Departement of Research Evaluation

RESEARCH UNIT SELF-ASSESSMENT DOCUMENT

2023-2024 EVALUATION CAMPAIGN
GROUP D

Team Decision Aiding
LAMSADE, PSL Université & CNRS

Contents

1 GENERAL INFORMATION FOR THE CURRENT CONTRACT: DECISION AIDING TEAM

The Decision Aiding team's scientific project relies on the expertise and interaction of six projects covering research domains related to decision aiding in complex environments. During the evaluation period (2017-2022), 25 permanent faculty members (7 DR CNRS, 4 CR CNRS, 3 full professors, 11 assistant professors, 2 professors emeritus) were in our team[1]. It is a multidisciplinary team with 6 members in economics or environmental studies. From 2017 until January 2019, Jérôme Lang served as the head of the team, with Meltem Öztürk Escoffier as co-head. Since January 2019, Meltem Öztürk Escoffier took over as the head of the team.

1.1 Scientific subjects and their implications

Our team's research activities focus on the analysis, modeling, and resolution of complex decision problems. We are internationally renowned for our leadership in Decision Aiding (DA) and for our substantial scientific output. Our expertise encompasses a diverse array of sub-fields, including multi-criteria decision aiding, group decision aiding (social choice theory), interactive decision (game theory), decision under uncertainty and public and private sector decision support.

We analyze decision problems in various environments, from fully automated systems, like recommender systems, to those with significant stakeholder involvement, like public decisions. To address the wide-ranging demands of these environments, we draw upon knowledge from multiple research fields, such as computer science, economics, mathematics, environment and management science. Our team's multidisciplinary composition allows us to tackle the complexity of studied systems, as evidenced by the diversity of methodologies we employ, including micro-economics (especially social choice, game theory, and decision theory), operations research (such as mathematical programming techniques and solving multi-objective, multi-decision maker problems), and artificial intelligence (incorporating reasoning and machine learning).

Our focus is based on both the formal aspects (such as axiomatization), and the algorithmic aspects (including the development of efficient algorithms as well as complexity analyses). Additionally, we examine procedural aspects (how to define and implement a decision protocol), as well as practical applications in areas like environment science, transportation, and health.

Our approach covers a thorough examination of the decision-making process, from modeling to problem-solving, with a emphasis on learning, transparency, and explicability.

The scientific animation of the team is facilitated through monthly team meetings, a cycle of conferences for all members, seminars hosted by the projects (see the next paragraph), presentations given by colleagues visiting our laboratory. We also promoted scientific discussion through half-day workshops, and trip outside Paris (one day and a half) where the team collectively discussed about research directions and future challenges. We actively participate in the life of our laboratory by engaging in various activities, including the annual LAMSADE days, monthly doctoral student seminars, and the laboratory's general assembly. Additionally, we contribute to our community by organizing conferences, workshops, and taking on responsibilities within the PSL, Dauphine University, LAMSADE, and the MIDO department (Mathematics and Computer Science department). Our team's resources currently include various projects and chairs, which are financed by different institutes, as well as a funding of 14,000 euros and

[1] 5 of which only during a part of the period

two master internship grants provided every year by LAMSADE. Additionally, we regularly secure funding for thesis grants and visiting professorships by actively responding to calls from the laboratory.

Our team is structured into 6 projects, including 4 cross-disciplinary projects in collaboration with other teams at LAMSADE. Several team members are involved in multiple projects. Our 6 projects are:

- Preference modelling and multicriteria decision aiding
- Intelligent agents for decision and reasoning
- Social choice and game theory: axioms and algorithms (joint project with the "Algorithms, Combinatorial Optimisation" team)
- Combinatorial multiobjective optimisation (joint project with the "Algorithms, Combinatorial Optimisation" team)
- Policy analytics (joint project with the "Data Science" team)
- Machine intelligence and learning systems-MILES (joint project with team "Data Science")

The significant scientific achievements of our team are outlined below, grouped by project:

Project: Preference Modelling and Multicriteria Decision Aiding (MCDA)

This project deals with the main steps of a decision-making process, when the presence of the decision maker (DM), through its preferences, is crucial and when the representation and the aggregation of such preferences become hard due to the presence of conflicting criteria. The project aims at covering a large spectrum of aspects: theoretical (development and axiomatization of new preference models), methodological ones (development of MCDA methods and preference learning techniques), practical and experimental (implementation of these models and techniques in a real-world context). Although the project is within the scope of Operational Research, the majority of the obtained results are also interpretable in the field of Social Choice Theory or Artificial Intelligence. Our activities at the national and international level will be detailed in Section 4.

Studies realized during the evaluation period cover five complementary axes presented below. The first three axes have been at the core of LAMSADE's research for several years and our team has an international visibility on these topics. Throughout the evaluation period, we have continued to work on these topics with our traditional collaborators, including our colleagues from Belgium, Italy, and Greece. In addition, we have taken this opportunity to strengthen our competencies and expand our focus on learning preferences and the development of composite indicators.

Problem structuring: Very often a decision problem is defined by "given a set of criteria C, a set of alternatives X, how to find the best alternative or how to rank them?". However, the definition of such sets, as well as the choice of the right type of the problem (is it a choice, a ranking or a classification problem?) are crucial. See for instance [1] for designing alternatives and [2] for a discussion on the choice between a rating or a classification problem.

Preference model: The preference structures that are often found in decision models are linear orders or preorders; but anyone involved in an application knows that the preferences of

decision makers are far from being as perfect, but they are not random either. For that reason we are interested on more flexible preference structures that are closer to the decisional behavior, for instance, structures with thresholds such as semi-orders or structures with incomparability or those that can handle contradictory information; see for example [3, 4, 5] . We have also introduced the deliberated judgment, embodying the requirement that the DM should carefully examine arguments and counterarguments [6, 7].

Preference representation/aggregation: When alternatives are defined as Cartesian products of value domains, a common way to rank them is to use an additive utility function. However, such an aggregation model is very compensatory and assumes independence between criteria. To deal with these two points, other aggregation methods are proposed in our project: see for instance [8] for the axiomatization of an aggregation based on veto and majority principles (non-compensatory method) ; [9] for the axiomatization of Choquet integrals where positive or negative synergies between criteria can be represented; and [10] for an ordinal classification for a group of persons.

Elicitation and Interpretability: The aggregation models that we use are all interpretable in the sense that the aggregation rules are well-defined (even more since there are frequently axiomatized) and the meaning of their parameters (thresholds, weights, etc.) are well-known. These points give us the advantage to have interpretable and/or explainable results. Such information can be joint with the preference elicitation process. This step is essential to obtain valid models and robust recommendations; see for instance [11] for the introduction and axiomatization of the concept of necessary and possible interaction indices related to the Choquet integral model or [12] for an elicitation procedure for robust winner determination.

Indicators and Real-world applications: All the previous steps can be used to elaborate composite indicators, viewed as an MCDA problem, integrating different level of aggregation. Integrating preferences here differentiates us from what is commonly done in statistics. For instance, see [8] for a bibliometric index or [13] for the use of a MCDA approach for a prison life index. This project is financed by CNRS as an “emerging project” but also by the Ministry of Foreign and European Affairs of France and European Council. It will be detailed in Section 2 (Portfolio). Other studies have been done on the computation of the Nutriscore label and on the choice of the installation of the new train station in Rouen.

In addition to the publications that the members of this project have in international journals and conferences, we have also co-organized several international conferences/workshops: The 15th international conference on Scalable Uncertainty Management, 2022, the 13th Multidisciplinary Workshop on Advances in Preference Handling IJCAI 2022, 13th European Meeting on Game Theory, 2017, and the86th Meeting of EWG MCDA, 2017. Some of our studies have been financed by the CNRS, different organisations (such as European Council) or industry (for instance SNCF).

Project: Intelligent Agents for Decision and Reasoning

The topics of the project are related to algorithms performing search in large state spaces. The applications go from difficult games to hard combinatorial optimization problems.

Neural Networks Architectures
In 2015, we were the first to enter a computer Go competition in China using modern Deep Learning convolutional architectures. In 2016, we replicated the AlphaGo experiments and we improved the level a lot using residual networks [14, 15]. Residual networks were used in AlphaGo Zero, AlphaZero and MuZero and enable an increase of 600 Elo compared to the original AlphaGo (98% win-rate against AlphaGo). In 2018, we used average pooling for the

value head and it improved greatly the training of the evaluation. Average pooling was also used in Polygames in 2020 and besides being more accurate, it enables to have an evaluation independent of the board size and to do transfer learning [16]. In 2020 and 2021 we again improved a lot the architecture of neural networks for zero learning using Mobile Networks (accuracy of 61% on the Katago dataset that we created compared to 55% for residual networks) [17, 18]

Deep Reinforcement Learning
We participated in 2020 to Polygames the generic re-implementation by Facebook of AlphaZero for many games [16]. Starting in 2020 we worked on Athénan, a Deep Reinforcement Learning framework quite different from AlphaZero since it uses Unbounded Minimax instead of Monte Carlo Tree Search as a search algorithm, and only uses and learns a value network, not a policy network. Athénan uses the Descent framework which is way more efficient than AlphaZero for learning to play in many games. With Athénan we won 5 gold medals in the 2020 Computer Olympiad, 11 gold medals in the 2021 Computer Olympiad, and 5 gold medals in the 2022 Computer Olympiad. This is by far the greatest number of gold medals won by a program in the various Computer Olympiads (the Computer Olympiads are an annual event held since 1989). Athénan is still today the defending champion for 13 games.

Search
We worked with NASA and Safran on planning for autonomous vehicles, combining search and graph neural networks [19]. Another planning algorithm we developed uses reduced graphs and enables to plan for millions of NPCs in real time in video games such as Assassin's Creed. We improved on NRPA with Generalized NRPA [20]. It is designed to use a heuristic prior. The algorithm to learn the policy combined with the heuristic prior was designed using a mathematical derivation of the gradient.
Applications of our Monte Carlo Search algorithms include Vehicle Routing (with EDF) [21], Traffic Engineering (improving the QoS of internet networks) [22], Molecule Design (best algorithm to design the RNA molecules of the Eterna benchmark) [23], the Snake-in-the-Box (improved lower bounds in high dimensions), automatic refutation of mathematical conjectures on graphs [24] and retrosynthesis of molecules (better than AstraZeneca MCTS).

Others
Other works include using Deep Learning to accelerate cosmological simulations, creating a GPT chatbot answering similarly to Molière's characters in order to celebrate the 400th anniversary of the birth of Molière, Procedural Content Generation for puzzles, agents for modern board games such as Catan and Risk, search for imperfect information games.

Project: Social Choice and Game Theory: axioms and algorithms (joint project with team 2)

The objective of this project, involving members of teams 1 and 2 of LAMSADE, is to investigate alternative mechanisms of collective decision-making and to study strategic interactions in competitive and cooperative environments. In this framework, we develop normative models (via, in particular, the axiomatic characterization of voting rules, games, or solution concepts) and we analyze them from the viewpoint of algorithm design and computational complexity. The project is structured in two main axes:

(Computational) social choice: We are interested in analyzing collective decision situations (in particular, voting situations and resource sharing problems) by means of the axiomatic characterization of the related decision-making mechanisms. We are also interested in the algorithmic design and computational complexity of such mechanisms on their effective application, as well as their vulnerability to strategic behaviour and the role played by information sharing on their

implementation.

Algorithmic game theory: Our main interests here are the study of the complexity of computing solutions for games, the compact representation of games, the analysis of learning algorithms in dynamic interaction situations (e.g., convergence), and the evaluation of the social welfare of stable outcomes.

Achievements
Important research works done along the lines of this project include: the analysis of the prices of anarchy and stability which means how the efficiency within a society degrades due to selfish behaviour [25], and of the price of optimum, evaluating the costs (and the actions) a central authority should (and undertake) pay to prevent such degradation [26]; the design of algorithms for fair division of public resources [27] (Honourable Mention paper at IJCAI'19); the social ranking problem aimed at studying how to rank the elements (individuals, universities, political parties, etc.) of a society starting from a binary relation over their subgroups [28] and its property-driven analysis [29]; the axiomatic analysis of the majority judgement voting method [30] and its application to the "Primaire populaire" in France; the role played by uncertainty in collective decision-making [31, 32]; the study of argument-based aggregation operators [33] and multi-agent normative systems [34]; the trade-off between efficient and fair use of common resources [35].

