

This is the Friday Schedule Program of ADA 2024. Note that the program may still change slightly.

The presenter(s) are underlined, and the other authors are in plain text. View abstracts below or by clicking the presenter's name.

The discussants of the PhD Incubator presentations are indicated with parentheses. Blitz PhD incubator presentation are indicated with (Blitz).

The session IDs are formatted followingly: <Day>.<Session Number>.<Lecture Hall>.

For example, Wed.4.D refers to the 4th session of Wednesday and is arranged in lecture hall D.

The Poster Session Thu.3.X is arranged outside lecture hall B.

Time \ Day	Friday 12 July 2024		
	Lecture Hall B	Lecture Hall D	Lecture Hall E
08:30 - 09:00	Registration & Coffee		
	Parallel Sessions		
	Fri.1.B (previously Thu.5.B) Judgment and Dec. Making II Session Chair: Tong Deng	Fri.1.D (previously Thu.5.D) Forecasting III Session Chair: Majid Karimi	Fri.1.E (previously Thu.5.E) Strategic Decision Making Session Chair: Mathieu Dahan
09:00 - 10:00	<u>Trent Tucker</u> <u>Tong Deng</u> Chen Wang	<u>Zhi Chen</u> Long Zhao <u>Long Zhao</u> Xiaochuan Pang, Zhi Chen, Guwei Zhang <u>Majid Karimi</u> Arthur Carvalho	<u>Tommi Ekholm</u> Theresa Schaber <u>Yanwei Jia</u> Jussi Keppo, Ville Satopää <u>Mathieu Dahan</u> Joseph McCarthy, Chelsea White
10:00 - 10:15	Break		
	Parallel Sessions		
	Fri.2.B Judgment and Dec. Making III Session Chair: Zeev Shtudiner	Fri.2.D Applications in Military and Security Session Chair: Laura Albert	Fri.2.E AI and Inference Session Chair: Jussi Leppinen
10:15 - 11:45	<u>Robin Dillon-Merrill</u> Richard John, Nicholas Scurich <u>Sreyaa Guha</u> Matthias Seifert, Canan Ulu <u>Yanwei Jia</u> Jussi Keppo, Ville Satopää <u>Zeev Shtudiner</u> Arthur Fishman	<u>Oleh Stupak</u> Marat Salikhov, Ruslan Momot, George Charlson <u>Gregory Parnell</u> Eric Specking, Randy Buchanan <u>Kash Barker</u> Nazanin Tajik, Andres Gonzalez, Sridhar Radhakrishnan <u>Laura Albert</u> Carmen Haseltine	<u>Vicki Bier</u> Alexander Gutfraind <u>Chih-Chou Chiu</u> Ya-Lun Lee, Hung-Jui Wang, Ruby Lin, Ling-Jing Kao <u>Anna Sroginis</u> Nikolaos Kourentzes, Tove Helldin <u>Jussi Leppinen</u> Ahti Salo, Michele Compare
11:45 - 12:30	Lunch		
	Parallel Sessions		
	Fri.3.B Behavioural Economics Session Chair: Jeeva Somasundaram	Fri.3.D Applications in Healthcare Session Chair: Md Rifayat Islam	Fri.3.E Applications in Energy Session Chair: Ulla Ahonen- Jonnarth
12:30 - 14:00	<u>Matthew Nagler</u> Ben Ho <u>Moha Ghaderi</u> Kamel Jedidi, Milosz Kadzinski <u>Nicolò Bertani</u> Joren Gijsbrechts, Miguel Godinho de Matos, Laura Wagner <u>Jeeva Somasundaram</u> Pham Quang DUC, Laura Zimmermann	<u>Peng Sun</u> Chenxi Xu, David Ridley <u>Michael Kim</u> Xinyuan Zhang, Jussi Keppo <u>Nikolaos Argyris</u> Lars Peter Østerdal, M. Azhar Hussain <u>Md Rifayat Islam, K.Nadia Papamichail</u> Marzena Nieroda, Kenneth Muir, Artitaya Lophatananon	<u>David Brown</u> James Smith <u>Antti Silvast</u> Per Dannemand Andersen <u>Markku Kallio</u> Iivo Vehviläinen, Hanna Virta <u>Ulla Ahonen-Jonnarth</u> Åsa Elmqvist, Magnus Hjelmbom
14:00 - 14:15	Fri.4.B Closing Session (Lecture Hall B)		

Fri.1.B: (previously Thu.5.B) Judgment and Dec. Making II

Session Chair: Tong Deng

Utilizing ludic pedagogy to introduce decision analysis concepts

Submission ID-045

Trent Tucker

Thompson Rivers University

The Decision Analysis course I teach has a reputation among the MBA students who take it of being a conceptually difficult course. In order to address this issue and ease the students into learning new quant concepts, I've adopted a "ludic" approach to my teaching of the course material. The Ludic Pedagogy model — as described by Lauricella and Edmunds (2022) — "builds upon four elements: fun, play, playfulness, and positivity." They conclude that "in this model, students can boast increased retention of course information, a reduced cognitive load, and deeper learning (p.11)" — outcomes that any educator would be pleased with!

