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"Multicriteria Aid for Decisions"

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## Announcement:

A membership directory of the European Working Group on "Multicriteria Aid for Decisions" is now available at:

http://www.inescc.pt/~ewgmcda/Directory.html

If you would like to be in this directory please send an e-mail to José Figueira (figueira@fe.uc.pt) or to Luís Dias (ldias@inescc.pt) with the following data:

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- *Surname, first name*
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(Please see examples already published in the directory)



## Opinion Makers Section

(This section is prepared by João Clímaco)

### The strength of weaker MCDA methods

*by*

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*Finland*

Inspired by the interesting discussion in the EWG/MCDA Newsletter, we would like to contribute with some of our own thoughts of the behavioural aspects of decision-making and ideas on how to overcome some biases.

During the past ten years we have participated in a number of real-life MCDA applications, mainly in the field of public environmental decision making. In our vocabulary 'real-life application' (RLA) is close to the definition of Kasanen et al. (2000), but most of our applications would fit well into one or more of the categories B to F that Vincke proposed in the Newsletter of fall 2000. We have acted in these projects as the MCDA analysts as well as developed some new methodologies and software tools in conjunction with these applications.

To begin with, let us discuss some possible answers to the philosophical question "What is our goal in MCDA?":

- To assist in making "better decisions". Unfortunately, in general, there is no objective measure for a claim that one decision is better than another. At best, we can eliminate dominated alternatives, and try to control the decision process so that obvious mistakes and oversights are avoided.
- To assist in making decisions that the DMs (or the public) will be happier with. Even this weaker goal can be difficult to reach in RLAs because we cannot know the reference point, i.e., what the solution might have been with some other MCDA method, or without any method at all.
- To assist in making decisions that the DMs (or the public) will be satisfied with. Without a reference point, the DMs can judge qualitatively how well they think they understood the problem, how satisfied they were with the method, and how strongly they believe in having made the right decision. Such *satisficing* decision aids were discussed by Rauschmayer in the Newsletter of spring 2001.
- To save work and other resources in the decision-making process. Good MCDA methods can streamline or automate parts of the information processing and reduce the information requirements in decision making

(e.g. ordinal vs. cardinal information, preference information-free methods). These savings can be assessed relatively easily. In this weakest goal, the decisions do not necessarily have to be subjectively or objectively "better". Of course the decision quality may improve if the saved resources can be used to deepen the analysis.

With these different possible goals in mind, we can try to evaluate how results from behavioural research should be considered in MCDA. For one thing, we think it is necessary to point out that the results from behavioural research typically emerge from only small fragments of behaviour. There is no clear understanding how these limited observations should be combined to understand the overall decision-making process.

Nevertheless, even fractional behavioural information is obviously useful. We believe that the most important function in each goal setting is to ensure that the decision-making method does not put any unreasonable demands on the DMs. Having the DMs make holistic evaluations in high-dimensional spaces may result in arbitrary answers. The DMs may refuse to express tradeoffs between criteria that are fundamentally incomparable or otherwise alien to them. Too many pairwise questions (as in large AHP models) may cause boredom and fatigue and result in increasingly inconsistent answers.

Understanding how humans process information is clearly important when constructing various decision models. The DMs (and the public) are more likely to accept the method and the results if they are able to understand the decision model and find the method somehow "natural".

In the stronger goal settings, it is indeed essential to try to avoid the various behavioural biases that may have substantial influence e.g. "on the form of the value function model", as Stewart states in the Newsletter of fall 2000. He also mentions that "… all methods make use of direct or indirect weighting of the criteria". Of course, there is also a category of so-called *preference information-free* MCDA methods that can be used without direct or indirect weighting of the criteria. One obvious advantage of these methods is that they are less susceptible to the framing, anchoring and availability biases.

