EWG-MCDA
EURO Working Group on Multicriteria Decision Aiding
Groupe de Travail Européen Aide Multicritère à la Décision
NEWSLETTER
BULLETIN

Groupe de Travail Européen "Aide Multicritère à la Décision"
Série 3, nº32, Automne 2015.

European Working Group "Multiple Criteria Decision Aiding"
Series 3, nº 32 Autumn 2015.

MCDA Research Groups

LAMSADE: 40 years of research and new perspectives

Alexis Tsoukiàs
Director of LAMSADE
Paris 31/10/2015

1. The facts

The LAMSADE (Laboratoire d'Analyse et Modélisation de Systèmes d'Aide à la Décision) is officially a joint research centre of Université Paris Dauphine (the best known business oriented French University which is NOT a Business School) and the CNRS (Centre National de la Recherche Scientifique; the all-purpose fundamental research agency of France and the largest European research organisation). Compared to the French standards is a small to medium research centre although:

- the permanent scientific staff (professors and CNRS researchers) are approximately 50 (13 full time CNRS researchers);
- to which we add approximately 40 PhD students, post-docs and other non-permanent scientific staff;
- and 5 administrative staff (two of which are CNRS employees);

for an overall figure of around 100 people working together within the premises of the Dauphine campus.
The annual research budget of the LAMSADE (excluding the salaries of the permanent research staff, but including the salaries of the PhDs and the post-docs) is approximately 1.5M€. Roughly speaking 1/3 of this budget comes from the two parent institutions (mostly from the University, a smaller fraction from the CNRS), the rest from research projects and grants. Half of such grants come from public agencies and institutions, the rest from private sector contracts.

The LAMSADE is increasingly an international centre: there are about 20 different nationalities present today (Algeria, Belgium, Brazil, Cameroon, China, France, Greece, Iran, Italy, Korea, Lebanon, Mauritania, Morocco, Romania, Saudi Arabia, Tunisia, Turkey, UK, Venezuela), but we also had in the past colleagues from Luxembourg, Portugal and other countries. In the last 5 years we received visitors (invited or hosted) from more than 40 different countries and our international research network covers the whole world (highlights: the DIMACS, Rutgers University, USA; the GERAD, Montréal, Canada; the LSE, London, UK; and many others).
Last, but not least, the LAMSADE is the initiator and co-founder of two well established international communities: the EURO MCDA Working Group (http://www.cs.put.poznan.pl/ewgmcda; publishing the bulletin you are presently reading) created in 1975 and since then regularly meeting every six months and the Algorithmic Decision Theory community (established with the DIMACS: http://www.algode.org) which already organised 4 international conferences (the last in Lexington, Kentucky; the next one foreseen for 2017 in Luxembourg). The LAMSADE is also heavily involved with the COMSOC (Computational Social Choice) international community as well as in Combinatorial Optimisation (ISCO and others).
Although the LAMSADE is a research centre, teaching being organised in Dauphine through Departments, we are obviously strongly implied in Computer Science training and education (noting however, than 1/3 of the overall teaching duty of our professors concerns undergraduate and graduate courses NOT in Computer Science: management, economy etc.). Under such a perspective we tightly cooperate with the Mathematics and Computer Science Department of the University (MIDO: http://www.mido.dauphine.fr) where all of our professors are practically affiliated. We take care of the undergraduate courses in Computer Science as well as of the Master in Computer Science which specialises in 5 five directions: Computer Science for finance, Decision Engineering, Information Systems, Operational Research and Decision Sciences, Intelligent Systems, the last two being more oriented to R&D careers. We are also heavily involved with (we actually coordinate) the Master in Peace Studies (http://www.peacestudies.dauphine.fr) although this is not a Computer Science diploma (obvious ...; it is

part of the graduate courses in International Economics and Development). Finally we are also strongly involved with the Lifelong Training Department of the University where we contribute to many training initiatives.

2. The History

The LAMSADE has been established in 1974 by Bernard Roy who had just joint Dauphine two years before as a Computer Science Professor after a long experience as head of the Scientific Board of SEMA-METRA, at that time one of largest consulting companies in France (and in Europe). It should be noted that SEMA-METRA has strongly contributed to the Operational Research culture in France (and beyond). As said, Bernard Roy has been recruited as a Computer Scientist (for several reasons most OR in France is considered Computer Science), but at that time the LAMSADE was aiming to become a Management Science research centre.

In 1976 the LAMSADE became a joint research centre of the CNRS and Université Paris Dauphine (an association never interrupted since) and when towards the end of the 80s, beginning of the 90s, Computer Science started to be strongly developed in Dauphine most of the freshly recruited colleagues joined the laboratory, making it de-facto the Computer Science research centre of the University: 95% of all Computer Scientists of Dauphine are members of the LAMSADE. However, 10% of our research staff are not "officially" Computer Scientists and approximately 6% of our PhD students are not Computer Scientists.

All these figures should not be confusing. The large majority of the LAMSADE research staff are Operational Researchers (while in other countries they would be affiliated to Management Science or in Mathematics), but officially count as Computer Scientists. Moreover, the whole laboratory considers itself as being a centre in "Decision Sciences and Technologies": our colleagues who are "not" Operational Researchers, nevertheless should be considered as researchers in this wider area.

As a CNRS research centre the LAMSADE is expected to conduct essentially fundamental research (although appropriate funding not always follows ...). Historically the laboratory is known for having elaborated an original approach to decision aiding and more precisely in Multiple Criteria Decision Analysis, including an original idea about robustness. This original approach integrated pragmatic considerations (how "practically" decision support is provided and how problems, decision processes, methods and solutions are constructed within a decision aiding process) with axiomatic considerations (characterising models and methods used in decision support), including both classic decision theory models, but also models related to formal reasoning and more generally concerning the autonomy of artificial agents. Later on such considerations have been integrated with algorithmic considerations concerning the design and use of algorithms to be used in presence of combinatorial structures and more generally in presence of very large amount of information (providing procedures with guaranteed performance). Algorithmic Game Theory, Algorithmic Decision Theory, Computational Social Choice became thus relatively recent developed areas in the laboratory. Very recently we started developing the areas related to Data Sciences (learning from and management of large data structures).

The LAMSADE is proud to have generated two spin-offs during the past:

- EURODECISION (www.eurodecision.com) which is now a solidly established consulting company in Operational Research applications, including logistics, planning, networks etc.;
- KARMICSOFT (www.karmicsoft.com) which is a SME specialised in software engineering and more precisely in agile programming with applications in decision support.

The laboratory has very little direct consulting activity (principally dedicated in validating, empirically and operationally, our methods and results) but has a large set of industrial partners with which conducts research projects (recent "clients" include SNCF, RENAULT, DCNS, SAGEM, ORANGE and a variety of SMEs) as well as public agencies and institutions. In the past the LAMSADE had a software production (the first versions of the ELECTRE packages have been produced in cooperation with the Poznan Technical University), but this is now discontinued: we now strongly cooperate with the Decision-Deck project (www.decision-deck.org) or to ad-hoc client directed customised projects.

We can summarise this history identifying through a number of topics characterising our research:

- the axiomatics of decision;
- the algorithmics of decision;
- the autonomy of decision;
- analytics and decision systems;
- the practice of decision aiding.

