La 86e Rencontre du Groupe de Travail européen sur le thème de l'Aide multicritère à la décision
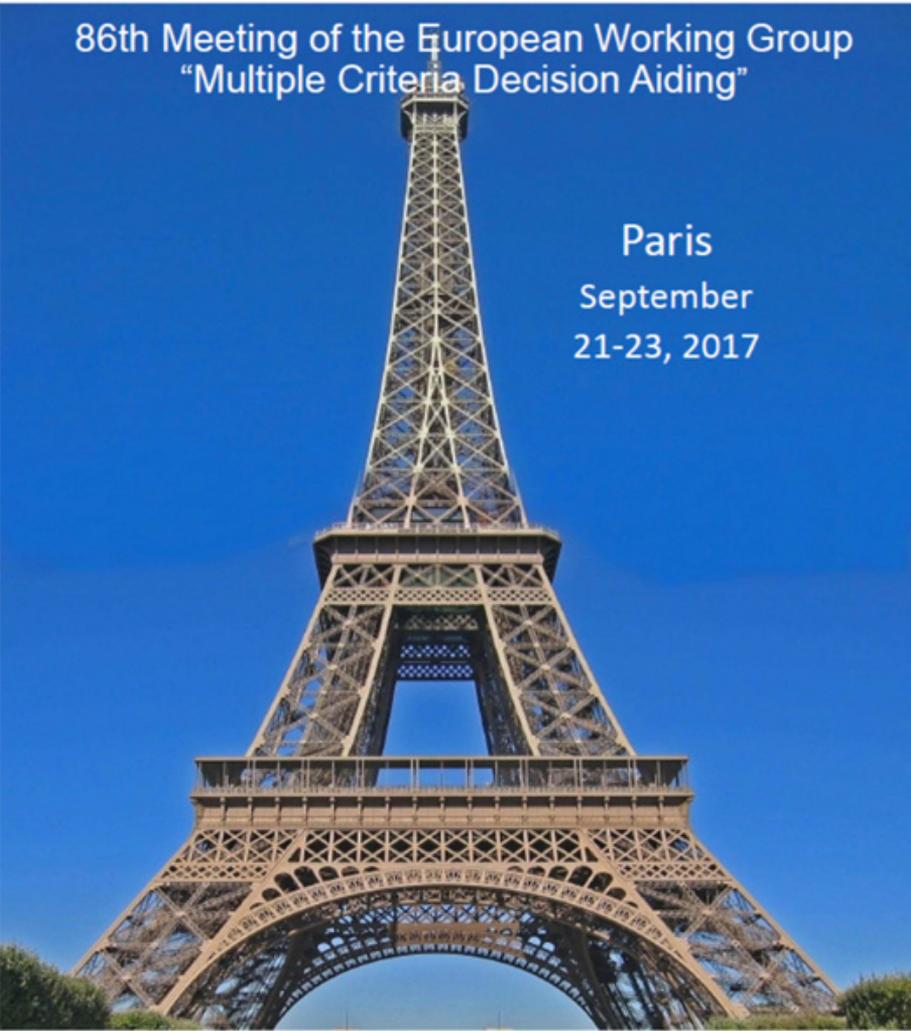
Jeudi 21 septembre 2017 / Thursday, September 21, 2017

Les présentations auront lieu à l'Académie Polonaise des Sciences (PAN). / The sessions will take place at the scientific center of the Polish Academy of Sciences.

12h00-13h15	Registration/Light lunch
13h15-13h30	Opening and welcome address

Session 1	**Theory and methodology 1**

13h30-14h00	*Vers une PAMC fondée sur les limites des classes de performances (PAMC IAMARA)* **Amin Affes, Abdelwaheb Rebai**
14h00-14h30	*ENUCUT-V, a hybrid approach to integer linear vector optimization problems* **Walter Habenicht**
14h30-15h00	*Preference Elicitation for Robust Optimization with Ordered Weighted Averages: application to assignment and shortest path problems* **Nadjet Bourdache, Patrice Perny**
15h00-15h30	*A bicriteria perspective on an L-penalty approach for solving MPECs* **Kerstin Daechert, Sauleh Siddiqui, Javier Saez-Gallego, Steven Gabriel, Juan Miguel Morales**

Papers submitted to discussion

Multicriteria clustering: an overview of the main contributions
Mohamed A. Boujelben