Preference information-free methods include e.g. the Hypervolume criterion method by Charnetski & Soland (1978), Overall compromise criterion method by Bana e Costa (1986), and SMAA-family of methods by Lahdelma et al. (1998, 2001). These methods operate by exploring the space of possible weights internally, and reveal what kinds of preferences favour each alternative. In particular, the SMAA-methods perform a stochastic weight space analysis, and compute how large shares of weights would make an alternative the best one (stochastic efficiency), or place it on a particular rank (SMAA-2). This descriptive information can then be used to identify the probably best alternatives, to eliminate inferior alternatives, or to find alternatives reflecting potential compromises. The DMs can either make the decision based on this information, or narrow the weight space by providing (partial) preference information. This approach is less sensitive to the different behavioural biases, because it can be used completely without or with only partial preference information.

Preference-information-free decision-making methods can also alleviate the problem of representing the preferences of non-existent decision actors, which was mentioned by Rauschmayer in the Newsletter of spring 2001. As these methods consider all possible preferences, they will also include the preferences of these missing DMs. Obviously, their interests must be represented among the set of criteria, and no formal method can ultimately guarantee this.

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## Présentations bilingues dans un groupe de travail bilingue

*by*

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It is a main aim of analysts working in multi-criteria aid to stay quite close to reality. Assumptions about decision actors should be as close as possible to their real behaviour or to their capacities. The same should be true for the proceeding within our working group.

What are the real language capacities of the members of the group and of those who would like to be members but find the bilingual meetings too arduous? Did the group membership change over the last years (with the opening up towards eastern Europe)? Those of you who know me, know that I am equally comfortable with English and French, but I am concerned by the fact that some members are excluded from presentations in French (many more than from English presentations). Taking into account the now 27-year long history of the working group as well as the geographical and lingual centres of MCDA, I fully accept the preponderant role of French as the non-English language. Experiencing the difficulties of presenting in other languages, and seeing a particularly high "threshold level" for many French-speaking people to present or discuss in English, I am not at all against a multilingual workshop, but I find the practice of monolingual presentations not satisfying.

What could we learn from other practices? In many Swiss (and some German) journals, there are at least summaries in (an)other language(s) at the end of the article. I think that it would not demand too much effort from those who present at the MCDA workshops to do their slides (etc.) as well as a short distributed summary in the other language (English or French). In some special cases (e.g., when presenting software) this might demand too much, but in most cases, this small effort should be feasible. At the Leipzig workshop next march, Martin Drechsler and myself will use this formula as a general recommendation – we will see whether it works.

## Answer to Felix Rauschmayer's article (in Opinion Makers Section, Newsletter, series 3, no 3, Spring 2001)

*by*

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Felix Rauschmayer's article is a challenging one. He addresses the issue of the responsibility of the analyst. Whom and / or what is she responsible to?

The author's answer tends clearly in the direction of the Humanity, both present and future, and then of the Nature : "[…] her responsibility to [them] might outweigh her responsibility to the [decision maker]". This choice, that the author labels as ethical, generates direct practical difficulties, namely the ways to exercise this responsibility. To summarise the author's options, this can be achieved by "the integration of specific stakeholders, of specific criteria, or forms of evaluation which consider, for example, the interests of future generations". Her attitude and action to do that? "In extreme cases, she might drop the case, or *falsify the decision process*. […] more importantly, the analyst should influence the preferences of the [decision maker] openly, if the latter neglects his responsibility to others" (our emphasis).

As an individual and a professional, I do share most of the author's concern for the future and proposals. But there is a limit beyond which I cannot follow him. Namely, his proposal to falsify the decision process. I am convinced that the analyst influences the decision process anyway, both consciously and unconsciously, and I can live with that. But falsifying the decision process is something different, something about legitimacy. The analyst can have a strong feeling of responsibility to someone or somewhat, but has she the legitimacy to act in their name?

This question is difficult for unborn beings. In my opinion, the only way to pretend to this legitimacy is to do it in the open and to accept to be challenged by other people pretending the same. The usual place for this is *politics*. I am very respectful for those – NGOs, political parties, pressure groups – who try to be the heralds of those who cannot defend themselves, because they are too poor, too far, too young or not even born yet. (The same holds for

those defending the animals and the nature.) The mistakes and sometimes abuses made while trying to represent them should not prevent people to continue in that direction.

