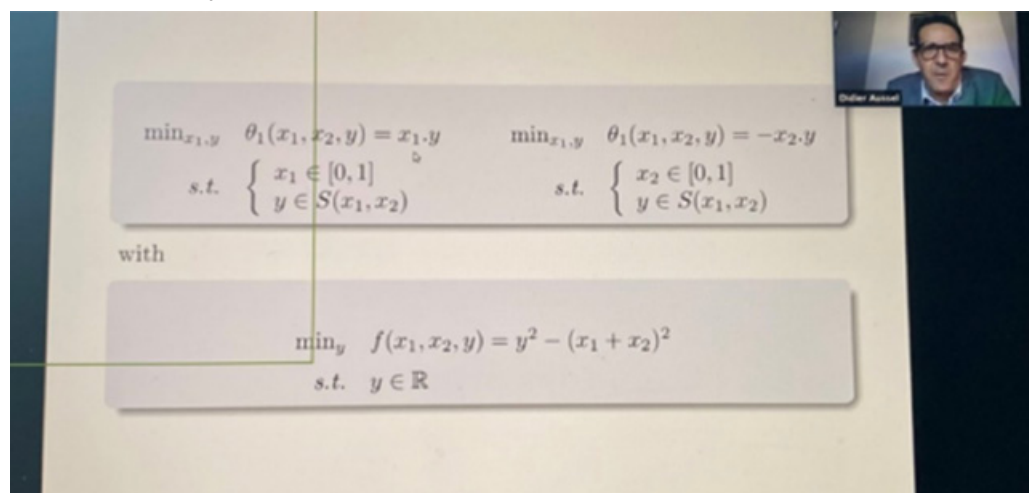
At the second day of the school, *Prof. Dr. Ivana Ljubic* (ESSEC Business School of Paris, France) held her lecture named *"Mixed-Integer Bilevel Linear Programs".* She gave to the participants some specific examples on the topic together with models and their optimistic and pessimistic solutions. Her tutorial was well received with almost 200 people at times watching at the online meeting (https://alop.uni-trier.de/2020/10/14/prof-ivana-ljubic-presents-tutorial-on-second-day-of-autumn-school). At the last day of the school, *Prof. Dr. Didier Aussel* (University of Perpignan, France) gave his lecture called *"Bilevel Problems, MPCCs, and Multi-Leader-Follower Games".* He introduced the participants into some ongoing projects related to bilevel optimization and advised some further readings to the young scientists. His talk took place in the afternoon session and attracted some interesting questions from the participants.

Even if the event was settled as online, participants could find a chance to communicate and extend their networks by using online platforms such as *"Slack"* created during the conference and virtual coffee breaks, which were carefully organized by the autumn school organization.

At the farewell session, *Prof. Schmidt, Prof. Leal Palazón* and *Prof. Schulz* thanked the participants, speakers and the technical and administrative team for the organization of the autumn school. Then, the organizing professors and lecturing professors shared their greetings and best wishes with the participants.

Presentations of the speakers and some of the elevator pitches of the *ALOP - Autumn School on Bilevel Optimization 2020* can be found at the following link https://alop.uni-trier.de/event/autumn-school-on-bilevel-optimization/. 🌍

The welcoming ceremony of the event started with the opening remarks of *Prof. Dr. Volker Schulz* (Trier University) and *Prof. Dr. Martin Schmidt,* mainly about the organization and the schedule of the school. Besides, *Prof. Schulz* gave the participants a brief presentation about the city of *Trier* and *Trier University* (https://www.uni-trier.de/index.php?id=1&L=2). *Trier* is a beautiful city in the federal state of Rhineland-Palatinate in Germany, considered as the oldest city of the country and *UNESCO World Heritage Site* since 1986. It lies in a valley and on the Moselle coast. Trier has also an important location near the border with Luxembourg and within the important Moselle wine region (https://en.wikipedia.org/wiki/Trier). On the other hand, some technical details and previous events, before COVID-19, were shared with the participants of the school. Since Trier University is celebrating its 50th anniversary, the autumn school became a "birthday party" as well.

After this warm welcoming ceremony, the first invited speaker, *Prof. Dr. Martine Labbé* (Université Libre de Bruxelles, Belgium), gave a lecture entitled *"Introduction to Bilevel Optimization, Linear Bilevel Problems,* and *Maybe Beyond". Prof. Labbé* introduced "Bilevel Optimization" to the autumn school participants along three main topics: an introduction to bilevel optimization, linear bilevel problems and bilevel problems with bilinear objectives. She presented the topic with useful and clear examples and significant real-world applications which covers her research projects in real life. Her talk gave the young scientists a definite idea on the topic. The autumn school continued with the *"Elevator Pitches"* session, which was separated into two days of the event. During these sessions young researchers were given the chance to introduce themselves as well as their current or previous works related to bilevel optimization. These brief introductions

▲ ALOP 2020: Prof. Dr. Didier Aussel gives his lecture about "Bilevel Problems, MPCCs, and Multi-Leader-Follower Games".

Pre-APORS Conference, Philippines (Online September 23-25, 2020)

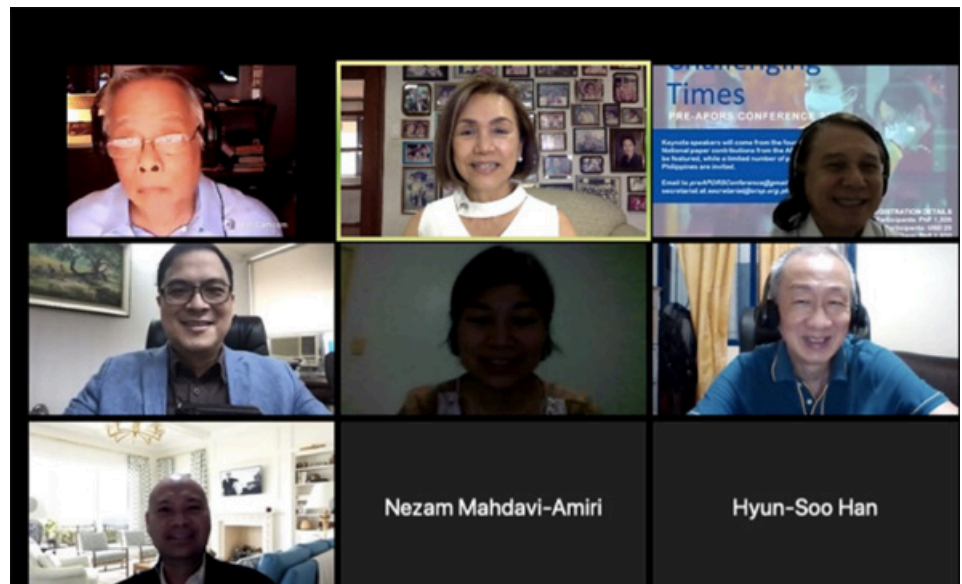**Elise del Rosario** <elise@jgdelrosario.com>

Hundreds of conferences have been cancelled and postponed because of the *COVID-19* pandemic. This included the *IFORS 2020* in Seoul which was postponed to 2021. *APORS* thought that its scheduled meeting must give way to the postponed *IFORS 2020* and therefore moved its Triennial meeting to 2022. But to keep connections active, *APORS* hosted its first Virtual Conference during September 23-25 with the theme *"OR: Continuing Relevance in Challenging Times",* hosted by the Operations Research Society of the Philippines (ORSP).

The first day featured speakers from the four regions of IFORS, which posed a challenge, given the time zones from where they were giving their talks. North America *(NORAM)* was represented by *Karla Hoffmann,* Latin America *(ALIO)* by *Andres Weintraub,* Europe *(EURO)* by *Grazia Speranza,* and Asia-Pacific *(APORS)* by *Simon Dunstall.*

▲ ORSP Organizers doing a debrief after the last session. From left to right, top to bottom: Vic Reventar, Elise del Rosario, Edwin Loma, Rizaldy Capulong, Ma. Shella Tan-Mariscal, Juanito Chan, and Francis Miranda.

Organizers were elated that their first choices for the regional talks readily agreed to serve as keynote speakers and share their expertise on the theme. *IFORS VP* representing *NORAM* and past President of *INFORMS, Karla Hoffmann,* dealt with an optimization project that translated into USD 20 billion revenues for the US Federal Communications Commission through the reassignment of over 1000 broadcast TV stations to new channels for over-the-air broadcasting in the US and Canada in order to free up spectrum for mobile use and 5G.

For his part, past IFORS President *Andres Weintraub* gave the wide range of applications that his group in the Universidad de Chile has worked on forest and mine planning, containers scheduling for a large shipping company, and scheduling matches for the football season. He had a lot more projects to share but was limited by the time available. Nevertheless, while saying that the *OR*-based implementation for these institutions and industries had been in place for decades with impacts in the hundreds of millions of dollars, he concluded by sharing the lessons he learned from his consulting experience.

IFORS President *Grazia Speranza* took into account developments in ICT, IoT, advanced analytics, sustainability issues, including the current pandemic as she dwelt on research directions and results in the field of transportation and supply chain management. Likewise, citing their work in *CSIRO,* Australia, *Simon Dunstall* pointed out that current pressing challenges particularly in environmental, agricultural, natural hazards and transportation issues increasingly require integration of computational and automation technologies including physics-based modelling, spatio-temporal analytics, cloud computing, IoT and edge computing. He pointed out the need for OR professionals to understand, to integrate and capitalize on what other sciences and technologies bring to the table.

With the four keynote speakers concluding their talks with key take-aways and lessons learned from their experiences, participants were all set for what was to come for the second day, the presentation of the national paper contributions of the countries making up *APORS*. On September 24, papers that involved COVID-19 were expectedly a popular topic. New Zealand's *(ORNZ) Michael O'Sullivan* discussed deterministic and stochastic models of patient flows in the wards and ICU of hospitals while Australia's *(ASOR) Hannah Johns* tackled surge modelling for the Royal Flying Doctor Service, both projects done in preparation for the ensuing demand brought on by the pandemic. From India *(ORSI), Nita Shah* discussed a scheduling model that maximizes manufacturing of PPE kits with minimum labor and production capacity while *Vijay Chandru* presented a decision support framework that uses approved diagnostic tests and screening methods.

Philippine's *(ORSP) Shella Mariscal* discussed findings in their use of analytics for the company COVID-19 testing program as well as in their use of simulation to address traffic congestion. Congestion in the emergency department of a hospital was addressed by *Yong-Hong Kuo* of Hong Kong *(ORSHK)* through a simulation optimization approach that guides resource allocation decisions.

Dongdong Ge of China *(ORSC)* offered a smart supply chain network management solution which integrate machine learning, robust optimization, and operations management that is well-equipped to face of challenges brought about by COVID-19. Citing actual experience in the areas of supply chain and health care, *Sim Cheng Hwee* from Singapore *(ORSS)* explained how federated learning has emerged as a new approach for organizations to learn collaboratively in a secure manner without having to part with their data.

In the area of methodology and research, *ORSC's Ziyan Luo* offered a superior algorithm to address the computational challenge posed by the octagonal shrinkage and clustering algorithm for regression for high dimensional and/or large sample size data. Iran's *(IORS) Nezam Mahdavi-Amiri* put forth an algorithm based on an adaptive projected structured exact penalty scheme to solve constrained nonlinear least squares problems. From Nepal *(ORSN), Urmila Pyakurel* presented a solution to the maximum evacuation planning problem and showed its effectiveness using the empty lanes of the network.

Aldy Gunawan from *ORSS* discussed several variants of routing problems with profits, focusing on the orienteering problem (*OP*) and ended with *OP* applications in tourism and logistics. A research on how systems dynamics has been applied in the solid waste management was the topic of Malaysia's *(MSORSM) Zulkifli Mohd Nopiah* presentation. *Govinda Tamang* from *ORSN* presented the trend of fertility rate, mortality rate, life expectancy at birth, age dependency ratios and economic growth of the south Asian countries with a discussion on insights provided by DEA frontier analysis.

From *ASOR, Semini Wijekoon* showed how power system planning involving a large-scale mixed-integer programming (MIP) problem that determines the most cost-effective mix of generation and transmission for the future electrical grid could be made tractable through decomposition and illustrated how visualization helped in understanding the solution space. how visualization helped in understanding the solution space. In the public sector, Japan's *(ORSJ) Tatsuo Oyama* pointed out the three major roles for *OR* in solving societal problems and gave examples and challenges for each of these three roles of: quantitative data analysis mathematical modeling analysis, and theory building analysis.

Hyun-Soo Han of Korea *(KORMS)* took participants through a tour of various *OR/MS* applications in Korean companies that include Samsung Electronics, Pohang Iron and Steel Company *(POSCO),* Daewoong Pharmaceutical Co. Ltd, and Inchon

▲ A word cloud of topics presented at the conference, presented by APORS President Francis Miranda in the closing session.

International Airport Co. *(IIAC)*. He cited lessons learned, among which is that *OR* adoption of senior management is a big factor in successful implementations.

The third day papers from *ORSP* covered tools such as networks, simulation, mathematical programming, and analytics to address problems of water losses, production capacity optimization, logistics, and evacuation planning in both the public and private sectors. The plenary talk was given by *Xiaoyun (Jack) Xu* who shared his early assessment of the implications of the COVID-19 pandemic for food supply chains in the Philippines, as he reviewed the coping strategies and effectiveness at both central and local government levels. The final slot was a Tutorial given by *Vicente Reventar* who provided an overview of open-sourced solvers from COIN and Google's *OR*-Tools with a demonstration of how to use these tools via a cloud-based optimization server like *NEOS*.

The 360 registered participants appreciated the opportunity to listen to all the well-credentialled and highly experienced Operational Researchers who discussed applications, shared lessons learned, and expounded on research directions on methodologies. In general, the topics were found very timely and indeed posed challenges to *OR* professionals.

The organizers had their own share of challenges! As in any first-time experience, the technical difficulties as live feeds going dead, speakers unable to connect, panelists who could not be heard, bad internet connection, were eventually ironed out by the second day. Despite the first day teething troubles, the *pre-APORS* virtual conference was able to feature diverse mix of speakers sharing with an equally diverse set of participants. *APORS President Francis Miranda, ORSP President Marie Shella Mariscal,* and *APORS* pre-Conference Chair *Rex Robielos,* with the rest of the *ORSP* Board, were very relieved that everything turned out well. Nevertheless, everyone was still looking forward to a face-to-face event when *APORS 2022* in Cebu, Philippines, happens. 🌐

▲ Screen grabs of the regional keynote talks.

Instead Online Event on Algorithms for Transportation: ATMOS 2020, Italy (September 2020)

Dennis Huisman <huisman@ese.eur.nl>; **Christos Zaroliagis** <zaro@ceid.upatras.gr>

The symposium on *"Algorithmic Approaches for Transportation Modelling, Optimization, and Systems"* *(ATMOS 2020;* http://algo2020. di.unipi.it/ATMOS2020/index.html) was organized online in September 2020. That was the first time in history of *ATMOS. ATMOS* is a symposium connected to the *ALGO congress* continuously since 2003.

When we as program committee chairs were approached in January 2020, we expected to have a conference in the beautiful town of Pisa in Italy (with its world famous tower). At that moment, COVID-19 was still far away (literally in the Far East and mentally in our heads). However, the situation in Italy changed dramatically in February 2020 and in the rest of world in March. As a consequence, we had to decide together with the other *ALGO*

▲ Christos Zaroliagis and Leaning tower Pisa.