3. Perspectives

Today the LAMSADE is organised on a bi-dimensional structure: 3 large thematic areas (Decision, Optimisation and Data Sciences) and 10 long term research projects:

- Preference Modelling and Decision Aiding;
- Multiple Criteria Optimisation;
- Autonomous Agents and Reasoning;
- Algorithms with guaranteed performance;
- Discrete Structures and Mathematical Programming;

- Services Engineering;
- Data Structures and Management;
- Learning;
- Algorithmic "Game Theory/Decision Theory/Social Choice";
- Policy Analytics.

Such research projects possibly cross more than one thematic area and potentially go beyond the LAMSADE boundaries.

Research in LAMSADE is expected to be essentially theoretical and foundational and we are strongly committed in keeping our high standard in this direction. However, due to our tradition (embed our theoretical investigation to the real world) and to the increasing demand from the society we are also committed in working for innovative applications where new ideas and topics for theory can emerge. Under such a perspective the area of Policy Analytics is becoming increasingly important, grouping the research conducted within the laboratory around the topics of supporting the design, the implementation and the assessment of public policies.

Our ambition is international leadership. But without becoming a mainstream Decision Sciences centre. We have always been specific. Cultivating ideas which only long time after became mainstream research topics. For this reason (and purpose) we like mixing cultures, disciplines, ideas and people. And we believe in the young (early stage researcher as it is established now). For this reason and purpose we do serious research without never being really serious. We like fun and good food as much as investigating difficult problems. And we brew the best Italian coffee in Dauphine.

Consultancy Company

Dr. Judit Lienert
Cluster Leader Decision Analysis
Environmental Social Sciences (ESS)

P.O. Box 611
Ueberlandstrasse 133
CH-8600 Duebendorf, Switzerland
www.eawag.ch/about/personen/homepages/lienerju

Environmental Decision Analysis at Eawag, Switzerland

Judit Lienert[1], **Fridolin Haag**[1], **Mika Marttunen**[1], **Peter Reichert**[2], **Nele Schuwirth**[3]

Eawag: Swiss Federal Institute of Aquatic Science & Technology (www.eawag.ch)
[1]Department Environmental Social Sciences (ESS), Cluster Decision Analysis
[2]Department Systems Analysis, Integrated Assessment & Modelling (Siam), Working group Systems Analysis & Water management
[3]Department Systems Analysis, Integrated Assessment & Modelling (Siam), Working group Ecological Modelling

We use Decision Analysis methodologies at Eawag to better understand and deal with environmental decision problems related to water management, water technology, and aquatic ecosystems. Eawag is the Swiss Federal Institute of Aquatic Science and Technology and belongs to the ETH Domain. Eawag is concerned with concepts and technologies for dealing sustainably with water bodies and water as a resource. The work at Eawag is deeply rooted in research, but also builds a bridge between science and practice.

Specific research in decision analysis has been carried out at Eawag since about ten years, initially in the department of Systems Analysis, Integrated Assessment & Modelling (Siam), under the lead of Peter Reichert. Since 2012, the cluster Decision Analysis under the lead of Judit Lienert moved to the newly founded department of Environmental Social Sciences (ESS). In the Siam department, the working groups led by Nele Schuwirth (Ecological Modelling) and Peter Reichert (Systems Analysis & Water Management) contribute besides other topics to methodological improvements and applications of decision support methods for environmental management.

Cluster Decision Analysis

The cluster Decision Analysis targets ill-defined, complex environmental decision problems, in which different stakeholders pursue conflicting objectives and uncertainties are high. Research aims at contributing to open questions in Multi-Criteria Decision Analysis (MCDA); specifically in Multi-Attribute Value Theory (MAVT) and Multi-Attribute Utility Theory (MAUT).

The research focuses on: (1) Setting-up decision problems; this includes research about integrating 'Problem Structuring Methods' (PSM) into MCDA. (2) Tackling various sources of uncertainty, including uncertainty of predictions, the stakeholder's preferences, and future socio-economic development. (3) Developing better

applicable, simplified procedures for the elicitation of stakeholder preferences, without compromising on theoretical soundness, hereby contributing to Behavioral Operations Research.
Environmental problems require the expertise of different scientific disciplines to find adequate solutions. The Decision Analysis cluster thus combines social, engineering, and natural science knowledge by closely interacting with e.g. chemists, biologists, and water engineers. The projects are usually transdisciplinary, integrating experts, stakeholders, or lay people into research in different steps of the decision making process.

Project: How to handle hospital wastewater

Micropollutants (e.g. pharmaceuticals) are increasingly detected in water bodies: their elimination in wastewater treatment plants is incomplete. Pharmaceuticals can be technically removed at sources e.g. in hospitals, or urine could be collected, since urine contains ca. 60–70% of the medicals excreted by humans. Urine source separation was intensively researched in the project Novaquatis, also with MCDA (Borsuk, Maurer et al. 2008).
The hospital wastewater project focused on two exemplary Swiss hospitals. MCDA was used to combine expert predictions (e.g., costs, pharmaceutical mass flows, ecotoxicological risk; (Escher, Baumgartner et al. 2011)) with the subjective preferences of 26 stakeholders for more than 50 alternatives. In the general hospital, technical options that remove the total load of pharmaceuticals performed systematically better than cheaper options. Results were very stable across stakeholders. Acceptance of measures in hospitals is potentially high if the trade-off between pharmaceutical removal and costs is reasonable (Lienert, Koller et al. 2011).
We also studied more general research questions related to the practical application of MCDA in environmental decision problems using MAVT. The standard method to elicit weights was modified by introducing a "Reversed-Swing Method" that seemed more realistic. The MCDA procedure was a compromise between time demand and elaborateness, which was tested with sensitivity analyses (Schuwirth, Reichert et al. 2012).

Project: Sustainable Water Infrastructure Planning (SWIP)

Water infrastructures such as water supply pipes, sewers, and treatment plants are vital to society, but expensive, long-lived, and ageing. Infrastructure planning is complex and uncertainty about climate change and future socio-economic development adds to this complexity. Main goal of the project SWIP was to develop an improved procedure for water infrastructure planning (also see two videos a, b). SWIP combined engineering with decision sciences in four sub-projects. Tools, methods, and a decision analysis framework to improve the long-term planning process for water infrastructures were developed with active participation of local stakeholders in a case study near Zürich.
Large effort was put into carefully setting up the decision problem. A stakeholder analysis, combined with social network analysis helped selecting participants (Lienert, Schnetzer et al. 2013). Stakeholder workshops were carried out to develop the objectives hierarchy, decision alternatives, and four future socio-economic scenarios (Lienert, Scholten et al. 2015).
Two separate series of MAUT-based interviews with ten stakeholders each were carried out for the water supply and the wastewater system. For water supply, a pipe failure model to support water asset management decisions was developed (Scholten, Scheidegger et al. 2013, Scholten, Scheidegger et al. 2014). The subsequent MAUT tackled uncertainty by combining scenario planning with MCDA and used a global sensitivity analysis (Scholten, Schuwirth et al. 2015).
For the wastewater system, a focus was on preference elicitation. This included comparing online weight elicitation with stakeholder interviews (Zheng, Egger et al. subm.), preference elicitation over time for two weight elicitation methods using public online surveys (Lienert, Duygan et al. subm.), and the comparison of a direct weight elicitation procedure with holistic pairwise choices based on UTA-GMS (Zheng and Lienert in prep.).
Overall, the different MCDA approaches in SWIP revealed that viable water infrastructure alternatives can be proposed which performed relatively well for most stakeholders and all future scenarios. Approaching such a demanding problem from different angles, and including different stakeholder perspectives was fruitful and increases the confidence in the decision. But for practical applications, the MCDA procedure seems rather academic and costly. Thus, simplifying the MAVT-based decision process is a focus of ongoing research.