Coming back to the analyst, whatever she tries to do in order to influence the decision process, she must do it openly. She can propose everything – new goals, stakeholders, alternatives, constraints, criteria, etc. – and remains free to adapt her behaviour according to the fate of her proposals. I share the author's view that sometimes, the only honourable action is to withdraw from the decision process, as mentioned explicitly in (Pictet, 1996 : 143 ss.).

The analyst's position – not to mention the facilitator's – is a precarious one. Her participation to the process depends on her acceptance by all the actors. If she looses their trust, the game is over. The risk is not only the loss of professional prestige ; it deals also with the opportunity for the analyst to influence significantly or not the process in the direction she believes to be the right one.

Assessing this risk is everyone's duty. For myself, I am convinced to be more effective by influencing openly the processes I am involved in. In a recent case, I have been asked to participate for this very reason. Up to now, I never had to withdraw – even though I had once to threaten to do so – and hope I never will have to.

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## Commentary to Jacques Pictet's answer (this issue)

*by*

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I appreciate Jacques Pictet's support for most of the concerns and proposals expressed in my article. He disagrees with my proposal of falsification for most extreme cases of decision aid. My most extreme cases are those no one of us will never be confronted with (at least, I very much hope so). These cases are found in history (especially Germany is "famous" for it), but also in our times: "Dear analyst, could you help me to decide about the best way to a genocide?" In those cases, it mostly is a case of very great courage for the analyst to withdraw from the task, but it might be better to falsify the process. The rarity of those cases might justify not to talk about the possibility of falsification, but it must be clear that

1. there is something above a professional code of conduct; and
2. the limit between "legitimate" influence and falsification is fuzzy.

This last point became clear to me when I thought about J. Pictet's answer. As the limit is fuzzy, and as there are both sides of the limit, the legitimate and the (nearly always) illegitimate, we have to think about getting the limit clearer. This can't be done without ethics.

## "Biases" in Decision Making: Some Responses to Felix Rauschmayer and Mordecai Henig (in Opinion Makers Section, Newsletter, series 3, no 3, Spring 2001)

*by*

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I am gratified and not a little flattered that my brief article in the Autumn 2000 Newsletter gave rise to two responses, both longer than my original article. Thank you colleagues!

As I read and re-read the articles by Felix Rauschmayer and Mordecai Henig in the Spring 2001 Newsletter, I found myself in essential agreement with the sentiments and views expressed. I was a little perplexed, therefore, to detect a sense, especially from Mordecai, of adopting a debating stance as if there were substantial points of disagreement between us. I can only think that somehow I had not expressed myself clearly. The fault is entirely mine, but I am grateful to the editors for giving me the opportunity to clarify one or two points.

A primary source of confusion appears to derive from my use of the word "bias" in what I believed to be the sense implied by Kahnemann and Tversky.

"Bias" in this context does not have the technical meaning that it has in statistics, where bias is a measure of systematic deviation from a "true" parameter value. Rather, I use the word in the common language sense of any tendency to move towards one type of conclusion rather than another. The Chambers' English dictionary talks of "any special influence that sway's one's thinking". In this sense, bias in human judgement can be described without there needing to be any true reference (Rauschmayer) or axiomatic systems (Henig).

This can perhaps be illustrated by considering the well-known "anchoring and adjustment" bias in cognitive tasks. Although this is usually demonstrated in the context of estimating subjective probabilities for example (where there might, but need not necessarily be a true "correct" answer), there seems to be every reason to believe that it would apply equally well to tasks in MCDA such as assessment of importance weights. In essence, the phenomenon of anchoring and adjustment is that numerical judgements or assessments are strongly influenced by whatever initial value is first tabled, which in turn may be a product of many influences unrelated to the actual decision problem at hand. For example, suppose the facilitator of a group discussion around importance weights makes use of a software system in which weights are displayed on bar graphs, where the height of each bar may be dragged up or down to represent the weights. The facilitator might well adopt one of the following strategies (and I have certainly used both):

1. Start with all bars of equal height;
2. Start by suggesting a rank ordering of weights, on the basis of which the bars are initially set to heights corresponding to the centroid weights of SMARTER.