Pendegraft's famous 1997 exercise — "LEGO of my Simplex" — is an example of this. Through naïve play with LEGO bricks, students are introduced to linear programming concepts and the formal mathematics comes later. This past year I challenged myself to incorporate a ludic approach into nearly all of my lectures. The purpose of this talk is to share novel ludic approaches to data analysis, linear programming, and Monte Carlo simulation from my classroom. If you're looking for a way to make management science concepts more engaging and less threatening for students — this session is for you!

Understanding the Mental Simulation in Risk Decisions with Operational Data Based on Causal Discovery

Submission ID-139

Tong Deng, Chen Wang

Industrial Engineering Department, Tsinghua University

The key point of risk decision is the uncertainties of the potential outcomes, which will evolve over time in dynamic processes. Prior studies have indicated that individuals engage in mental simulations of event development during the risk decision process. Due to the cognitive effort required for mental simulation, it is only triggered under certain conditions. Most previous research has been conducted through experiments or surveys. Our goal is to use data-driven approach and vast contextual data to explore the existence of mental simulation in risk decision and its triggering conditions. We adopt a nonlinear causal discovery method to find the factors influencing risk decision and mental simulation at root. Inspired by risk perception studies, we categorize these contextual factors according to its controllability. In case of air traffic management decision-making, we conduct several numerical studies assuming that decision-makers' mental simulation is consistent with the admitted air traffic evolution process. We have designed an air traffic simulator following the air traffic rule. This simulator enables us to explore the considered time length of mental simulation and uncover the mental simulation abilities of these air traffic controllers. Our research can provide valuable insights for risk decision in complex network systems.

Fri.1.D: (previously Thu.5.D) Forecasting III

Session Chair: Majid Karimi

Constructing Quantiles via Forecast Errors: A Bias-Variance Framework

Submission ID-101

Zhi Chen¹, Long Zhao²

¹ *National University of Singapore*

² *National University of Singapore*

Probabilistic forecasts such as quantiles are essential inputs to decision-making under uncertainty. The most common type of forecasts often comes in the form of point forecasts, and it is, therefore, necessary for the decision maker to construct uncertainty measures around the obtained point forecasts. One simple approach suggests leveraging historical forecast errors to create quantiles around the given point forecast (the E2Q method). While these E2Q estimators may take different forms, we develop a theoretical framework to understand how the bias and variance of a quantile estimator affect the overall performance, as measured by the pinball loss. We find that unbiasedness is not optimal for a given variance, and the bias towards the center of the distribution is more costly. Besides, higher estimator variance leads to worse performance. These bias-variance insights allow for comparisons among different estimators. For example, with limited samples, we find that sample quantile (SQ) is inferior to normal approximation (N) for tail quantiles in both bias and variance. In the same setting, an estimator based on a more general parametric fit, such as the generalized normal (GN), could perform worse than N. Empirically, we validate our theory using the M5 competition submissions.

Comparison Between Linear Opinion Pool and Stacking

Submission ID-077

Forecast aggregation via linear opinion pool tries to obtain the optimal weights that minimize the variance of the aggregated forecast. We prove that this is equivalent to a linear regression where the realization is regressed on the predictions from experts subject to the constraint that the summation of the coefficients is one. Meanwhile, in the machine learning community, stacking, which is a popular ensemble learning method, also adopts a similar linear regression but without such a constraint. In this paper, we seek to understand the role of the constraint theoretically and identify conditions when one should use a linear opinion pool.

Leveraging i.i.d. training samples of realizations and predictions, our analysis reveals nuanced insights. Under identical distribution between training and test sets, a surprising absence of bias-variance tradeoff emerges, with the constraint-free linear regression potentially outperforming its constrained counterpart regarding both bias and variance. If the test set deviates from the training, adding such a constraint could be worst-case optimal. Moreover, the test performance of the regression without constraint could be arbitrarily worse. This demonstrates that the constraint works as an insurance for potential shifts in distribution.