Members of this projects are involved in the coordination of funded projects on related topics. We mention in particular two ANR projects:

- *Computation, Communication, Rationality and Incentives in Collective and Cooperative Decision Making (CoCoRICo-CoDec)* (60 months, ending date 10/2019);
- *THeory and Evidence to Measure Influence in Social structures (THEMIS)* (48 months, starting date 03/2021).

International conferences are also organized by project's members with the role of conference and program chair: the 13th European (formerly Spain-Italy-Netherlands) Meeting on Game Theory (SING13-2017); the 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (IJCAI-ECAI-2018); the 15th international conference on Scalable Uncertainty Management (SUM15-2022).

Research context
Most of the collaborations at the national level have been done in the framework of working groups of the CNRS "Groupements de Recherche" (GDR) in Artificial Intelligence (8 members of the projects involved in the GDR IA), in Operations Research (6 members of the projects involved in the GDR RO) and Informatics Mathematics (3 members of the projects involved in the GDR IM), especially around the research themes of the inter-GDR IA-OR working group TADJ (Théorie Algorithmique de la Décision et des Jeux). Several research articles are done in partnership with other research laboratories in fundamental computer science like, for instance, LIP6 (Laboratoire d'Informatique de Paris-6), IRIT (Institut de Recherche en Informatique de Toulouse), CRIL (Centre de Recherche en Informatique de Lens). Some interdisciplinary researches is this domain are addressed together with laboratories oriented to economics, like CREM (Centre de Recherche en Économie et Management), CES (Centre d'Economie de la Sorbonne) and GATE L-SE (Groupe d'Analyse et de Théorie Economique Lyon Saint-Etienne). At an international level, the research community of reference for project's collaborations is the COMSOC one, at the intersection of social choice theory and theoretical computer science. Several research projects and articles in computational social choice and algorithmic game theory are done in cooperation with European research institutions in computer science and mathematics (for instance, in Germany, Greece, Italy, Spain and The Netherlands).

Project: Policy Analytics (joint project with the "Data Science" team)

Policy analytics project is a transversal project, that involves two teams in LAMSADE – Decision Aiding Team and Data Science Team, and was sustained financially by the GDR 3720, "Policy Analytics", until 2019.

Scientific themes
The "policy analytics" framework was initially introduced at a conceptual level, and then evolved as applications were developed. The very specificity of this decision-aiding area of research is the public aspect (use of public resources), as it implies to add several elements which have to be taken into account scientifically:

- the consequent need for transparency, accountability, and legitimacy associated with the use of public resources,
- the way in which public policy generally affects a variety of stakeholders,
- the deliberative process normally entailed by public policy decision-making,
- the long time horizon over which decision-making occurs and at which goals are set.

Hence decision-making techniques, which are already well-known and developed in Team 1, have to be re-analysed and calibrated to these constraints.
The link with the "Data Science" team is based on the inclusion of data analysis in the decision-aiding, and the open-mindedness in terms of tools that are used for generating meaning and values for participants to the decision process. Numerical tools development, theory and applications are thus the three pillars of the project, and most of the participants have several of these abilities.
To innovate in this matter, applications rely on interdisciplinary approaches based on questions and problems rather than ex-ante scientific representations: they stand at a rare interface, as they unite abstract theoretical knowledge and research, decision-aiding tool-oriented framing and inclusion of stakeholders concerned by the public policy to be conceived.

Scientific positioning in relation to the international context The project has strong links with operational research and a special track was organized at the EURO conference in 2019 by an English colleague. England, Italy and Australia are countries with which the policy analytics group in LAMSADE has strong links. As for the environmental applications, Ostrom's resilience approach of eco-socio-systems have strong common points, but with less focus on formal analysis (argumentation, problem structuring).

Major scientific advances in the period Several topics of interest from 2017 until 2022 were related to environmental issues and led to real-life activities of decision or information. The scientific approach is an applied one, so it is possible to list examples of research works that resulted in real policy applications: the elaboration of an operational and legitimate wetland prioritization platform in Bourgogne-France-Comté ([36]); a concertation in Northern Vosges on the topic of forest conservation ([37]) which was based on the production of a serious game; this tool had already been used in a participatory research about a pollution political fight near Marseille, and eventually the creation of a serious game for educative purposes (middle school level) about Ostrom's common good theory applied to this pollution issue ([38]; one PhD student worked in a consulting company and helped design a recommendation tool for research policy ([39]); risk-management was also addressed in actual applicative contexts [40, 41]. Research was in general published in high level international journals, in many different fields, and we could elaborate position papers with our colleagues from Australia ([36]).

Scientific animation of the team On top of a bi-monthly seminar that lasted from 2018 until end of 2019, the dissemination of our approach relied on the organization of many conferences and workshops on various topics: Change analytics (recognizing, analyzing, provoking change in society – Montpellier 2019); “Jeux et Enjeux” international workshop on serious games and their application to the conception of policy elaboration; a series of international conferences on social responsibility of algorithms in Dauphine (RSA 2017, 19, 22). Another series of workshop reinforced the links between Dauphine, INRAE and Australian National University Project with whom several publications have been written, projects were launched, including a PhD grant.

In the project, among 14 PhD students that worked with us from 2017 until 2022, 6 worked in a company and had a CIFRE funding, 1 had an ADEME grant and 1 was joint with another research institute (IRSN), one is working between France and Australia, and three had ministry and PSL grants: this shows that most of the PhD subjects are deeply embedded in societal needs, and this can also be found with post-doctoral researchers who are or were working in our projects. For the moment, 4 out of 5 postdocs found permanent positions in research institutes or universities.

Project: Combinatorial Multiobjective Optimisation (joint project with team ”Algorithms, Combinatorial Optimisation”)

This project is presented by Team “Algorithms, Combinatorial Optimisation”.

Project: Machine Intelligence and Learning Systems-MILES (joint project with the “Data Science” team)

This project is presented by Team “Data Science”.

1.2 Consideration of the recommendations in the previous report

- **Le bilan des publications est excellent, on constate cependant que la production n’est pas valorisée sous forme de logiciels ou de prototypes**

As it will be noted in Section 4, our team has discontinued offering the ELECTRE and UTA software due to two reasons: our preference for open source options and the lack of qualified personnel for software maintenance and updates. Our team is a founding member of the inter-laboratory platform Decision-Deck (https://www.decision-deck.org/project/, partners: Ecole Centrale de Paris, IMT Atlantique, Lamsade, University of Luxembourg and University of Poznan), which provides open source multi-criteria decision support software. Several members of our team are involved in this project, including two members on the board. Although the platform offers a wide range of software options, there is still a shortage of manpower for software maintenance, updates, and formatting (making the software user-friendly).

In addition, we are eager to implement our social choice methods in other settings in the future. During the ANR CoCoRICo-CoDec project a new open voting platform was created by the project members. The platform is currently managed by LIG (Laboratoire d’Informatique de Grenoble) (click for the web page). Currently, we have created libraries for the R language to support our social ranking methods, but we hope to extend our capabilities further.

To achieve these goals, we strongly need the assistance of a skilled research engineer.

- **Il est regrettable que la qualité reconnue de la recherche des membres du thème 1 ne se soit pas encore traduite par des dépôts de reconnaissance d’ERC (European Research Council) ou de projets européens**

As it will be presented in Section 3 (Evaluation Area 2), we are partners of some projects financed by the European Union/European Commission: INTERREG-ECOSERV (click for the web page), LODE "Loss Data Enhensment" (click for the web page); or by the European Council: Prison Life Index (click for the web page). And recently, we submitted, as a partner, a project to the new ERC Synergy Grant (ERC-2023-SyG). Our project is entitled "Platforms and Principles for Digital Democracy" (see Section 3-Evaluation Area 2); it has just passed the first selection stage and we hope that will will be accepted. It is true that we are not the coordinators of these European projects. On the other hand, it is important to note that we are coordinators and partners of many projects funded by public authorities such as ANR or CNRS, or companies (see Section 3-Evaluation Area 2). We also have two PRAIRIE chairs and one Humboldt Research Award. All these resources allow us to have a comfortable financial situation.
- **La cohésion du thème devra être d'autant plus renforcée que l'interdisciplinarité du thème est davantage marquée à la suite de recrutements récents. Ce renforcement pourrait notamment prendre la forme de publications interdisciplinaires plus fréquentes.**

The implementation of a policy promoting co-supervised theses has resulted in a significant increase in collaborations among members of the team and with members from other teams. The presence of various projects, such as ANR projects and single calls from the CNRS, has also facilitated collaborations between our researchers and led to the successful integration of recently recruited colleagues, including those from outside computer science. This is evidenced by the collective publications and numerous thesis co-supervisions between computer scientists and researchers in other disciplines. During the evaluation period, 5 PhD theses have been advised by a pair formed by a computer scientist and someone from another discipline. There have been twenty articles co-written by at least two members of our team from two different sections (14 articles in journals and 6 articles in international conferences with proceedings).

- **Le projet scientifique du pôle n'est pas à la hauteur de la qualité des chercheurs qui le composent**.

During the recent evaluation period, we made significant progress in both consolidating existing projects (especially, policy analytics, which had just been created at the time) and enriching some of our research areas such as reinforcement learning, composite indicator creation, and preference elicitation. In addition, we have recently embarked on several new research initiatives, for instance, participatory democracy, explicability, or deliberative public policy making.

For a detailed overview of our scientific project for the future, see Section 4. We are confident that this project is well-aligned with our existing competencies and our established international leadership in our fields. By leveraging our expertise and resources, we aim to make significant contributions to the advancement of scientific knowledge and the development of innovative solutions to some of the most pressing challenges facing our society today such as environment, health and democracy.

-**Pour les Poles 1 et 2, la tendance a rester dans la continuité sur les thematiques historiques du LAMSADE et le manque de prise de risque sur des sujets disruptifs doit etre un point de vigilance pour favoriser une dynamique scientifique propice a la créativité**

One disruptive topic that had been launched just before the previous evaluation was "policy analytics". It involves researchers from diverse disciplines working with a variety of methodologies. Despite this challenge, the team members have been successful in understanding each other and collaborating on issues related to decision in complex environment, resulting in significant new findings and collaborations (see Section 1).

We're also continuing to expand the scope of our existing projects, thanks to the willingness of our team members to explore new ideas and new colleagues who have joined us. As an illustration, we'd like to highlight three theses that are being jointly supervised by different teams within the lab or with other universities: Chen Dang is exploring reinforcement learning techniques for OR problems; Virginie Do is working on a project that combines social choice techniques with machine learning; Yassine Mejri is working with chemists on discovering new molecules by joining deep learning techniques and multi-criteria decision support tools.

In Section 4, we will explain our commitment to exploring new research topics and taking risks, as we believe this is crucial to stay at the forefront of our field and demonstrate new possibilities to our colleagues.

- **Les chercheurs de ce pôle sont encouragés à s'investir davantage dans la formation par la recherche et notamment dans la prise de responsabilités pédagogiques au niveau des parcours de masters, ce qui permettra un meilleur équilibre des efforts de recherche entre les membres du pôle**:

It is true that many of our assistant and full professors have significant training responsibilities. However, a number of our colleagues from CNRS have also taken on important roles. For example: a DR CNRS colleague served as director of the computer science doctoral school from 2015 to 2021; the current director of the computer science graduate program at PSL and the deputy director of Lamsade are both DR CNRS from our team. These are our three DR CNRS in computer science. The other two CR CNRS researchers who recently joined us have some responsibilities such as communication in LAMSADE (including maintaining the web site), and managing the allocation of travel funds to young researchers. Some of our CNRS colleagues are also involved in research master program and teach courses on game theory, social choice theory, or risk management. Two of our CNRS colleagues had a contract of "professeur attaché" during which they took over some responsibilities and taught master courses. We also want to emphasize that it is difficult for our researchers outside computer science to take responsibilities in our training; nevertheless, some of them participate in the teaching activities.

2 PORTFOLIO INTRODUCTION: DECISION AIDING TEAM

Our portfolio comprises seven elements, with each project contributing at least one element, which can be a theoretical result exemplifying our research (points 2, 3, 4, 5), a real-life application (point 6), an outreach action (point 7), or an international implication (point 1).