Project: Practical decision analysis for value-focused planning of wastewater infrastructures

This running PhD project of Fridolin Haag builds on SWIP and further investigates following aspects. (1) Reduction of complexity: Reducing the number of objectives decreases effort for preference elicitation and for the predictions. Systematic modifications and simplifications of objectives hierarchy structures are explored and effects on preference elicitation and results studied. (2) Improvement of attributes and the prediction of consequences: Possibilities for attributes measuring outcomes of wastewater infrastructure decisions are explored. The suitability of different sets of attributes in a

context where stakeholders have a diverse background is tested. A Bayesian network model is built to allow prediction of attributes not assessed by common engineering models. (3) Non-additive aggregation: For the decisions we are concerned with, the additive model does not always reflect peoples' preferences. An elicitation procedure is developed that allows identifying other aggregation schemes to better represent stakeholders' preferences. The research topics are investigated in the context of case studies concerning mergers of wastewater treatment plants in Switzerland.

Project: Improving Problem Structuring in MCDA

MCDA is best applied to well-structured problems, and so far it lacks tools for proper decision structuring. Therefore, the combination of so called problem structuring methods (PSMs) and MCDA has recently received more and more attention. PSMs are a label for a group of methods that aim to structure the problem situation well rather than solving it. PSMs aim to promote an engaged and structured conversation, to view the situation from a variety of perspectives, and to synthesize information. The study is led by Mika Marttunen from SYKE, Finland, who is currently working at Eawag, and is done in close collaboration with Valerie Belton from the University of Strathclyde, Glasgow, UK. It consists of two parts:

1. Combined use of PSMs and MCDA. The aim is to find ways to improve MCDA processes in ill-structured and messy decision situations. Recommendations will be presented to support the seamless integration of PSMs and MCDA in different types of decision situations.
2. Manageable objectives hierarchies in MCDA. We aim at developing and testing procedures, which can help to find a proper balance between two conflicting objectives, namely being concise and being complete, when developing objectives hierarchies. We will also explore the effect of the size and structure of the objectives hierarchy on preference elicitation, the decision outcome, and visualization of the results.

Decision support in river management

Working group Ecological Modelling

In the working group "Ecological Modelling" we mainly contribute to (1) the development of mechanistic ecological models to predict the effects of changing environmental influence factors and human impacts (e.g. management alternatives) on the community structure of aquatic organisms and ecosystem functions that are relevant for environmental management; and (2) model-based decision support for river management with a focus on the further development and application of river assessment methods based on multi-attribute value theory.

Working group Systems Analysis & Water Management

The group "Systems Analysis and Water Management" contributes to the development and improvement of methods and models for the analysis of aquatic systems and societal decision making in the following areas: (1) Development of techniques for statistical inference of model states and parameters that account for the need of using prior information and of considering input and model structure uncertainty and intrinsic stochasticity. (2) Development and application of hydrological, biogeochemical, and ecological models of river and lake systems to quantitatively describe scientific knowledge and predict effects of changes in driving forces and of management measures. (3) Design and apply decision analytical procedures to quantify societal preferences and apply them jointly with scientific predictions of outcomes of management alternatives in environmental decision support.

Decision support for river management

We support societal decision making in water management by combining the quantitative description of scientific knowledge about the behavior of environmental systems and the effects of decision alternatives with the quantitative description of societal preferences. Our application focus is on river management. Our conceptual approach is discussed in (Reichert, Borsuk et al. 2007, Schuwirth, Reichert et al. 2012, Schuwirth, Stamm et al. 2012, Reichert, Langhans et al. 2015).

Models for scientific prediction

Our focus was on quantifying our understanding of lake and river ecosystems and predicting the effects of management alternatives. We contributed to the understanding of biogeochemical processes and plankton dynamics of lakes (e.g. Omlin, Reichert et al. 2001, Dietzel, Mieleitner et al. 2013), herbicide pollution of rivers (Frey, Schneider et al. 2009), invertebrate and fish communities in rivers (Borsuk, Reichert et al. 2006, Schuwirth, Kühni et al. 2008, Schuwirth and Reichert 2013) and to the integration of effects of river rehabilitation measures (Borsuk, Schweizer et al. 2012).

Quantification of societal values

Societal valuation requires a trade-off between costs, societal services provided by the ecosystems, and ecological gain (that could be formulated as a service). Ecosystems can be impaired by these societal services

(e.g. by hydropower plants or water abstraction) or there may be synergies between ecological gain and societal services if the services require a near-natural state of the ecosystems (e.g. aesthetic value). Most of our work focused on quantifying the ecological gain by formulating ecological assessment procedures in the language of decision analysis (i.e. as a value function). This has the advantages of using the same methodological basis across different assessment areas, to methodologically support ecologists in formulating their values, and in facilitating the use of ecological assessment as a branch of the overall societal value function that formulates the trade-off between ecological gain, societal services, and costs.

Important contributions were to formulate ecological assessment methods using multi-attribute value theory (Langhans, Lienert et al. 2013), methodological aspects for the development of ecological indices for ecosystem management (Schuwirth, Kattwinkel et al. 2015) and to apply these concepts for quantifying and valuing the ecological effects of river restoration (Paillex, Schuwirth et al. subm.). Since we encountered that trade-offs between different ecological objectives are often not compensatory, we are working on the development of decision support methods that allow for non-additive aggregation of sub-objectives (Langhans, Reichert et al. 2014). We transfer this knowledge to practice in collaboration with Swiss authorities (e.g. the Swiss Federal Office of the Environment) to support surface water assessment and management in Switzerland.

We developed software to support these activities: The R-package "utility" (Reichert, Schuwirth et al. 2013) to implement and visualize (also non-additive) value and utility functions and visualize results; the R-package "ecoval" for evaluating and visualizing ecological assessment procedures for surface waters, and the R-package "rivernet" to read, analyze and plot river networks which is used for ecological assessments of catchments.

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User eXperience Driven Design for Multi-criteria Decision-Aid Innovation

Michael Zam
KarmicSoft, Lamsade
m.zam@karmicsoft.com

Abstract

Incremental transformation of stakeholder’s decision problems in robust models remains a challenging and complex task that needs better methods and tools. Realistic user experience gives the most valuable input but usually requires several cycles. Some of them will involve data, some others will ask you to change previous choices, but some of them can also challenge the domain model, the whole decisional process and even the software environment you use to run it.
In this paper we address the challenge of deep change impact in a multi-criteria decisional process driven by the user experience. We introduce a vision and a collaborative cloud-based MCDA software environment capable to deal with changes at any level, so practitioners and researchers can aim optimal solutions, regardless the abstraction level of the change source.
DecisionCloud is a MCDA extension of the MyDraft platform. Way beyond declaring criteria, alternatives, constraints, evaluations and running classical decision problems, DecisionCloud provides features such as domain modeling and instant GUI prototyping. The whole evolutionary process runs in the cloud and is fully traced. Users, designers, and coders, if any, collaborate consistently using only their web browsers and grow their decision models directly in the cloud.