PC chairs and the local organizers, to prepare the conference in an online setting. For *ATMOS,* we chose for the option of 15 minutes live presentations via MS Teams (with a video and slides as back-up) followed by 10 minutes Q&A.

▲ Dennis Huisman in Pisa, (virtual) host city of ATMOS 2020.

Although in a different way, we were one of the few conferences in September 2020 that still took place. As a result, there were even more submissions than regularly and also the quality of the submissions was high. At the end, we accepted 17 regular papers to be presented at a conference, while we had more than 50 participants in almost all *ATMOS 2020* sessions (higher than in previous years).

Thomas Horstmannshoff of the Otto von Guericke University Magdeburg (Germany) gave an excellent invited talk entitled *"Considering Multiple Preferences in Searching Multimodal Travel Itineraries". Thomas'* talk was about the application of multimodal shortest path problems in multimodal routing apps. He showed in his talk that up to five traveler preferences could be taken into account in a real-world large-scale multimodal transport network in Germany.

In addition, Martin Savelsbergh, affiliated with Georgia Institute of Technology in Atlanta (USA), gave the keynote talk. This inspiring lecture was entitled *"Algorithms for Large-Scale Service Network Design and Operations".* He showed that advanced algorithms could be used to solve large-scale real-world network design problems. He motivated all participants to develop algorithms that can solve real-world problems such that we can make the world a better place!

Overall, we look back at a successful symposium and we conclude that although an online event is definitely not similar to a live event, it is a good alternative in these strange times. Finally, we would like to thank all speakers, participants and in particular, the local organizers of the *University of Pisa* who solved all issues when there was a small technical problem. 🌍

1st E-Conference Societal Complexity – Amsterdam (June 23, 2020)

Dorien DeTombe < detombe@nosmo.nl >;
Gerhard-Wilhelm Weber < gerhard.weber@put.poznan.p >

To compensate for the nonattendance of major conferences or this year 2020 due to the COVID-19 pandemic, this e-conference was initiated by *Prof. Dr. Dorien DeTombe* and *Prof. Dr. Gerhard-Wilhelm Weber,* and held on ZOOM. It was organized in cooperation with some befriended EURO Working Groups (EWGs) and the International Research Society on Methodology of Societal Complexity. Participants were invited from all over the world and presented their studies, grouped by regions. The presenters gladly agreed to have the conference online to compensate a bit missing contacts in times of COVID-19. During the coffee- and lunch-breaks and the final discussion, the subject was on the pandemic, what kind of the measurements were taken in the continents and countries, and what effects of mitigation they had. In the program, governmental information alternated with experiences in personal lives. Participants were relieved to have an opportunity to discuss with each other these matters of life and death. Due to the modalities of ZOOM conferencing there

▲ OR mosaic on togetherness in complex times.

was a limited amount of speakers invited. Each one had fifteen minutes of presenting time, followed by ten minutes of mutual discussion. The e-conference was guided by Conference Chair *Prof. Dorien DeTombe.* It took place in the times of the *lock-down* of Spring and Summer times 2020 which occurred because of the pandemic COVID-19. It was another element in workshop series organized by *Prof. DeTombe,* her colleagues and friends. Like in this past, she was the driving force of the event. She gathered the scholars from around the globe, prepared the conference online, collected and compiled the abstracts to another nice booklet, as in so many years of her career. In fact, our small book appeared as *"Book of Abstracts and Papers",* Volume 36, Greenhill & Waterfront; cf.36DeTombeWeberBookofAbstractsComplexity2020.This conference project was another testimony of her contribution to *OR* and its communities, her impact to the world in which we are living and to the solution to its urgent problems.

In 1993 the former *EWG Methodology of Societal Complexity* was a part of the *International International Research Society on Methodology of Societal Complexity,* founded and chaired by *Dorien DeTombe.* Ever since, group and society organized many events in all continents all over the world and published many monographs and articles in scientific journals, see http://www.complexitycourse.org. For many years the *EWG* organizes focused annual streams or sessions on this topic at *EURO* and *IFORS* conferences. Methodology of Societal Complexity concentrates on methodologies, methods and tools for analyzing, structuring, guiding and evaluating complex societal problems. Complex societal problems are often policy problems that can occur in many fields, like in the agro-industry (e.g., water pollution by too much manure, and fowl plague), in the transportation sector, in healthcare (e.g., Malaria, HIV/Aids, Flu), in water affairs, in economy and finance (e.g., credit crisis). The field focuses on handling local safety problems like large city issues and natural disasters as flood and hurricanes and global safety problems like war and terrorism. Although many of these issues have different causes, they have so much in common that they can be approached in the same way by applying *COMPRAM* - a methodology based on the use of experts and actors, and the voice of the people in a democratic way.

In general, complex societal problems are unstructured, dynamical, constantly changing and have a large impact on a society on macro-, meso- and micro-levels. Handling complex societal problems needs a special multi-disciplinary approach. The content knowledge comes from content experts. The process knowledge comes from facilitators. The power is in the hand of actors. *Research of Methodology of Societal Complexity* pays attention to the methods and tools which facilitators need for guiding these kinds of problems. The facilitators use methodologies specially created for societal problems combined with methods and insights from fields like medicine, law, economics, societal sciences, methodology, mathematics, computer science, engineering sciences, socio-cybernetics, chaos theory, and *OR* combined with content knowledge. Often a combination of methods is needed as prescribed by *COMPRAM.*

The speakers of the conference and their lectures were as follows: *Herman Mawengkang* (USU, Medan, Indonesia) with Husain: *"A Dynamic Model for Smart Sharia Tourism Planning",* *G.-W. Weber* (PUT, Poznan, Poland), *Melvin Selim Atay* and *Suryati Sitepu: "Generation of and Classification of Digital Marble Art (EBRU) - Revisiting Operational Research and Deep Learning",* *Hamidreza Alipour* (IAU, Rasht, Iran) et al.: *"Assessment of the Degree of Development of the Cities of Gilan Province, Iran (Economic Approach)",* >>

>> *"The Role of Emotional Accounting in Decision-Making Process (Case study: Management and Accounting Students of IAU)"* and *"Estimation of Tourism Demand Function in World"*, Sonia Najmeddin (Allameh Tabataba'i University, Tehran, Iran), *Amin Padash* and *D. DeTombe: "Develop Voluntary Public Participation Model, Toward Sustainable Development, Key to victory over COVID-19"*, Cathal Brugha (UCD, Dublin, Ireland): *"Time to Confront Bad Governance"*, Cor van Dijkum (Amsterdam University - NOSMO; Utrecht University): *"Some Thoughts about the Corona Crisis as a Complex Societal Problem"*, Dorien DeTombe (Sichuan University, Chengdu, China): *"Covid-19 and Privacy: A Complex Societal Problem"*, Erfan Babaee-Tirkolaee (Mazandaran University of Science and Technology, Babol, Iran), *Alireza Goli, Selma Gütmen and G.-W. Weber: "Sustainable Aggregate Production Planning with Overtime and Outsourcing Options under Fuzzy Seasonal Demand"*, Maxim Rybachuk (CEMI RAS, Financial University under the Government of Russian Federation) and George Kleiner: *"Multilevel Socio-Economic Complexity: System Theory Approach"*, Doncho Petkov (Eastern Connecticut State University, USA), *Olga Petkova* et al.: *"Understanding Multi-methodology Interventions Through Sense Making"*, Nina Kajiji

▲ OR and Complexity: collage on OR solutions sought.

(University of Rhode Island; NKD-Group, Inc. USA) with *Gordon Dash* et al.: *"Information Complexity of RANN Networks and Government Bond Market Spillovers Under TCJA and COVID-19"*, and *Stephen G. Taylor* (University of Concordia, Montreal, Canada): *"Public Health: a Complex Societal Challenge"*. 🌐

Principles and Practice of Constraint Programming, Belgium (September 7-11, 2020)

Helmut Simonis <helmut.simonis@insight-centre.org>;
Roberto Rossi <roberto.rossi@ed.ac.uk>

The *26th International Conference on Principles and Practice of Constraint Programming (CP 2020)* was held as a virtual event from September 7-11, 2020, with over 500 registered participants (https://cp2020.a4cp.org/). The conference was originally scheduled to be held at the campus of *Université catholique de Louvain (UCLouvain)* in Louvain-la-Neuve (Belgium), but was reorganized by program chair *Helmut Simonis* (UCC, Ireland) and conference chairs *Tias Guns* (VUB, Belgium), *Siegfried Nijssen* and *Pierre Schaus* (both UCLouvain, Belgium) as a purely virtual event due to the on-going COVID-19 pandemic. The publicity chair, *H´el`ene Verhaeghe* (UCLouvain, Belgium), took on a much wider responsibility as the virtual chair, responsible for the *Whova* (https://whova.com/) based *conference platform*.

This series of conferences has been running yearly since 1995, when the first *CP conference* was held in Cassis, France. This year's conference was quite unlike its predecessors though, embracing the virtual format. The daily hours were shortened to allow participation from all time zones from Australia to the Americas, and talks were pre-recorded and made available offline.

Technical presentations in the main conference program were limited to a three-minute spotlight talk, followed by a seven-

minute Q&A session, and a thirty-minute concurrent poster session after each presentation session. This format allowed for focused interaction between speakers and the audience and gave the audience an opportunity to get a relatively quick overview of the complete program.

Overall, the conference accepted 55 papers out of 122 submissions, split into the main technical track, and more specialized application and thematic tracks. Both the application track and the *Constraint Programming and Machine Learning* track had 9 accepted papers, with additional papers from the *Computational Sustainability, Testing and Verification*, and *Constraint Programming and Operations Research* tracks. The paper submission deadline had been delayed by five weeks, to soften the impact of the COVID-19 disruption, giving authors more time to complete their submissions, but as a result leading to a very compressed reviewing and discussion stage. >>

>> Over a hundred members of the program committees helped in the selection of the papers, guided by the senior program committee for the technical track, and track chairs *Andreas Schutt* (Data 61, Australia), *Michele Lombardi* (University of Bologna, Italy), and *Nadjib Lazaar* (LIRMM, France).

The first day of the conference was reserved for the Doctoral Program, and for workshops. This year, three workshops were selected by the workshop chair, *Maria Andreina Francisco Rodriguez* (Uppsala University, Sweden):

The *CPTAI 2020* workshop was titled "*From Constraint Programming to Trustworthy AI*" and dealt with issues of accountability and transparency (https://tinyurl.com/y3m58e3h). Besides presentations, the workshop also started work on a white paper on this topic. The "*Fourth Workshop on Progress towards the Holy Grail*" (PTHG 2020) again looked at the holy grail of Computer Science: The user simply states the problem and the computer solves it (https://tinyurl.com/y6aradgm). The workshop covered areas from problem acquisition to solver construction and providing user explanations. The "*19th International Workshop on Constraint Modelling and Reformulation*" (ModRef 2020) dealt with issues of modelling, whether it is by human or machine (https://tinyurl.com/yxd6szpe). The invited talk by *Maria Garcia de la Banda* (Monash University, Australia) on "*Rethinking Model Reformulation: from Speed focused to Human focused*" (https://www.youtube.com/watch?v=4ijBInbgKsc) was one of the highlights of the program.

The invited keynote talk on Tuesday was given by *Andrea Rendl* (Satalia; UK, Lithuania, Greece and Austria) on "*Optimisation in Practice*" (https://www.youtube.com/watch?v=x7IhtuB89SY). She talked about issues of solving optimization problems in Industry, which attracted a lot of interest and discussion in the on-line Q&A forum. The highlight of Wednesday's program were the best paper awards, and the three tutorials selected by the Tutorial Chair, *Lars Kotthoff* (University of Wyoming, USA):

Simon de Givry and *Thomas Schiex*, INRAE, France: "*Numbers and Logic Together in CP: A Practical View of Cost Function Networks*", *Michela Milano* and *Michele Lombardi,* University of Bologna, Italy: "*Boosting Combinatorial Optimization via Machine Learning*", *Christopher Jefferson,* University of St Andrews, Scotland: "*The Theory and Practice of Symmetry in Constraints: How to find it and break it*".

On the last day of the conference, the yearly awards of the *Association of Constraint Programming* (https://www.a4cp.org/) were presented. The long-time member of the community, and designer of the popular open-source Gecode system (https://www.gecode.org/), *Christian Schulte* (KTH Stockholm, Sweden) passed away in March this year. He was posthumously awarded the *ACP Service Award* for 2020, and the Doctoral Thesis award was re-named in his honor. *Christian* was remembered in a special session by an overview of his numerous technical achievements, but also his interaction with and encouragement of colleagues and students. The recipient of the *ACP Christian Schulte Thesis Award* was *Jeremias Berg* (University of Helsinki, Finland) for his thesis on "*Solving Optimization Problems via Maximum Satisfiability: Encodings and Re-Encodings*", which he presented at the conference.
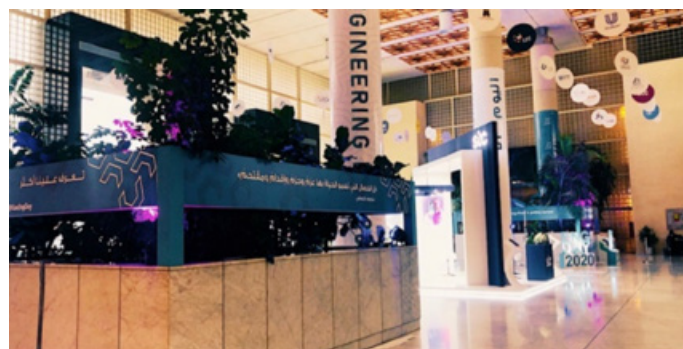
The conference closed with a panel discussion on the lessons learned from the virtual conference format. The consensus was that while the virtual conference cannot replace a live event, elements of this year's conference, like pre-recorded videos, on-line discussion fora, and having talks available after the conference should be part of future CP events. The proceedings of the conference are available from *Springer* (https://link.springer.com/book/10.1007/978-3-030-58475-7), while most talks and presentations can be watched on the CP 2020 *YouTube* channel (https://www.youtube.com/channel/UCQsTD5thbBxZKQW6UR-gh6Q). Next year's conference (https://www.youtube.com/watch?v=hJhtC1M9HJw) will be, circumstances permitting, in Montpellier, France, with *Laurent Michel* (UConn, USA) as program chair. 🌍

Engineering Day 2020, in Jeddah, Saudi Arabia -Learning through excellence (February 22-26, 2020)

Sadia Samar Ali <ssaali@kau.edu.sa>,

Competitive academic and corporate environment demands candidates with professional and scientific capabilities and competitive edge for facing national and international challenges. *Education* must encourage students to develop right attitude, problem solving abilities and management skills for their long-term career success. *Educational* institutes must empower the youth through creation of attractive and interactive learning platforms for shaping their employability and life skills. Pursuance of this ambition is in the core of *King Abdulaziz University's* curriculum, Jeddah, Saudi Arabia (https://www.kau.edu.sa/home_english.aspx). Management strongly believes that right educational environment and digital exposure is the key to drive innovation and transform learning for enhanced achievements through digital technologies. The university has been implementing effective strategies for improving student success for many years and one such effort is this direction is its annual *Engineering Day* being held every year since 2007. This highly collaborative event witnesses

▲ Passage for the various stages.

gathering of dynamic and creative education professionals with intensive focus on exploring new technologies, best practices and evaluation of pressing issues, challenges, and opportunities. Emerging subjects of *Operational Research* were broadly included and discussed.