A formal framework for deliberated judgments
Olivier Cailloux, Yves Meinard

Forced Choice
S. Cerreia-Vioglio, F. Maccheroni, M. Marinacci, A. Rustichini

Practical and theoretical aspects of the CAT-SD method for nominal classification
Ana Sara Costa, José Rui Figueira, José Borbinha

MCDA interval based outranking approach for ordinal classification problems
Eduardo Fernández, José Rui Figueira, Jorge Navarro

Robust Ordinal Regression and Stochastic Multicriteria Acceptability Analysis for the level dependent Choquet integral
Arcidiacono S. Giuseppe, Corrente Salvatore, Greco Salvatore

Towards a Multi-Criteria Collective Aggregation-Disaggregation Methodology
Nikolaos Matsatsinis

15h30-16h00	Coffee break

Session 2	**Applications 1**

16h00-16h30   *Dynamic programming for multi-objective process design*
Eric Fraga

16h30-17h00   *Data generator for multicriteria satisfaction analysis*
Alkaios Sakellaris, Konstantina G. Miteloudi, Evangelos Grigoroudis, Nikolaos Matsatsinis

17h00-17h30   *Multi-criteria effectiveness map for evaluation of project success*
Isaak Vryzidis, Athanasios Spyridakos

Papers submitted to discussion

Landscape Services Evaluation: A Multi-Criteria Spatial Decision Support System
Maria Cerreta, Simona Panaro, Giuliano Poli

Any bias in Spatial Multicriteria Decision Aiding?
Valentina Ferretti

Measuring resilience in communities involved in flooding Osumi river, Berat, Albania, using MCDA methods of evaluations
Robert Kosova, Antonino Scarelli, Valentina Sinaj, Evgjeni Xhafaj, Irakli Prifti

An extendable web-based multicriteria group decision support system
Konstantina G. Miteloudi, Alkaios Sakellaris, Nikolaos Matsatsinis

EGov-Evaluator: A web-based decision support system for the global evaluation of e-government in Europe
Eleftherios Siskos, Dimitris Kalogeros, John Psarras, Yannis Siskos

The European Innovation Scoreboard Revisited: A Multicriteria Evaluation Perspective
M. de Vicente y Oliva, J. Manera Bassa, S. BenAmor

19h00   Banquet
Ambassade de Pologne en France / Polish embassy in France

Vendredi 22 septembre 2017 / Friday, September 22, 2017

Les présentations auront lieu à l'Université Paris Dauphine dans la salle Raymond Aron (étage 2). / the sessions will take place at Paris Dauphine University in the Raymond Aron room (2nd floor).

Session 3	**Theory and methodology 2**
9h00-9h30	*An efficient SAT formulation for learning multicriteria non-compensatory sorting models* **Khaled Belahcène, Christophe Labreuche, Nicolas Maudet, Vincent Mousseau, Wassila Ouerdane**
9h30-10h00	*Introducing Pareto Minimal Correction Subsets* **Miguel Neves, Inês Lynce, Vasco Manquinho**
10h00-10h30	*Développement d'une approche combinatoire de conception systématique d'instruments d'action collective* **Adam Baïz, Michel Nakhla**

Papers submitted to discussion

Multidimensional Attitudes in Intertemporal Choice
Veronica R. Cappelli

A note on the detection of outliers in a binary outranking relation
Yves De Smet, Jean-Philippe Hubinont, Jean Rosenfeld

Selection of a suitable MCDA method based on robustness of results and sensitivity analysis
Malik Haddad, David Sanders, Giles Twekesbury, Nils Bausch

Expressiveness and robustness measures for the evaluation of an additive value function in multiple criteria preference disaggregation methods: An experimental analysis
Miłosz Kadzinski, Mohammad Ghaderi, Jakub Wasikowski, Nùria Agell

Incorporating Strength of Preference Information in UTA methods for the robustness improvement in cases with limited alternative actions
Athanasios Spyridakos, Nikolaos Tsotsolas, Isaak Vryzidis

Conception d'un MOOC sur l'Aide MultiCritère à la Décision
Maria de Vicente y Oliva, Jaime Manera Bassa, Vincent Clivillé