1. **A DR CNRS as the Program Chair of IJCAI 2018 (click for the web page)**

   IJCAI is one of the leading conferences on AI. Each year it receives between 3000 and 5000 submissions (in 2018: 3470), from which around 20% are accepted (in 2018: 709). The role of the program chair is, among other tasks, to hire the program committee (in 2018: around 50 area chairs, 500 senior program committee members and 2000 program committee members), manage the review process, choose invited speakers and special tracks. All this has impacts on the future research directions of IA. Jérôme Lang's selection as the chair, and his inclusion on the IJCAI board of trustees (2015-2020), contributed to the international visibility of LAMSADE.

2. **Athenan: Minimax Strikes Back (gold medals in Computer Olympiads 2020, 2021, 2022)**

   Athénan uses Minimax-based search algorithm called Descent, as well as different learning targets. For multiple games, our *Polygames* is much more efficient than the re-implementation of AlphaZero. We won several gold medals with Athénan in the 2020, 2021 and 2022 Computer Olympiads.

3. **Honorable Mention at IJCAI 2019: Portioning Using Ordinal Preferences: Fairness and Efficiency ([27])**

   A public divisible resource is to be divided among projects. We study rules that decide on a distribution of the budget when voters have ordinal preference rankings over projects. Examples of such portioning problems are participatory budgeting, time shares, and parliament elections. We introduce a family of rules for portioning, inspired by positional scoring rules (click for the web page).

4. **THeory and Evidence to Measure Influence in Social structures ([42])**

   The article [42] is one the of the first articles of Themis ANR project which brings insights based on techniques from multi-agent systems, compact representation, algorithmic game theory, computational social choice, and social network analysis. The project opens a new research domain proposing an ordinal framework for power indices and has inspired colleagues around the world to publish their own results within our framework.

5. **Nondominated Set for Multiobjective Discrete Optimization ([43])**

   The article presents the current best algorithm to generate the Pareto front of multiobjective discrete optimization problems.

6. **Prison Life Index**

   This multidisciplinary project involves computer science, economics, law, and sociology and partnerships with NGO Prison Insider, ULB, CNAM, and SciencePO Grenoble. It aims to evaluate incarceration conditions across different countries (see for instance an article in the journal "Le Monde": (click for the article) or this intervention on France3 TV channel: (click for the video) or [13] for the modeling of the problem).

7. **A serious game: PollutionSolutions**

   "PollutionSolutions" is a serious game highlighting the practical application of "complex systems" modeling. Its primary objective is to raise awareness among the appropriate

age group about the underlying mechanisms of collective action and encourage more effective public action against pollution. It has been used with middle school students with the Aix-Marseille rectorate. Click (here) to see an article on the website of IGPDE (Institut de la gestion publique et du développement économique) and (here) for an interview realized by IGPDE .

3 SELF-ASSESSMENT DOCUMENT: DECISION AIDING TEAM

Evaluation area 2. Attractiveness

Standard 1. The unit has an attractive scientific reputation and contributes to the construction of the European research area.

Invitations:
Our team has a significant scientific influence on an international level, which has enabled us to establish a broad research network. This network has provided us with opportunities to be invited to renowned institutions, as well as to well-known international and national conferences and workshops.

- Institutions:

  Thanks to our long-standing collaborations and close proximity to several European countries, many of our colleagues have had the opportunity to visit universities in Europe. In particular, we have established frequent collaborations with institutions in Belgium, England, Germany, Italy and Turkey. Our colleagues have had the opportunity of visiting several universities, with visits ranging from a few days to a few weeks. These universities include Bilgi University, Ghent University, Heinrich Heine University Düsseldorf, Technische Universität Berlin, UCL Department of Security and Crime Science, Université Libre de Bruxelles, Université de Mons and University of Wuppertal. Some of our colleagues have had the privilege of attending Dagstuhl seminars, a prestigious gathering for researchers in computer science and related fields.

  Additionally, Gran Sasso Science Institute (Italy, one week), International Risk Governance Council (Sweden, one month), Oregon State University (USA, one month), University of Catania (Italy, one week), University of Košice (Slovakia, 2 weeks) have also been visited by our colleagues.

  In recent years, our colleagues have also established collaborations with institutions in Cameroon and Australia. They have visited the University of Yaounde in Cameroon in 2018, 2019, and 2021, and RMIT University and ANU University in Australia in 2018-2019.

- International conferences, doctoral schools, workshops, ...:

  We have been invited to give several key talks in international and national conferences, workshops and schools for PhD students:

  - keynotes at international conferences: IJCAI 2022 (International Joint Conference on Artificial Intelligence, Vienna, 2022) , SUM 2022 (International Conference on Scalable Uncertainty Management, Paris, 2022), CLAR 2020 (International Conference on Logic and Argumentation, Hangzhou, China, 2020), ISDA 2020 (International Conference on Intelligent Systems Design and Applications, 2020), IDRiM 2019 (International society for Integrated Disaster Risk Management, Nice, 2019), ICDCIT 2018 (International Conference on Distributed Computing and Internet Technology, Odisha, India, 2018)
  - keynotes at national conferences: JIAF 2019 (Journées d'Intelligence Artificielle Fondamentale, Toulouse, 2019) , ROADEF 2018 (congré annuel de le société Française de Recherche Opérationnelle et d'Aide à la Décision, Lorient, 2018).

- keynotes at workshops: DA2PL 2022 (From Decision Aiding to Preference Learning, Compiegne, 2022), CMSS 2022 (Centre for Mathematical Social Science Summer Workshop, 2022, Auckland), Linz Seminars 2022 (Austria, June 2022), Aggregation across disciplines: connections and frameworks 2021 (Neuville-sur-Oise, 2021), NLJA 2019 (Nonclassical Logics and Judgment Aggregation, Prague, Czech Republic, 2019), INDEPTH 2019 (Institutional Design and Economic Preferences, Saint Etienne, 2019), Knowledge Representation and Collective Decision Making 2019 (Toulouse, 2019), RAMOO 2017 (Recent Advances in Multiobjective Optimization, Kaiserslautern 2017), Logic In Bochum III 2017 (Germany, 2017).
- keynotes at summer schools or others: Automne Institut in IA (Porquerolles, 2022), Journées Plénières du GDR IA (2 talks: 2019 and 2022), PhDs in Logic IX 2017 (Ruhr University Bochum, Germany, 2017), Summer School on Game theory and Rationing (Campione d'Italia, 2017).

Organization of major international conferences

During the evaluation period, we organized several scientific events. We start by mentioning the three international events that we organized at Dauphine University. We list them in inverse chronological order:

- Organisation of the 15th International conference on Scalable Uncertainty Management (SUM22) (click for the web page), Paris Dauphine University, 17-19 October 2020, 50 participants.
  General chair: Meltem Öztürk,
  Program chairs: Florence Dupin de Saint-Cyr, Nico Potyka,
- Organisation of the 86th meeting of the European Working Group "Multiple Criteria Decision Aiding" (click for the web page), Paris Dauphine University, September 21-23, 2017. 90 participants.
  Chairs: Daniel Vanderpooten, Bernard Roy, José Rui Figueira, Salvatore Greco, Roman Slowinski.
- Organisation of the 13th European Meeting on Game Theory (SING13), (click for the web page), Paris Dauphine University, 5-7 July 2017. 200 participants.
  Chair: Stefano Moretti.

Some of the events that our team organizes are regular:

- Workshop D-TEA (2017,2018,2019, 2020, 2021, 2022): Decision: Theory, Experiments and Applications, Paris School of Economics. (click for the web page)
  Committee: Mohammed Abdellaoui, Itzhak Gilboa, Brian Hill, Emmanuel Kemel, Rida Laraki, Stefania Minardi.
- Online ComSoc seminar series (click for the webpage)
  Chair: Dominik Peters.
- Online social choice seminar series (click for the web-page).
  Committee: Youngsub Chun, Danilo Coelho, Simona Fabrizi, Piotr Faliszewski, Jobst Heitzig , Marcus Pivato , Remzi Sanver, Arkadii Slinko.

In addition to events organized at the University of Paris Dauphine, our team has also participated in a range of external events.

- 13th Multidisciplinary Workshop on Advances in Preference Handling (M-Pref/IJCAI 2022) (click for the web page), 30 participants, Vienna, 23 July 2022.
  Chairs and organizers: Sebastien Destercke, Christophe Labreuche, Meltem Öztürk, Paolo Viappiani

- Logic and Ethical Reasoning (LER), (click for the web page), co-located at UNILOG, 2022
  Organizers: Juliano Maranhão, Gabriella Pigozzi.
- The First Workshop on Models of Legal Reasoning (MLR 2020), co-located at KR 2020, (click for the web page)
  Organisers: Juliano Maranhão, Giovanni Sartor, Gabriella Pigozzi.
- Fourteenth International Conference on Deontic Logic in Computer Science (DEON 2018) (click for the web page) Organizers: Jan Broersen, Cleo Condoravdi, Shyam Nair, Gabriella Pigozzi
- AMANDE - Argument Strength 2018 Workshop (end of ANR project AMANDE), Toulouse, 2018 (click for the web page)
  Organizers: Leila Amgoud, Sylvie Doutre, Patricia Everaere, Jean-Guy Mailly, Stefano Moretti, Gabriella Pigozzi, Srdjan Vesic
- Les entretiens des risques (2017, 2019),
  Organizers: Sylvie Grandel, Myraim Merad

Editorial boards and program committees

Several members of our team serve on editorial boards of international journals (in alphabetic order):

- Artificial Intelligence: ICGA (International Computer Games Association) Journal; Journal of Argument and Computation; Journal of Autonomous Agents and Multiagent Systems.
- Decision, Algorithmics and Operations Research: EURO Journal on Decision Processes; International Journal Applied Mathematics and Computation ; Operational Research - An International Journal (ORIJ); RAIRO; Operations Research; and Theory of Computing Systems.
- Game Theory and Social Choice: Games; International Journal of Game Theory; Journal of Computational Optimization in Economics and Finance; Journal of Dynamics and Games; Journal of Multicriteria Decision Making in Economics & Finance; Mathematical Social Sciences; Social Choice and Welfare; Theory and Decision.
- Simulation and environment: Biological Invasions; Environment, Systems and Decisions Journal; Journal of Artificial Society and Social Simulation.
- National journals: Rédaction de Botanique; Revue scientifique pour la biodiversité du Massif central.

We have also edited some special issues: one on “advances in preference handling” in AMAI (Annals of Mathematics and Artificial Intelligence); one on “argument strength” in Argument and Computation; one on “game theory and practice in cooperative games and voting” in Game Theory Review; one on “game theory and practice: non-cooperative games and equilibria” in Game Theory Review; and one on “logic for normative multiagent systems” in The IfCoLog Journal of Logics and their Applications.

Our team is heavily involved in program committees of prestigious conferences. A member of the team was the program chair of IJCAI-2018 as well as the General chair of ECAI-2020.

Several members of our team have been general chair or program chair in other conferences such as SUM 2022 (Int. Conference on Scalable Uncertainty Management), ACG 2019 (Int. Conference on Advances in Computer Games), CGW 2018, CGW 2017 (Workshop on Computer Games) and SING13 2017 (European Meeting on Game Theory).

Additionally, our team also plays an active role in program committee of major AI conferences as well as ACM-EC (Economics and Computations).

In addition to our team's involvement in major conferences, several of our colleagues have also contributed to more specialized conferences as program committee members. For example, four of our members are actively involved in the ADT conference, and three members are involved in DA2PL. Additionally, our team has participated in conferences such as EUMAS (European Conference on Multi-Agent Systems), MISTA (International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic control and Computer Engineering), ICORES (International Conference on Operations Research and Enterprise Systems), MIWAI (Multidisciplinary International Conference on Artificial Intelligence), LNGAI (International Workshop on Logics for New-Generation Artificial Intelligence), CLAR (International Conference on Logic and Argumentation), DEON (International Conference on Deontic Logic and Normative Systems), LORI (International Conference on Logic, Rationality and Interaction), TARK (Conference on Theoretical Aspects of Rationality and Knowledge) to share our expertise in these areas.