On the basis of research results on anchoring and adjustment, I would conjecture (although I have not carried out the experiments – anyone like to try?) that the finally accepted weights would show less dispersion in the former strategy than in the latter. This would be a bias which we can describe without implying in any sense that "true" weights exist. I recall (but couldn't find the reference in the last minute rush of preparing this article) John Buchanan reporting similar anchoring and adjustment phenomena in the context of interactive methods.

The concern I was expressing in my previous article was that those involved in applying MCDA should be more sensitive to the existence of such biases or influences, where these influences may even be generated by the analysts/facilitators themselves. In contrast to Mordecai, I am not convinced that we yet understand the extent of such influences. I do share with Felix Rauschmayer the sense that this has to do with the ethics of MCDA practice. Analysts need to realize that there are many subtle ways in which they and their models can "bias" the results obtained, in the sense of generating tendencies towards one type of solution rather than another. For example, in applying value function methods, over-linearization will lead to the exclusion of convex-dominated solutions, and to the encouragement of extreme solutions (very good on some criteria, very poor on others). It is not constraining the value judgements of decision makers in any way to point this out; in fact it is our ethical duty to do so!

Another point of potential confusion relates to the concept of a "satisfactory" or "satisficing" solution. I did not mean to imply that there exists a "solution" to an MCDM problem in any objective sense. But I do believe that the aim of MCDA should be to take decision makers to the point at which they are content or satisfied that the issues have been adequately explored, and that they do fully understand the choices or recommendations they are making. In group decision-making contexts this implies also that the resulting policy choices can be fully motivated, and that the interests of all interested parties have been given fair consideration. There have been times when I (as facilitator/analyst) have been uncomfortable with decision makers foreclosing on options too early, leaving the potential for serious post-decision regret and conflict, and have felt obliged to make this known. In this sense, I agree with Felix Rauschmayer that I am not always "obliged to accept all types of preferences". I find Mordecai Henig's statement that the contribution of MCDM includes "... complying with revealed preferences" a little simplistic and even perhaps dangerous. If we simply reflect back preconceived answers, are we adding much value? If I know that there is potential for judgemental biases, and have reason to suspect that there will be substantial post-decision regret, I need at very least to point this out to decision makers.

In conclusion, however, there is no doubt concerning the one point on which we all agree, namely Mordecai's final sentence: "There is more to decision making than selecting an alternative".



# MCDA Research Groups

## German Working Group "Decision Theory and Practice"

*by*

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The working group was founded in the former German Democratic Republic. After the reunification of Germany, it was integrated into the "Deutsche Gesellschaft fuer Operations Research (DGOR)", which became the "Gesellschaft fuer Operations Research (GOR)" after the unification with the "Gesellschaft fuer Mathematik, Oekonomie und Operations Research (GMÖOR)", the other former German OR- Society.

The character of this working group remained essentially the same over all the organizational changes concerning the sponsorship of the group. Its main topics are:

- To provide a basis for exchanging experiences for those people interested in decision theory, especially in multicriteria problems and problems with incomplete information.
- To bring together people working in the field from different disciplines, especially from Mathematics, Economics, Business Administration, Physics, and Engineering.
- To bridge the gap between scientists and practitioners.

From the very beginning of the group, multicriteria decision making played a central role in its work. There was a very fruitful cooperation between mathematicians like Alfred Goepfert and Reinhard Nehse, who did a lot of work in vector optimization and engineers like Jochen Ester and others, who applied vector optimization techniques as well as outranking methods to different problems in engineering.