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10h30-11h00	Coffee break

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	Keynote lecture
11h00-12h00	*Multiobjective Combinatorial Optimization – Beyond the Biobjective Case* **Kathrin Klamroth**

12h00-13h30	Lunch break (*Bar des étudiants, 2nd floor*)

13h30-14h00   Preparation of next meetings/Vie du groupe

Session 4	**Applications 2**

14h00-14h30   *Incorporation of risk and management criteria in positive mathematical program-ming: The case of marginal agricultural lands in Poland*
Athanasios Petsakos, Rafal Pudelko, Stelios Rozakis

14h30-15h00   *Designing an argumentative decision-aiding method for urban planning*
Franck Taillandier, Benjamin Delhomme, Irène Abi-Zeid, Rallou Tho-mopoulos, Cédric Baudrit

15h00-15h30   *Computer-aided Drafting of Urban Designs for Walkability*
Ivan Blečić, Giuseppe A. Trunfio

15h30-16h00   *Optimization of Multiple Satisfaction Levels in Portfolio Decision Analysis*
Maria Barbati, Salvatore Greco, Miłosz Kadzinski, Roman Słowiński

Papers submitted to discussion

Méthodologie multicritère d'aide au choix d'un système énergétique standard autonome en territoire isolé
K. Bouyachou, B. Urli

Simulation of a Ranking of Military Defense Systems for the BENELUX countries
Willem K. M. Brauers, Thomas Baelus

Patients' satisfaction: The medical appointments valence in Portuguese public hospitals
Diogo Cunha Ferreira, Rui Cunha Marques, Alexandre Morais Nunes, José Rui Figueira

Integrating human preferences in automated decisions of unmanned aerial vehicles
Arwa Khannoussi, Catherine Dezan, Jean-Philippe Diguet, Patrick Meyer

Comparison between two multicriteria methods for assessing land suitability for agriculture
A. Mendas, A. Mebrek, Z. Mekranfar

Démarche d'Aide Multicritère à la Décision pour l'Evaluation Préventive des Risques de Gestion Aéro-portaire
Hassane Yamnahakki, Abdellah Menou

16h00-16h30   Coffee break

86th Meeting of EWG on MCDA   Programme

Session 5	**Evolutionary approaches**

16h30-17h00   *Interactive Evolutionary Multiobjective Optimization driven by Dominance-based Rough Set Approach*
Salvatore Corrente, Benedetto Matarazzo, Roman Słowiński

17h00-17h30   *Interactive many-objective evolutionary optimization guided by preferences modeled with an augmented Chebyshev function*
Tomasz Sternal, Roman Słowiński

17h30-18h00   *Abstract Hybrid Algorithm for Multi Objective Optimization based on Game Theory*
Paweł Jarosz and Tadeusz Burczyński

18h00-18h30   *Interactive Evolutionary Multiobjective Optimization with NEMOII-Ch for facility location problems*
Maria Barbati, Salvatore Corrente, Salvatore Greco

Papers submitted to discussion

Prioritization of Public Buildings Energy Retrofit Strategies: an AHP model
Chiara D'Alpaos, Paolo Bragolusi

Assessing the quality of life of French municipalities: a multicriteria approach
Alexis Guyot, Emilios Galariotis, Michalis Doumpos, Constantin Zopounidis

Sustainable Supplier Selection Based On Sustainable Procurement Practices
Devika Kannan

Use of Risk Based Inspection and Maintenance Techniques in refineries. Can MCDA be of use in these cases?
Zoe Nivolianitou, Nicolas Defteraios

A multi-criteria approach for the construction of Land-use Change Spatial Composite Indicators in CS@Monitor Project
Valentina Sannicandro, Raffaele Attardi, Maria Cerreta, Carmelo M. Torre

Solving procedure for multiobjective dynamic problem with changeable group hierachy of stage criteria dependent on the stage of the process
Tadeusz Trzaskalik

18h30   Conclusions

The 86th Meeting of the European Working Group "Multiple Criteria Decision Aiding" took place on 21-23 September, hosted by the Polish Academy of Sciences research station in Paris. The subject of the conference was within branch of informatics related to decision support systems. The nature of this area of research is to create mathematical models and software tools which help processing of data into form that is useful for decision making. This activity is crucial in the context of complex decision problems, in which various points of view on the quality of alternative solutions are formalized by conflicting assessment criteria.