Scientific Expertise

Our colleagues contribute to actions led by national authorities. For instance, some of our team members are involved in steering the MITI CNRS initiative "Sciences pour l'AI, l'IA pour les Sciences" (Sciences for AI, AI for Sciences), while others are involved in the GDR-RO, where they direct the axis DMEI (Decision, Modeling, Evaluation, Uncertainties). Additionally, our team plays a role in the scientific animation of IMERA (Institut Etudes Avancées). We are also involved in the scientific council of Institut Pluridisciplinaire Hubert Curien.

At the international level, we are invited as national expert to the European Science and Technology Advisory Group, Expert-Research Representative for France SRA International

We also provide expertise to research funds such as The Research Foundation Flanders, FRQNT (Fonds de Recherche du Québec - Nature et Technologies) and NSERC, the Canadian science funding organization (Discovery Grant application). We are members of many hiring committees for assistant or full professor positions all around France.

We do also scientific expertise for the industry, for instance for SNCF, ANSES, INERIS, AF-PCNT COPRNM, CNDP.

Prize and distinctions
In inverse chronological order:

- Tristan Cazenave and Quentin Cohen Solal have received many gold medals in Computer Olympiads 2020, 2021, 2022 (click for the web page): 6 gold medals in 2022 (games: Ataxx, Breakthrough, Draughts Canadien, Draughts International, Santorini, Surakarta) ; 11 gold medals in 2021 (Amazons, Breakthrough, Bresilian Checkers, Canadian Checkers Dames canadiennes, Hex 11, Hex 13, Hex 19, Havannah 8, Havannah 10, Othello, Surakarta) and 5 gold medals in 2020.

- Jérôme Lang has received the Humboldt Research Award in 2020, (click for the web page).
- The article “S.Airiau, H. Aziz, I. Caragiannis, J. Kruger, J. Lang, and D. Peters, Portioning Using Ordinal Preferences: Fairness and Efficiency. In Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence, IJCAI 2019” ([27]) has received the Honorable Mention at IJCAI 2019, (click for the web page).
- The article “Nicolo Bertrani, Abdellah Boukhatem, Enrico Diecidue, Patrice Perny and Paolo Viappiani, Fast and Simple Adaptive Elicitations: Experimental Test for Probability Weighting, 2021” has received the 2021 DAS Student Paper Award by the Decision Analysis Society INFORMS.
- The PhD thesis of Anaëlle Wilczynski supervised by Laurent Gourvès and Julien Lesca, defended in 2019, received the following distinctions: Thesis prize AI 2019 (ex aequo) from the French Association for Artificial Intelligence (AFIA), Young researcher award 2019 from Fondation Dauphine and Accuracy, Honorable mention of the dissertation prize ”Artificial Intelligence, Data Sciences and Interfaces” from PSL and ADELI.
- Jérôme Lang has received the CNRS silver medal in 2017 (click for the web page).

Others
Our team also plays an active role in scientific societies, with several of our members serving on the boards of these organizations. We have had two colleagues served on the board of ROADEF (Société Française de Recherche Opérationnelle et d’Aide à la Décision), (click for the web page), one on JFRO (Journées Franciliennes de Recherche Opérationnelle) and one of our colleagues has served on the board of the Society for Social Choice and Welfare (click for the web page). Through our involvement in these societies, we are committed to advancing the field of Decision Aiding, Operations Research and Social Choice Theory and promoting collaboration and knowledge-sharing among researchers.

Standard 2. The unit is attractive for the quality of its staff hosting policy.

PhD students and post-doctorates

During the evaluation period, in total 42 PhD students have been in our team. 18 of these students have defended their thesis. The average length of a thesis is 46.7 months (the average duration of CIFRE theses is slightly below this average, being 40,6 moths). The funding resources of our PhD contracts are diverse. About one quarter of them are funded by the ministry (11 by MESRI and 1 another ministry), another quarter are ”theses CIFRE” (11). The other half of the funding is quite diversified: PR[AI]RIE chairs, LAMSADE funds, PSL, co-supervision (co-tutelle), and other organizations like other universities.

Our team has employed a total of 11 post-doctoral researchers, with most of the of the funds coming from PR[AI]RIE chairs, regional sources, and contracts with various institutes.

As it will be explained later, one third of our publications includes PhD or post-doc students.

Permanent researchers, assistant and full professors and visiting professors

During the evaluation period, a total of 11 CNRS researchers (7 DR and 4 CR), 14 assistant (“maîtres de conférences”) and full professors (3 full professor and 11 assistant professors including 3 HDR) and 2 professor emeritus have been members of our team. Our team is

multidisciplinary thanks to the existence of our CNRS researchers: 2 DR in section 37, 1 DR in section 39-52, 1 DR in section 37-52 and 1 CR in 39-52.

During this time, our institution has attracted new talents, with one full professor, one assistant professor and three new researchers (one DR and 2 CR) joining us: André Rossi (recruited in 2018), Hugo Gilbert (recruited in 2020), Myriam Merad (who joined us in 2019), Dominik Peters (recruited in 2021) and Paolo Viappiani (who joined us in 2021). This demonstrates our continued appeal to highly qualified researchers. Two of our colleagues, Gabriella Pigozzi and Hassène Aissi, defended their HDR in early 2022. Stefano Moretti was promoted to a DR position at CNRS, and Meltem Öztürk Escoffier was promoted to a full professor position at the end of 2022. However, we also experienced some departures: Denis Bouyssou retired at the end of 2022, and Matias Nunez decided to move to another laboratory but continues to collaborate with us. Yves Meinard is in the process of requesting a transfer for family reasons. Julien Lesca left temporarily our laboratory to enrich his experience in the private sector. Nonetheless, we remain an attractive destination for talents, and we have just opened a new assistant professor position on algorithms for AI. Furthermore, we continue to draw the interest of highly qualified applicants to CNRS.

During the evaluation period, we had the opportunity to host several colleagues from abroad. With only the funding from Dauphine and Lamsade, we received a total of 24 colleagues, each for a month. In addition to this number, there were other visits that were funded by projects or other institutes. The origins of our visitors are diverse: mainly from Europe (England, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal), but also from all around the world (Australia, Cameroon, Israel, Japan, Tunisia, Turkey, USA).

Environment for post-docs, doctoral students, researchers

A detailed description of how the post-docs, doctoral students, and researchers are integrated in LAMSADE is in a separate part of the document. We emphasize however that our new colleagues, postdocs, and doctoral students are immediately integrated into our team. They are invited to our monthly meetings, seminars, and were invited to our retreat in Normandy. However, we have a very significant office space problem at Dauphine University. Our doctoral students are cramped into three offices, and we cannot offer proper offices to our CIFRE PhD students or postdoctoral researchers who are often accommodated in the office of permanent staff (similar remark can be made for invited professors).

Standard 3. The unit is attractive because of the recognition gained through its success in competitive calls for projects.

We are involved in several projects funded by authorities such as ANR, CNRS, institutes, or the European Commission.

Projects that we coordinate :

- Coordinator of Project ANR Themis (2021-2025)(click for the web page): The project “THéorie et observation Empirique pour Mesurer l’Influence dans les Structures sociales” involves three research laboratories: CRIL, Lamsade and LIP6. It aims to create, analysis and promote an ordinal theory on power indices.

- Coordinator of Project ANR CoCoRICo-CoDec (2014-2019)(click for the web page): The goal of CoCoRICo-CoDec was to study several classes of collective decision problems under three point of views: the impact of the computational difficulties of the mechanisms involved, the

impact of their communication requirements, their vulnerability to strategic behaviour. Three partners of the project were: CREM, LAMSADE, and LIP6.

- Coordinator of Adecsi, CNRS-INS2I-Projet Emergent (2020-2022): The project “Aide à la Décision et Choix Social pour un indicateur sur les conditions d’Incarcération dans différents pays” aims to create a composite indicator in order to evaluate the conditions of incarceration around the world. It involves CNAM, LAMSADE and Prison Insider (NGO).

We have been French PI of several joint projects:
- joint Project UCL (University College London) - PSL (2020-2023): The projects’ goal is to analyse trafficking and organised crime networks with a Complex Systems Approach.
- PHC (Partenariat Hubert Curien) PROCOPE (2016-2017) with the University of Wuppertal on multiobjective combinatorial optimization.
- PHC (Partenariat Hubert Curien) PROCOPE (2018-2019) with the University of Kaiserslautern on Approximation of multiobjective problems.
- PHC (Partenariat Hubert Curien) PROCOPE (2020-2021) with the University of Kaiserslautern and University of Wuppertal on Representation of efficient solutions of multiobjective problems.

Projects funded for individual research activities:

Two of our members (Tristan Cazenave and Jérôme Lang) have a chair within PR[AI]RIE ((click for the web page 1), (click for the web page 2)). PR[AI]RIE (PaRis AI Research InstitutE, https://prairie-institute.fr) is an Institute for Interdisciplinary Research and Education in AI. It is one of the four French Institutes of Artificial Intelligence, which were created as part of the national French initiative on AI announced by President Emmanuel Macron on 2018.

Two of our young colleagues, Dominik Peters and Hugo Gilbert, have received funding to support the launch of their research projects. Dominik Peters, who joined our team as a CR at the beginning of 2022, has secured funding from PSL (Young Researcher Starting Grant) for the next few years. This will enable him to make research visits and recruit a post-doctoral researcher. Meanwhile, Hugo Gilbert, who joined us in September 2020, has obtained a ”Mobilité Jeune Chercheur” (Young Researcher Mobility) grant from CNRS, which will fund his research visits abroad.

Projects as partners:

- Europeen Project LODE ”Loss Data Enhensment” (2018-2020) (click for the web page): The project’s goal is the identification of key aspects of replicability and adaptability to national systems and databases and interoperability.

- European Project (co-funded by the European Union) INTERREG-ECOSERV (2018-2022) (click for the web page): The project aims to develop strategies and instruments that provide decision-makers with concrete options for action to improve ecosystem services.

- Projet ANR AGAPE (click for the web-page) (2019-2023): The project aims at designing and implementing a General Auction Player (GAP) that can interpret and reason about the rules governing an auction-based market. Partners: IRIT, Lamsade, LIG, IBISC.

- Projet ANR SIOMRI-CARE (click for the web page): the project is focused on the contribution of capabilities to the acceptability and resilience of major risks. Partners: INERIS, Lamsade, LMN.

- Project PRIME80 CNRS (2021-2024) Decide: multidisciplinary project with Université Paris-Saclay (pharmacognosie and computer science): the project aims to develop a decision aiding tool to help experts in their discovery of novel molecules.

- Projet ENTRAIDE (2021-2023): in collaboration with ERMASS-Université de Yaoundé Cameroun. The objective is to propose a clear and robust interpretation of the parameters of a decision model with interactions.

- Cities partnerships Program Seed Funding 2019-2020 (UCL's Global Cities programme): The aim of the project is to study crime using agent-based modelling and optimisation techniques.

- EA-International Emerging Actions (2021-2022): in collaboration with the University of Cork, the project is focused on exact approaches for computing the optimal recommendation set in the context of preference elicitation with minimax regret.

- PHC Cèdre (programme de recherche franco-libanais CEDRE) (2018-2019): The project is focused on efficient algorithms for quality repair in dynamic networks.

- Two PGMO projects (Gaspard Monge Program for Optimisation and operational research) (2017): PRMO which analysis most critical elements for multiobjective optimization problems and IROE which is focused on shortest path problem variants for the Hydro-unit commitment problem.

- Project DEMETERRES-MOUSSE funded by the Ministry of Ecological Transition (2022-2024): The objective is to analyze the effectiveness and relevance of a new decontamination technology, the "column flotation particle foam", in a post-accident management scenario for territories. Partners are CEA, IRSN, Lamsade.

Standard 4. The unit is attractive for the quality of its major equipment and technological skills.

The Decision Aiding team is not concerned by this point.

Evaluation area 3. Scientific production

Standard 1. The scientific production of the unit meets quality criteria.

The total number of documents for Team 1 in the LAMSADE's HAL collection contains more than 435 documents signed by at least one member of Team 1. About 42% of the documents in the collection are journal articles, 35% of them are papers published in conference proceedings and 10% of them are books or book chapters. The overall repartition among document categories are presented in the pie chart of Figure 1.