Wisdom of Sequential Crowds: Quantile Forecast Aggregation With Learning and Updating

Submission ID-059

[Majid Karimi](#)¹, Arthur Carvalho²

¹ Department of Operations and Supply Chain Management, College of Business Administration, California State University San Marcos

² Department of Information Systems and Analytics, Farmer School of Business, Miami University

From forecasting the yield of corn in agribusiness problems to winning the Nenana Ice Classic by correctly estimating the exact date and time the ice breaks on the Tanana River, point forecasts are often made sequentially, allowing for *learning* and *updating*. This study investigates quantile forecast aggregation in the presence of learning from previous forecasts and updating whenever new information becomes available. In the absence of learning or updating, simple averaging of quantiles is often a common and robust solution, canceling out the individual biases. In sequential settings, however, point forecasters (humans, machines, or both) can engage in *social learning* — learning from others' actions — and update their forecasts in light of new information. Furthermore, optimal forecast combinations in sequential settings, in particular, can be hard to come by due to the significance, relevance, or efficacy of the forecasters' historical performance. Using synthetic and real data, we explore different aggregation methods, including our proposed Bayesian approach, and compare different techniques. We find that incorporating learning and updating results in sharper and more calibrated forecasts in sequential settings, particularly for the proposed Bayesian approach and even when considering simple learning heuristics such as quantile matching estimation.

Fri.1.E: (previously Thu.5.E) Strategic Decision Making

Session Chair: Mathieu Dahan

Under what conditions? A scenario technique for exploring the prerequisites of future events

Submission ID-114

[Tommi Ekholm](#), Theresa Schaber

Finnish Meteorological Institute

In an increasingly complex world, strategic decisions require in-depth understanding of the conditions that define future events' realization. We present a novel, scenario-based approach to explore under what conditions a chosen future event would occur. Our approach can be seen as fusion of exploratory scenarios with the backward-looking perspective of backcasting, while resembling cross-impact methods in how future events' realization is seen to arise from several interacting, uncertain assumptions. It focuses on mapping the assumptions and causal mechanisms that lead to the realization of the investigated event. This results in identifying the subset of assumption combinations that lead to the event being realized or not realized, and scenario sets where the event is either realized or not. This analysis provides insights beyond 'Is the event likely to occur?', revealing the various circumstances under which it can occur. We also provide ways for considering probabilities and deliberate decisions within the technique. To illustrate the technique, we present a case study that explores the conditions, uncertainties and necessary decisions for limiting global temperature increase to a specified level.

The Wisdom of Strategically Diverse Crowds

Submission ID-011

[Yanwei Jia](#)¹, Jussi Keppo², Ville Satopää³

¹ Chinese University of Hong Kong

² National University of Singapore

³ INSEAD

We investigate the impact of strategic diversity on predictions made by a group of interacting agents. The agents receive public and private information and have varying external motivations, from conformity to contrarianism. We find that the agents' strategic tendencies become more pronounced, i.e., conformists (contrarians) aligning closer to (deviating further from) the shared public information as the average level of conformity in the population increases. Both a typical agent's and the group's consensus perform worse as the level of strategic diversity in the group rises. Consequently, strategic diversity in crowd forecasting does not yield the same benefits as the information diversity. Nevertheless, in the presence of strategic diversity, a mild contrarian crowd induces the best performance for both typical agents and the group consensus. We illustrate the distinct implication of strategic diversity on aggregating agents' predictions by studying a new weighted-by-deviation scheme that assigns greater weight to contrarian viewpoints to preserve more independent private information. We show that,

Joseph McCarthy , [Mathieu Dahan](#) , Chelsea White*Georgia Institute of Technology*

We study a two-player discounted zero-sum stochastic game model for operational planning in military campaigns. At each stage, the players manage multiple commanders who order military actions on objectives that have an open line of control. When a battle occurs to determine control of an objective, its stochastic outcome depends on the actions and the enabling support provided by the control of other objectives. Each player aims to maximize the cumulative number of objectives they control, weighted by their criticality. To solve this large-scale stochastic game, we derive properties of its Markov perfect equilibria, significantly reduce state and action spaces, and accelerate Shapley's value iteration algorithm by eliminating dominated actions. We demonstrate the computational value of our equilibrium results on a case study that reflects representative operational-level military campaigns with geopolitical implications. Our analysis reveals a complex interplay between the game's parameters and dynamics in equilibrium, resulting in new military insights for strategic leadership.

Fri.2.B: Judgment and Dec. Making III

Session Chair: Zeev Shtudiner

Cognitive and Motivational Determinants of Normalcy Bias

Submission ID-017

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¹ *Georgetown University*

² *University of Southern California*

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Normalcy bias occurs when individuals underestimate or ignore the possibility that a disaster or crisis is occurring, even when warnings or evidence suggests otherwise. People may downplay the significance of a threat and assume that things will continue to function as they always have (normally). Fundamentally people fail to recognize the current risks and warnings. Many cognitive factors may contribute to this including an optimism bias, normalization of deviance, a near-miss bias, habituation, or the cry wolf effect. Motivational factors would include motivated reasoning to avoid the inconvenience or discomfort associated with making significant changes or social proof if others around them behave as if everything is normal. This presentation will explore the normalcy bias and its many causes in the context of the challenges faced by decision makers in the US Coast Guard.