▲ Poster of the focused workshop.

Annual Engineering Day of Faculty of Engineering, KAU (https://eng-day.kau.edu.sa/Default-135802-AR) was held at the campus of *King Faisal Convention Centre,* Jeddah, Saudi Arabia (https://conferencehall.kau.edu.sa/) to promote academic excellence and innovation through connection with *education peers* and *corporate stalwarts* from February 22-26, 2020. The main objectives of this event spanned over four days were to (i) Promote the role of corporates and entrepreneurs in the growth and development of community and non-profit sector through interactive collaborations, (ii) Foster national vision 2030 and strengthen national transformation program 2020 through youth empowerment and education, (iii) Encourage voluntary activities and habits among students for community development, (iv) Create learning and employability opportunities through international corporate and academic connect.

With almost 15,000 corporate and academic attendees representing large, medium, small enterprises, entrepreneurs, and educational affiliations, demonstrated the recent trends, game changing moves and future predictions. The event focused mainly on themes of innovation in technical education for employability, community development through volunteering fields, mobilization of leadership in scientific and professional global frontiers. Spanned over four days the event included 23 workshops, 32 speeches delivered by plethora of educators, administrators, entrepreneurs, investors, education companies and tech innovators. The event also comprised of "Shows" on *innovative digital technologies* and "Competitions" on *simulations, robotic technologies,* and *web developments.*

Prominent speakers delivered on topics related to *Creative micro-entrepreneurship, Brands and*

▲ Labels in front of King Faisal Convention Centre.

creative economy, Merging engineering & medicine, Accelerate your startup, Leading for peak performance, Business models, Strategies, Overcoming fear and inhibitions, Conversion of idea into business, Social entrepreneurship, Block-chain technologies, Demystifying the hype: IoT, Cybersecurity and data science. The speakers explained importance of discipline for productivity, alertness during digital times, and expressed their views on technology for excellence in healthcare and strong leadership during difficult times as main navigators and best practices.

The workshops centered on broader themes of *Social Entrepreneurship Challenge, Cyber Security, Kaizen, Add Value through Lean, Competency Architecture, Balance between Work and Life, Social Entrepreneurship Challenge, Administration Issues, Motion Graphics, Making Hard Decisions* and *Graphic Design.*

Prof. Sadia Samar Ali from Department of Industrial Engineering, Faculty of Engineering, King Abdulaziz University, also conducted a workshop for *"Making Hard Decisions".* Scheduled on February 26, from 10:00 to 12:30h, the workshop was assisted by *Eng. Abrar* and focused on briefing students about structured methods and analytical tools for improving decision-making skills. Main discussions centered on *Value of information, Sensitivity analysis,* and *Making choices,* and educated participants about the importance of structuring the problems for identification of appropriate insights and alternatives.

The workshops not only strengthened the knowledge foundation of students but also offered rigorous experiential training and networking with career-oriented community. In the future, the chances through the link with *Operational Research* will further be sought and pursued. 🌍

A Holistic Experience of EWG-ORD Virtual Workshop 2020, South Africa (August 29, 2020)

Anirban Banik <anirbanbanik94@gmail.com>
Gerhard-Wilhelm Weber <gerhard.weber@put.poznan.pl>,

"We write to taste life twice, in the moment and in retrospect" (Anaïs Nin).

Recently, the *EURO Working Group on Operational Research for Development* held its annual workshop on *Data Technologies and Analytics for Sustainable Development* (https://www.nkd-group.com/EWGORD-2020/home.html). The objective of the workshop was to provide a suitable platform for relevant researchers to gather annually to present their research findings before the panel of experts as well as to discuss on the progress, challenges and innovative applications on *Operational Research* for the overall development of the society. The workshop was organized by *Prof. Nina Kajiji* (University of Rhode Island, USA), *Prof. Gordon H. Dash* (University of Rhode Island, USA) and *Prof. Milagros Baldemor* (Don Mariano Marcos Memorial State University Philippines). Cordial thanks to them and their team members *Dr. Elise del Rosario* (OSSFFI, Quezon City, Metro Manila, Philippines), *Prof. Begoña Vitoriano* (Complutense University of Madrid, Madrid, Spain) and *Anirban's* friend and co-author *Willi (Prof. Gerhard-Wilhelm Weber)* for their very care- and tasteful work.

The annual workshop of 2020 was scheduled for onsite meeting *Magaliesberg,* South Africa. But due to the ongoing global pandemic *COVID-19,* the workshop was rescheduled as a virtual meeting held on 29 August 2020. In the event, *Prof. Dr. Cathal MacSwiney Brugha,* Professor Emeritus from University College Dublin was the invited speaker. P*rof. Brugha* shared his work entitled *"Analytics for Development and Maintenance of Communities in an Environmentally Stressed World".* The workshop 2020 published a *Book of Abstracts* online which is a collection of short papers of all the submissions presented in the online event. This book can be accessed by using the given link: (http://www.nkd-group.com/EWGORD-2020/EWG-ORD2020Abstracts.html).

As a *rookie* at our *OR* conferences, the first author, *Anirban Banik,* from National Institute of Technology Agartala, India, was looking for a suitable platform which will help to troubleshoot research problems and aid in overcoming the hazy concepts. This workshop very much satisfied both the objectives of him and of both authors. It was fascinating, with several novels and innovative application of *OR* techniques addressing our real-world problems. The workshop not only fulfilled its objective of providing a common platform for researchers from developed and developing countries but also helps young researchers to support and encourage them in their respective ongoing researches and to introduce them into *OR* as a their new home. So, we authors express our sincere gratitude toward the organizers for providing this opportunity to us and all participants. At the workshop, *Anirban Banik* (National

▲ Cover Page of online published Book of Abstracts by EWG-ORD Workshop 2020.

Institute of Technology Agartala, India) presented his ongoing research work on *"Adaptive Neuro-Fuzzy Inference System (ANFIS) model for predicting water quality index of Haora River in North-Eastern India"* which *Anirban* co-investigated and co-authored with *K.C. Choo* (CO2 Networks, Malaysia), *Prof. Pandian Vasant* (Universiti Teknologi Petronas, Malaysia), *Prof. J. Joshua Thomas* (UOW Malaysia KDU Penang University College, Malaysia) and *Willi* (Poznan University of Technology, Poland, and METU, Ankara, Turkey). In their ongoing research, the authors scientifically investigated the effect of immersion of religious figures on the water quality of the river. In the study, they selected Haora River in *North-Eastern,* India, for collection of samples. Water quality parameters such as pH, dissolved oxygen, total dissolved solids, total suspended solids, electrical conductivity, calcium, magnesium and chlorides, are used for developing the *"water quality index".* In their research, the authors introduced an adaptive *neuro-fuzzy inference system* which will be implemented to predict the water quality index of *Haora River.* Uncertainty analysis will be conducted to evaluate the workability of the model, followed by the implementation of a *sensitivity analysis* for identifying the most significant parameters affecting the water quality of the river most. At the venue in India, a *"performance index"* will be defined and calibrated. Then the predicted results of *ANFIS* model will be compared with other existing methods such as artificial neural network, multi-linear regression analysis. This section of the research will aid in demonstrating the precision and performance of the proposed *ANFIS* model. The proposed study hopes to provide an insight regarding the impact of religious figure immersion and its possible contribution to water pollution and water shortage. The study and implementation project also hopes to encourage people to learn from nature not just in spiritual but also other parts of life by following ancient domestic manuscripts with proved recipes and advices on the relations with nature and how to treat it. The research will focus on discouraging the use of synthetic paint and replacing them with natural dye. The workshop with its presentations and sincere discussions helped a lot us to troubleshoot our research problems, and the experts enlightened us with their experience and knowledge. The workshops also allowed us to improve our novelty and methodology of the research. In fact, a constructive *Question-and-Answer* time after the presentation was useful to gather knowledge regarding the shortcomings and possible solutions to overcome them. After the workshop, the participants felt highly motivated and ready to implement all the suggestions made by the experts in their *corresponding operational researches* to enhance their novelty. 🌍

EWG-ORD 2020 Workshop: from Magaliesburg to Online South Africa (August 29, 2020)

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Nina Kajiji < nina@nkd-group.com >; **Elise del Rosario** <elise@jgdelrosario.com>

The year 2020 will not be forgotten for a long time. It will be entered into history books as the year of the awful pandemic of the modern era. However, in all this heartache, sad news, and global economic upheaval, the COVID-19 pandemic has nurtured a new kind of creativity. The *European Working Group on Operational Research for Development (EWG-ORD,* http://bit.ly/EWG-ORD) exhibited this creativity by shifting the 2020 Workshop for members from beautiful Magaliesburg, South Africa, to its first-ever virtual workshop held on August 29, 2020. With Workshop members facing global travel restrictions and limited accommodations, the *EWG-ORD* Executive Board was faced with the dilemma to either cancel the meeting or find a suitable alternative. Justly, the Board voted to organize a one-day virtual meeting using the ZOOM platform.

▲ EWG-ORD 2020: Valuable lectures and discussions in one "room" and with the world.

Fitting for this first virtual ZOOM Workshop event, the 2020 theme of *"Data Technologies and Analytics for Sustainable Development"* proved very timely (http://bit.ly/EWGORD2020Workshop). The by-line was initially chosen to complement the focus of the annual meeting of the *Operations Research Society of South Africa (ORSSA).* But, as planning evolved, the byline soon became the leading charge for the Workshop meeting. By the Workshop start, the organization reached its planned limit of 12 contributed papers.

The participant group truly reflected the Workshop's global heritage. Participants ranged from far-east Australia to far-west Colombia. Our comprehensive attendee list totalled 24 members from 15 countries. The Workshop has a storied history for small and super-engaged sessions. The supportive nature of our sessions has always attracted new and exciting participants. To that end, it was gratifying to have several new members join the Working group.

The invited talk of *Dr. Cathal MacSwiney Brugha,* Professor Emeritus of Decision Analytics at University College Dublin, Ireland, and the Analytics Society of Ireland's president, set the Workshop tone. Professor *Brugha's* talk titled *"Analytics for Development and Maintenance of Communities in an Environmentally Stressed World"* presented a theory-supported but practical model for developing sustainable communities plagued with environmental stress such as global warming, COVID-19 fatigue, and planet stress. Some of the other research topics addressed at the Workshop included models of university-based fire evacuation control, staffing of emergency services, modeling societal complexity to manage pandemics, cervical cancer screening, and other studies as highlighted in the official book of abstracts (http://bit.ly/EWGORD2020-Proceedings). We are most pleased by the fact that the contributed research presentations sustained the *EWG-ORD* mission to *"… to promote the importance of operational research in improving the lives of people in developing and developed countries through sustainable practices."* We can report that *EWG-ORD* doubled down on its support of the *United Nations'* agenda on *sustainable development goals.*

The workshop was much appreciated by the members, as is evidenced by the following selected comments,
• *"You are fantastic and enthusiastic people. I really enjoyed meeting you, even though virtually. Hope to see you next year in Greece."*
• *"It was a great pleasure to join the conference. The conference was well organized and the lectures were interesting."*

The workshop was made possible by support from the Association of European Operational Research Societies *(EURO),* the Operations Society of South Africa *(ORSSA),* The *University of Rhode Island,* USA, and The *NKD-Group, Inc.,* USA. Additionally, The *NKD-Group, Inc.,* graciously provided technical and ZOOM webinar support.

The event's success was a product of the hard work and coordination of the three Chairs of EWG-ORD 2020 Workshop – *Nina Kajiji, Gordon Dash,* and *Milagros Baldemor.* They were guided by *Gerhard-Wilhelm Weber* (EURO representative), *Elise del Rosario, Begoña Vitoriano,* and friends from *EURO* and *ORSSA.* The chairs expressed their gratitude to the scientific committee, *EWG-ORD* board members, and all paper reviewers, but most of all, the Workshop participants.

Already planning ahead, the *EWG-ORD Workshop 2021* has been submitted as a satellite event to *EURO 2021,* Athens, Greece. The tentative venue for the *EWG-ORD* Workshop is in Thessaloniki, Greece. We invite you to send your questions and inquiries by email to info@ewgord.org. 🌍

Two Fruitful Decades of Graphs and Algorithms - Celebrated Online , Israel (June 7-8, 2020)

Martin Golumbic <golumbic@cs.haifa.ac.il>; **Nili Beck** <becknili@mta.ac.il>;
Michal Stern <stern@mta.ac.il>

The year 2020 marked the 20th anniversary of the *"Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics, and Algorithms"* sponsored by the *Caesarea Rothschild Institute* at the *University of Haifa* in Israel. The workshop emphasizes the diversity of the use of combinatorial algorithms and graph theory in various application areas. Such areas of interest include randomized algorithms, networking, graph algorithms, internet congestion and patterns, computational biology, applied combinatorics, web applications, geometric graphs and computation, optimization and graph theoretic models.

Over these 20 years, the workshop has hosted over 150 plenary speakers from around the globe, complemented by hundreds

▲ Organizers of the anniversary and online conference: Martin Golumbic, Nili Beck and Michal Stern.

talk on *Parameterized analysis, graph minors and planar disjoint paths. Shakhar Smorodinsky* from Ben Gurion University gave the third plenary talk entitled *"An extension of the notion of a median".* There was also a fine line up of 11 contributed talks.

The full program and abstract book for the 2020 workshop and for previous years are available at the website https://cri.haifa.ac.il/.

The Founder and permanent General Chair of the Haifa Graph Workshop was *Martin Golumbic,* and the Program Chairs this year were *Nili Beck* and *Michal Stern.* We want to thank *Tamir Gadot, Abhiruk Lahiri* and *Nathan Wallheimer* for the excellent organization and running the technical challenges of this year's workshop.

We are pleased to have served the *Algorithmic Graph Theory* community over these years, welcoming researchers from all corners of the academic world.

Wishing all of you good health and continued research accomplishments.

Uri N. Peled Memorial Lecture
Caesarea Rothschild Institute, University of Haifa

In memory of *Uri Natan Peled, ז"ל*
September 5, 2009 at the age of 65.

Year	Lecturer
2010	Bill Cunningham (Canada)
	Gyorgy Turan (USA and Hungary)
2011	Jayme Luiz Szwarcfiter (Brazil)
2012	Amitava Bhattacharya (India)
2013	Annegret Wagler (France)
2014	Edward Scheinerman (USA)
2015	Andreas Brandstadt (Germany)
2016	Jian Li (China)
2017	Bernard Ries (Switzerland)
2018	Pavol Hell (Canada)
2019	Vadim Lozin (UK)
2020	Ignasi Sau (France)

▲ Uri N. Peled Memorial Lecture 2020 in a gallery with its predecessors.

of contributed lectures. This year was no exception - except that we moved the workshop to a ZOOM platform (June 7-8, 2020). On the one hand, we are sorry not to have been able to host receptions and lunches in person. On the other hand, many more people could attend who might not otherwise have been able to travel to Haifa.

A somber highlight of the Workshop since 2010 has been the annual *Uri N. Peled Memorial Lecture,* together with prizes awarded to outstanding Haifa graduate students who published research papers. *Uri Peled* was a frequent visitor to the University of Haifa, and contributed much to the academic atmosphere at the Caesarea Rothschild Institute. By this annual Lecture, we honor his memory and his research contributions in graph theory, Boolean functions, polyhedral combinatorics, information theory and discrete mathematics.