As shown in Table 1, over the evaluation period 2017-2022, Team 1's members have published 395 articles in international journals or conference proceedings. Publications reflect collaborative works with an average of 3.6 authors per publication. 31% of publications involve PhD students and 18% of publications are joint with members of the "Algorithms and Combinatorial Optimization" and the "Data Science' teams. Figure 2 shows the production for each year of the evaluation period.

Our team's publications primarily appear in highly selective conferences and journals, which attests to the solid theoretical and methodological foundations of our work. Being a multidisciplinary team, the preferred publication media of our members are diversified, nevertheless

n. of publications (journals and conferences proceedings)	average number of authors per publications	number of papers involving PhD students	Number of papers involving at least two teams
395	3.5	117	67

Table 1: Some values about Team 1's scientific production over the evaluation period 2017-2022.

we can make some generalizations (See Figures 3 and 4 for an example of most targeted publication venues):

- Our studies related to artificial intelligence are often published in leading AI conferences, such as IJCAI, AAMAS, AAAI or ICML (we have a total of 39 publications in these four conferences ranked A^* by CORE) or in prestigious international journals such as AI, JAIR, JAAMAS (we have 15 publications in these three journals ranked respectively A^*, A and A by CORE).
- Our studies related to algorithmics and operations research, if not published in the above mentioned media, are published in distinguished specialized journals in this domain. As an example, we can mention Algorithmica (A^*, CORE), Operations Research (A^*, CORE), EJOR (A, CORE), Theoretic. Comp. Sc. (A, CORE) where we have 13 articles. AOR, DAM, EJDP are also very appreciated journals in our field in which we often publish (for instance we have 9 articles in these three journals). We also have several publications on specialised conferences, such as ADT (7 articles).
- Our colleagues in economics prefer international journals, esteemed in their field. We have 13 articles in SCW (category 1 by CNRS section 37), 4 articles in Games and Economic Behavior (category 1 by CNRS section 37), 2 in Journal of Economic theory (category 1 by CNRS section 37), 4 in MSS (category 2 by CNRS section 37), 3 in International Journal of Game Theory (category 2 by CNRS section 37), etc. The conference Economics and Computation (EC) is an exception, being very selective conference on economics, which is rare in this domain. We have 5 articles in this conference classed A^* by CORE.
- Our colleagues outside computer science have specific support, such as well-known international journals, among others Biological Conservation (4 articles), History and Philosophy of the Life Sciences (2 articles) or Applied Network Science (3 articles).

Our international co-authors are from more than 35 different countries, from which Australia (University of South Wales), Belgium (Université de Mons, UCLouvain, Ghent University), England (Oxford University, University of Liverpool, Univ. College of London), Holland (University of Amsterdam), Germany (Technische Universität Munchen, Heinrich Heine Uni. Düsseldorf), Italy (Politecnico di Milano, University of Salento), Ireland (Cork University), Luxembourg (University of Luxembourg), Polond (University of Gdańsk) and Turkey (Bilgi University) are the ones with whom we work most often. Even if most of our internatioanl co-authors are in Europe, we also have several collaborations outside Europe. We can mention for example the United States (University of Rochester, University of Missouri), Japan (The University of Tokyo, University of Fukuoka), India (Dibrugarh University, University of Hyderabad), Canada (Royal Military College of Canada) or Taiwan (National Taiwan Normal University, National Dong Hwa University).
46% (respectively 22%) of the publications in journals (respectively in conference) are in common with at least one other researcher working in a foreign laboratory. 33% (respectively 35%) of articles in journals (respectively in conferences) are joint with at least one colleague from another research center in France.

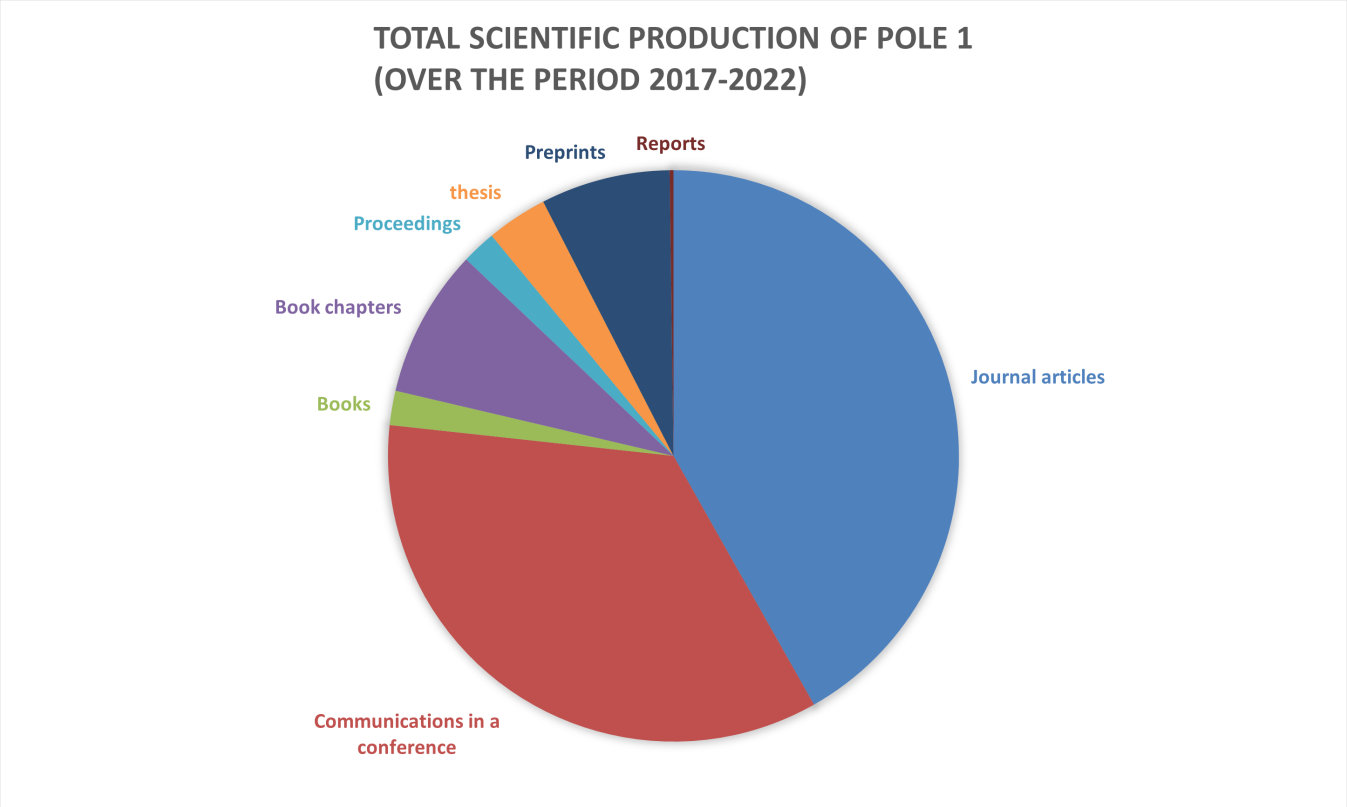

Figure 1: Overall scientific production of Decision Aiding Team during the evaluation period (HAL collection LAMSADE-DAUPHINE).

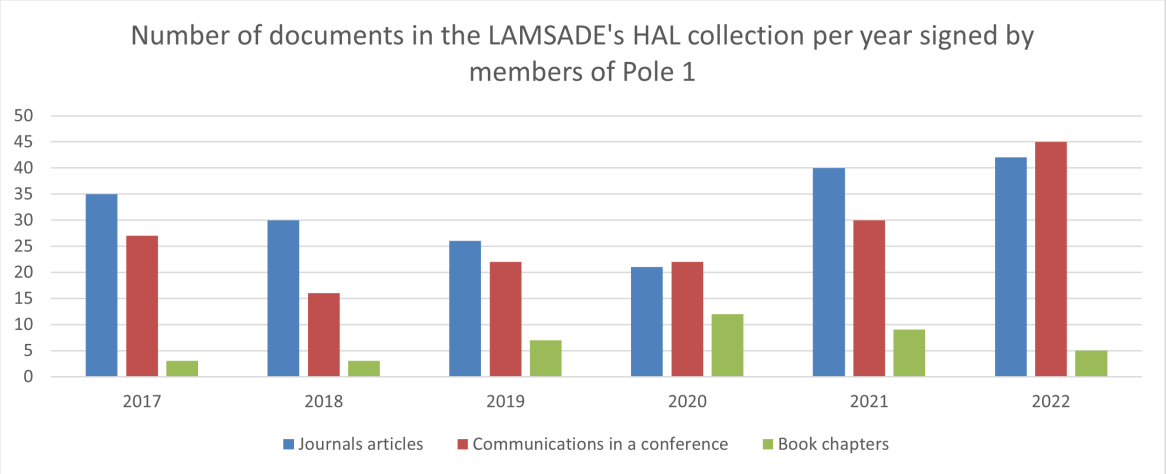

Figure 2: Scientific production of Decision Aiding Team during the evaluation period.

Standard 2. Scientific production is proportional to the research potential of the unit and shared out between its personnel.

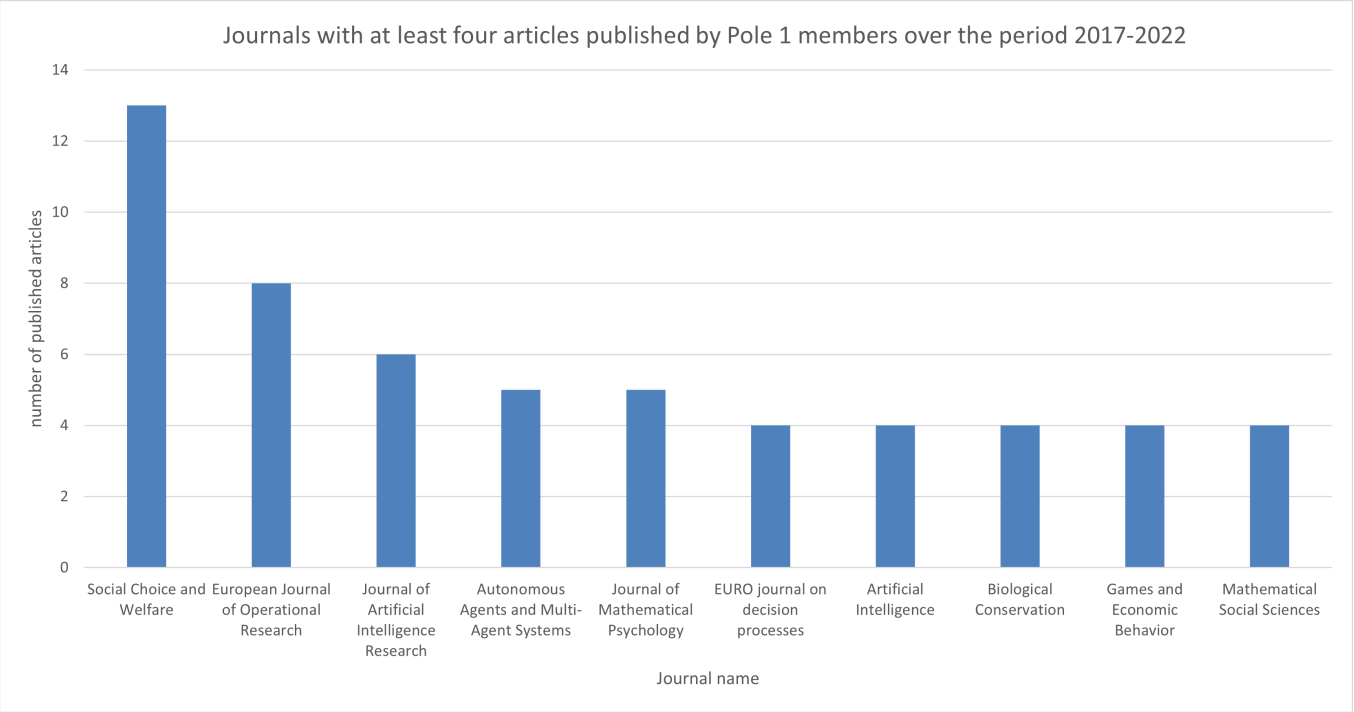

Figure 3: Journals with at least 4 articles published by members of Decision Aiding Team.