Keywords: design, experimentation, multi-criteria decision aid model-driven, user experience, traceability, time machine, rapid development, cloud computing

1. The challenge

The quest for innovation in decision-making is a major priority for organizations in an accelerating world of competition. By interacting with the market, business stakeholders are the ones who bring new ideas every day. Translating these ideas into working decision-aid software

that will optimize new business services and processes remains a hard task and proper tools and methods need to be provided.
Classical software life cycle usually implies several loosely connected tools handled by numerous people with different roles in order to manage different assets, from business requirements to testing and deployment. Optimizing this complex process for both speed and quality is still a daunting task. One of the major challenges is to encourage explorations — therefore allowing changes at any level of representation — without jeopardizing the con-sistency between the artifacts (idea, user story, model, GUI, test …).
There is usually a struggle between two forces when it comes to embracing change and dealing with the consequences:

- If you're eager to try a new idea that will have a big impact in the rest of the artifacts, you might take too long repairing inconsistencies, burn the budget quickly and loose market momentum
- If you know a change needs too much rework, you will hesitate to try it and maybe fail to catch a brilliant innovation. Cumulating compromises will eventually severely affect the optimal properties of your solution.

To propagate changes through the whole life cycle artifacts is difficult because there are a lot of micro decisions that should be reviewed. As long as mapping artifacts requires explicit human decisions, it will be hard to review them for every single change.
The challenge we address in this paper is to illustrate a way to release the tension between the two forces: evolution vs. con-sistency.

2. The solution approach

2.1 User eXperience Driven Design — UXDD

We consider that the main process is about designing decision models and should be driven by the user experience. Therefore, it should:

- Be user centric and provide realistic high quality GUI
- Minimize redundancy and mapping between representa-tions
- Consider the business and process model as the central asset and generate on the fly both downstream and upstream assets for feedback
- Include checking mechanisms: GUI user testing, model unit testing and audits
- Be supported by a generic evolutionary environment that engage for flexibility and provides full traceability, just like Wikipedia does for authors.

As long as the model is the central asset and the only one that is really stored, and as every other asset is generated on the fly, there is little or no risk to deal with inconsistencies between artifacts. Actually, we focus mainly on mapping the users' intentions by letting them interact directly with model instances, e.g. creating objects, setting values for attributes, calling operations, running use cases, etc.
It must be clear that even if we admit hand-drawing style dia-grams and free-form sketches are valuable for speed, feedback, abstraction and encourage conversations, we choose to generate them rather than letting designers doodle them freely. Therefore, they are always consistent with the domain model.
User eXperience Driven Design (UXDD) combines Domain Driven Design [1], the naked objects pattern [2] and advanced user experience. The UXDD approach:

- Provides instant GUI for model instances
- Invites users to interact with them from the beginning
- Declares model evolution as a first-class citizen
- Encourages collaboration and promotes learning by doing
- Embraces the executable model-driven paradigm
- Provide an open process guidance mechanism
- Requires full traceability features including time-machine.

2.2 MyDraft

In order to assess and enhance the UXDD approach, we hav im-plemented it in MyDraft and have used it successfully in the last 4 years in several projects, both industrial and academic. MyDraft is a collaborative cloud-based platform meant to build and run data-driven rich web applications in minutes without technical skills. Therefore, non software experts can build competitive solutions — including MCDA problems — by themselves. The GUI reflects the underlying executable domain object model, including classes with attributes, operations and state machines. User interaction can be recorded in order to generate use case scenarios. Therefore, complete and formal specifications are not an input anymore, but instead are generated by the platform in the form of diagrams, mockup screens, audits and more.
User feedback stimulates model increments. Full traceability features — including automatic versioning, unlimited undo-redo, and time machine — help designers and business analysts to explore new ideas and select the best choices quickly. The evolu-tionary collaborative process starts with a white sheet and can quickly become a sophisticated multi-criteria decision-aid tool, with configurable workflows, business rule engine, solvers and statistical computations. But the whole purpose is to draft the best consistent ideas and emerge proven models,

grown by the whole team: users, business analysts, designers, and sometimes coders.
During evolution, inconsistencies between various elements (as data models and GUI fragments) usually appear. Our tradeoff is allowing only marginal ones and detecting them by audit features. Therefore, designers can fix them later on but do not lose the mental connection with the users and their ideas.
MyDraft copes simultaneously with evolution at several levels, managing objects, models and meta-models in a unique versioned repository, and embracing the executable model-driven paradigm rather than code generation techniques. Design time and runtime activities are therefore unified and the system almost never stops.
Under the hood, MyDraft manages co-evolution of executable objects, models and meta-models by making them live together in the same cloud-based environment, and simultaneously available to a huge number of end-users, designers and programmers. The core of the cloud application resources switches then from file-based artifacts to models and establishes the design as the principal activity that drives the evolution of the whole system.
As these activities are notoriously collaborative, the traceability becomes essential. In MyDraft, design time and runtime activities are collapsed in a storage space-time continuum [3]. Data and metadata are versioned accordingly. Both end users and designers can travel in time and learn from their experience. The evolution support helps progressively to promote better models, more expe-rienced designers and happier end-users, making the cloud-based ecosystem itself prosper.

2.3 DecisionCloud

DecisionCloud is a reusable multi-criteria decision aid package running over the MyDraft platform. DecisionCloud is used in several academic and commercial applications applied to health, financial and industrial domains.

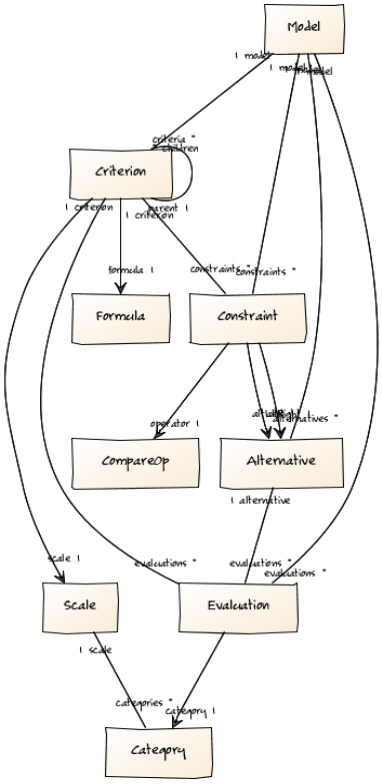

Figure 1. DecisionCloud metamodel.

Criterion, Alternative and Evaluation are the main elements of the metamodel, cf. Figure 1. Criteria have a reflective association, allowing customizing unlimited criteria trees. In a specific appli-cation, built for a French railroad company, we provided decision trees up to 5.000 nodes to assess traveler’s comfort, based on specific evaluations. Each node, i.e. criterion, can reference a different customized formula, i.e. aggregation methods as weighted sum, Electre-tri, base of rules, Choquet integral, etc.

3. UXDD for decision-aid innovators

3.1 UXDD in practice

The UXDD approach starts with some simple business modeling, for instance tasks to be prioritized according to multiple criteria, and provides a way for the end user — either evaluators, decision makers or designers — to interact with objects, cf. Figure 3.

3.2 The DecisionCloud package

When the business model is stable, stakeholders are required to choose the alternatives to be considered. For instance, if the tasks are the objects to be compared and sorted, the Task class will have to inherit from the

Alternative class (Figure 3a, column Superclass). This will only take a click. The immediate consequence is that every task instance becomes also an instance of the Alternative class, thus taking advantage of the DecisionCloud package features.
Criteria can be defined on the fly and aggregated using different customized methods. The overall iterative process is both open and guided. Colored indicators emphasize the robustness of the current solution, seen as a real life case but also as an illustration of the decision process. A multicolumn tree component shows the emergent global overall criteria as the ultimate root, cf. Figure 2.