Today the work of the group is based on different groups of researchers capturing a wide range of areas of decision making. The group of Bruno Brosowski is working on non-linear vector optimization problems for various industrial applications. Walter Habenicht and his group are working on discrete vector optimization problems with applications in logistics and scheduling. Applications of vector optimization approaches in physics and engineering are treated by Johannes Jahn, while Heinrich Rommelfanger and his group apply fuzzy approaches to multicriteria decision making. The group of Dieter Schweigert is working on multicriteria combinatorial problems, and Rudolf Vetschera works on multicriteria approaches in group decision making and principal agent theory. Finally, the groups of Gert Wanka and Christiane Tammer do a lot of theoretical work on non-linear vector optimization, especially on duality and control theory.

Every year the group organizes a three-days workshop with a rather intimate atmosphere. The next workshop will be organized by Walter Habenicht at Stuttgart-Hohenheim. It will take place on march 21st – 23rd . Those, who are interested in the workshop, may contact the group by the following e-mail address: mjgeiger@uni-hohenheim.de or they may visit the homepage of the group: http://www.ibl.uni-hohenheim.de/decision/ .

# Forum

## What are real-life applications of decision support?

*by*

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Recently our colleague Alexander Lotov submitted to the discussion list of the MCDM society the above question. In fact the question arose from the concern (rather common among the MCDM community) that there are few real life applications of our theories and methods. Further on it is not clear what a real-life application means and how we consider that a real-life succeeded or not. At the time I have contributed a brief comment to the problem. I come back with

pleasure on this issue trying to further explain my thoughts.

First of all I only partially agree with the concern about ``few real-life applications of MCDA". There are few reports about real-life applications published in scientific journals and even less done by academic people, but multiple criteria decision support is practiced every day by a large number of companies and consulting agencies (more or less correctly and/or successfully). Such experiences almost never appear in scientific journals and this is quite natural. Practitioners do not need a scientific legitimation of their activity. Further on, the usual standards applied by scientific journals in order to accept a paper are difficult to apply at empirical considerations and in any case make difficult (to a practitioner) to write such a paper. Unless we motivate practitioners with arguments which are not only academic such a situation will not change.

The legitimate concern is whether the people which teach decision support and produce theory about it have real-life experiences of decision support! I do not claim that scientific legitimation of a theory lies only on empirical grounds, but I consider that empirical validation is an important dimension of any scientific theory. From that point of view the small number of real-life applications reported by academic people in the scientific literature can be considered a concern.

Remains open the question of what can be considered a real-life application. In fact several times, acting as a referee, I receive papers which claim to include real-life validation of the suggested theory, while in reality at the best it is just an empirical validation with data coming from reality.

To my point of view a real-life application is the one where it is possible to observe what I call a decision aiding process. That means that at least a client and an analyst are involved, the first expressing a "problem", the second trying to give him some advice. Other actors may be involved, each with different concerns and stakes in the process.

The above description can apply to cases where the client is a patient and the analyst is a psychologist or a physician, the client is anybody and the analyst is a lawyer. What distinguish and characterise our field is the use of formal methods, that is methods reducing ambiguity, typical of human communication. Under such a perspective the output of the decision aiding process is not the result of a method applied to a model, but the advice given to the client and further the use of such an advice done by the client. This is the reason for which is important, in order to speak about real-life applications, that it exists a client. I cannot see an operational validation of a theory without a client involved.

Can we speak about "successful" real life applications? This involves two dimensions. The first is client's satisfaction. Here we have to pay attention. Satisfaction does not mean that the method output or the analyst advice were accepted by the client. It can be the case (and I had such experiences) where the advice was more or less rejected, but where the process was satisfactory because enabled the client to understand better his problem. Therefore satisfaction refers to the decision aiding process and not to its result. The second dimension is correctness. In the sense that the advice has to be based on a sound basis and fulfill at least basic meaningfulness requirements. Not all methods and models apply to all cases.