Beliefs About Quality Under Impending Regime Shifts.

Submission ID-092

[Sreyaa Guha](#)¹, Matthias Seifert², Canan Ulu³

¹ *Nova School of Business and Economics*

² *IE Business School*

³ *McDonough School of Business*

Previous research has shown that individuals exhibit optimism or pessimism when predicting price movements of financial assets, depending on whether the asset is owned by the decision-maker. In fact, asset ownership is likely to influence the formation of probabilistic beliefs when observing distorted signals regarding the underlying quality of the asset. We study the role of ownership in belief updating under impending regime shifts which are characterized by the stability of the decision-making environment and signal precision. Using a sequential task design, we elicit beliefs in response to observing price movements, when the underlying quality of the (owned/non-owned) asset can change with the shift in the regime. We show that ownership generally reinforces beliefs regarding asset quality when signals are generated in stable environments with noisy signals. However, in unstable environments with precise signals, perceptions between owned and non-owned assets are indistinguishable. An analysis of the belief errors reveals that individuals overextrapolate in their predictions for owned assets in stable environments with noisy signals, and overextrapolate for non-owned assets in unstable environments with precise signals. We show that this behavioral pattern can be explained as a combination of the system neglect hypothesis and ownership-driven attention.

From Point Predictions to Probabilistic Aggregate: A Novel Variational Bayes Approach to Harnessing the Wisdom of the Crowd

Submission ID-066

[Yanwei Jia](#)¹, Jussi Keppo², Ville Satopaa³

¹ *The Chinese University of Hong Kong*

² *National University of Singapore*

³ *INSEAD*

Decision makers often rely on the combination of many individual judgments, known as crowds' wisdom. In the single-question setting, where there is no past data or other prior information, recent literature finds that using peer predictions, i.e., predictions about others' judgments, can greatly enhance the accuracy of aggregated judgment. However, the methods proposed so far either request individuals provide

Exploring Ethnicity and Gender Discrimination in Judging Resume Fraud and Counterproductive Workplace Behavior

Submission ID-147

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¹ Ariel University, Department of Economics and Business Administration

² Bar-Ilan University, Department of Economics

The impact of ethnicity and gender on employment and income disparities in the labor market has been extensively studied, revealing patterns of discrimination. We focus on these specific attributes as potential influencers of perceptions regarding resume fraud and counterproductive behavior in the workplace. In our research, 1,002 participants reviewed CVs of prospective job candidates and were subsequently informed about various instances of resume fraud and counterproductive behavior exhibited by the candidates. The names of the candidates were selected to reflect distinct ethnic origins and genders. Our findings indicate the presence of ethnic discrimination. Specifically, individuals within each ethnic group tended to evaluate candidates from their own group with less severity compared to candidates from the opposite group. We did not uncover any indications of gender bias; both male and female candidates were assessed in a similar manner. Our findings uncover ethnicity-based discrimination in the evaluation of negative behavior within the workplace.

Fri.2.D: Applications in Military and Security

Session Chair: Laura Albert

Strategic Management of Data Access

Submission ID-116

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⁴ Corpus Christi College, University of Cambridge

⁵ Keystone Strategy

A standard data access guideline is to limit employee access to only the essential data for their roles, raising the question of how to define these roles and their corresponding data needs. We aim to address this question by considering a game-theoretic model of joint cybersecurity and operational decision-making. The firm chooses the level of data access for its employees and the level of overall protection they enjoy. Providing more data access to employees makes the firm more economically efficient but also more vulnerable to attacks by an adversary who steals the data that employees possess, inflicting damage that increases with the amount of data stolen. Adversaries may vary in their attack strength and sophistication rate (the ability to pinpoint the most lucrative targets). We find that in our model, the firm may counter-intuitively decrease its overall protection level when adversarial attacks become stronger and increase its overall access level when the adversaries become more sophisticated.

Decision Analytics: Using Decision Analysis in Analytics Projects

Submission ID-052

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¹ University of Arkansas

² U.S. Army Engineer Research and Development Center

Abstract

Analytics/Data Analytics/Data Science is a growing field that uses recent and real-time data, statistics, and AI/machine learning to find meaningful patterns and information to make data driven decisions to meet organizational objectives. Analytics involves sifting through large data sets to discover, interpret, and share new insights and knowledge. Analytics uses descriptive, predictive, and prescriptive methods. Our research uses data analytics to provide data driven insights to Army installation management decisions in three areas: severe weather alerts, avoiding heat related injuries in training, and evaluating the financial return on investment of installation resilience options to reduce the impact of severe weather influenced by climate change. Our research team involves the U.S. Army's Engineer Research and Development Center project managers and researchers, Army installation managers, contractors, and university researchers. We describe the decision analysis techniques we have used to structure decision analytics problems, identify the data sources, identify system design objectives, capture the system requirements, develop prescriptive models, evaluate the system solutions, verify the system solutions, and validate the solutions.