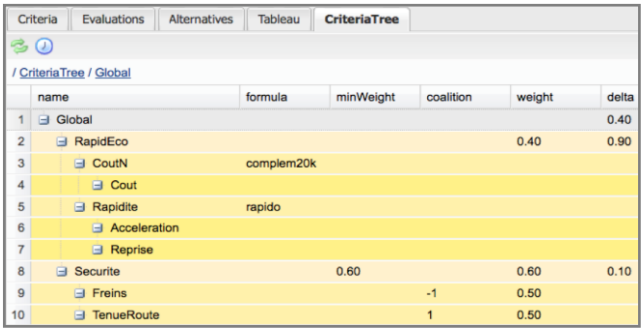

Figure 2.

3.3 UXDD — Overall goal and concrete objectives

The main objective of the UXDD experience is to produce inter-active design experience based on short feedback loops, with a focus on evolution. The feedback provided by end users allows the designers to discover new effective and flexible ways to catch the user preferences.

3.4 Overview of the structure of the experience

The standard UXDD cycle covers the following steps:

- Define classes and instances altogether
- Define grids and forms and let users interact with objects
- Add state machines and test them on the fly before you code
- Link GUI components upon class associations
- Add behavior and execute it from the GUI
- Show unit test and quality assurance features
- Change an inheritance link and show the side effects
- Generate diagrams and mockup screens
- Display versions and travel though time causal loop

4. Conclusion

The solution is relevant to researchers confronted with requirement management and model evolution issues at several abstraction levels as a day-to-day challenge of the decision-aid design processes and applications. Propagating change through data, models and meta-models remains a major challenge of today’s modeling tools.
MyDraft and DecisionCloud reveal an agile way to build and run decision-oriented rich web applications with little or no code. Beyond CRUD (Create-Research-Update-Delete) operations, custom behavior can be unit tested.
No background knowledge is expected for the designers other than basic object-oriented design and simple multi-criteria decision aid knowledge. Coding skills are optional.
Changes can occur at any level of abstraction: evaluations, al-ternatives, aggregation method choice, decision process elements, domain model, but also environment details as the way the elements are designed and executed. As long as the platform itself is dynam-ically built in itself, anything can change at any time, just in time.
Along with MyDraft, DecisionCloud offers a unique vision and opportunity to stimulate innovation. We invite readers to experiment the UXDD approach using the MyDraft platform. Creating a free trial account only takes a minute. Short video demos are available here: http://goo.gl/pKTQX8. Please contact us if you also need to test UXDD with the DecisionCloud package.

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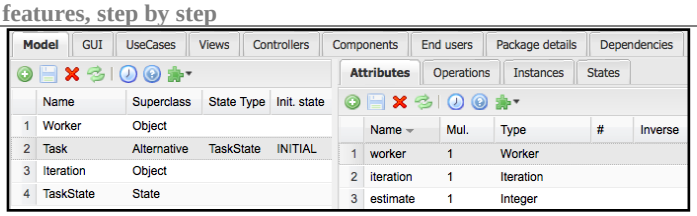
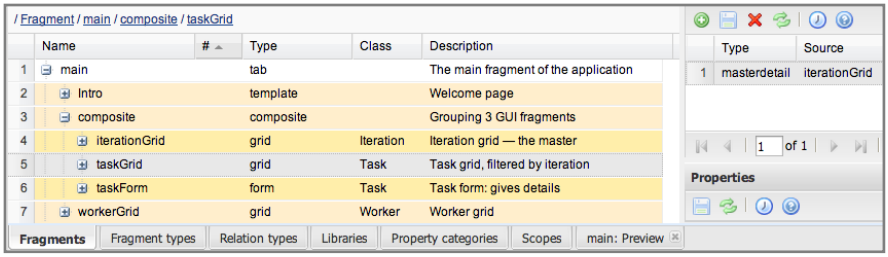
UXDD with MyDraft — Main features, step by step

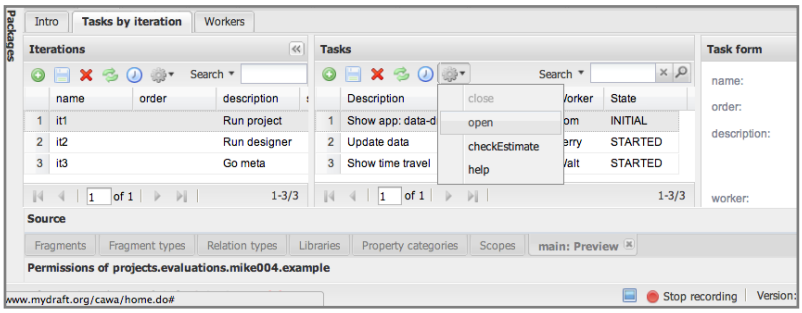
a) Define classes, attributes/associations, instances, states and operations.



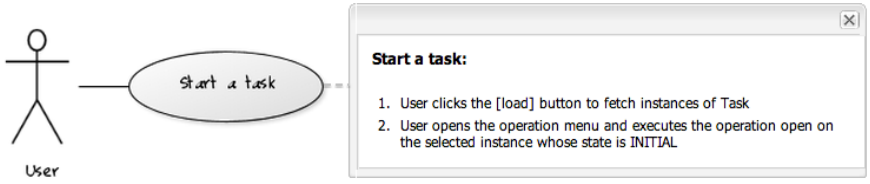
b) Configure GUI fragments — grids, forms, charts, etc. — linked through associations.



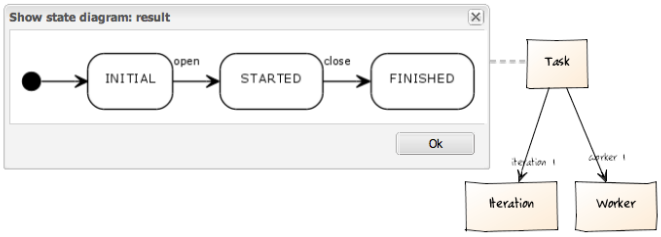
c) Preview: users interact with domain objects and call operations that will perform transitions. Note that recording is ON. User selects a task and executes the *open* operation.



d) Generated use case scenarios from previously recorded interactions.



e) Generated class diagrams and state machines.



f) Integrating unit testing for operations, if any.

g) Traceability support includes automatic versioning, instant time travel, project/object restoration, undo/redo, compare/merge.

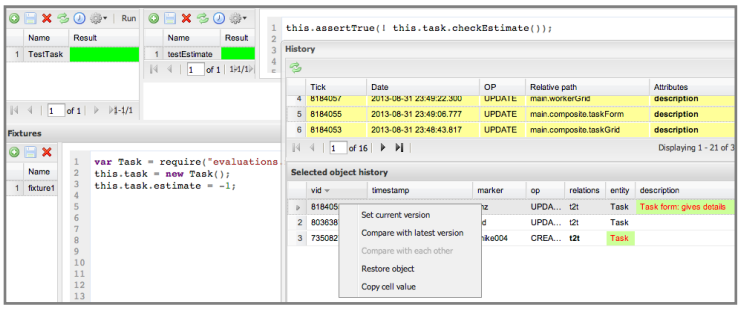


Figure 3. UXDD step by step

Persons and Facts

POZNAN UNIVERSITY, December 8, 2015

A faithful member of our Working Group, Professor Benedetto Matarazzo from the University of Catania, was awarded “the Medal of Merit” by theSenate of the Poznan University of Technology.