Conference presentations were oriented around the topics in multi-criteria combinatorial optimization. The goal here is to find solutions acceptable to the decision maker from the point of view of many criteria, with the proviso that the solution space is a discrete set. The presented algorithms took into account the latest global trends in various methodological areas. On the one hand, some approaches have been discussed that aim to find or to approximate the so-called non-dominated solutions. They were based on mathematical programming or mechanisms modeled on natural evolution. On the other hand, interactive optimization algorithms were presented, in which the emphasis is on the organization of dialogue with the decision-maker and on the search for the most-preferred solution with high robustness. Special attention has been paid to methods that effectively deal with computationally difficult problems, with big criteria set.

The practical usefulness of presented algorithms was described using classical problems of multi-criteria combinatorial optimization, such as the allocation of contractors to tasks, the traveling salesman problem, determination of the minimum flow in the network, knapsack problem, and the construction of the minimum spanning tree. Such problems are used in transport, logistics, IT and management. The use of decision support methods in the context of real decision problems regarding multi-criteria assessment of customer satisfaction, agricultural crops, tender offers, transport routes, material suppliers and urban projects was also discussed.

A critical discussion of the presented papers contributed to the development of European cooperation in multi-criteria decision support. Presentation of innovative methodological solutions and a large number of practical applications contributes to the role of decision support as one of the most important branch of modern computer science.

The conference consisted of five thematic sessions.

During the first session *Theory and methodology 1*, four teams presented their results in the field of multicriteria decision support. The first presentation titled *Vers une PAMC fondée sur les limites des classes de performances (PAMC IAMARA)* was given by Amin Affes. She discussed the problem of designing procedures for aggregating preferential information in the problems of multi-criteria decision support. The speaker, first explained the weakness of the current interactive methods based on comparisons of variants by the user and then concluding about her preferences on this basis. Afterwards she proposed a new method called IAMARA, using the so-called independent reference points. This method makes it possible to standardize comparisons made by the decision maker. In the second presentation Walter Habenicht presented the ENUCUT-V algorithm, which is a hybrid approach to integer linear vector optimization. Thanks to the use of the quad-tree data structure and the construction of the so-called sections in the searched space of solutions, this method allows a significant reduction of the number of considered solutions to the integer problem, and thus increase the efficiency of the algorithm. In the third presentation Nadjet Bourdache presented the algorithm based on the *weighted ordered weighted average* (WOWA) paradigm, enabling finding robust solutions for the problem of task assignment and the problem of searching for the shortest path in a graph. The last presentation delivered by Kerstin Daechert was devoted to solving MPEC problems (*Mathematical Problems with Equilibrium Constraints*) using the L-penalty method. The most important point of the presented work was an improved theorem specifying the conditions under which it is possible to find solutions to the MPEC problem, depending on the value of parameter L and to show the limitations of the method by indicating examples of problems for which finding solutions is not possible.

The second session, titled *Evolutionary approaches*, was devoted to the application of evolutionary algorithms to solve multi-criteria decision support problems. In the first presentation, Salvatore Corrente presented a new algorithm, in which the evolution of solutions in the population is controlled by the use of decision rules induced in accordance with the paradigm of the *Dominance Based Rough Set Approach*. In the second presentation, Tomasz Sternal presented an interactive evolutionary algorithm that extends the NSGA-III algorithm to build a decision-

maker preference model using the *Achievement Scalarizing Function*. He also presented how the instance of such a model can be effectively built solely on the basis of comparisons of the pair of non-dominated solutions made by the decision maker and how to use the constructed model to effectively control the evolution of solutions. In the last presentation of this session Paweł Jarosz presented a hybrid multicriterial optimization algorithm called IMGAMO. This algorithm uses the elements of game theory. The idea is to decompose the original problem into a form in which each player optimizes his own objective function, and the final solution to the problem is obtained by exchanging information between players and aggregating their ratings. The effectiveness of all three proposed methods has been confirmed by the results of computational experiments carried out on classical test problems used to evaluate the effectiveness of this type of algorithms.