Ignasi Sau from Montpellier, France, gave this year's *Memorial Lecture* on the topic *"FPT algorithms for hitting forbidden minors". Meirav Zehavi* from Ben Gurion University gave a plenary
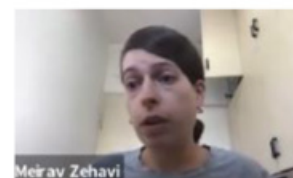

▲ Plenary talks at 20th Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics, and Algorithms. 🌍

Advanced Information and Scientific Development – Online, Jakarta (August 6-7, 2020)

Herman Mawengkang <hmawengkang@yahoo.com>
Mochamad Wahyudi <wahyudi@bsi.ac.id>

ICAISD 2020 was an international conference for sharing knowledge and research in Computer and Information Science and provides a platform for researchers and practitioners from both academia as well as industry to meet and share the cutting-edge development of computer and information science-based research. Please see … and hear - http://icaisd.info/icaisd/.
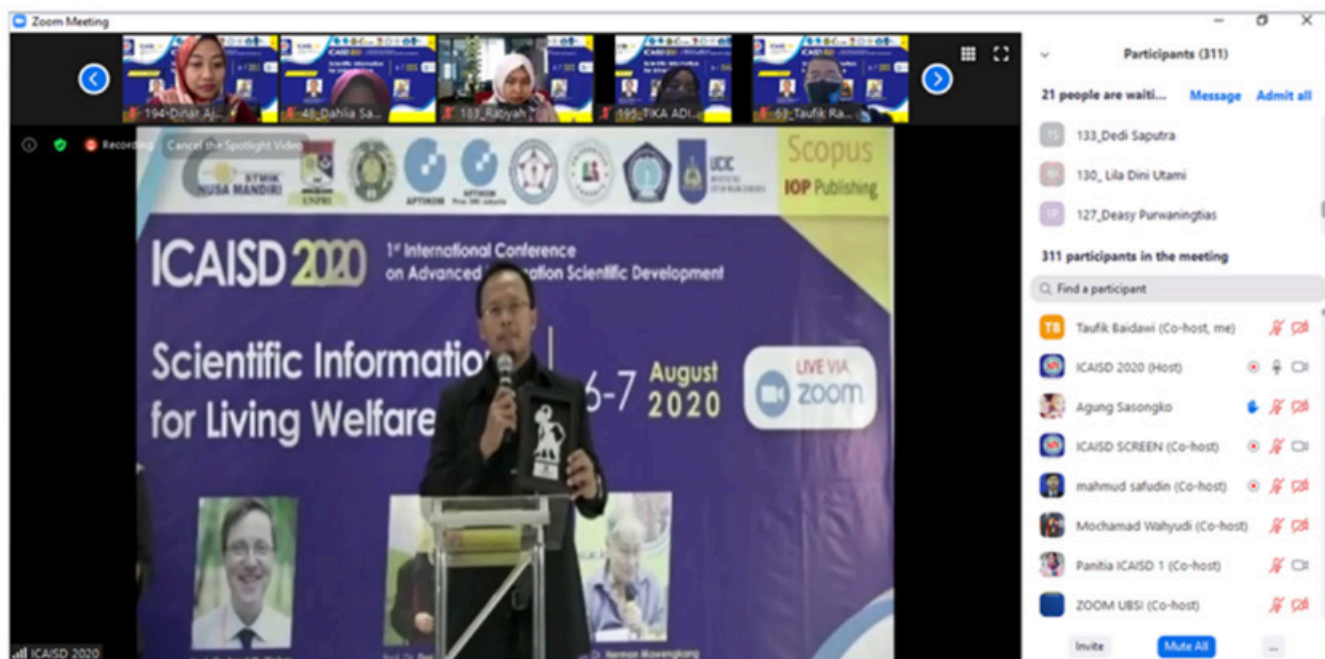
The conference took place at *BSI Convention Center,* Bekasi near Jakarta, West Java, Indonesia. It was collaboration between Universitas Bina Sarana Informatika (UBSI) and *APTIKOM* Indonesia on August 6-7, 2020. Due to the COVID-19 pandemic, the conference was conducted online using ZOOM. This event was the first conference in this novel conference series. The topic of the conference was dedicated to a motto from *Operational Research: "Scientific Information for Living Welfare",* which is of vast importance worldwide, especially, for an emerging nation like Indonesia with its young population. This conference aimed (1.) to bring together the scientists, engineers, researchers, practitioners, academicians, and representatives of civil society organizations within a scientific forum; (2.) to share and to discuss theoretical and practical *Operational Research* knowledge about innovation in applied sciences, management and artificial intelligence. Specifically, this conference was used as a scientific forum for accommodating discussion among young researchers that mostly originated from Indonesia in the field of Information Technology and Management. Therefore, some of the invited speakers and many of the regular participants at this conference were young and promising researchers that are becoming more and more well-known and reputable in the world. In fact, *OR* and Computer Science have served at *ICAISD 2020* as our unique interface to the real world with all of its industrial, economic, developmental and educational challenges, and as a precious opportunity of the youth to get

▲ ICAISD 2020: cheerful poster of start-up event in difficult times.

further introduced into modern research and the international scientific community.

The keynote talks focused especially on the *OR,* Computer Sciences, Applied Sciences, Management and Artificial Intelligence. They discussed nine Main Areas of latest *OR,* computational and applied mathematical issues and developments, for example, in Software Engineering, Security and Networks, Information Systems, Linguistic Computing, Computing, and Theoretical Foundations of Mathematics, Applied Sciences and Artificial Intelligence - with a future promise to *OR* Applications and Education.

▲ Welcome Speech of ICAISD 2020 by Dr. Mochamad Wahyudi (Rector of Universitas Bina Sarana Informatika).

*I*There were four keynote speakers of the conference. These were the local leaders and representatives *Prof. Dr. Zainal A. Hasibuan* (APTIKOM, General Chair of Indonesia), *Prof. Dr. Herman Mawengkang* (Universitas Sumatera Utara, Medan, Indonesia), and the international guests *Prof. Dr. Dorien DeTombe*: (Delft University, the Netherlands): *"Covid-19 a Pandemic that Should be Handled by the Compram Methodology"*, and *Prof. Dr. Gerhard-Wilhelm Weber* (Poznan University of Technology, Poland, and METU, Ankara, Turkey): *"Quality Management in Marketing Communication: with Contradiction Finding and Classification".*

▲ ICAISD 2020 keynote speaker Prof. Dr. Herman Mawengkang.

CAISD 2020 became a great success event, attracting researchers from ten countries including Indonesia involved:

▲ ICAISD 2020 keynote speaker Prof. Dr. Dorien de Tombe.

Poznan University of Technology, Poland; *Delft University,* the Netherlands; *National Taiwan University of Science & Technology,* Taipei, Taiwan; *Istanbul Gelisim University,* Turkey; *Shahjalal University of Science & Technology,* Kumargaon, Sylhet, Bangladesh; *Daffodil International University,* Dhaka, Bangladesh; *Universiti Kebangsaan Malaysia,* Bangi, Selangor, Malaysia; *Universiti Teknologi Malaysia,* Skudai, Johor Bahru, Johor; *Universiti Malaysia Sabah,* Kota Kinabalu, Sabah, Malaysia; *Okayama University,* Japan; *Johannes Gutenberg University Mainz,* Germany; *King Abdul Aziz University,* Jeddah, Saudi Arabia, and provided a great academic experience for the participants. It was attended by 214 participants, and there were more than 150 abstracts accepted for presentation at *ICAISD 2020.*

During the conference, *Prof. Dr. Gerhard-Wilhelm Weber* kindly invited to the next conference highlights of *EURO 2021* in Athens, Greece (https://www.euro-online.org/web/pages/421/activities-list), and *IFORS 2021* in Seoul, Korea (http://www.ifors2020.kr/). Among the co-organizing institutions, a driving force was *University of Sumatera Utara,* leading university in Sumatra Island, Indonesia, especially, its Department of Mathematics. The friends there successfully organized five conferences called *InterOR - "The International Conference on Operational Research"* - it is celebrated every two years, and they attended *IFORS* and *EURO* conferences, served for streams and sessions. *InterOR* series has been an inspiration for the new *ICAISD* series.

As the Editor-in-Chief and the Conference Host, we would like to extend our deepest appreciation to all local organizers, the team around the Conference Chair, *Mr. Taufiq Baidawi,* who worked very hard and showed a great care and warmth, to all the keynote speakers, participants and all the many friends from near and far. Without their supports, this conference was not a success. Finally, we wish you all a great success in the years to come. Hope to see you again at *ICAISD 2021,* August 7-8, Jakarta, Indonesia. 🌍

▲ Remarks and report by the ICAISD 2020 Chairman Mr. Taufik Baidawi.

Computational Logistics – Online, ICCL2020, Netherland (September 28-30, 2020)

Eduardo Lalla-Ruiz <e.a.lalla@utwente.nl>; **Martijn Mes** <m.r.k.mes@utwente.nl>;
Stefan Voß <stefan.voss@uni-hamburg.de>

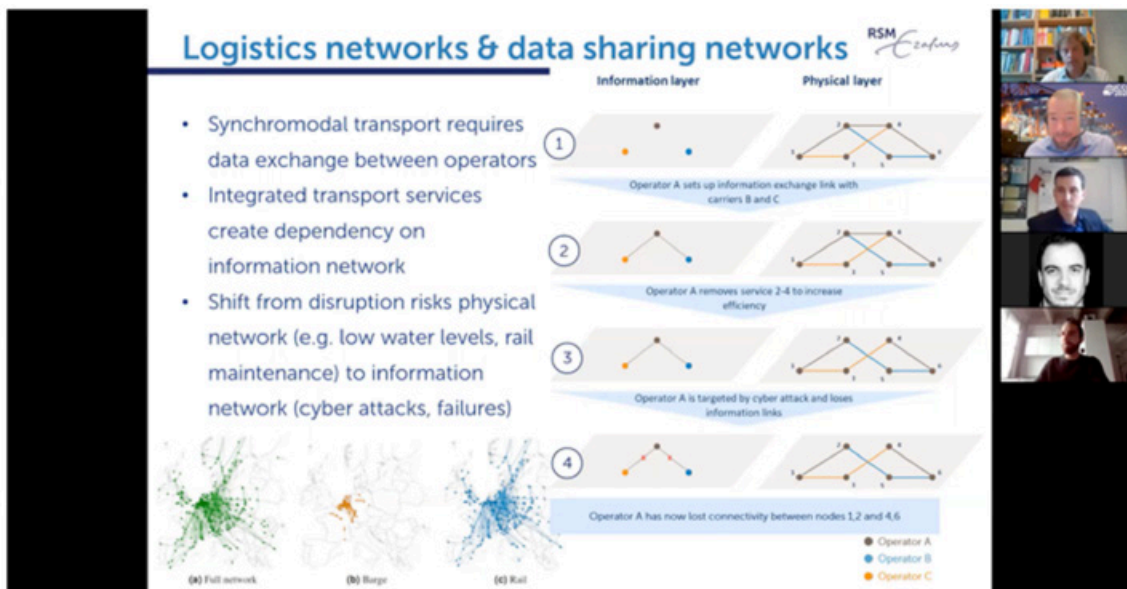▲ The Conference Chairs: Stefan Voß, Martijn Mes, and Eduardo Lalla-Ruiz.

The *International Conference on Computational Logistics (ICCL2020)* took place virtually at the University of Twente, The Netherlands, during September 28-30, 2020. The aim of the conference was to bring together researchers and practitioners working at the interface of large/complex logistics systems and advanced computational methods from the fields of Operational Research, Artificial Intelligence, and Business Analytics. The conference was organized under the coordination of *Eduardo Lalla-Ruiz* and *Martijn Mes,* in constant consultation with the *ICCL* founder, *Stefan Voß.*

Initially, we planned this international event at the campus of the University of Twente. This is the only American style campus in The Netherlands, with student housing, sporting facilities, swimming pools, supermarket, general practitioner, barber, physiotherapist, cafes, restaurants, theatre, etc. The talks and presentations were originally going to take place at the hotel and conference center, conveniently located to the recreational facilities of the campus and surrounded by nature. Furthermore, we arranged a social program with visits to an inland container terminal, an automated warehouse, and a brewery. Nevertheless, due to the COVID-19 outbreak, we decided early June 2020 to change the template of the conference to a hybrid one, and a few weeks later, we decided to go fully online due to the pandemic worldwide evolution. We do not regret that decision as things became worse again within The Netherlands as well as in other countries were *ICCL* participants come from. Moreover, the online setup went surprisingly well in terms of participation and contributions. In that regard, the number of participants in our virtual *ICCL* was around 178, which was a relevant attendance increase compared to previous *ICCL* editions. This might have been caused by the drastic fee reduction as well as the removal of the travelling "barrier" thanks to the online setup. The participants of *ICCL2020* hold affiliations at institutions in at least 26 different countries on five continents (Asia, Europe, North America, Oceania, and South America).

For the online conference setup, we created a compact schedule to accommodate attendees from different time zones, such that, e.g., attendees from the US and Latin America could attend in the morning and attendees from East Asia in the evening. For every session, both the plenary and the parallel sessions, we used ZOOM meetings. The links to these ZOOM meetings were provided on a password protected page on the *ICCL2020* website; but also via daily emails containing the links to all ZOOM meetings of that day. In total, we made use of 5 Zoom rooms with 3 rooms corresponding to 3 parallel tracks, one for the plenary talks, and one for a lounge area. This lounge area was an open ZOOM meeting, where participants could join any time during the conference to have a chat or discussion with other participants. Within the lounge area, attendees could have breakout rooms in order to have private networking meetings if desired. Furthermore, the lounge area was also the place to go for technical support. To control and manage all ZOOM rooms, we had a physical control room at the University of Twente, where 5 technical hosts (one for each ZOOM room) were sitting together (respecting social distancing).