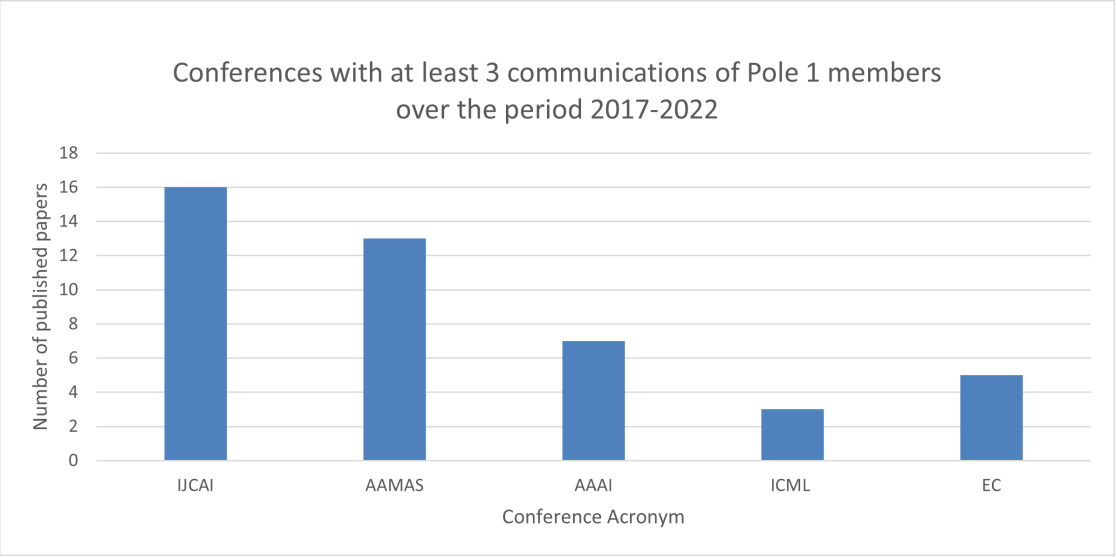

Figure 4: Conferences proceedings with at least 4 papers published by members of Team 1.

The scientific production is proportional to the research potential of the team

As already mentioned, there are more than 435 documents (of which 395 articles on journals or international conferences with selection) indexed in HAL, which means that in average each member has published 18,91 articles (of which 17,17 are in journals or international conferences with selection) during the evaluation period. It results to 3,15 articles (of which 2,86 on journals or international conferences with selection) per member per year.

Doctoral and post-doctoral students actively participate in scientific production

117 of publications of our team involve the participation of at least one PhD student (31% of

publications of our publications). As we already mentioned the majority of PhD thesis are co-supervised by at least two colleagues, this allows our doctoral students to have enriching supervision with different points of view, sometimes multidisciplinary.

Actions to support young researchers

General comments are available on the global document of our laboratory. However, we provide some concrete examples from our team on this subject.

Dauphine and Lamsade offer a favorable environment for hosting researchers and assistant professors. New assistant professors benefit from a significant reduction in their teaching load during their first three years (half of their regular workload in the first year, and one-third in the following two years). There are also opportunities for researchers through PSL. Our new CR CNRS has secured substantial funding to recruit a postdoc and finance visits abroad. We also encourage our new colleagues to submit proposals to calls for projects such as those from CNRS or ANR. Our new assistant professor has been awarded a project from CNRS. Additionally, at Lamsade, we have a specific funding for young researchers who are encouraged to co-supervise theses with more experienced colleagues. This is exemplified by our two young colleagues, H. Gilbert and D. Peters who co-advise new PhD students.

Actions to support researchers who return to research?

General comments are available on the global document of our laboratory. However, we provide a concrete example from our team on this subject.

At Dauphine, there are possibilities for CRCT (reduction of teaching activities) leave to resume research activities or to change research subjects. During the evaluation period, we had a colleague who took advantage of CRCT leave upon her return from maternity leave.

Standard 3. The scientific production of the unit respects the principles of scientific integrity, ethics and open science. It complies with the applicable guidelines in this field.

General comments are available on the global document of our laboratory. However, we mention that a DR CNRS colleague of our team is a member of the Ethics Committee of Paris-Dauphine from 2022.

Evaluation area 4. Contribution of Research Activities to Society

Standard 1. The unit stands out by the quality and quantity of its non-academic interactions.

Relations and partnership relations with the economic, social and health worlds

We have several contacts with the economic, social and health world. For example, we can mention our collaborations with industries, semi-public companies, public institutions, and small organizations such as startups or NGOs. These contacts are realized in different ways, of course, through CIFRE theses (which will be detailed later), but also through funded projects or through expertise provided by our members. For instance, we provide expertise to the Ministry of Defense, the Ministry of Environment, UNFCCC, UNDRR, SNCF, Edf RetD, ANSES, Santé Public France, EdF CEA, Alten SA, and Vinci Energies. We have joint projects with healthcare actors such as the Italian National Cancer Institute or the French National Authority for Health

(HAS) as well as with ONGs such as Prison Insider.

Platforms developed or shared or used by the external actors

Lamsade is one of the founder of Decision Deck platform (click for the web page) which collaboratively develops Open Source software tools to support the Multi-Criteria Decision Aiding (MCDA) process by developing multiple software resources that are able to interact. Its purpose is to provide effective tools for consultants, students and teachers. Two of our members are active members of the project, they are also in the board of Decision Deck. As it will be explained in Section 4 (Trajectory), actually, the development of platform needs crucially a research engineer in order to concretize its currents projects.

Societal and technological issues and the impact of the team

The global changes we are experiencing (e.g. climate change, urban concentrations, migrations, etc.) induce the emergence of many challenges: (i) accompanying the energy transition, (ii) preventing major and emerging risks and disasters, (iii) contributing to the estenability, sustainability and resilience of territories and complex socio-technical systems, (iv) contributing to inclusive, participatory and deliberative governance. Our team contributes, through its research, to the development of concepts, theories, methodologies and tools to support actors and stakeholders in meeting these challenges. Our research contributes to the transparency and accountability of expertise and decisions by combining embedded research in mathematics, computer science, management and more broadly by mixing engineering sciences and human and social sciences. Within this framework, our team remains faithful to the conception of the research model set up by its founder Bernard Roy (1974), by contributing to a research embedded in the problems of society and current affairs in order to: (i) percolate research developments into the practice of the economic and decision-making world and (ii) identify new fundamental research themes. We are facing new challenges: (1) to maintain our involvement in expert assessments and decision-making processes, (2) to make our findings accessible and to work towards pedagogy with actors and stakeholders, (3) to contribute to citizen science.

Hosting Ph.D. students whose research is funded by non-academic partners
During the evaluation period, there were 11 CIFRE theses and 2 theses financed by industries. Our partners are: AFPCNT, Alten SA, Caisse des Depots Groupe, Naval Group Research, NOKIA, Prison Insider NGO, VINCI Energies. As we already mentioned the average duration of CIFRE thesis is 40,6 month.

Standard 2. The unit develops products for the cultural, economic and social world

Some of our researchers are actively engaged in the development of practical guides and methodologies to support decision-making and risk management in a range of contexts. For instance, to accompany the National Plan for the Management of Radioactive Materials and Wastes (PNGMDR) or to accompany the development of a methodology for prioritizing biological and chemical hazards in foodstuffs (for Anses) or to assess the risks associated with establishing a monitoring program for waters intended for human consumption.

Some of our members are involved in knowledge transfer actions. For example Rida Laraki is one of the founder of the association “Mieux Voter” (click for the web page), which promotes the use of the majority judgment method, a social choice rule developped by Rida and his co-authors. The purpose of the association is to show individuals the benefits and practical

applications of this method in various contexts. Most notably, the majority judgment was implemented in recent elections for left-wing primaries (les primaires de gauche) and for the distribution of the participatory budget in Paris. Currently, we have not filed any patent applications or created a startup.

Standard 3. The team shares its knowledge with the general public and takes part in debates in society

A diverse range of members, including PhD students and professors, share their knowledge with the broader public. They accomplish this through various means, such as participating in media appearances and forums, contributing to popularization platforms, and engaging in outreach efforts through academic societies such as ROADEF.

As it is presented in the "portfolio" of LAMSADE, Théo Delemazure, a PhD student, made a very nice vulgarisation contribution to the field of Artificial Intelligence with his development of the "de gauche ou de droite" platform (click for the web page). Utilizing reinforcement-based machine learning search techniques the platform has become very popular. It is enhanced with simple explanations on Artificial Intelligence techniques, and statistical analysis. Several million searches have been performed on the site and the official application is available on the Android play store. Théo has appeared on different medias such as Quotidien (TV show). Several media (including RTL, France 2, France 5, Europe, etc.) have talked about the platform. On a different subject, Théo published an article in the Political Newsletter of Liberation and on www.causette.fr (click for the web page) about the speaking time of our deputies, a study based on statistics (male deputies would speak 40% more than female ones).

As it is presented in the "portfolio" of our team, Juliette Rouchier has created a game called "PollutionSolutions" and used it with middle school students (please see our portfolio for more details, (please click here for an interview)).

Tristan Cazenave, a prominent figure in the field of AI, has contributed his expertise to a wide range of media outlets, including newspapers like Le Monde and Le Figaro, radio stations such as France Info and France Inter, TV networks such as BFMTV, and specialized journals like New Scientist and the CNRS journal. Through his over twenty interventions, Cazenave has shared insights on both general aspects of AI and its specific applications in board games.

Myriam Merad is a well-known expert in the field of industrial risk prevention and governance, lending her insights to various media outlets. She has made appearances on TV channels like France 5, as well as on radio programs such as France Culture and RFI.

The Prison Life Index has been promoted in various media channels. Among other journal articles or youtube videos (Dalloz, Le progrès, Le Poste, Media Cité,), see for instance an article in the journal "Le Monde" (click for the article) or this intervention on France3 tv channel: (click for the video).

In addition, our team includes members who actively promote OR and AD by serving on boards of scientific societies and participating in forums. They have taken various initiatives, such as creating an OR/AD master thesis prize, organizing a national competition for the best industrial project in OR/AD, publishing the Roadef newsletter or being on the editorial board of Interstices (online journal of INRIA) or International newsletter of MCDM (International Society on Multiple Criteria Decision Making). We also have colleagues who visit high schools as part of the Declic program to engage with students and inform them about our work as researchers.

4 TRAJECTORY: DECISION AIDING TEAM

We are a world-renowned Decision Aiding team known for our strong scientific output and our active role in establishing new communities (such as Algorithmic Decision Theory and Computational Social Choice), as well as our participation in editorial boards and program committees for journals and conferences. Our expertise in various and complementary decision making domains (including multicriteria decision making, social choice, decision under uncertainty, and interactive decision-making), and our multidisciplinary approach make us a unique presence in the international arena. With these advantages, we are poised to tackle new scientific challenges and address pressing social and economic issues.

Today's problems are getting more and more complex. Our team is well-equipped to face this challenge and we aim to be a leading actor to guide research directions in complex contexts. We believe that we cover important points which are mandatory to resolve a complex problem. For instance, the resolution of such problems requires:

- a clear definition and modeling of the problem (many of our projects focus on this);
- a multidisciplinary approach;
- an expertise in different technical domains, including multicriteria decision-making, group decision making, and uncertainty handling (in most real-world applications, a combination of all of these elements is required);
- a deep understanding of the methods used (especially on axiomatization, computational complexity, robustness, and explicability of results).

All of these elements are our strengths, but some of them require careful attention, such as maintaining our multidisciplinarity and a balance between applied vs. fundamental research. The segmentation between disciplines in France (both for research and teaching) poses a challenge to multidisciplinary work, making it difficult for us to recruit academics and researchers outside of computer science, with the CNRS being the only source for such recruitment. Funding calls for projects are increasingly focused on obtaining specific results within the project period, which can discourage colleagues from pursuing more groundbreaking or innovative research.

We have identified some points for future improvement, we mention in the following some of them:

- We aim to prioritize methods that are specifically designed for large-scale applications. However, the private sector is becoming increasingly attractive for researchers in this field, making it more challenging for public research to hire.
- The management of uncertainty is a critical topic in Decision Aiding, with several research domains linked to this theme. For example, topics such as search, robustness, and decision under uncertainty (in the sense given by economists) are all relevant to this field. While we currently cover the first two topics, we lack specialists in the third one. We hope to remedy this shortcoming in the future.
- We believe that many problems require more than cross-fertilization between techniques related to the Decision Support domain as we are actually doing. In this regard, we are committed to enhancing the mixed use of interpretable models, which are one of our core strengths, with machine learning techniques, including those that may be "black boxes", such as deep learning.