Protection Decisions for Node-to-Route Relationships in Multi-layer Networks

Submission ID-133

Interdependent relationships can exist across multiple layers of a multi-layer network. For example, the failure of a node in one layer can disrupt one or more nodes and links in an interdependent layer. In particular, we formulate an optimization model to explore protection-interdiction problems across layers when the interdiction of a node in one layer impacts a route in another layer. We illustrate this problem with an example of interdependent information and physical network layers, where the diffusion of disinformation infects and disrupts a node in the information layer, and this results in the disruption of a route taken in the physical layer. We explore protection decisions that limit disinformation spread in the information layer and limit the disruption of routes in the physical layer.

Voting by mail: on managing the security risks of election systems

Submission ID-154

Carmen Haseltine , [Laura Albert](#)

University of Wisconsin-Madison

The scrutiny surrounding vote-by-mail (VBM) has increased in recent years in the United States, raising concerns regarding the integrity and security of absentee voting. We address these issues by introducing a dynamic modeling framework for performing a risk assessment of VBM processes. We introduce a discrete-time Markov chain (DTMC) to model the VBM process and assess election performance and risk with a novel layered network approach that considers the interplay between VBM processes, threats (both malicious and non-malicious), and security mitigations. Unlike previous research efforts that are static, the proposed framework captures dynamic risks and performance over time. The DTMC model is evaluated by a case study based on real-world data from Milwaukee County, Wisconsin. The analysis provides critical insights and a quantitative foundation for developing robust security strategies to ensure secure and reliable elections.

Fri.2.E: AI and Inference

Session Chair: Jussi Leppinen

Risk, Uncertainty and AI: Non-probabilistic Methods for Anticipating and Preventing AI Risks

Submission ID-098

Alexander Gutfraind ², [Vicki Bier](#) ¹

¹ *University of Wisconsin-Madison*

² *Loyola University Chicago*

The rapid advancement of artificial intelligence (AI) created a situation where risks may be difficult to foresee. Some researchers have begun applying probabilistic methods to AI risks, but this seems unlikely to be useful for AI safety in practical applications.

We argue that many AI problems could be addressed using a toolkit of non-probabilistic risk-management methods (drawn from fields such as safety engineering, product management, and medicine). Methods for anticipating AI risks range from fault trees and event trees, to hazard and operability studies or failure mode and effects analysis, to scenario analysis and robustness analysis. Simpler but potentially effective solutions include checklists, what-if thinking, and pre-deployment testing, some of which are well-suited for use by non-expert users.

With regard to mitigating AI risks, we distinguish between strategies for safe design and strategies that enable rapid reaction to undesired behaviors. The former include fail-safe design, prototype-driven development, and staggered rollout. Reactive solutions include contingency planning, monitoring and anomaly detection, and dedicated response units. Such strategies can be used in parallel, creating "defense in depth" that can reduce the risk of undesired behaviors. Such non-probabilistic methods should make it possible to develop safer AI applications while allowing the field to advance.

Predicting Consumer Shopping Locations using integrated Markov Chains and Long Short-Term Memory Networks

Submission ID-035

Ya-Lun Lee ¹, Hung-Jui Wang ², Ruby Lin ², Ling-Jing Kao ¹, [Chih-Chou Chiu](#) ¹

¹ *National Taipei University of Technology*

² *Digital Transformation Research Institute, Institute for Information Industry*

In the retail industry, understanding consumer shopping behavior is pivotal for retailers aiming to predict shopping locations accurately, thereby improving personalized services, optimizing marketing strategies, and fostering customer loyalty. While traditional statistical models like regression and time series analysis were prevalent, their limitations in capturing complex dependencies and nonlinear relationships prompted a shift to deep learning technology. Deep learning algorithms, renowned for their adaptability to nonlinear patterns, have gained traction across various fields to enhance prediction accuracy. This study addresses research gaps by focusing on electronic invoice data and integrating Markov chain methods with Long Short-Term Memory (LSTM), a deep learning algorithm tailored for time series data. The Markov chain model, relying on state transition probabilities, describes time series probability models and predicts a consumer's next shopping location likelihood. The integrated approach, evaluated using five machine learning methods, including CART, logistic regression, MARS, random forest, and gradient boosting, reveals that the Markov chain and LSTM model surpasses other methods in predicting consumer shopping locations. Crucial factors such as product quantity, prices, consumption time, and location highlight the need for businesses to adjust marketing strategies and product layout based on consumer geography and time factors for enhanced revenue and profitability.