When looking back at the online organization, a lot went well, with some things that might even be improved. We proudly look back at the content and organization of the sessions, consisting of excellent talks, committed session chairs, and engaged participants. In our view, the setup with technical hosts sitting together in a physical control room contributed to this successful conference. By sitting together, we had a good overview of all processes and could respond fast in case of technical or organizational issues. Furthermore, the technical hosts also contributed to a more relaxed and engaging environment, by instructing the speakers and session chair before the start of a session and welcoming the participants. At the start of the session, the session chair takes the lead and the technical host remains available via chat for technical support. Although the sessions were great and allowed for interaction and fruitful discussions, the social and networking aspects outside the sessions were limited (the lounge area was barely used). Instead of assuming participants might take the initiative, it would have been better to actively motivate participants to engage in social activities. For example, we could have used the ZOOM breakout rooms to randomly assign and move participants to smaller breakout rooms, where they have the opportunity to meet new people. Also organizing some logistics quiz or alike could have benefited the lounge area usage.
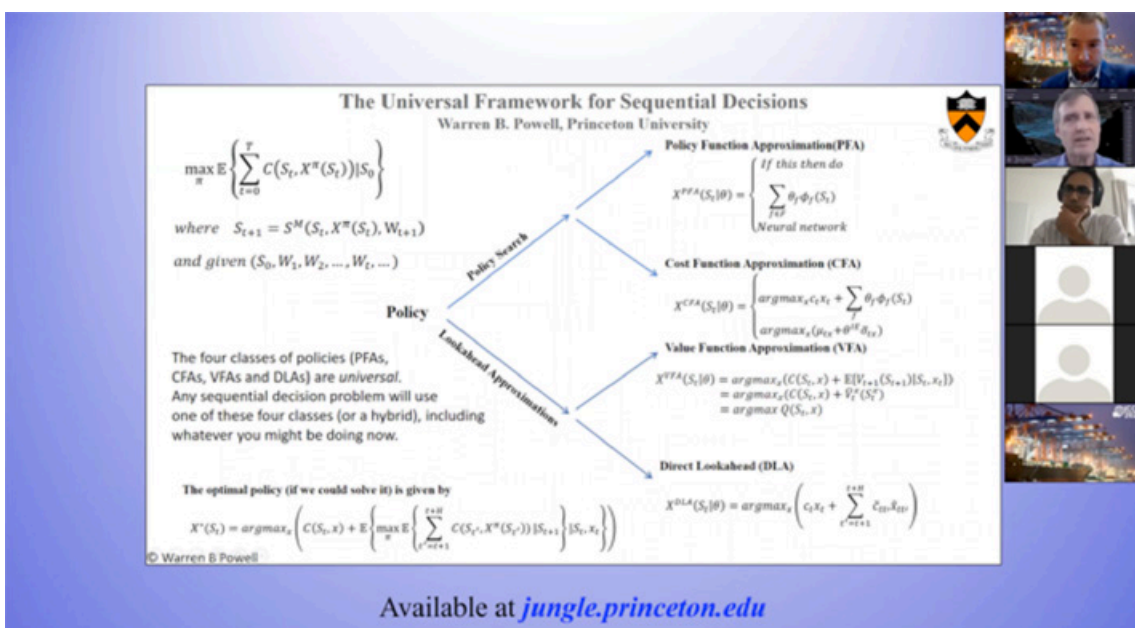
▲ Keynote presentation of Prof. Rob Zuidwijk.

In terms of conference output, *ICCL2020* received 93 submissions consisting of full papers and abstracts. While the abstracts were intended for presentation only, the 49 accepted full papers were also included in a *Springer Lecture Notes in Computer Science* (https://link.springer.com/book/10.1007/978-3-030-59747-4). On average three referees were selected per submission, to provide qualitative comments and feedback to authors. Referees were selected based on their expertise using the bidding system from *EasyChair*. The topics covered by the submissions included typical *ICCL* subjects like maritime shipping as well as vehicle routing, but also more recent developments, e.g., synchromodality, smart yards, sharing economy, self-organizing logistics, autonomous vehicles and drones. Besides traditional model-based optimization methods, attention was also given to more data-driven approaches, such as (deep) reinforcement learning. These developments indicate that *ICCL* is an evolving community advancing towards new challenges and utilizing new techniques/technologies within logistics. Finally, after the presentation and discussion during the conference and based on the reviewers' feedback and score, a special issue published in the *Annals of Operations Research* is planned for selected papers.

Regarding the *ICCL* program, it consisted of a welcome session given by the chairs *Martijn Mes* and *Eduardo Lalla-Ruiz,* seventy-two technical presentations, two keynote talks from two distinguished scholars: *Prof. Warren Powell* (Princeton University, USA) and *Prof. Rob Zuidwijk* (Rotterdam School of Management, The Netherlands), and a closing session given by *Stefan Voß*. Regarding the technical presentations, they were clustered into twenty-four sessions divided into five main areas: maritime and port logistics, vehicle routing and scheduling, freight distribution and city logistics, network design and scheduling, and selected topics in logistics.

For the year 2021, we will try our luck again to physically host the *International Conference on Computational Logistics* at the University of Twente. In addition to the technical sessions and keynote presentations, we still want to organize the before mentioned social program. In addition, we plan to organize in-depth tutorials right before or after the conference. Interested in this conference? Please visit www.iccl2021.nl. 🌍

▲ Keynote presentation of Prof. Warren Powell.

An Operational Approach to Neuroscience: ICMNS-2020 – Netherlands (July 6-7, 2020)

Burcu Gürbüz <burcugrbz@gmail.com>

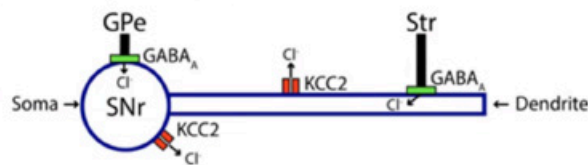The *"International Conference on Mathematical Neuroscience 2020"* (ICMNS-2020) was held online on July 6-7, 2020, at 14:00-19:00 (GMT+2, Central European time) (https://www.danieleavitabile.com/icmns2020digital/).

ICMNS is a regularly organized scientific event which was launched in 2015 and has been organized 5 times to date. This year, owed to the Coronavirus outbreak, the 6th edition was organized online. The organizing committee members of this successful event worked very hard and this team consists of the distinguished academics: *Assoc. Prof. Dr. Daniele Avitabile* (Vrije Universiteit Amsterdam, the Netherlands), *Assist. Prof. Dr. Tatiana Engel* (Cold Spring Harbor Laboratory, New York, USA), *Assist. Prof. Dr. Tilo Schwalger* and *Prof. Dr. Wilhelm Stannat* (both from Technische Universität Berlin, Germany).
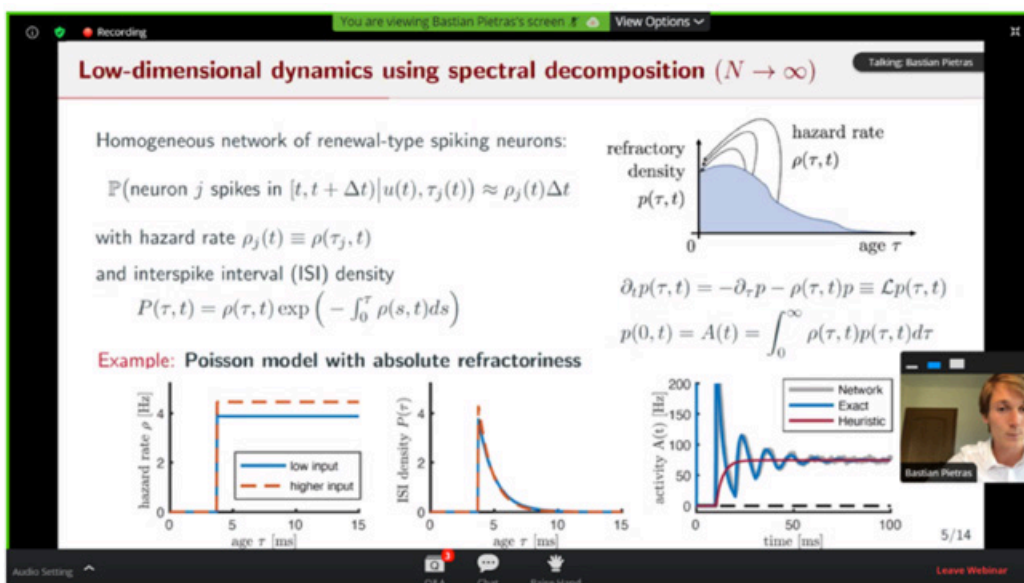

▲ Prof. Dr. Jonathan Rubin (University of Pittsburgh, USA) explains "The role of chloride dynamics in neuronal integration of multiple input streams".

One of the advantages of the online event was that the talks of *ICMNS-2020* were streamed live on *YouTube*, so they were publicly available following the links in the program. Talks were recorded and uploaded to the YouTube channel of for the event named as *"ICMNS 2020 Digital"* (https://www.youtube.com/playlist?list=UUXClLvVl35uBrYIgN8dOZsw).

problems and chances in neuroscience which are also contain the relations with *Operational Research (OR)*. Studying such problems in neuroscience requires strong mathematical tools from many areas in mathematics such as stochastic calculus, probability and statistics, information theory, geometry, and numerical analysis. Besides, the conference was advancing a new topic in mathematics and new applications, namely, valid quantitative models in neuroscience. Brain neuroscience research is seeking to improve models of decision making in complex, interactive environments. Due to these reasons, neuroscience researches have been strongly supported and enriched by other disciplines with the help of *OR* studies which give different aspects to direct these research works. In those research areas of *OR,* the advantage of being able to work on subjects of multidisciplinary science from neuroscience has been used. This concerns the structure and functions of the nervous system. Then behavioral and cognitive sciences with their instrumental and theoretical improvements support the research at a quantitative level.

▲ Dr. Bastian Pietras (Technische Universität Berlin, Germany) gives his presenting on "A stochastic neural field model for finite numbers of renewal-type spiking neurons".
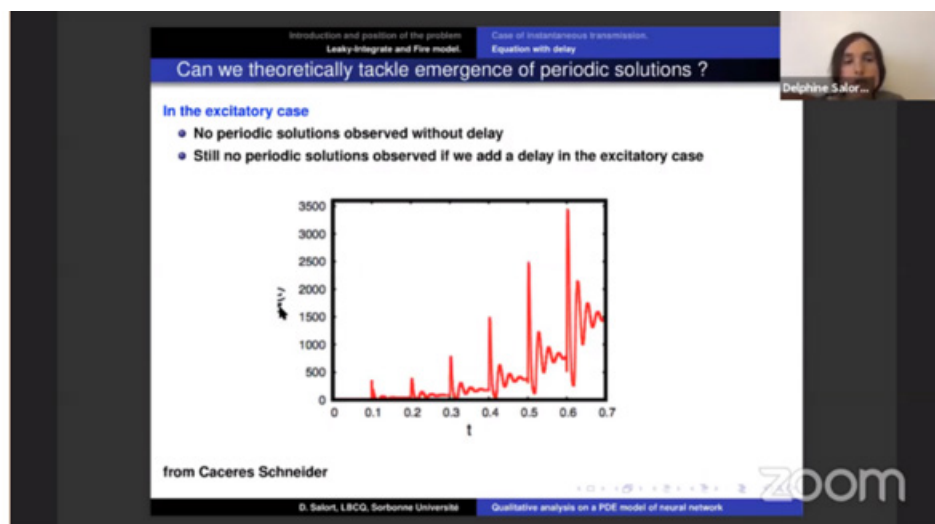
The goal of this event was to provide an interdisciplinary scientific environment to bring together theoretical neuroscientists and mathematicians interested in mathematical concepts and techniques for investigating

The conference had eight different Parallel Sessions which were organized by leading academics and they were named as follows: *"Cellular and sub-cellular dynamics"* by *Prof. Dr. Krasimira Tsaneva-Atanasova* (University of Exeter, UK), *"Dynamics of structured networks"* by *Prof. Dr. Krešimir Josić* (University of Houston, USA), >>
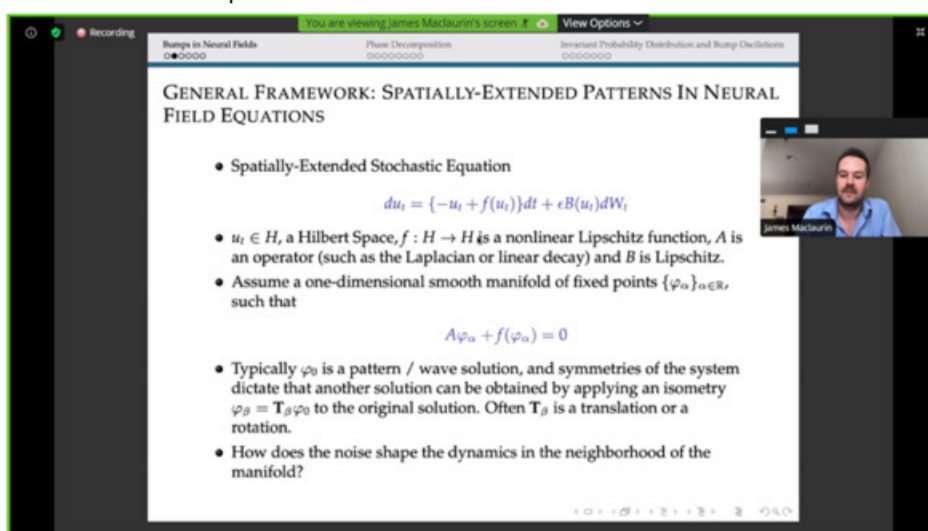
>> *"Inferring models from data"* by *Prof. Dr. Jean-Pascal Pfister* (University of Bern, Switzerland), *"Mean-field methods"* by *Prof. Dr. Eva Löcherbach* (Université Paris 1, Panthéon Sorbonne, France), *"Neural fields and spatio-temporal dynamics"* by *Assist. Prof. Dr. Áine Byrne* (University College Dublin, Ireland), *"Neural coding"* by *Assoc. Prof. Dr. Vladimir Itskov* (The Pennsylvania State University, USA), *"Numerical methods"* by *Prof. Dr. Evelyn Buckwar* (Johannes Kepler University Linz, Austria), *"Mathematical theory of deep learning"* by *Sir Henry Dale Fellow Dr. Andrew Saxe* (Oxford University, UK), respectively.

▲ Prof. Dr. Delphine Salort (Sorbonne Université, France) shows her results on "Qualitative analysis on a PDE model of neural network".

The Plenary Speakers of *ICMNS-2020* with their talks were titled as: *Dr. Anne Churchland* (Principal investigator and Chair of Cold Spring Harbor Laboratory, USA): *"Discovering diversity in decision making: cells, brains, and individuals"*, and Senior Group Leader and Head of Mechanistic

▲ Assist. Prof. Dr. James Maclaurin (New Jersey Institute of Technology, USA) reports on "Metastable phenomena in stochastic neural fields over long timescales".

Cognitive Neuroscience, *Dr. Vivek Jayaraman* (Janelia Research Campus, USA): *"About a biological ring attractor network"*. These sessions of the plenary speakers were scheduled on the different days of *ICMNS-2020*.

Although this scientific event was organized on specific subjects, more than 500 people from all over the world were the viewers of the records of this event. *Dr. Burcu Gürbüz* (Johannes Gutenberg-University of Mainz, Germany, and Üsküdar University, Turkey) was one of the attendees of this scientific event.
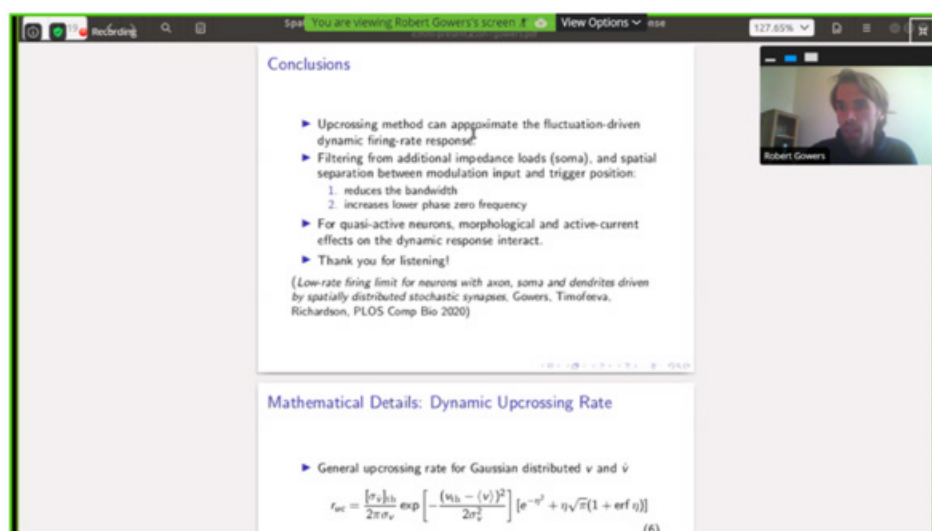
The Closing Ceremony of *ICMNS-2020* included a speech of *Prof. Dr. Wilhelm Stannat.* He mentioned the records of the event and thanked all the participants, plenary speakers, organizers and social media managers of this recognizable event. Besides, participants were informed about upcoming events related to neuroscience, mathematical biology and operational research. The upcoming event SMB 2020 Annual Meeting, or *eSMB-2020,* has a unique platform for those who have studies on neuroscience-related applied mathematical research topics (https://smb2020.org/). Another important upcoming event for OR studies is the *22nd Conference of the International Federation of Operational Research Societies (IFORS 2021)* to be held on August 22-27, 2021, in Seoul, Korea. It will also contain a stream *"OR in Neuroscience"* (cf. http://www.ifors2020.kr/). 🌎

▲ Dr. Robert Gowers (University of Warwick, UK) with his research on "Spatial structure filters the fluctuation-driven dynamic firing-rate response".