The above description implies the existence of a, let's say, observable entity which is the couple client-analyst. Only a third observer can analyse critically the behaviour of such an entity.Unfortunately in our field we do not use what in other fields is called a supervisor, that is a independent observer of the decision aiding process. I think that we have a lot to learn by adopting such an approach.

Consider in fact the question about client's independence and capacity to be critic towards the analyst. In other terms: are we sure that we do not influence the client by just using a certain approach instead of another? And how the client can be aware of such an influence? This is a key issue in analysing the experience of a real-life application of decision support, but almost never has been discussed.

Real-life applications of decision support have to be an essential component of the experience background of people doing research. However, I feel that we still do not have a common concept of what that does it mean and moreover on how such experience can be correctly used and validated. I hope my modest contribution will be useful in this direction.

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The full documentation of the discussion is avalaible at the fowllowing URL:

**http://www.ccas.ru/mmes/mmeda/real-life.htm**

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# Software

## Software for Visualization of the Feasible Set in Criterion Space in Nonlinear MCDA Problems

*by*

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Visualization of information, i.e. transformation of symbolic data into geometric information that aids in forming a mental picture of the data, turned out to be the most effective tool of human-computer communication. Multiple Criteria Decision Aid (MCDA) procedures can benefit from applying visualization. Our approach introduced in [1] is based on visualization of the Feasible Set in Criterion Space (FSCS). User (decision maker or expert) obtains general orientation in the criterion space that may help him to access the limits of what is possible in terms of criteria. In the case of more than two criteria, visualization is based on approximating the FSCS by simple figures and subsequent on-line display of the approximation using its two-criterion slices. Visualization of the FSCS can be incorporated into various MCDA methods. Say, it can be used for visualization of location of the current solution in interactive MCDA procedures. However, its most effective real-life application turned out to be related to goal programming, in the framework of which visualization of the FSCS helps to identify a preferable feasible goal (Feasible Goals Method, the FGM).

In the linear case, the FSCS is convex. For this reason, a polyhedral approximation of it can be constructed using a combination of optimization and Fourier convolution of linear inequalities ([2], [3]). If the number of criteria does not exceed seven, the approximation can be as precise as desired. Due to this, the Pareto set in criterion space can be displayed as the frontier of the FSCS; user can obtain information on efficient criterion tradeoff. Collections of two-criterion slices of the approximation can be even animated. These features help to apply the FGM in real-life decision problems described by large linear models (see [2] and [3]).

The problem is much more complicated in the nonlinear case, for which the FSCS is usually non-convex. In this case, as it was proposed in [4], collections of boxes (parallelotops) with edges that are parallel to the coordinate axes are used for approximating the FSCS. Centers of the boxes are computed as filtered outputs of random feasible decision points.

Assume that the decision set $X$ belongs to a metric space $W$ and the criterion space is $R^m$ with the Tchebycheff metrics. Let us consider a mapping $f$ from $W$ to $R^m$. Then, the FSCS is $Y = f(X)$. Let $\mu$ be the uniform measure defined on $X$, $\mu(X) = 1$. We assume that $X$ is the unification of a finite number of compact measurable sets, on which $f$ is continuos. Let us consider a finite collection $T$ of points from $Y$ (covering base) and the set $(T)_\varepsilon$ , the $\varepsilon$-neighborhood of $T$, which is the approximating set of boxes. The quality of the approximation is measured by the values of $\varepsilon$ and

$$\eta(\varepsilon) = (\mu(f^{-1}((T)_\varepsilon \cap Y)),$$

which shows what portion of $X$ results in criterion points that belong to $(T)_\varepsilon$. The following iterative method is used for constructing a covering base $T$ that results in a desired $(\varepsilon^*, \eta^*)$-approximation of $Y$ with given $0 < \eta^* < 1$ and $0 < \varepsilon^*$. Before any iteration, a covering base $T$ is supposed to be given. Iteration consists of three steps:

1. outputs of $N$ random independent points from $X$ are computed;
2. these outputs are used for estimating the dependence $\eta(\varepsilon)$ for the covering base $T$ and testing the termination condition $\eta(\varepsilon^*) \geq \eta^*$ with a reliability $\chi < 1$ that depends on $\eta^*$ and $N$;
3. if the termination condition is not satisfied, $T$ is augmented by one or several output vectors that are most distant from $T$.