- We are convinced that it is important to develop user-friendly software to facilitate the diffusion of our methods. Unfortunately, currently we are lacking a qualified personnel, such as a research engineer, to help us.

Our six projects are well established and functioning effectively, hence we plan to maintain the current organizational structure of these projects in the coming years. However, as our projects mature, we anticipate some changes and evolution on them over time. Moreover, we have made the decision to embark on a new project, named "Decision Aiding and Optimization under Uncertainty" in collaboration with "Algorithms, Combinatorial Optimisation" Team. This joint effort will enable us to showcase our expertise in managing uncertainty, while also fostering a fresh dynamic between our two teams, which share a common tradition of working on this theme.
The following paragraphs outline the specific developments we aim to implement in each project. Please note that we conclude this section with some projects which have been accepted for the coming years or which have been submitted.

Preference Handling for Multicriteria Decision Aiding[2]

The subject of "preference modeling and preference aggregation" is one of the cornerstones of LAMSADE and is the focus of our project as we aim to advance it in response to new technical and socio-economic developments. Our efforts have established a European school of decision aiding that is distinguishable by its "constructivist" philosophy and its models that account for complex preferences (such as incomparability, violation of transitivity or representation of contradictory information). Our team has continued to work on this theme since the 1980s, updating it to address current issues and challenges. We have led multiple international decision-aiding projects with researchers from various countries, including the active EURO working group on Multiple Criteria Decision Aiding (EWG-MCDA) (click for the web page), ADT conference series (Algorithmic Decision Theory click for the web page) and DA2PL workshop series (From Multiple Criteria Decision Aid to Preference Learning, click for the web page).
Initially, the work of our team was centered on the philosophy of Decision Aiding and method design, leading to the establishment of the EWG-MCDA. We then expanded our focus to include the algorithmic aspects (resulting in the creation of the ADT conference series). Over the past decade, the preference learning and interpretation of results has become a central topic for us (resulting in the creation of DA2PL workshop series).
In the coming years, our team will continue to advance the development of sophisticated multicriteria aggregation methods and perform their mathematical analysis. We will also aim to incorporate new features such as more uncertainty handling and the ability to process large amounts of data. Our research draws from both computer science and economics and operates within a multidisciplinary framework.
The mathematical properties satisfied by the aggregation methods, as determined through the axiomatization, provide a deep understanding of the methods. This distinguishes our approach from other machine learning techniques, such as deep learning. The thorough understanding of the model used in our approach is crucial in guiding the learning of preferences and enhancing the interpretability of results. Our work on explicable results and preference aggregation aligns with the objectives of two other projects within our laboratory: "Social Choice and Game Theory" and "MILES". In the medium term, we plan to develop hybrid approaches to address decision problems in fields such as health and law, which involve large amounts of data and demand interpretable results. These hybrid approaches will combine our interpretable models with black boxes commonly used in machine learning.
Multicriteria Decision Aiding is a research area which is strongly linked to practical applications. Since its establishment, LAMSADE has been involved in a number of real-world applications.

[2]Preference Modelling and Multicriteria Decision Making (MCDM)

In the future, we will focus on two particularly promising application domains: the development of composite indicators, which will enable us to tackle societal issues such as the environment and the health, and recommendation systems, which are becoming increasingly prevalent in our society. These two application domains are complementary, with the first often requiring input from human decision-makers or experts and the second relying on automatically generated, often noisy and voluminous, data. These differences also influence the approaches we develop. Our work on composite indicators, which are commonly used to evaluate and manage public policies, concerns also the "Policy Analytics" project.
We have a goal to develop software that can be easily accessible to students, as well as potential users in industry and politics. Currently, we have received multiple requests for such software. However, we face a challenge in updating our ELECTRE family software as we lack a research engineer with the required qualifications. We are part of the Decision Deck project (http://www.decision-deck.org/project/), a consortium aimed at providing open-source Decision Support software. Despite being a part of this project, we still face difficulties in making our software user-friendly, which is crucial for wider dissemination. This is due to the shortage of qualified personnel and resources.

Search[3]

We plan to improve planning for autonomous vehicles with other constraints than way points. We also plan to investigate the use of recent neural networks architectures such as Transformers and Variational Auto-Encoders for difficult problems. Monte Carlo Search is a general algorithm that has many applications. We aim at improving Monte Carlo Search for combinatorial optimization problems and to apply it to other problems. We will also address the parallelization of the algorithm on GPU. We have already published an efficient algorithm to batch the inference of the neural network in MCTS.We will use GPU to perform many simulations in parallel for algorithms such as Nested Monte Carlo Search and GNRPA. The Descent framework has excellent results in games, we will apply the ideas of Descent to various other domains such as molecule design and planning for drones. We also plan to adapt Descent to other kind of games such as Stochastic games. Besides game, the Alpha Zero approach has many applications. We brought improvements to Alpha Zero. We now aim at adapting it to other domains than games such as music recommendation or algorithm design.

Social Choice and Game Theory: axioms and algorithms (joint project with "Algorithms, Combinatorial Optimisation" Team)

From its launch in 2016, most of the scientific collaborations among members of this project aim to promote the cross-fertilization of research paradigms from the two main axes of algorithmic game theory and (computational) social choice. Seminars, workshops and informal meetings are fostered by project's members to enhance the emergence of promising research directions on problems arising from current societal challenges.
In this respect, the project remains focused on some of the original research lines, including: the design of voting mechanisms and the analysis of their computational hardness; the modelling of strategic aspects of voting and argumentation theory; the study of mechanisms for fair division of divisible and indivisible public resources; the computation of solutions for cooperative and non-cooperative games and the analysis of efficient equilibria; the theory of argumentation and the problem of judgement aggregation.
A recently identified research avenue is related to the topic of *social rankings* [28, 29], at the core of the running ANR project THEMIS, that has been developed during the last two or three years by some project's members at the crossing areas of algorithmic game theory, axiomatic analysis of power indices and voting theory.

[3]Old name: Intelligent Agents for Decision and Reasoning

Another novel research direction, revolves around the models of interactive democracy in practice, including (but not limited to): liquid democracy [44], participative budgeting [45], CO2 emissions regulation [46] and preference elicitation in a multi-agent setting [47]. This research direction is linked to the contribution of new project's members who joined the laboratory (and the project) during the last two years: Angelo Fanelli (CR CNRS), Hugo Gilbert (MdC), Dominik Peters (CR CNRS) and Paolo Viappiani (CR CNRS).
The high-quality achievements in terms of publications records and other research and dissemination activities within the research domains of this project, fully justify its sustainability under the current organisation and strongly advocates in favour of its transversal structure.

Policy Analytics: Decision-aiding for innovative conception and evaluation of public policy in context of uncertainty (joint project with "Data Science" Team)[4]

Thematic evolution:
The project will not change its main topic and still promote the issues linked to decision-aiding based on science for public policy. However, the focus will change and be more specifically focused on uncertainties and the evolution of knowledge. We experience series of crisis, linked to social, economics, culture and environmental quick changes and thus need tools to sustain complex and multi-dimensional decision-aiding that can integrate different types of knowledge. The organization of technical democracy is a complex issue, in the sense that resolving problems with high uncertainty necessitate the confrontation of multiple points of view (actors) and the integration of knowledge in already established rules and laws. Some open questions we wish to deal with:

- How to carry on with decision-aiding, risk regulation, uncertainty, ambiguity in a situation of emergency and crisis
- How should deliberation and participation be organized in diverse contexts of decision-aiding and what are the implications for legitimacy?
- Ethical and responsibility issues about the decisions and regulation mechanisms, but also about data collection, management and analysis.
- How to communicate about uncertainty in open situation mixing multiple stakeholders? Interventions in action-research will concern: Security and safety: links between health and environment
- Energetic transition in the perspective of climate change
- Food systems and the energetic transition
- Study of grass root emerging social innovation for coordination.

The questions dealing about organizations are clearly based on the ability to make special spaces for concerned public, administrations, private or public institutions and researchers to meet. Team 1 and 3 are good at collecting data and treating them in the context of governance issues; the abilities in decision aiding should also enable to envisage new approaches for evaluation of public policy; and there are already clear abilities to instantiate interaction protocols for collaborative work. In the future, we have resources that come from ANR projects of 3 years, from a star. Our French collaborations will be more clearly specialists of questions of uncertainty as we will be dealing with pollution issues or the prevention of accidental crisis – either with BRGM or IRSN. Participation to ethical comity of a participant will allow to follow closely the evolutions of the rules for leading open science in context of political tension. Within

[4] Old name Policy Analytics

the lab, the team is very well integrated.

As all projects we have some strengths and threats. Our strengths are: double ability to develop normative and positive approaches as well as science-society applications ; modelling abilities in quantitative and qualitative dimensions Weaknesses: small number of active participants, not a large audience in LAMSADE, which is certainly due to the difficult interdisciplinarity with social sciences. We also see some threats: reduction in the team (Yves Meinard is leaving) so the biodiversity applications will not be pursued.

Combinatorial Multiobjectif Optimisation (joint project with "Algorithms, Combinatorial Optimisation" Team)

This project will be presented by "Algorithms, Combinatorial Optimisation" Team.

Machine Intelligence and Learning Systems-MILES (joint project with "Data Science" Team)

This project will be presented by "Data Science" Team.

New project: Decision Aiding and Optimization under Uncertainty (joint project with "Algorithms, Combinatorial Optimisation Team")

For the next term, we decided to open a new research project shared by "Decision Aiding" Team and "Algorithms, Combinatorial Optimisation" Team. Its aim is to provide solutions to decision aiding and optimization challenges resulting from real world applications, based on operational research tools for problem modeling and efficient resolution (e.g. Mathematical programming, graph theory, (Meta)-heuristics, approximation, etc.). The targeted applications are numerous (network, transportation, safety, ecological transition), and are characterized by an uncertain context (unforseen events, failures, attacks, climate change, imperfect information, etc). Depending on the source of uncertainty, the proposed solutions should be robust, adaptative, or resilient.
The revelevance of the creation of this project originates from the impact of being able to propose appropriate methods for handling uncertainty, and the efforts that researchers from the two teams have already devoted, and will continue to dedicate to this important topic.

New financed or submitted projects for coming years

We have several projects lined up to begin in 2023:

- Coordinator of Project PEPR AIDHY (2023-2026) (PEPR Hydrogène décarboné), (click for the web-page): the project involves 14 partners with an investment of 6.6 million euros. This funding aims to support the national strategy on hydrogen by promoting low-carbon hydrogen production.

- Co-coordinator of the "SHS" (2023 – 2030) (Sciences Humain et Sociale) axe of the projet PEPR IRIMA, (click for the web page): It project is on risk management: hydroclimatic, telluric, technological, and sanitary. It aims is to accelerate the transition to a society capable of dealing with a whole range of threats, by being more resilient, more flexible and more flexible.

- Coordinator of CO2ERASE , project funded by CNRS-INSI as "support for a strategic project": The title of the project explains well its aim: "Personal CarbON trading and carbOn tax for Emission Reduction in A reSEarch laboratory", project accepted, to be founded in 2023.

A European project that we are involved in as a partner was submitted in late 2022:

- Partner of ERC Synergy ”Grant Platforms and Principles for Digital Democracy” (applied on the 8th of november 2022): The aim of the project is the creation of alternative forms of civic participation to advance the theory and practice of societal decision making. The partners are: Umberto Grandi (Toulouse, coordinator), Cesar Hidalgo (Toulouse), Ulle Endriss (Amsterdam) and Jérôme Lang (LAMSADE).

5 BIBLIOGRAPHY: DECISION AIDING TEAM

[1] Alberto Colorni and Alexis Tsoukiàs. What Is a Decision Problem? Designing Alternatives. In *Preference Disaggregation in Multiple Criteria Decision Analysis*, pages 1–15. May 2018.

[2] Alberto Colorni and Alexis Tsoukiàs. Rating or sorting: Terminology matters. *Journal of Multi-Criteria Decision Analysis*, 28(3-4):131–133, May 2021.