The third session entitled *Theory and methodology 2* was started by Wassil Ouerdane, who presented a new method of determining the parameters of the *NCS (Non Compensatory Sorting)* model, which first guarantees the finding of a model consistent with the input data, if there is one, and secondly it is more efficient than currently used methods, like the MIP (*Mixed Integer Programming*) approach. Achieving both goals at the same time was possible thanks to reducing the problem to the SAT problem. In the next presentation, Vasco Manquinho introduced the concept of *Pareto Minimal Correction Subsets* (PMCS) defined as a minimum subset of conditions that should be removed from the definition of a multi-criteria problem, so that there is a solution that meets the other conditions. The presented work was an extension of earlier methods based on the concept of *Minimal Correction Subsets* and it contains a number of theoretical and experimental results proving the significance of the newly introduced concept. In the last presentation Simone Cerreia-Vioglio analysed the issue of the temporal character of the decision-making process. Under some assumptions, he presented a model in which a decision-maker without time to make a decision, chooses a solution randomly among all available variants, while having an infinite amount of time, makes a random selection only from a set of optimal solutions. After he presented how the decision-maker's preference model changes between the above states over time.

The main lecture of the conference entitled *Multiobjective Combinatorial Optimization – Beyond the Biobjective Case* was held after the end of the

third session. The speaker Kathrin Klamroth summarized the current state of global research on multi-objective Combinatorial Optimization. The classification of multicriteria problems is presented in the order of the difficulty of solving them. The topic of a meaningful description of the searched space and the effective updating of the intersection points of multi-walled cones is discussed in detail, which is a common problem in many problems in the discussed field.

The last two conference sessions were devoted to the use of multi-criteria decision support algorithms. The first speaker, Eric Fraga, presented an algorithm that uses dynamic programming to design multicriteria processes based on the example of designing processes for the production of chemicals in the chemical industry. The purpose of the presented method is to support people designing industrial processes, by automatically generating a number of ways to organize the entire process, which after being presented to the decision maker can be further optimized. The next two presentations addressed the issue of the use of algorithms for multicriteria decision support in urban planning. First, Franck Taillandier, presented the method of decision support for the problem of planning urban space development. The presented model offers the possibility to structure the discussion by bringing arguments of interested parties to the form of a directed graph, in which the vertices represent the arguments of the discussants, and the edges represent the conflicts between the relevant arguments. Then, using the ontology prepared for this purpose, it is possible to convert the graph to the problem of multi-criteria optimization, which can be further solved using classical methods. Then, Giuseppe A. Trunfio presented some results on an algorithm enabling the assessment of the quality of walking routes in some Italian cities. This method allows the aggregation of many factors such as the quality and width of the surface available for pedestrian traffic, the attractiveness of a given place, or the proximity of tourist attractions. The proposed algorithm can be easily used to assess the quality of routes in other cities around the world. In the last presentation of the fourth session, Adam Baïz presented a combinatorial method supporting the design of *new instruments of collective action* which are an alternative to currently used constructs such taxes, regulations and the market rules. The authors presented the advantages of the proposed method on the example of creating new tools for controlling the energy market prepared for the *French Ministry of Ecology and Solidarity.*

During the last session, three applications of algorithms for multi-criteria decision support in various areas were presented. In the first presentation, Rafał Pudełko presented the results of the work, in which the authors, using the mathematical programming technique and the risk management theory, search for the best way of managing infertile land in Poland. The proposed method takes into account the political and economic context when choosing the optimal strategy. Then, Alkaios Sekellaris presented an internet application that allows to generate simulated data on the satisfaction of users with services, without having to make earlier assumptions about their preferences model. These data are generated using the distribution of GEV (*Generalized Extreme Value distribution*) and can be used to test customer satisfaction analysis methods. In the last talk, Isaak Vryzidis presented a methodology that might be useful for the theory of multicriteria decision support, enabling the evaluation of projects and their chances for success. The proposed technique uses, among others, the popular UTA algorithm and linear programming technique. It allows the aggregation of heterogeneous criteria and also fits well with the current trends to apply multi-criteria decision support in management, allowing not only for the evaluation of individual projects, but also for their entire portfolio.

Thanks to this conference, the Polish Academy of Sciences research station in Paris was a place of intensive scientific exchange between several top specialists in all over the world, specializing in decision support systems, which is one of the most important branches of computer science.

The conference was organized under the honorary patronage of Professor Tomasz Młynarski, Ambassador of the Republic of Poland in France. Professor Bernard Roy was the guest of honour during the conference, and was awarded the Medal of the Polish Academy of Sciences.

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