This prestigious distinction is granted to a scientist who greatly contributed to development of research in co-operation with researchers from Poznan University. The Medal marks gratitude to Benedetto for his positive impact on academic relations with Poznan University during last 30 years.

On December 8, 2015, during a special seminar, the Rector of PoznanUniversity of Technology conferred the Medal on the Laureate.

Benedetto Matarazzo gave a lecture entitled "Decision aiding in my way".

Software

The State of MCDA Software

H. Roland Weistroffer

School of Business, Virginia Commonwealth University, Richmond, Virginia 23284-4000, USA

A multitude of multiple criteria decision analysis (MCDA) methods have been proposed in the literature, many of which are described in the book Multiple Criteria Decision Analysis: State of the Art Surveys edited by Figueira, Greco, and Ehrgott (2005). A new edition of this book is in the process of being published. Correspondingly, many software applications have been developed to implement all or parts of these MCDA methods. There is software available for various stages of the decision making process, from problem exploration and structuring, to establishing the decision maker's preferences and identifying a most preferred compromise solution. Many users though, may not find it easy to identify and select the appropriate software for their specific problem situation. To help potential MCDA users, the aforementioned book by Figueira et al. also includes a chapter on available MCDA software packages (Weistroffer, Smith, and Narula, 2005), and the new edition, to appear soon, will include a similar chapter by Weistroffer and Li (in press). This current article summarizes what is in that chapter and gives a brief overview of the state of available MCDA software.

As mentioned above, decision analysis software can assist decision makers at various stages of the decision-making process, including problem exploration and formulation, identification of decision alternatives and solution constraints, structuring of preferences, and tradeoff

judgments. Many commercially available, general decision analysis software packages have been included in biennial decision analysis software surveys in OR/MS Today, the first one published in 1993 (Buede 1993). The 2014 OR/MS Today survey (Patchak 2014) included 38 decision analysis packages, some of which can be considered MCDA software. While specifically focusing on MCDA software, this current overview looks not only at commercially marketed packages, but also software that has been developed at academic institutions for research purposes and is available to the broader community, usually free of charge or for a nominal fee. Commercial packages may sell for hundreds or even thousands of dollars (though some vendors give educational discounts) and usually have dedicated websites and sophisticated marketing literature and may come with training courses and technical support. Software developed not-for-profit by academics usually comes without support and may have only limited documentation.

In order to provide guidance for choosing the most appropriate software for a specific decision situation, MCDA software can be categorized based on various considerations, such as the characteristics of the decision problem (viz. finite set of alternatives versus infinite options that can be defined by mathematical functions), the MCDA method(s) implemented by the software, the type of decision making (viz. single decision maker versus group decision making), and the technology platform(s) supported by the software.

The first consideration for selecting appropriate MCDA software should be the characteristic or type of the decision problem at hand. MCDA normally involves the decision maker to choose a solution from the set of available alternatives, which can be finite or infinite, and thus MCDA problems can be roughly divided into two main types, viz. multiple attribute decision analysis (MADA) problems and multiple objective optimization (MOO) problems. In MADA problems, the decision maker must choose from among a finite number of explicitly identified alternatives, characterized by multiple attributes, where these attributes define the decision criteria. An example would be buying a new car and choosing among the various models available, characterized by attributes such as size, engine power, price, fuel consumption, etc. In contrast, MOO deals with problems where the alternatives are only implicitly known. In MOO problems, the decision criteria are expressed in the form of mathematical objective functions that are to be optimized. The argument vectors of the objective functions constitute the decision variables and can take on an infinite number of values within certain constraints. An example would be developing a new engine for an automobile manufacturer, where the decision criteria may include things like maximum power, fuel consumption, cost, etc., described by functions of the decision variables such as displacement capacity, compression rate, material used, etc. MOO models may involve linear or nonlinear objective functions and constraints, and may have continuous or integer decision variables. MOO software typically implements various optimization algorithms, such as linear programming, non-linear programming, generic algorithms, meta-heuristics, etc. Table 1 lists the software packages reviewed by Weistroffer and Li (in press).

Table 1: MCDA Software

Software for Multiple Attribute Decision Analysis (MADA)	1000Minds	4eMka2 / jMAF	Accord
	CDP	DecideIT	Decision Explorer®
	Decision Desktop / Diviz	Decision Lab / Visual PROMETHEE	DPL 8
	D-Sight	ELCTREIII-IV	ELECTRE TRI
	ELECTRE IS	Equity	ESY
	Expert Choice	FuzzME	GeNIe-Smile
	HIPRE 3+	HIVIEW	IDS
	INPRE and ComPAIRS	IRIS (VIP)	JAMM / jRank
	Logical Decision	MakeIt Rational	Market Expert Markex
	MindDecider	MINORA	M-MACBETH / WISED
	MOIRA, MORIA Plus	NAIADE	OnBalance
	Prime Decisions	Priority Mapper	Prism decision System
	RICH Deicison	Rubis	SANNA
	MC-SDSS for ArcGIS	TransparentChoice	Triptych
	UTA Plus	Very Good Choice	VIP Analysis
	VISA	Visual UTA	WINGDSS
	WINPRE		
Software for Multiple Objective Optimization (MOO)	ACADEA	Analytic Optimizer	APOGEE
	BENSOLVE	FGM	GUIMOO
	iMOLPe	IND-NIMBUS	interalg
	iSight	modeFrontier	Optimus
	ParadisEO-MOEO	Pareto Front Viewer	RGDB
	SOLVEX	TRIMAP	Visual Market

The second consideration in selecting MCDA software is the specific MCDA method implemented by the software.

Corresponding to the two types of MCDA problem formulations, methods can be categorized into multiple criteria design methods and multiple criteria evaluation methods (Cho 2003). Multiple criteria design methods are intended to solve MOO problems, sometimes also referred to as multiple criteria design problems or continuous multiple criteria problems. A very large number of optimization methods of this type have been proposed, where each individual method is designed to solve a specific or a more generic type of MOO problem. Different MOO software generally implements different MOO methods. Multiple criteria evaluation methods are intended to solve MADA problems, sometimes also called multi-criteria evaluation or selection problems. Not all advertized software packages explicitly state the method(s) employed, and often this information needs to be derived from their technical description.

Group decision-making is a central concern in organizational settings since many important decisions are taken collectively by groups of people. The complexity of MCDA is greatly increased in the group setting. MCDA group decision support involves not only problem definition, criteria identification and prioritization, and individual preference elicitation, but also requires aggregating different individual preferences on a given set of alternatives into group judgments (Limayem and DeSanctis 2000). Some software packages are specific group decision support systems (GDSS), while others support both individual and group decision-making. Also, some packages provide group decision support only in specific versions or add-on modules.

The computing environment supported by a software package is also an important consideration in selecting an appropriate software package. If the desired software does not run on the user's currently available platform, extra updating costs may occur. Also, some users may prefer a web-based application rather than a standalone package, while others may not want to host the data on a server and prefer a desktop version. At least one available MCDA application offers a software-as-a-service (SaaS) version. Some mobile-based MCDA applications are also available, though currently these applications seem to be primarily intended for making personal decisions only. In the future, more mobile applications may be developed. Most MCDA packages were developed for Microsoft Windows based personal computers. Several software packages, mostly MOO software, are Microsoft Excel add-ons or Matlab solvers. There are some software packages exclusively implemented as web applications, and some with a web application version. There is also software implemented as plug-ins, or subroutine libraries. Some software packages are in fact subsystems of other packages. At least one software package requires a desktop client and a MySQL server. There is also an open source software package available.