Is there a hype bias? The perception of AI in demand planning

Many of the forecasting methods available to companies have a proven track record of high accuracy. Nonetheless, they are frequently adjusted by human experts to incorporate additional information. This information is often unstructured and difficult to systematically add to statistical models. Although there are cases where they add value to predictions (for example, incorporating special events), on average adjustments, tend to harm accuracy. At the same time, we observe the rapid rise of artificial intelligence (AI) in predictive tasks, often touted as working out of the box, and being able to handle unstructured rich contextual information. AI methods are typically black box and mathematically intractable. Explainable AI (XAI) methodologies attempt to increase the transparency of the models, however, there is limited evidence of the success of XAI tools in business environments. We hypothesise that users can exhibit a “hype bias” where they will be less averse to AI implementations, compared to conventional modelling (primarily statistical) approaches, even though they are complex and opaque, due to hype. We investigate this hypothesis with a laboratory experiment by providing both statistical and AI forecasts with or without model details, exploring cognitive biases towards more complex methods simply due to their hyped performance.

A Stage-Gate Decision Process for Guiding the Development of AI Solutions for Preventive Maintenance

Submission ID-115

Jussi Leppinen¹, Ahti Salo¹, Michele Compare²

¹ Aalto University

² Aramix s.r.l.

The development of Artificial Intelligence (AI) solutions for preventive maintenance is a risky and resource-demanding process, as there can be several candidate solutions whose performance in transforming data into useful prognostic information is uncertain. These uncertainties can be managed by structuring the development process into multiple stages in which these uncertainties are iteratively reduced before choosing and implementing the final solution.

We apply Robust Portfolio Modelling to screen increasingly specific candidate solutions through a structured stage-gate process that consists of four development stages and three decision gates. The development stages produce evidence on how the candidate solutions contribute to six development objectives represented by both financial and non-financial criteria. At the decision gates, decisions about the continuation/termination of candidate solutions are taken by identifying portfolios of candidate solutions that are non-dominated in view of time and budget constraints. Uncertainties are captured with incompletely specified criteria weights and scores for the candidate solutions.

We illustrate the process by considering the development of an AI solution for a train's toilet door system. The process brings consistency to the development process and helps mitigate the risk of not reaching the development objectives due to premature fixation on a single candidate solution.

Fri.3.B: Behavioural Economics

Session Chair: Jeeva Somasundaram

Altruism and the Endowment Effect

Submission ID-015

Matthew Nagler¹, Ben Ho²

¹ The City College of New York

² Vassar College

Using random assignment in an online laboratory setting to different orderings of a sequence of charitable donation solicitations and a tangible item auction, we conduct a preregistered study of whether altruistic behavior plays a causal role in eliminating the endowment effect. We use a social norming treatment to exogenously stimulate giving, observing the effects on the WTA-WTP disparity in the subsequent auction. We also toggle asking participants to describe vividly the experience of giving before participating in the auction and employ several construal level manipulation checks. A negative association, consistent with prior work, would provide a possible explanation for the survival of altruism in market contexts, while a causal link could also offer valuable insights for devising new policy solutions to address public goods problems.

Random Preference Model

Submission ID-023

Moha Ghaderi¹, Kamel Jedidi², Milosz Kadzinski³

¹ Pompeu Fabra University

² Columbia University

³ Poznan University of Technology

Modeling preferences from observed choices is a pivotal theme in mainstream economics and decision theory with expansive applications in policymaking, marketing, and transportation. The standard approach in modeling preferences is to attach utility scores to choice options consistent with the order defined by the preferences. Nevertheless, the utility scores are merely artifacts or mediums to represent preferences, whereas preferences are the underlying construct generating choices. We aim to develop a framework faithful exactly to this view.

Reminder policy effectiveness with heterogeneous agents and scarce resources: the case of mobile data.

Submission ID-076

[Nicolò Bertani](#)¹, [Joren Gijsbrechts](#)², [Miguel Godinho de Matos](#)¹, [Laura Wagner](#)³

¹ *Católica Lisbon*

² *ESADE*

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It is empirically well-established that individual behavior is reactive to reminders. However, interventions in reminder policy (whether and when to remind) have often been unsuccessful. We speculate this is because interventions fail to account for individual heterogeneity, ending up being detrimental to many, and for the interplay between the timing of the reminder and behavior. To confirm this, we study how mobile data consumption changes in reaction to a near-end reminder. We show that aggregate analysis not only does not reflect individual heterogeneity, but it is straight-up misleading because of Simpson's paradox. We build formal dynamic models that use limited attention and overconfidence to explain observed individual behavior, while reproducing the aggregate pattern. Every model implies a different optimal reminder policy. To assess the feasibility of a uniform policy, we explore the prevalence of each model in the population: we classify each individual by drawing testable implications and embedding them in a Bayesian mixture model. To understand the interplay of the timing of the reminder and behavior, we run a field experiment at a telecommunications company. We analyze whether the prevalence of the models changes with the timing of the reminder. For the company, reminder policy does not affect revenues.