Conferences, hackathons, competitions and startups: The story of Migport, COVID-19 impact on digitalization (2020)

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Gerhard-Wilhelm Weber <gerhard.weber@put.poznan.pl>

The coronavirus outbreak affects our lives economically, socially, and physically. The coronavirus spread rapidly from March 2020 onward also in Europe. Europeans and neighboring regions of Middle East and North Africa experienced a "new normal". The "new normal" means no travel, lockdown, and disease. Given the hard conditions in people's lives, there started a new trend as well – the *COVID-19 Hackathons.* The word "Hackathon" comes from *hacking* and *marathon.* Given the social problems, economic, and lockdown effects of the coronavirus, innovators around Europe and the globe started organizing hackathons everywhere. The first author, *Berat Kjamili,* participated in the organization of *Coronathon Turkey* (www.coronathonturkiye.com), which is the biggest Turkish COVID-19 hackathon with over 1500 participants and 150 projects submitted. Academia, entrepreneurs, the government and civil society organizations collaborated and searched for solutions to the social problem of the pandemic. 730,000 Turkish Lira for the selected start-ups and 42 ideas have been supported by *Coronathon Turkey* stakeholders and *Scientific and Technological Research Council of Turkey (TÜBİTAK).* Besides, this movement did not happen only in Turkey. Other innovators started hackathons in Estonia, Germany, Italy, Sweden, and further countries. European Commission brought together all the foremost COVID-19 hackathon organized under EU Commission's umbrella and organized the biggest hackathon of the world with over 21,000 participants, 2100 submitted projects, *EUvsVirus Pan-European Hackathon* (www.euvsvirus.org). *Berat Kjamili* representing Migport (www.migport.com) and *Coronathon Turkey* (www.coronathonturkiye.com), joined the hackathon as one of the main initiators and as the project manager. *Matchathon* was another event that the European Commission organized with the volunteers. As a result, 2235 new partnerships were secured for the 123 winning teams of the *EUvsVirus. Coronathon Turkey* and *EUvsVirus* are proof that social entrepreneurship and collaboration is a way to solve social problems; that is, individuals, volunteers and social entrepreneurs can achieve it without being an NGO. The fact that people from all around the world met at the hackathon led to several social initiatives to start in Europe and provide hope for the future.

Last but not least, founder *Berat Kjamili's* and advisor *G.-W. Weber's (Willi's)* start-up *Migport,* which is an online platform for refugees to share knowledge and ask questions to locals for their daily problems *Migport* (www.migport.com), decently impacts the world by aggregating anonymized information of refugees regarding skills, needs, and preferences that can help better predict the needs of newcomers. During COVID-19 times, *Migport* has won two awards, one *Migration Entrepreneurship award* at highly prestigious "*Seedstars Summit*" in March 2020. *Seedstars* is an investment organization that invests in emerging markets. The second award received is the *Gender and Inclusion Award of Digital Arabia Network regarding* the empowerment

▲ Berat Kjamili, at EUvsVirus badge.

of female refugees within *Migport.* After organizing the hackathons, *Migport* is motivated more than ever to find ways of financial inclusion to better integrate refugees in their host countries using Operational Research, fintech and big-data analytics. *Migport* also delivered a keynote speech at *ICCESEN 2019 – 6th International Conference on Computational and Experimental Science and Engineering, Kemer, Antalya, Turkey, October 23-27, 2019* (http://2019. iccesen.org/news/iccesen-2015).

Following the tradition of the previous five years, *ICCESEN 2019* was conducted in Antalya, Turkey, and very successfully again. Several universities of Turkey organized it under the lead of Conference Chair *Prof. Iskender Akkurt* (Süleyman Demirel University, Isparta, Turkey). ICCESEN 2019 hosted registered participants from all over the world; ICCESEN conferences usually have 500-700 attendees with around 1000 papers, and they are a unique chance for academics of the Middle East and North Africa to meet with international experts, to show their newest results and develop scientific collaborations. Scientists and engineers from applied mathematics, *OR,* industrial engineering, physical science and technology, computer science, business administration, economics, education, medicine, and related disciplines gave oral and poster presentations on a wide variety of subjects, organized in 10 themes and sessions. >>

▲ ICCESEN 2019, Migport Keynote Speech stage, Kemer, Antalya, Turkey, with Berat Kjamili.

>> Along its six years by then, *ICCESEN* series build up a well-known international platform to share research endeavors, to exchange "nonstandard" ideas, to advance knowledge and insights on a broad range of subjects which typically use quantitative methods – as provided by *OR,* as a "secret" behind *ICCESEN's* success. Indeed, many contributions came from the emerging areas of OR. They gave a lot of chances for discussions and making new friendships. The scientific side *ICCESEN 2019* was complemented by the exceptional environment of the venue, the natural beauty of the Gulf of Antalya. The congress provided an opportunity to elaborate on new connections between various branches of science, high-tech, and *OR*. Interdisciplinary works demonstrated the potentials of mutual scientific impacts between *OR* studies and aerospace engineering, medicine, radiology, healthcare, electrical engineering, economics, optimization applications, or social sciences. Like in all of the five previous *ICCESEN* editions before, *Willi* was an Invited Speaker and, in the 2019 congress, referred on *"Social Entrepreneur Using Business Metrics: Migport Refugee Big Data Analytics - With a Note on Ability and Disability"* from both an economic and a societal point of view, an interdisciplinary and a new *OR* perspective. As a guest editor, he offered a special issue of the journal *Optimization Methods and Software* again. Because of his dense working program, one of our faithful *EURO* friends from Turkey, emerging scientist *Berat Kjamili*

(Department of Economics, METU, Ankara, and start-up *"Migport"*) gave the aforementioned invited lecture on *Willi's* behalf. He also advertised the *EURO* and *IFORS* conferences, and our lively European and worldwide *OR* community. In recent years, *Berat Kjamili* has helped us a lot at our *EURO* and *IFORS* conferences, with his innovative and courageous work for the migrants and for us all in Turkey, in Europe and worldwide, and with his kind and cheerful nature. *Berat Kjamili* and all the friends who cooperate with him and even represent him become "trained" by this towards further collaboration at our *EURO* conferences. What is more, *Willi* was present by e-mail conversation and by many friends who were present at *ICCESEN 2019* as organizers and participants. Additionally, he was a member of the Scientific Committee. The participants of *ICCESEN 2019* were kindly informed about the spirit of our *EURO* and *IFORS* conferences, and our nearest conferences, especially, *IFORS 2020* in Seoul, Korea (http://www.ifors2020.kr/) which became postponed to August 22-27, 2021, and EURO 2021 in Athens, Greece, July 11-14, 2021 (https://www.euro-online.org/web/pages/421/activities-list). By his visits to Turkey and, if he cannot attend in person, substituted by a friend or electronically, *Willi* collaborates with *OR* in Turkey. He maintains contacts between the "old and new" Turkish friends and our conferences. He is in regular contact with *OR* research groups in all over Turkey. 🌍

Mathematical Methods in Economics 2020, Brno , Czech Republic (September 9–11, 2020)

Milan Hladík <hladik@kam.mff.cuni.cz>

The *38th International Conference on Mathematical Methods in Economics (MME)* was organized on September 9–11, 2020, by the *Mendel University* in Brno, Faculty of Business and Economics (https://mme2020.mendelu.cz/). It is traditionally held under the auspices of the *Czech Society for Operations Research (CSOR)* and the *Czech Econometric Society*. The *MME* conferences constitute an annual scientific event organized in the Czech Republic in the field of operational research, econometrics and mathematical economics. The conference topics include also multi-criteria decision making, decision support systems, quantitative management methods, fuzzy systems, simulation, mathematical modelling, optimization, and related research areas.

Due to the COVID-19 pandemic, many conferences all over the world were cancelled or turned into an online form. Surprisingly, *MME 2020* succeeded in to be held in a mixed present-online form. I can confirm from my personal experience that the local organizers were very well prepared, and the combination of *present lectures* and *remote* online presentations harmonized excellently.

MME 2020 was attended by almost 100 participants at the location; they came from the Czech Republic, China, Austria, Poland, the Netherlands, Norway and Slovakia. The program launched with the opening ceremony in charge of the Chair of the Organizing Committee, *Svatopluk Kapounek*. After that, the first plenary session started with two invited lectures. >>

>> *Professor Jesus Crespo Cuaresma* from the Vienna University of Economics and Business presented a lecture entitled *"Model Uncertainty in Econometrics: What to do when you don't know what to do"*. *Professor Peter Molnár* from the University of Stavanger, Business School, in Norway talked on *"Online Attention and Financial Markets"*.

The total number of presentations was more than 80. They were scheduled into 22 regular sessions, split into four parallel streams. All accepted 103 papers were published in the Conference proceedings of MME 2020 (https://mme2020.mendelu.cz/wcd/w-rek-mme/mme2020_conference_proceedings_final_final.pdf) edited by *Svatopluk Kapounek* and *Hana Vránová*. They were also submitted, as in previous years, for indexing in the Web of Science CPCI database.

▲ Petra Tomanová (University of Economics), winner of MME 2020 "Best Paper" PhD student competition. Surrounded by Josef Jablonský (head of the jury) and Helena Brožová (vice president of CSOR).

It has been a long tradition that a competition of PhD students for the best paper takes place during *MME* conferences. The competition is organized and honored by the *CSOR*. Six best-selected papers were presented at the conference in a special session. *Petra Tomanová* (University of Economics, Prague) became the winner with her paper *"Robustness of Dynamic Score-Driven Models Utilizing the Generalized Gamma Distribution"*. The second prize went to *Karel Kozmík* (Charles University, Prague) with his paper *"Using Machine Learning to Predict Optimal Parameters in Portfolio Optimization Problems"*, and the third prize was awarded to *Petr Vejmělka* (Charles University, Prague) for his

▲ MME 2020: welcome dinner and interactive scientific exhibition in VIDA! Science center.

▲ MME 2020 Plenary Speaker Prof. Jesus Crespo Cuaresma (Vienna University of Economics and Business). He also had to follow COVID-19 regulations on wearing masks even during his lecture.

paper *"Recursive Estimation of IGARCH Model"*.

The essential part of each conference is a social program since it always offers many opportunities to discuss problems in an informal environment. The welcome evening took place in the *VIDA! Science Center* in Brno, where the conference participants had the science center only for themselves. They could explore more than 180 interactive exhibits spread across nearly 6,200 square meters, including for example a 3G flight simulator or a bicycle ride on a tightrope six meters above the ground.

▲ Cheer and interaction in VIDA! Science center: MME 2020.

The organizers also prepared two optional outdoor trips. One trip was directed to the *Sloup-Šošůvka caves*, which are situated in the northern part of the protected nature reserve Moravian Karst. The second trip headed to the Labyrinth underneath *Zelený trh* in the Brno city center, where is a large maze of undergrounds tunnels, corridors and rooms. The tour in the Labyrinth was followed by a guided tour in the city center of Brno. In the evening after the trips, the conference dinner took place at the university campus in Building X with accompanying music (traditional South Moravian sounds).

MME traditionally hosts annual meetings of the *CSOR*, too. The *CSOR* is a member of *EURO* and *IFORS* (since 1994). It supports development of *Operational Research* by promotion of education activities, organization of scientific meetings or coordination of cooperation with partner institutions. I was also confirmed that the following *39th MME 2021 conference* will be organized by the Czech University of Life Sciences Prague, Faculty of Economics and Management, on September 8–10, 2021, in the city of Prague. 🌍

Multimodality in Multi-Objective Optimization, MMMOO 2020 - in Leiden, Netherlands (September 5 - 9, 2020)

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Heike Trautmann <trautmann@wi.uni-muenster.de>;
Michael T.M. Emmerich <m.t.m.emmerich@liacs.leidenuniv.nl>; **Hao Wang** <h.wang@liacs.leidenuniv.nl>

▲ Co-organizers of the workshop on "(Multimodal) Multi-Objective Optimization (MMMOO): Challenges, Characteristics, and Peculiarities", which was part of this year's PPSN XVI (from left to right): Christian Grimme, Pascal Kerschke, Heike Trautmann (all three from the University of Münster, Germany), Michael T.M. Emmerich and Hao Wang (both from Leiden University, The Netherlands).

The *16th International Conference on Parallel Problem Solving From Nature (PPSN XVI)* took place from September 5 until September 9, 2020 in Leiden, The Netherlands. However, due to the Covid-19 pandemic, it was held in a *hybrid format,* allowing its participants to attend the conference either on-site or fully virtual.

Our workshop on *"(Multimodal) Multi-Objective Optimization (MMMOO 2020): Challenges, Characteristics, and Peculiarities"* (erc.is/go/mmmoo2020) was held on Sunday, September 6, 2020, and due to the strong interest in the workshop's scope, we received a wide variety of contributions from all over the world. This enabled us to easily fill two full time slots (of 90 minutes each) with a series of very inspiring talks on different aspects of multi-objective optimization, followed by a vivid panel discussion at the end of our two sessions.

The workshop brought together researchers working on multimodality in single- and multi-objective optimization to jointly develop a new view on multimodality in multi-objective (MO) optimization.

In practical applications, MO optimization is usually treated secondarily due to its rather deterrent complexity/difficulty (compared to single-objective (SO) optimization problems). Therefore, practitioners in general scalarize their problems, e.g., by optimizing weighted sums of the underlying objectives. A major reason for such behavior is the much lesser tangibility of MO problems; it is extremely challenging to imagine interaction effects between ≥ 2 decision variables and ≥ 2 objectives simultaneously (let alone visualize them within a single plot).

Even researchers usually limit themselves to visualizing only the Pareto fronts of MO problems, i.e., the image of the set of MO global optima. As a result, our "knowledge" about MO problems is highly influenced by our understanding of SO problems. For instance, it is well-known that multimodality can be very challenging in SO optimization. Thus, for a long time, research simply inferred that such structures cause similar problems for optimizers in the MO setting. In consequence, such structures have regularly been considered for the design of MO benchmark problems. Yet, recent works have shown that multimodality might in fact even facilitate MO optimization.