Increases in computing power have been at the heart of the substantial growths in applications of MCDA (Wallenius et al. 2008). The aforementioned chapter by Weistroffer et al. (2005) provides a comprehensive survey of MCDA software, but many of the software packages presented in that survey have been discontinued or are no longer supported, and new software has been developed more recently, hence the need for an updated treatise. Poles, Vassileva, and Sasaki (2008) reviewed MOO software available since 1999, focusing on the tools and features that advisable MOO software should contain. An early empirical evaluation of five MCDA software packages and a comparison of their usefulness to a basic spreadsheet package was conducted by Zapatero, Smith, and Weistroffer (1997). Taking a different angle, Seixedo and Tereso (2010) constructed an AHP-based MCDA software application for selecting MCDA software. Mustajoki and Marttunen (2013) more recently did a comparison of some MCDA software with a specific focus on applicability to environmental impact assessment.

An updated review of the current state of MCDA software provides insights of not only what has been improved or what has not changed in MCDA software application development, but also what may be expected for the future. For one, most commercially marketed packages deal primarily with MADM problem models and use relatively simple algorithmic approaches. For example, many commercial software packages adopt MAUT and/or AHP methods, where AHP and SMART are frequently implemented together. In contrast, the large variety of sophisticated MCDM methods proposed in the literature have mostly been implemented only on an ad hoc basis to solve a specific problem situation, or as experimental software to demonstrate the salient features of the proposed method. Though many MOO methods have been proposed in the literature, there are still relatively few commercial MOO software packages offered. The available MOO commercial packages are mostly either integrated solver engines (e.g. Analytica Optimizer), or integrated in application-specific software solutions (e.g. iSight, modeFrontier).

Changes in MCDA software in the past decade are also evident. First, MCDA has begun to penetrate many new areas of research and applications. For example, MCDA methods have been applied in new engineering applications, such as ESY for nuclear emergencies and iSight in 3D simulation design. Another example is spatial planning and management, where MCDA software packages are designed for integration with geographic

information systems (GIS), such as MC-SDSS for ArcGIS, Priority Mapper, and Visual PROMETHEE PROMap, and engineering applications. Second, MCDA software solutions have moved towards web-based and service-oriented platforms, facilitated by increasing computing power and improved Internet technology. Third, it is interesting to see MCDA applications, such as ParadiseEO-MOEO and Decision Lab 2000, that have adopted an open source philosophy, an approach that has already become a major part of general, mainstream information technology development. Open architecture provides greater opportunities for implementation of state-of-the-art MCDA methods and continuous software enhancements by open source developers. It also allows the flexibility to adapt specific MCDA methods for particular business problems. However, the learning curves for open source solutions are quite steep and open source development may require sophisticated understanding of MCDA principles and methods. Nevertheless, we expect to see more open source initiatives in MCDA software development in the future. Another area for potentially more future MCDA software development is mobile MCDA applications. Currently, MCDA mobile applications seem to be designed only for personal decision-making. Some examples of such applications include Mobile Decision Maker by Broad Research Software (http://mobiledecisionmaker.com), decision buddy (http://www.decisionbuddyapp.com), and Decisionaker by lemonway (http://www.lemonway.com/index.php/products/14-ios-application/58-decisionaker-support-page).

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About the 82nd Meeting

University of Southern Denmark, Odense,
24 – 26 September 2015

On the 24th – 26th September 2015, the 82nd Meeting of the European Working Group on Multiple Criteria Decision Aiding was held at the University of Southern Denmark in Odense (Denmark). About 40 researchers from different countries participated to the meeting that had as main theme "Decision-making problems in sustainable development" and was scheduled in seven different sessions which gathered 27 papers. During the second day the information about the 83rd Meeting of EURO Working Group on MCDA to be held in Barcelona (Spain) in Spring 2016 was discussed. On Saturday 26th September 2015, the participants visited the local Odense city and Egeskov Castel.

82ème Journées du Groupe de Travail Européen «Aide Multicritère à la Décision»

82nd Meeting of the European Working Group «Multiple Criteria Decision Aiding»
University of Southern Denmark, Odense, DENMARK
24-26 Septembre 2015 - 24th – 26th September 2015

SCIENTIFIC PROGRAM /PROGRAMME SCIENTIFIQUE

Day 1: 24 September 2015

12:00 – 12:45 Enregistrement / Registration of participants

12:45 – 13:00 Mot de bienvenue / Welcome address

13:00-14:30 Session 1, Chair: Stefan Bracke

- Arayeh Afsordegan, Luis Del Vasto-Terrientes, Aida Valls, Núria Agell, Mónica Sánchez: A Hierarchical Assessment to Find the Most Sustainable Wind Farm Sites.
- Jafar Rezaei, Chrysoula Vana, Lori Tavasszy: A green supplier segmentation using supplier potential matrix, ELECTRE TRI-C and carbon impact assessment.
- Marco Cinelli,Stuart R.Coles, Mallikarjuna N.Nadagouda,Jerzy Błaszczyński,Roman Słowiński, Rajender S. Varma, Kerry Kirwan: Multiple Criteria Decision Aiding Moves Sustainable Nanotechnology Forward.

Discussion papers

- Marcus Brandenburg, Tobias Rebs: Simulation and optimization to configure eco-efficient supply chains under consideration of performance and risk aspects .
- Fouad Ben Abdelaziz, Unstable interactions in customers' decision making.

14:30 – 14:45 Coffee break

14:45 – 16:15 Session 2, Chair: Roman Słowiński

- Alessandro Hill, Silvia Schwarze: Multi-objective design of ring tree networks under single-node-failures.
- Ewa Konarzewska-Gubala, Mostefa Ider: Stochastic Goal Programming for Energy Mix Portfolio Selection (case of Poland).
- A.R. Pizarro, M. Münster and H.Ravn: Waste management with multiple objectives - a Danish case.

Discussion papers

- S. Rozakis: Multi-objective project selection for technology transfer in the academia.

16:15 – 16:30 Coffee break

16:30 – 17:30 Session 3, Chair: Fouad Ben Abdelaziz

- Vasile Postolica: ISAC'S CONES.
- Erik Skov Madsen: Vocational Education and Vocational Skills - urgent need in European Production

17:30 End of day 1

20:00-22:30 Official dinner in Restaurant Den Grimme Ælling (The Ugly Duckling).

Day 2: 25 September 2015

09:00-10:30 Session 4, Chair: Aida Valls

- Skulimowski, Andrzej M.J: Applications of Anticipatory Networks to Planning Sustainable Decisions.
- Stanislav E. Shmelev: Multidimensional Assessment of Sustainability at the Macro Scale.
- Stefan Bracke: Contribution for decision making regarding a balance between environment and functional-related product characteristics based on cluster analytics within the product development.

Discussion papers

- Marcus Brandenburg, Tobias Rebs: Inter-Organizational Quantitative Modeling for Sustainable Supply Chain Management.

10:30- 10:45 Coffee break

10:45- 12:15 Session 5, Chair: Milosz Kadzinski

- Eduardo Fernandez, Jorge Navarro: An extension of ELECTRE TRI-B using enhanced boundaries.
- Milosz Kadzinski, Tomasz Mieszkowski, Michal Tomczyk, Sebastien Bigaret: Construct your own ELECTRE method.
- Ghaderi, Mohammad Ruiz Vegas, Francisco Agell, Núria: Modeling Heterogeneity in Group Decision-making.