Make it Stick: The Role of Alternative Activities in Reducing Habitual Smartphone Usage

Submission ID-089

[Pham Quang DUC](#)¹, [Jeeva Somasundaram](#)², [Laura Zimmermann](#)³

¹ *IE Business School, Madrid, Spain*

² *IE Business School, Madrid, Spain*

³ *IE Business School, Madrid, Spain*

Monetary interventions have been utilized across a variety of domains to change consumers' habitual behavior. However, frequently the inculcated behavior change does not stick and the old habit recurs. We address this relapse problem across two longitudinal field studies (involving 153 subjects and 5,686 observations). Our research delves into the effectiveness of encouraging individuals to reduce undesired habitual behaviors, such as excessive social media or smartphone usage, using positive alternatives like learning a language or engaging in regular walks. Specifically, we study whether consumers who receive incentives for adopting both the beneficial activity (learning a new language or walking) and curbing the undesired habit demonstrate greater success in the post-treatment compared to those solely incentivized to reduce the undesired habit. We find that subjects who achieved both targets (instead of only one target) tended to have lower social media and smartphone usage during the post-treatment relative to their baseline. Our evidence shows that consumers who successfully engage in an alternative activity are less addicted to their smartphone and therefore tend to use it less during post-treatment.

Fri.3.D: Applications in Healthcare

Session Chair: Md Rifayat Islam

Push or Pull? Motivating investment for rare disease drugs

Submission ID-110

[Chenxi Xu](#), [David Ridley](#), [Peng Sun](#)

Duke University

Clinical trials for drug development is time consuming and costly. For rare diseases, the commercial market may not generate sufficient profit to attract pharmaceutical companies to develop drugs. In these cases, funding agencies may step in to help. However, asymmetric information is prevalent in this setting. In this paper, we study how to manage both adverse selection and moral hazard in order to motivate investments into rare disease drugs efficiently. For example, given different preferences between the funding agency and the firm, should the funding agency pay the firm up front, or after the clinical test? Our model reveals perhaps a counter-intuitive result that under certain conditions, it is optimal for the funding agency to provide financial support after the drug fails the clinical trial.

DIVERSIFIED LEARNING: BAYESIAN CONTROL WITH MULTIPLE BIASED INFORMATION SOURCES

Submission ID-010

[Michael Kim](#)¹, [Xinyuan Zhang](#)¹, [Jussi Keppo](#)²

¹ *University of British Columbia*

² *National University of Singapore*

acquisition policy, which always seeks to diversify over the biased sources to reduce the risk of being manipulated by misinformation. In the penalty case, we show that such diversification property still holds, but the optimal policy is implicitly characterized and problem-specific. Thus, we obtain the optimal solution for the estimation and testing problems, which motivate good approximations and heuristics for the general setting

Value-driven Welfare Analysis: a multidimensional dominance approach and application to comparisons of European populations

Submission ID-069

[Nikolaos Argyris](#)¹, [Lars Peter Østerdal](#)², [M. Azhar Hussain](#)^{3, 4}

¹ *Loughborough University*

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Recent decades have seen an increased acceptance globally that the measurement of social welfare must encompass more than material economic standards, and should include dimensions such as health, education, social relationships etc. At the heart of this problem is the question to compare population distributions over a multi-dimensional space. Here we introduce the theoretical framework for such multi-dimensional comparisons and apply this to a specific dataset. The basis of our framework is multivariate first- and second-order stochastic dominance. We introduce theoretical results that enable practical comparisons of multidimensional distributions using these concepts. Additionally, we consider how value judgements can be integrated in the evaluation framework to refine the determinable comparisons. We illustrate our approach with the results of an application to compare welfare across European countries.

Exploring XAI-driven Personalised Health Risk Communication and its Effect on Healthy Behaviour Intention

Submission ID-130

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This work explores the communication of health risks in different settings (human vs AI vs human with AI) and its effect on healthy behaviour intentions. Indeed, consumers are reluctant to follow health advice from algorithms compared to human providers due to a lack of personalisation, transparency and understanding. A subdomain of AI, named as explainable artificial intelligence (XAI), integrates individual data (e.g., genetic information, medical record) to predict personalised future health risks and explain complex medical AI risk assessments for patients. Drawing on the theory of processing fluency, this study aims to test whether consumers are more fluent in processing health risks communicated through AI (vs human vs human with AI), which subsequently drives health behaviour intentions.