In an attempt to reduce our knowledge deficit in this particular domain, the workshop was intended to provide a platform for researchers to actively exchange ideas that improve our understanding of (multimodal) MO continuous optimization problems. Within our workshop, numerous international research groups gave inspiring spotlight talks on different related aspects. Each of these talks lasted roughly ten minutes and was followed by about ten minutes Q&A. In the first session of our workshop, *Marcus Gallagher* (University of Queensland, Australia) raised awareness for the *"Challenges of Multimodal Single-Objective Optimization"* before *Hisao Ishibuchi* (Southern University of Science and Technology, China) gave an overview about the status quo of *"Multi-Modal Multi-Objective Optimization".* Afterwards, we had two talks dealing with the (visual) characterization of MO problems, which ideally will improve our understanding of currently used benchmark problems. *Estefania Yap* presented joint work with *Mario A. Muñoz* and *Kate Smith-Miles* (all from University of Melbourne, Australia) in which they investigated *"Instance Spaces in Continuous Multi-Objective Optimisation".* The session was concluded by *Lennart Schäpermeier* (University of Münster, Germany), who introduced *"A Dashboard for Visualizing Multi-Objective Landscapes".*

The second session was opened by *Gabriela Ochoa* (University of Stirling, UK), who showed how *"Complex Networks in Search and Optimisation"* can be utilized for studying optimization problems. Afterwards, *Stef Maree* presented joint work with *Timo M. Deist, Tanja Alderliesten* and *Peter Bosman* (all from the University of Amsterdam, The Netherlands) in which they used *"Uncrowded Hypervolume-Based Multi-Objective Optimization"* to efficiently search for solutions in MO problems. Building on the previous talks, *Christian Grimme* (University of Münster, Germany) gave an overview on the *"Current Challenges and Research Potential of Multi-Objective Optimization"*, which simultaneously served as an introductory talk for a vivid panel discussion. >>

>> In a nutshell, the panelists – *Gabriela Ochoa* (University of Stirling, UK), *Carlos Fonseca* (University of Coimbra, Portugal), *Boris Naujoks* (TH Köln, Germany) and *Pascal Kerschke* (University of Münster, Germany) – as well as the contributing participants agreed that (a) one shouldn't simply transfer concepts from the single-objective to the MO domain, (b) the new approaches will help us to improve our understanding of MO problems, (c) some of the currently used notions (like "multimodality") need to be refined to the new insights, and (d) all the new methods and findings pave the way for lots of new research, affecting many aspects like theory, algorithm engineering, design and characterization of MO benchmark suites, etc.

As identified within the workshop, this research area offers lots of perspectives for future research. All previously identified focus areas are related to the emerging area of *benchmarking* and we thus plan to intensify our collaboration with the *Benchmarking Network* (https://sites.google.com/view/benchmarking-network/home). To synergize the efforts of the multitude of research groups working on MO optimization, we also intend to regularly integrate different aspects of MO optimization in various related scientific events like Dagstuhl seminars, Lorentz Center workshops, or follow-up workshops at upcoming conferences. 🌐

Variational Analysis and Optimization – MoCaO Webinar, Australia (June 3, 2020)

Alexander Kruger <a.kruger@federation.edu.au>

▲ Prof. Dr. Regina S. Burachik (University of South Australia, Adelaide) delivers her Webinar.

2020 has been a special year so far. As traditional face-to-face meetings became impossible, numerous webinars came to life everywhere. We are witnessing an explosion of online activities, and it looks like, despite all the complications caused by COVID-19 and partially thanks to them, a significant increase in research collaboration is happening in many areas.

Mathematics of Computation and Optimisation (MoCaO) group of the *Australian Mathematical Society* announced a new project: ***Variational Analysis and Optimisation Webinar*** in May 2020. The announcement was met with great enthusiasm in Australia and overseas, and the webinar started on June 3, 2020.

Since the organizers reside in Australia, our targeted time zones are different from those covered by most of the other online optimization seminars: afternoon in Australia, New Zealand and most of Asia, and morning in Europe. We apologise to our colleagues in North and South America.

We meet weekly on Wednesday at 17:00 AEDT = 14:00 in China (CST) = 13:00 in Vietnam (ICT) = 8:00 in Israel (IST) = 7:00 in Brussels (CET). So far, we have had 21 presentations by *Variational Analysis, Optimization* and *OR* experts from Australia, Czech Republic, France, Germany, Hong Kong, the Netherlands, New Zealand, Russia, Spain and Vietnam. All time slots until the end of 2020 have already been filled, and we have started planning for 2021. For closer information please visit our website http://www.mocao.org/va-webinar/. 🌐

Advances in Preference Handling Went Digital: Impressions from M-PREF 2020, Italy

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Ulrich Junker <uli.junker@free.fr>

Whereas preference modeling has a long tradition in decision support, the topic of preferences is nowadays also important in many other computational domains such as artificial intelligence, databases, and human-computer interaction. For example, a recom-mender system needs to take the shopping preferences of its users into account in order to be effective. Preferences are also important in digital assistants or in automated prob-lem solvers such as configurators. Nearly all areas of artificial intelligence deal with choice situations and can thus benefit from computational methods for handling preferences.

These new application areas for preferences are leading to new research questions. In 2004, a Dagstuhl-Seminar has united researchers from databases, artificial intelligence, mathematics, decision science, philosophy and it was decided to set up a new workshop series to study those questions. In 2008, it was decided to formally constitute a Working Group affiliated to *EURO* (Association of European Operational Research Societies) and in 2009; the *Algorithmic Decision Theory (ADT)* conference series has been started.

ADT takes place each second year and the working group continues to organize an *M-PREF* workshop in the other years. We believe that it is important to maintain a workshop in addition to a conference. A workshop is more informal and allows researchers to pre-sent somewhat less mature work while obtaining direct feedback from experts in the field. This is in particular attractive for younger researchers for whom such feedback is essential for progressing in their research. In the past years, many of the *M-PREF* papers have been published at major conferences and journals, thus proving that it served well its pur-pose of a starting point.

The 12th workshop on Advances in Preference Handling *(M-PREF 2020)* has been orga-nized by *Andreas Pfandler, Markus Endres,* and *Ulrich Junker.* It was held jointly with the *24th European Conference in Artificial Intelligence (ECAI).* Originally, this event had been planned for June 2020 in Santiago de Compostela, but then the global COVID-19 crisis interfered with the preparation. First, *ECAI* has been postponed to August 29 - Septem-ber 2, 2020, and then the organizers opted for a digital event.

Digital conferences require an easy way for discovering and presenting the talks, while allowing discussions among participants. *ECAI* used the virtual conference platforms *Whova* and *Underline.io.* They published the *M-PREF* schedule in *Whova* and provided us with a ZOOM room for the presentations. Running the workshop digitally has been a quite demanding task, but thanks to a good preparation, good support by
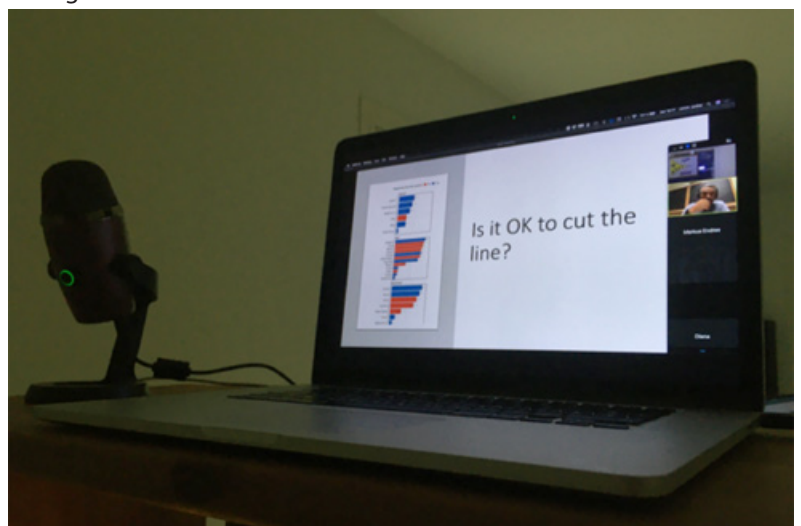

▲ M-PREF 2020 participants listening to Andrea Loreggia (EUI, Italy).

ECAI and its partners, excellent talks, and interesting questions by the audience, everything went well.

The workshop program featured four technical sessions and two invited talks, separated by enough breaks, which is important for such a digital event. All talks except for one have been given live, thus keeping the authenticity of the event. There have been between 15 and 20 participants simultaneously in the ZOOM room and they posed good questions.

The first session was about Preferences in Applications. *Lena Rudenko* (University of Augsburg, Germany) presented a preference-based approach for searching Twitter data with the purpose of avoiding empty search results if not all keywords are matched. *Markus Endres* (University of Passau, Germany) went even a step further and presented an expressive preference language for querying the Semantic Web.

▲ The organizer's setup at M-PREF 2020.

After a short break, *Vincent Mousseau* (CentraleSupélec, France) gave an instructive in-vited talk about learning interpretable multi-criteria sorting models. He revisited the Non-Compensatory Sorting Model and argued that it is easy to interpret and that its decisions are easy to explain.

The last morning session was on Voting Theory. *Rachael Colley* (IRIT, France) introduced the audience to liquid democracy which permits elections on multiple issues and complex delegations between voters. She proposed and compared several algorithms for making a collective decision. In the next talk, *Yongjie Yang* (Saarland University, Germany) exam-ined which rules for group identification are resistant to micro-

▲ A CP-Network at M-PREF 2020.

bribery, where a briber pays voters to change their preferences. Group identification consists in choosing group mem-bers from a set of candidates who are judging each other whether they can be part of the group. In the last talk of the session, *Zack Fitzsimmons* (Holy Cross, USA) studied the manipulation of elections by selecting the location of polling places.

The program continued after a decent one hour lunch break with Preference Learning and Aggregation. *Luigi Sauro* (University of Naples, Italy) discussed preference elicitation, where a utility function is learned by posing successive preference queries to a decision maker. *Luigi* compared different criteria for choosing queries, namely value information and reduction of uncertainty. *Pallavi Jain* (BGU, Israel) studied how to aggregate alterna-tive ways

in a logical language.

Half an hour later, *Andrea Passerini* (University of Trento, Italy) gave a fascinating invited talk about constructive preference elicitation for complex combinatorial problems such as PC configurations, layouts, floor plans, and other structured objects. Andrea presented different preference elicitation methods for finding a current recommendation as well as query selection. The methods included set-wise max margin learning as well as deep learning. In the final session, *Nic Wilson* (UCC, Ireland) showed how to combine social choice func-tions (which pick out a best option out of a set of options) while maintaining desirable properties. *Andrea Loreggia* (EUI, Italy) used CP-networks to decide when is it morally acceptable to break the rules (such as cutting the line).

The talks have all been high quality and interesting. The papers can be found on the workshop website http://mpref2020. preferencesql.com.

As closing remarks, we briefly presented the activities of the *EURO Working Group on Preference Handling* in 2020. We continue to publish blog entries on the working group website that comment topics of current interest and seek to stimulate future research. Furthermore, we
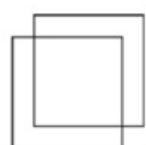

▲ Andrea Loreggia (EUI, Italy) explaining the importance of ethical rea-soning for AI at M-PREF 2020.

of partitioning a budget over a set of projects into a single partitioning. *Michael Huelsman* (University of Kentucky, USA) showed how to aggregate multiple preference orders over a combinatorial domain into a single order by using simulated annealing. The preference orders are represented compactly

started a *GDPR*-compliant newsletter. Readers who want to get informed about future events on preference handling may subscribe via the working group website http:// preferencehandling.free.fr. 🌍

Prague Summer School on Discrete Mathematics, Prague, (August 2020)

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The third edition of the *Prague Summer School on Discrete Mathematics* [http://pssdm.math.cas.cz/] organized jointly by *Computer Science Institute* of Charles University [https://www.mff.cuni.cz/en/iuuk] and the *Institute of Mathematics* of the Czech Academy of Sciences [http://www.math.cas.cz/] took place in the last week of August 2020. Prague has several strong groups in discrete mathematics at *Charles University* (which is the biggest and most prestigious university in Czechia) as well as at the *Czech Academy of Sciences* and the *Czech Technical University*. So, our initial motivation when we started thinking about organizing a series of biennial summer schools in 2015 was to bring exciting developments in discrete mathematics to local students and postdocs as well as international ones. In each of the first two editions, held in 2016 and 2018, we had around 40 participants and we thought that a tradition was established. The success of these two editions was mostly thanks to our scientific board which helped us to invite great lecturers (*Ronald de Wolf* and *Samuel Fiorini* in 2016 and *Piotr Micek, Aleksandar Nikolov* and *Peter Pal Pach* in 2018) but clearly the fact that the Schools were held in the beautiful city of Prague helped in making the event more attractive.

When in March the world started to understand the potential scale of the coronavirus pandemic, we already had closed the registration, confirmations from the lecturers, lecture rooms booked, and concluded negotiations with our main sponsor about travel stipends for participants. So, like organizers of many other events, we were facing the decision what to do in this new situation. That said, transferring to a virtual school -¬ which we eventually did, seemed for us quite a natural option. In fact, already prior to the coronavirus we discussed how to augment the format so that virtual participation would be possible, mostly because of environmental concerns. We are grateful to our lecturers who agreed with this modified format, and to our main sponsor, the *RSJ Foundation* [https://www.rsj.com/en/foundation/about-us], which allowed for flexibility in funding.

▲ Prague Summer School: Organizers and sponsors joined forces.

Both lecture series this year covered some of the most spectacular developments in discrete mathematics in recent years. The first lecture series on hardness of approximation was given by *Subhash Khot* [https://cs.nyu.edu/~khot/], the Silver Professor of Computer Science at the Courant Institute of Mathematical Sciences at New York University. The lecture series culminated with an outline of the proof of the so-called 2-to-2 Games Theorem. The *2-to-2 Games Theorem,* proved by *Irit Dinur, Subhash Khot, Guy Kindler, Dor Minzer* and *Muli Safra,* asserts algorithmic hardness of approximation of a certain graph labelling problem called 2-to-2 Games. The theorem asserts that, unless $P=NP$, it is not only difficult to algorithmically find in polynomial time optimal solutions to this labelling problem, but also solutions that are close to the optimal ones. The labelling problem is a technical one, but it can be used to deduce optimal or best to date in approximability results for classical problems like the *Max-Cut*. The second series of lectures by *Shayan Oveis Gharan* [https://homes.cs.washington.edu/~shayan/] of the University of Washington focused on the use of multivariate complex polynomials algorithm design. The rather sophisticated mathematical theory around these polynomials and, in particular, around the concept of *"real stability"*. These techniques have been successfully used in diverse parts of discrete mathematics for at least twenty years, including

▲ Subhash Knot gave the first lecture series at Prague Summer School.

▲ Shayan Oveis Gharan gave the second lecture series at Prague Summer School.

approximation of the permanent, or the solution of the *Kadison-Singer* conjecture by *Adam Marcus, Daniel Spielman* and *Nikhil Srivastava*. The topics covered in the course were particularly close to a recent result of *Gharan* (together with *Anna Karlin* and *Nathan Klein*) on the traveling salesperson problem, which is one of the most fundamental problems in combinatorial optimization. A classical algorithm of *Christofides* and *Serdyukov* from the 1970's gives an 1.5-approximation to this problem, and no general improvements had been known. In their recent work, *Gharan, Karlin* and *Klein* improve the approximation factor to $1.5-10^{-36}$. This tiny improvement opens a big new field for further research.

There were 70 participants registered for the school, ranging from undergraduate students to postdocs. Among the 23 countries they represented, there were 12 participants from the US, 7 from India and 6 from the UK. The lectures were accompanied by exercise classes, with three groups so as to accommodate different time zones of the participants.