Discussion papers

- Miriam Martínez-García Aida Valls Antonio Moreno: Making decisions with ELECTRE from semantic data.

12:15- 14:00 Lunch break

14:00 -14:30 EWG MCDA events

14:30- 15:30 Session 6, Chair: Figueira, J.R.,

- Patrick MEYER, Alexandru-Liviu OLTEANU: Generalized multi-criteria majority-rule sorting for handling imprecise or missing evaluations.
- Andrea Arcidiacono, Marta Bottero, Chiara D'Alpaos, Alessandra Oppio: Assessing the impact of urban quality on real estate market: a proposal for a MCDA framework.

Discussion papers

- Roman Slowinski, Milosz Kadzinski, Salvatore Greco: Collective Classification Decisions under Uncertainty and Rule Preference Model.

15:30- 15:45 Coffee break

15:45- 17:15 Session 7, Chair: Luis Dias

- Tolga GENC, Mehmet KABAK: Designing a Hybrid Energy Model with MCDM Methods.

- Luis Dias, Carolina Passeira, João Malça, Fausto Freire: Integrating Life-Cycle Assessment and Multi-Criteria Decision Analysis to compare bio-diesel alternative chains.
- Maria Cerreta, Simona Panaro: From Co-evaluation to Co-Decision: A Multi-Methodological Approach for an Endogenous Local Development Model.

Discussion papers

- Brabant, Q. and Couceiro, M. and Figueira, J.R., An empirical study of k-maxitive Sugeno integral in multiriteria decision aid.

17:15-17:30 Conclusion

Seminars

SEMINAIRE «MODELISATION DES PREFERENCES ET AIDE MULTICRITERE A LA DECISION»
Responsables: Bernard ROY, Daniel VANDERPOOTEN
(le mardi à 14h00 – salles à préciser)

Prochaines reunions

19 janvier 2016: Conférence de Gaëlle Lortal
Laboratoire de Raisonnement et Analyse dans les Systèmes
Complexes - Thales Research & Technology
"Utilisation de connaissances en cognition pour soutenir les
activités de veille"

9 février 2016: Conférence de Matias Nunez
LAMSADE – Université Paris Dauphine
"Unanimous Implementation: A Case for Approval Mechanisms"

8 mars 2016: Conférence de Kathrin Klamroth
University of Wuppertal
"A Multiple Objective View on Outlier Handling - the Exampleof Center Location Problems"

12 avril 2016: Conférence de Alessio Ishizaka
Université de Portsmouth
"Multi-criteria sorting methods: AHPSort I and II"

Forthcoming meetings

83rd Meeting of EURO Working Group on MCDA, Barcelona, Spain, March 31 - April 2, 2016

The International Conference on Multidimensional Finance, Insurance and Investment, June 26-29, 2016, Alcoy (Spain). http://icmfii.com/

Applied mathematical programming and Modelling (APMOD 2016), Brno, Czech Republic, June 8-10, 2016. http://www.apmod2016.org/

EURO 2016, Poznan, Poland, July 3-6, 2016. http://www.euro2016.poznan.pl/

12th MCDA/M Summer School 2016, Recife, Brazil, July 18-29, 2016.
http://cdsid.org.br/mc-summer-school2016/

GECCO 2016 - Genetic and Evolutionary Computation Conference, July 20-24, 2016, Denver, Colorado, USA.
http://www.sigevo.org/gecco-2016/

84th Meeting of EURO Working Group on MCDA, Vienna, Austria, September 2016

First EAI International Conference on Computer Science and Engineering, November 11-12, 2016, Malaysia.
http://compse-conf.org/2016/show/home

Announcements andCall for Papers

By Prof Bertrand Mareschal and Jean-Philippe Waaub

The **PROMETHEE Days 2016 workshop** will take place in Montréal next year from May 2 to 4, 2016, together with the Optimization Days 2016 International Conference. It is a great opportunity for you to share your PROMETHEE experience with PROMETHEE Community's fellows in one of the nicest places in North America.

Papers related to theoretical developments, comparative analyses or practical applications of the PROMETHEE multicriteria decision aid methods are welcome.

The best paper presented during the workshop will be granted the Jean-Pierre Brans PROMETHEE Award and all participants will have the opportunity to submit full versions of their papers for a special issue of the International Journal of Multicriteria Decision Making.

The Call for Papers and complete information related to the workshop are now available online from the PROMETHEE Days web site:http://www.promethee-days.comor directly from the Optimization Days 2016 web site:
https://symposia.gerad.ca/jopt2016/en

Web site for Annoucements and Call for Papers:
www.cs.put.poznan.pl/ewgmcda

Books

Evaluation and Decision Models with Multiple Criteria - Case Studies

Editors: Bisdorff, R., Dias, L.C., Meyer, P., Mousseau, V., Pirlot, M.
International Handbooks on Information Systems, Springer, 2015.

This book illustrates the diversity of Multicriteria Decision Aiding (MCDA) techniques through 15 applications, by underlining the difficulties that a "decision aider" (or analyst) could face in a real-world situation. The first three chapters propose the reader to (re)discover the theoretical foundations of the MCDA field as well as of preference modelling. The next 15 chapters present a large variety of applications: decision problems linked to issues such as energy, environment, transportation or finance. An originality of this book is that each of these chapters is highlighted by a comment of the editors which allows the reader to position the application in the general context introduced in the first three theoretical chapters, showing also how all the applications fit a common scheme of a decision aiding process. Hence the book not only illustrates the diversity of decision aiding contexts but also inscribes them all in a unifying decision aiding process concept. Finally, the last two chapters present free software tools which support the decision aiding process, namely the diviz ecosystem.

http://www.springer.com/us/book/9783662468159

Articles Harvest

(This section is prepared by Salvatore CORRENTE, **salvatore.corrente@unict.it**)

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Announcement:

The "Useful links" section of the group's homepage

(www.cs.put.poznan.pl/ewgmcda)

is being enlarged. Contributions of URL links to societies, research groups and other links of interest are welcome.

A membership directory of the European Working Group on "Multiple Criteria Decision Aiding" is available at the same site. If you would like to be listed in this directory please send us your data (see examples already in the directory).

Contact: José Rui Figueira (figueira@ist.utl.pt)

Web site for the EUROWorking Group "Multicriteria Aid for Decisions"

A World Wide Web site for the EURO Working Group on "Multicriteria Aid for Decisions" is already available at the URL:
http://www.cs.put.poznan.pl/ewgmcda/

Web site Editor: Milosz Kadzinski (Milosz.Kadzinski@cs.put.poznan.pl)

This WWW site is aimed not just at making available the most relevant information contained in the Newsletter sections, but it also intends to become an online discussion forum, where other information and opinion articles could appear in order to create a more lively atmosphere within the group.

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Salvatore Greco
Bernard Roy (Honorary Chairman)

Newsletter editor:

José Rui Figueira

URL:
http://www.cs.put.poznan.pl/ewgmcda

Permanent Collaborators:

Silvia Angilella, Maria João Alves, Carlos Henggeler Antunes, Juscelino Almeida-Dias, Salvatore Corrente

This newsletter is published twice a year by the "EWG on MCDA", in November/December and April/May , with financial support of the Association of European Operational Research

Contributions should be sent to:

José Rui Figueira (figueira@ist.utl.pt)

José Rui Figueira
Instituto Superior Tecnico
Departamento de Engenharia e Gestao
Campus da Alameda
Av. Rovisco Pais
1049-001 Lisboa, Portugal
E-mail: figueira@ist.utl.pt