[3] Ouahiba Bessouf, Abdelkader Khelladi, Meltem Öztürk, and Alexis Tsoukiàs. Bi-oriented Graphs and Four Valued Logic for preference modelling. *Annals of Operations Research*, 2022.

[4] Denis Bouyssou and Marc Pirlot. Unit representation of semiorders I: Countable sets. *Journal of Mathematical Psychology*, page 102566, 2021.

[5] Denis Bouyssou and Jean-Paul Doignon. Chain Representations of Nested Families of Biorders. In *Mathematical Topics on Representations of Ordered Structures and Utility Theory*, pages 143–169. January 2020.

[6] Olivier Cailloux and Yves Meinard. A formal framework for deliberated judgment. *Theory and Decision*, 88(2), 2019.

[7] Yves Meinard and Olivier Cailloux. Deliberation in Valuation and Decision Making: A Conceptual Clarification. *Œconomia - History/Methodology/Philosophy*, 2021.

[8] Denis Bouyssou and Marchant Thierry. The β -ranking and the β -measure for directed networks: Axiomatic characterizations. *Social Networks*, 52:145–153, 2018.

[9] Brice Mayag and Denis Bouyssou. Necessary and possible interaction between criteria in a 2-additive Choquet integral model. *European Journal of Operational Research*, October 2019.

[10] Ons Nefla, Meltem Öztürk, Paolo Viappiani, and Imène Brigui-Chtioui. Interactive Elicitation of a Majority Rule Sorting Model with Maximum Margin Optimization. In *ADT 2019 - 6th International Conference on Algorithmic Decision Theory*, Durham, NC, United States, October 2019.

[11] Paul Alain Kaldjob Kaldjob, Brice Mayag, and Denis Bouyssou. Study of the Instability of the Sign of the Nonadditivity Index in a Choquet Integral Model. In *Information Processing and Management of Uncertainty in Knowledge-Based Systems*, volume 1602 of *Communications in Computer and Information Science*, pages 197–209. Springer International Publishing, July 2022.

[12] Beatrice Napolitano, Olivier Cailloux, and Paolo Viappiani. Simultaneous Elicitation of Scoring Rule and Agent Preferences for Robust Winner Determination. In *Algorithmic Decision Theory (ADT 2021)*, volume 13023 of *Lecture Notes in Computer Science*, pages 51–67, Toulouse, France, November 2021. Springer.

[13] Lola Martin-Moro, Meltem Öztürk, and Florence Laufer. Modelling the Prison Life Index with Value Focused Thinking Methodology. working paper or preprint, November 2022.

[14] Tristan Cazenave. Improved Policy Networks for Computer Go. In *15th International Conferences (ACG 2017)*, pages 90–100, Leiden, Netherlands, July 2017. LNCS n°10664.

[15] Tristan Cazenave. Residual Networks for Computer Go. *IEEE Transactions on Games*, 10(1), 2018.

[16] Tristan Cazenave, Yen-Chi Chen, Guan-Wei Chen, Shi-Yu Chen, Xian-Dong Chiu, Julien Dehos, Maria Elsa, Qucheng Gong, Hengyuan Hu, Vasil Khalidov, Cheng-Ling Li, Hsin-I Lin, Yu-Jin Lin, Xavier Martinet, Vegard Mella, Jeremy Rapin, Baptiste Roziere, Gabriel Synnaeve, Fabien Teytaud, Olivier Teytaud, Shi-Cheng Ye, Yi-Jun Ye, Shi-Jim Yen, and Sergey Zagoruyko. Polygames: Improved Zero Learning. *International Computer Games Association Journal*, 42(4):244–256, 2020.

[17] Tristan Cazenave. Improving Model and Search for Computer Go. In *2021 IEEE Conference on Games (CoG)*, pages 1–8, Copenhagen, Denmark, August 2021. IEEE.

[18] Tristan Cazenave. Mobile Networks for Computer Go. *IEEE Transactions on Games*, 14(1):76–84, March 2022.

[19] Kevin Osanlou, Jeremy Frank, Andrei Bursuc, Tristan Cazenave, Eric Jacopin, Christophe Guettier, and J. Benton. Solving Disjunctive Temporal Networks with Uncertainty under Restricted Time-Based Controllability Using Tree Search and Graph Neural Networks. In *AAAI 2022*, volume 36, pages 9877–9885, Virtual conference, United States, February 2022.

[20] Tristan Cazenave. Generalized Nested Rollout Policy Adaptation. In *Monte Carlo Search. MCS 2020.*, volume 1379 of *Communications in Computer and Information Science*, pages 71–83, Online, France, January 2021. Springer International Publishing.

[21] Tristan Cazenave, Jean-Yves Lucas, Thomas Triboulet, and Hyoseok Kim. Policy adaptation for vehicle routing. *AI Communications*, 34(1):21–35, February 2021.

[22] Chen Dang, Cristina Bazgan, Tristan Cazenave, Morgan Chopin, and Pierre-Henri Wuillemin. Monte Carlo Search Algorithms for Network Traffic Engineering. In *ECML-PKDD 2021*, volume 12978 of *Lecture Notes in Computer Science*, pages 486–501, Bilbao, Spain, September 2021. Springer.

[23] Tristan Cazenave and Thomas Fournier. Monte Carlo Inverse Folding. In *Monte Carlo Search 2020, IJCAI Workshop,*, Yokohama (virtual), Japan, 2020.

[24] Milo Roucairol and Tristan Cazenave. Refutation of Spectral Graph Theory Conjectures with Monte Carlo Search. In *COCOON 2022*, volume 13595 of *Lecture Notes in Computer Science*, pages 162–176, Shenzhen (virtual), China, October 2022. Springer International Publishing.

[25] Vittorio Bilò, Laurent Gourvès, and Jérôme Monnot. Project Games. In *Algorithms and Complexity - 11th International Conference,* {*CIAC*}, Rome, Italy, May 2019. Springer.

[26] Bruno Escoffier, Laurent Gourvès, and Jérôme Monnot. The Price of Optimum: Complexity and Approximation for a Matching Game. *Algorithmica*, 77(3):836–866, February 2017.

[27] Stéphane Airiau, Haris Aziz, Ioannis Caragiannis, Justin Kruger, Jérôme Lang, and Dominik Peters. Portioning Using Ordinal Preferences: Fairness and Efficiency. In *Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence, IJCAI 2019*, Macao, China, August 2019.

[28] Adrian Haret, Hossein Khani, Stefano Moretti, and Meltem Ozturk. Ceteris Paribus Majority for social ranking. In *27th International Joint Conference on Artificial Intelligence (IJCAI-ECAI-18)*, pages 303–309, Stockholm, Sweden, July 2018.

[29] Giulia Bernardi, Roberto Lucchetti, and Stefano Moretti. Ranking objects from a preference relation over their subsets. *Social Choice and Welfare*, 52(4):589–606, 2019.

[30] Michel Balinski and Rida Laraki. Majority judgment vs. majority rule. *Social Choice and Welfare*, 54(2-3):429–461, March 2020.

[31] Jérôme Lang. Collective Decision Making under Incomplete Knowledge: Possible and Necessary Solutions. In *Twenty-Ninth International Joint Conference on Artificial Intelligence and Seventeenth Pacific Rim International Conference on Artificial Intelligence {IJCAI-PRICAI-20}*, pages 4885–4891, Yokohama, France, July 2020. International Joint Conferences on Artificial Intelligence Organization.

[32] Beatrice Napolitano, Olivier Cailloux, and Paolo Viappiani. Simultaneous Elicitation of Committee and Voters' Preferences. In Maxime Lefrançois, MINES Saint-Étienne, and France, editors, *Rencontres des Jeunes Chercheurs en Intelligence Artificielle 2019*, Actes des Rencontres des Jeunes Chercheurs en Intelligence Artificielle 2019, pages 59–62, Toulouse, France, July 2019. Co-localisées avec la Plate-Forme Intelligence Artificielle (PFIA 2019).

[33] Edmond Awad, Martin Caminada, Gabriella Pigozzi, Mikolaj Podlaszewski, and Iyad Rahwan. Pareto optimality and strategy-proofness in group argument evaluation. *Journal of logic and computation*, 2017.

[34] Gabriella Pigozzi and Leon van Der Torre. Multiagent deontic logic and its challenges from a normative systems perspective. In *Handbook of Normative Multiagent Systems*, pages 251–304. 2018.

[35] Pierre Cardi, Laurent Gourvès, and Julien Lesca. On Fair and Efficient Solutions for Budget Apportionment. In *AAMAS 2022 (International Conference on Autonomous Agents and Multiagent Systems)*, Auckland, New Zealand, May 2022.

[36] Yves Meinard, Olivier Barreteau, Christophe Boschet, Katherine Daniell, Nils Ferrand, Sabine Girard, Joseph Guillaume, Emeline Hassenforder, Matthew Lord, Myriam Merad, Ehsan Nabavi, Claire Petitjean, Irene Pluchinotta, Juliette Rouchier, Alexis Tsoukias, and Pascale Zaraté. What is policy analytics? An exploration of 5 years of environmental management applications. *Environmental Management*, 67(5):886–900, May 2021.

[37] Anaï Mangos, Juliette Rouchier, and Yves Meinard. Analysing constraints to improve conservation decision-making: a theoretical framework and its application to the Northern Vosges, France. *Environmental Conservation*, 48(3):174–181, September 2021.

[38] Juliette Rouchier. Les Serious Games et l'éducation au bien commun : l'exemple du jeu PollutionSolutions. *Action publique. Recherche et pratiques*, 2018.

[39] Romain Touret, Yves Meinard, Jean-Claude Petit, and Alexis Tsoukiàs. Cartographie descriptive du système national français du financement de la recherche sur projet en vue de son évaluation. *Innovations - Revue d'économie et de management de l'innovation*, N° 59(2):205, 2019.

[40] Mazri Chabane, Katherine Daniell, and Alexis Tsoukiàs. Decision support in participatory contexts: The organisational design dimension. *International Journal of Decision Support System Technology*, 11(3):47–80, July 2019.

[41] Maude Arru, Elsa Negre, and Camille Rosenthal-Sabroux. To Alert or Not to Alert? That Is the Question. In *52nd Hawaii International Conference on System Sciences (HICSS 52)*, Proceedings of the 52nd Hawaii International Conference on System Sciences — 2019, pages 649–658, Wailea, HI, United States, January 2019.

[42] Tahar Allouche, Bruno Escoffier, Stefano Moretti, and Meltem Ozturk. Social Ranking Manipulability for the CP-Majority, Banzhaf and Lexicographic Excellence Solutions. In Christian Bessiere, editor, *Twenty-Ninth International Joint Conference on Artificial Intelligence and Seventeenth Pacific Rim International Conference on Artificial Intelligence {IJCAI-PRICAI-20}*, pages 17–23, Yokohama, Japan, January 2021. International Joint Conferences on Artificial Intelligence Organization.

[43] Satya Tamby and Daniel Vanderpooten. Enumeration of the Nondominated Set of Multiobjective Discrete Optimization Problems. *INFORMS Journal on Computing*, 33(1):72–85, 2021.

[44] Ruben Becker, Gianlorenzo D'angelo, Esmaeil Delfaraz, and Hugo Gilbert. Unveiling the Truth in Liquid Democracy with Misinformed Voters. In *Algorithmic Decision Theory*, volume 13023 of *Lecture Notes in Computer Science*, pages 132–146. Springer International Publishing, October 2021.

[45] Florian Brandl, Felix Brandt, Matthias Greger, Dominik Peters, Christian Stricker, and Warut Suksompong. Funding public projects: A case for the Nash product rule. *Journal of Mathematical Economics*, 99:102585, 2022.

[46] Stefano Moretti and Raja Trabelsi. A Double-Weighted Bankruptcy Method to Allocate CO2 Emissions Permits. *Games*, 12(4):78, 2021.

[47] Maeva Caillat, Nicolas N. Darcel, Cristina Manfredotti, and Paolo Viappiani. Bayesian Vote Elicitation for Group Recommendations. In *From Multiple Criteria Decision Aid to Preference Learning (DA2PL 2020)*, Trento, Italy, November 2020. Andrea Passerini (University of Trento) and Vincent Mousseau (Centrale Supelec).