We plan to organize another edition of Prague Summer Schools in 2022. Let us hope that conditions will be more favorable. 🌍
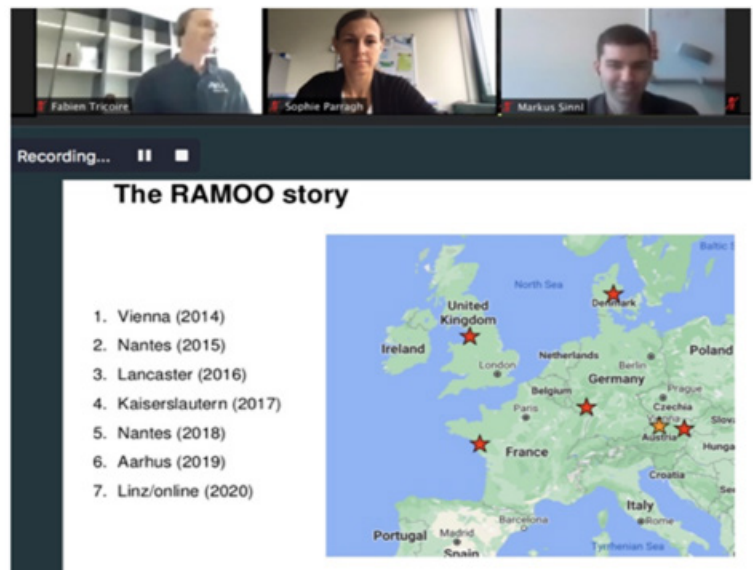
Recent Advances in Multi-Objective Optimization, Austria (September 17, 2020)

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Fabien Tricoire <fabien.tricoire@wu.ac.at>

Almost all practical problems involve multiple objectives and if they cannot be combined into a single objective function in a meaningful way, it is recommendable to produce the set of trade-off solutions. While a large body of research on heuristic and metaheuristic approaches for multi-objective optimization exists, increased interest in the development of exact solution methods is more recent and gave rise to the international workshop series *"Recent Advances in Multi-Objective Optimization"* *(RAMOO)*. It focuses on latest advances in exact methods in multi-objective (mixed) integer optimization.

The RAMOO story. The first *RAMOO* workshop was organized at the University of Vienna in 2014 by *Ivana Ljubic* and *Sophie N. Parragh*. This first meeting was motivated by ongoing research projects and a joint effort to bring together people working on exact methods in multi-objective (mixed) integer programming. The workshop featured two keynote talks given by *Professor Matthias Ehrgott* and *Professor Xavier Gandibleux* and 11 invited talks. During the workshop, the idea was born to organize another workshop of this kind in Nantes the following year. The success of the second workshop gave rise to the third and the story has continued ever since. The workshop has thus become an annual event, happening in different places all over Europe. The 2021 edition of the workshop will be organized in Wuppertal. Information to the growing community is distributed via the mailing list (https://moo.univie.ac.at/mailing-list/) and the workshop webpage (https://moo.univie.ac.at).

RAMOO 2020 preparations. Having announced the 2020 workshop in 2019 in Aarhus, it was supposed to return

▲ RAMOO opening slides, and the 2020 organizers.

to Austria, taking place at the *Johannes Kepler University Linz*. However, due to the COVID-19 situation, it became clear that moving to a hybrid or purely online setting was necessary. After having tested several different platforms, we settled for ZOOM and contacted the keynote speakers as well as the invited speakers, asking them if they were willing to move to an online setting. They all agreed and preparations were started to organize the online sessions in such a way that all speakers would receive the most convenient time slots with respect to their time zones. As a final step, individual meetings for resolving technical issues with the speakers and the session chairs were organized about a week before the workshop.

▲ RAMOO 2020 participants.

RAMOO 2020. Finally, it was September 17, 2020, the day of the workshop. More than 150 registrations from 30 different countries resulted in an average online presence of about 75 persons per session. Following the blue print of the very first workshop, the 2020 workshop started with the first keynote talk, given by *Professor Birgit Rudloff* (Vienna University of Economics and Business, Austria), on *"Multivariate Dynamic Programming: from the Mean-Risk Problem to dynamic Nash games"*. It was followed by four sessions featuring nine invited talks on a wide range of topics, ranging from approximation methods to branch-and-bound algorithms, lower bound set computation strategies, the integration of Benders decomposition, stochastics information, applications in routing with drones, disaster relief, the relationship to multiplicative programs and more; and the presentation of an upcoming handbook on multi-objective combinatorial optimization, which is currently in preparation. The second keynote talk was given by *Professor Kathrin Klamroth* (University of Wuppertal, Germany) on *"Multiobjective Optimization Methods for Neural*

Network Training". The talks presented recent results along with ongoing work, open questions and exciting new research directions. For more information we refer to the online program: https://moo.univie.ac.at/ramoo-2020-program/.

Due to the usual one-day setting, traveling to the workshop from far away has so far often not been a feasible nor a sustainable option. This year's workshop allowed the participation of members from the multi-objective optimization community from as far as New Zealand. It allowed discussion and exchange of ideas individually via chat and publicly after the talks in a nice atmosphere. Even if it is clear that an online workshop cannot replace all those great informal exchanges of ideas during coffee breaks, lunch or dinner, which workshops in physical presence allow, the feedback from the participants was very positive.

For us, it has been a pleasure to host the workshop and we express many thanks to the community for the real applause! 🌍

▲ RAMOO 2020 Keynote talk given by Prof. Birgit Rudloff.

▲ RAMOO 2020 Keynote talk given by Prof. Kathrin Klamroth.

Behavioral Operational Research

Hans W. Ittmann < hittmann01@gmail.com >

Behavioral Operational Research – A Capabilities Approach by Leroy White, Martin Kunc, Katharina Burger and Jonathan Malpass Eds., 2020, Palgrave Macmillan UK, Hampshire UK, pp. 392, ISBN 978-3-030-25404-9 (Print) and ISBN 978-3-030-25405-6 (eBook), 139.99 EURO (Hardcover), 109.99 EURO (eBook).

Little or no attention is given to the role humans and decision-makers play in the development of quantitative models. Typically, the techniques and modelling approaches operations researches are taught assume rational and perfect decision-makers. The reality is that OR techniques mostly fail to consider human behavior's with the result that proposed problem solutions do not play out as expected when implemented. As a result, in line with growing research in other fields, there is a renewed interest in and emphasis on Behavioral Operations Research (BOR) with the focus on the decision-maker as a human being as well as the associated aspects such as cognitive biases that affect decision-making.

This book, **Behavioral Operational Research: A Capabilities Approach**, is a timely addition to the acclaimed book **Behavioral Operational Research: Theory, Methodology and Practice** compiled by basically the same editors. (A review of the first book appeared in the ORSSA newsletter - Ittmann, 2017). Many of the ideas and concepts that were raised and included in the first book are further developed in this new book. In addition, given the current worldwide emphasis on automated decision-making new opportunities such as "human-in-the-loop" are discussed

In this book the editors endeavour to further develop the ideas and concepts underpinning BOR. An important goal is to illustrate that BOR appears to be an increasingly inter-disciplinary field and, in this way, show a return to the multi-disciplinary origins of OR. BOR is defined as "the study of the effects of psychology, cultural, cognitive and emotional factors on our thinking and action with the use of (advanced) analytical methods and/or models, to solve complex problems, support perplexing decisions and improve our ever-changing organizations".

The central premise of this book, as stated by the editors is: "to focus on the ways in which OR practitioners as model-builders, as facilitators of modelling processes, and as users of models deal with incomplete and imprecise information, subjective boundaries, uncertainty and iterative learning processes in support of the organizational problem-solving resources and decision making practices". To enable this the challenge is how to orchestrate existing competences, skills and know-how, and capabilities, generating valuable outcomes, in new ways by incorporating these into OR approaches and practices.

The book is divided into four Parts addressing capabilities and competences specifically. Parts 1 and 2 contain material that focus on competences within and beyond models while Parts 3 and 4 cover capabilities within and beyond models, respectively.

The four chapters in Part 1 explore *Competences With(in) Models*. The similarities and differences in competences and capabilities between Behavioral Operations Management (BOM) and BOR are considered in Chapter 1. Various insights as to how BOM competences can benefit the BOR practitioner are provided. For example, in the case of BOM normative models are mostly used with an optimal solution defined, whereas BOR typically uses normative modelling methodology for problems that may not have an optimal solution. The following three chapters consider different technical skills associated with managing the impact of heuristics and biases on normative models. In Chapter 2 the focus is on the well-known newsvendor problem and behavioral implications of "demand perception" in managing the inventory, something that has received a lot of attention in the literature. An experimental approach to understanding biases related to this problem is described. The attitudes to risk and biases of financial stakeholders in portfolio selection is the topic of Chapter 3 while insights into how bidder behavior, during auctions, can be incorporated in models are outlined in Chapter 4.

Competences Beyond Models is dealt with in five chapters of Part II. It provides insight into how skilled expertise in techniques permits greater quality in scientific decision support, as well as, how to mitigate, overcome or incorporate knowledge of biases, ambiguity and uncertainty. An explicitly behavioral view of the subject of uncertainty modelling in Multi-Criteria Decision Analysis (MCDA) is described in Chapter 5. This is illustrated using probabilities and scenarios since both these involve important behavioral issues. Enabling divergent thinking is a challenge for any modeling approach. In Chapter 6 this is addressed by considering the approach, most suitable, for representing different values, goals and knowledge when engaging and involving stakeholders in a participatory modeling process.

A literature review of spatial MCDA, i.e. integrating geographical information systems (GIS) with MCDA, is provided in Chapter 7. The objective is to initiate exploration, and a preliminary discussion, of behavioral aspects, where human judgment is involved in both the design of spatial MCDA models and in the interpretation of results. The next chapter is also a literature review which, in this case, endeavors to give a comprehensive overview on how BOR improves project managers' capabilities to make decisions in the project management domain. It is for example of value to know what the key behavioral issues are for project decision-making. The final chapter in this part, Chapter 9, provides a practitioner view on how to manage bias in transformation projects. The aim is to examine the unconscious effect of optimism in transformation programs and a practical calibration toolkit is proposed.

Part III that covers the concept of *Capabilities With(in) Models* addresses the skills required to understand group behavior in the modelling process. The role of the OR practitioner encompasses more than just creating a model and these are addressed in Chapter 10. Various behavioral factors such as facilitating the project, determining if and how behavior might be relevant, collecting data about behavior and incorporating that behavior into the model is critical to the role. Finally, it includes assistance needs to be provided to support any changes to behavior that is part of the model outcome. In Chapter 11 the usefulness of developing problem structuring capabilities, as part of BOR, is discussed.

The role of stakeholders is very important in the modeling process. Both the next two chapters address aspects relating to this issue. In Chapter 12 the aim is to address the issue of involving stakeholders in OR more explicit, as well as the reason for involving stakeholders, and implications for how to involve which of the stakeholders. Chapter 13 considers insights and lessons learnt from non-OR related projects while the last chapter in this Part explores how increasing the transparency, or understanding, of OR models can improve the usefulness of the models.

Capabilities Beyond Models, Part IV, covers a variety of aspects concerning the skills that BOR practitioners need in order to manage the process of an OR project. The first chapter in this part focusses on transformation projects. These are projects that originate from the need for an organizational change. The case study outlined in this chapter considers how the needs of different stakeholders must be balanced to achieve the transformation objective. A further case study is presented that highlights all the aspects required for achieving collective group behavior. Personal data is considered one of the most valuable assets for businesses. However, people behavior indifferently towards this asset. In Chapter 17 customer behavior and the impact on the organizations collecting personal data are explored. The penultimate chapter addresses "philosophical issues in the collection and interpretation of OR data" with a plea that BOR practitioners embrace the philosophical principles of behavioral science. As one would expect the final chapter focusses on what the future holds for BOR including future directions.

Some 32 researchers and practitioners, interested in OR and behavior, have contributed to this book. Their views, covering a range of behavioral OR issues, vary as some are convergent, some divergent while others are controversial. It brings a richness to what is presented and will stimulate further discussion, thinking and research on these topics. An interesting observation is the interplay with other levels of inquiry that is apparent in all chapters, contributing to inform much of the new discipline of BOR.

While writing this review the Covid-19 virus and pandemic is sweeping across the world. Modelers are developing a variety of models to assist governments in their decision making. Human behavior in the form of social distancing, wearing of masks and washing of hands are some of the important measures to counter the spreading and transmission of the virus. It is critical to incorporate these behavioral issues into many of these models. It illustrates the importance of what is covered in this book. *Behavioral Operational Research – A Capabilities Approach* is a useful, and timely, resource to the growing literature on BOR and it adds clarity, as well as the necessary substance, to attaining a better understanding of BOR.

Reference
Ittmann, HW, 2017, Book Review: *Behavioral Operational Research - Theory, Methodology and Practice,* IFORS Newsletter, December 2016. 🌐

Obituary

In Memoriam - Professor Duan LI (1952-2020)

Janny M.Y. Leung <jannyleung@um.edu.mo>

Professor Duan Li, Chair Professor of Operations Research at the City University of Hong Kong and Emeritus Professor of the Department of Systems Engineering and Engineering Management at The Chinese University of Hong Kong, passed away on November 16, 2020 after a valiant battle against cancer.

Professor Li served as Associate Provost (2017 to 2019) at City University of Hong Kong (CityU), where he led the task force to establish CityU's School of Data Science in 2018 and served as Acting Dean until January 2020. Before he joined CityU in 2017, he was on the faculty of the Chinese University of Hong Kong (CUHK) from 1994 to 2017, where he was the Patrick Huen Wing Ming Professor of Systems Engineering and Engineering Management, and served as Department Chair (2003 to 2012) and the Director of the Center for Financial Engineering (2014 to 2017). He was also the founding Director of the Master of Science Programme in Financial Engineering at CUHK (Shenzhen).

Professor Duan Li was born on July 4th, 1952 in Shanghai, China. His High School education was disrupted due to the Cultural Revolution. In 1968, he was assigned to the Shanghai Dianguang Instrument Factory, but continued his self-study profusely between and after his factory shifts. He was admitted to Fudan University in 1973 and graduated with a B.S. in Physics in 1977. Professor Li received his M.E. degree in automatic control from Shanghai Jiaotong University in 1982, and his Ph.D. degree in systems engineering from Case Western Reserve University in 1987. From 1987 to 1994, he was a faculty member in the Department of Systems Engineering at the University of Virginia, where he also served as the Associate Director of the Center for Risk Management of Engineering Systems.

Professor Li was a renowned expert in optimization, financial engineering, operations research, systems engineering, and optimal control. He pioneered the multi-period dynamic mean-variance portfolio selection studies, and made seminal contributions to non-convex optimization and dual control. Professor Li published over 200 journal papers, and was the co-author of *Nonlinear Integer Programming* (Springer, 2006).

Through his long career, Professor Li influenced generations of students and scholars. A humble, kind and generous person, he was widely admired and well-liked by his friends, colleagues and students. In 2017, his former students and associates edited a Springer Handbook on *Optimization and Control for Systems* in the Big-Data Era and a special issue in Risk Analysis to honor his academic achievements.

More tributes to Professor Li can be found at the following websites:

http://www.se.cuhk.edu.hk/obituary-for-prof-li-duan/

https://www.sdsc.cityu.edu.hk/news-events/news 🌐