We propose that the influence of health risks communication (human vs AI vs human with AI) on healthy behaviour intentions is mediated by processing fluency. Moreover, we hypothesise that a consumer's higher (vs lower) health literacy level strengthens the level of fluency for processing individualised health risk communication. The current study will employ a mixed-method approach and conduct several experimental studies to empirically test these propositions. This work will provide insights for healthcare service providers and AI developers in medical settings.

Fri.3.E: Applications in Energy

Session Chair: Ulla Ahonen-Jonnarth

Unit Commitment without Commitment: A Dynamic Framework for Managing an Integrated Energy System Under Uncertainty

Submission ID-044

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Though variability and uncertainty have always posed challenges for power systems, the increasing use of renewable energy sources has exacerbated these issues. At a vertically integrated utility, the system operator manages many generation units – renewable and otherwise – and storage units to ensure that the total energy production matches contemporaneous demand. Current industry practice at these utilities involves solving “unit commitment” and “economic dispatch” optimization problems to choose production plans: these models, while complex, do not explicitly incorporate uncertainty. In this paper, we develop a dynamic framework to help system operators manage production under uncertainty and illustrate it using data from the Duke Energy Carolinas and Progress systems. Our numerical experiments demonstrate that this dynamic approach is computationally feasible at an industrial scale and can improve on current practice. Specifically, our results suggest that this dynamic approach can reduce operational costs by about 2% on average in the present Duke Energy system and, in a “future” system with increased solar and storage capacity, can reduce operational costs by 4-5% on average. Perhaps more strikingly, this dynamic approach, on average, performs within 0.2-0.3% of production plans based on perfect foresight about future net demands.

The objective of this paper is to examine citizen and stakeholder inclusion in long-term energy planning. It focuses on extended planning horizons up to 2050 in Denmark. Based on in-depth interviews with expert stakeholders and analysis of policy processes surrounding long-term energy decarbonization scenarios, it examines how diverse stakeholders are included in the development of the Danish Energy Agency's technology catalogues, which forecast detailed techno-economic data across various energy technologies and infrastructures until 2050.

Three research questions are addressed:

- 1) What concepts and methods exist in the state-of-the-art for democratic participation of citizens and stakeholders in long-term energy planning and what are the key limitations of these approaches?
- 2) What methodological strategies can be used to expand the definition and inclusion of stakeholders in long-term energy planning?
- 3) How can the impacts of citizen and stakeholder inclusion in long-term energy planning be assessed and improved?

The research generates new empirical and conceptual knowledge on the study of technocratic policymaking, the concept of a stakeholder, the configuration of new knowledge infrastructures and platforms that are scaled up to share forecasted energy data, and the inclusion of citizens in complex forecasting of sustainability transitions during several next decades.

A model for global cooperation on climate change: Dynamic Lindahl equilibrium under uncertainty

Submission ID-149

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We study the value of a cooperative solution to the global climate externality problem in a world that is uncertain and dynamic. Our analysis incorporates negative emissions technologies that seem critical to resolve the crisis, especially if the climate future proves catastrophic. We generalize earlier theoretical results for Lindahl's equilibrium, and integrate with an up-to-date version of Nordhaus's pioneering RICE-model to quantify regional economic impacts. Low-income regions end up with the highest relative value of cooperation through three distinct channels: lower damages, equilibrium compensations, and burden sharing of abatement actions.

Condition-Based and Value-Difference Based Aggregation in Wind Power Permit Application Assessment

Submission ID-113

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Assessment of an application for wind power establishment is a multi-criteria decision problem including the core problem: whether to grant permission or not. In Sweden, County Administrative Boards decide the outcomes of these kinds of applications. Five permit officers were interviewed to investigate the difficulties they meet and the type of value aggregation(s) they use when assessing permit applications, and to test a seven-step model as a possible decision support tool. The commonly used type of aggregation was condition-based aggregation. Aggregation based on value differences was considered difficult to apply. Most of the respondents agreed that some of the aspects that speak against granting permission could be aggregated but that aggregation of all aspects would be hard due to differences between aspects. In addition, the value of the main aspect that speaks for permission, climate friendly energy supply, is very difficult to estimate. Thus, aggregation based on value differences was found to be difficult to apply in practical wind power permit application assessment. If policymakers wish to apply value-difference aggregation to make it possible to take both pros and cons into consideration and to discuss the trade-offs transparently, the seven-step model could be a way forward.