The number of points in the covering base $T$ that solves the problem depends on the form of the set $f(Y)$. For this reason, user may want to interrupt the process and select a satisficing value of $\varepsilon$. To support such decision, the dependence $\eta(\varepsilon)$ is displayed after any iteration. Detailed description of the method is given in [3].

The approximation is visualized in the form of collections of two-criterion slices, which can be computed and displayed fairly fast. In a picture, the values of two criteria are given on axes, values of a

third criterion are associated with colors, which change from slice to slice, and the ranges of all other criteria are specified (see Figure). User can explore a large number of pictures of this kind displayed on-line.

User may want to identify a preferable feasible goal on display. Then, a point from *T* that contains the identified goal in its *e*-neighborhood and the associated decision are found. Since the FSCS is approximated roughly, additional techniques for fine-tuning the feasible goal may be helpful.

The software that implements the above method was coded in the form of the add-in tool for MS Excel. It consists of four subsystems. The first one helps to formulate a nonlinear model using MS Excel means. The second one helps to specify criteria and approximation parameters. The covering base is constructed in the form of a table in the third subsystem. The last one visualizes the approximation on-line and helps to select a preferable goal on display. The software is described in [5]. A demo version can be found in Web at http://www.ccas.ru/mmes/mmeda.

The method requires large number of simulation runs. So, it can be applied in the case of relatively simple models (say, in early decision screening). However, the scope of its application can be broadened by its implementation at parallel and meta-computing platforms. Important that the method is ready for such implementation.

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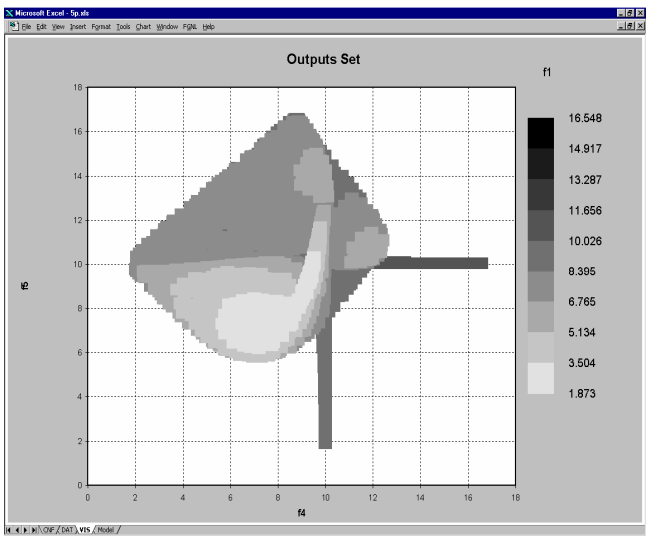
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[3] Lotov, A., Bushenkov, V., and Kamenev, G. (2001), *Feasible Goals Method. Search for Smart Decisions,* Computing Centre RAS, Moscow, Russia, 240 p. (in English).

[4] Kamenev, G., and Konrat’ev, D. (1992), “Method for Exploration of Non-Closed Nonlinear Models”, *Matematicheskoe Modelirovanie (Mathematical Modelling)* 4(3), 105-118 (in Russian).

[5] Berezkin, V.E., Kamenev, G.K., and Lotov, A.V. (2000), *Implementation of Feasible Goals Method for Nonlinear Case in MS Excel Environment*, Computing Centre RAS, Moscow, Russia, 42 p. (in Russian).

Figure. Black and white copy of color display. Collection of slices for five criteria problem is given. Two criteria (*f4* and *f5*) are located on axes. Intervals of the value of *f1* are given by shading here (color on display). Ranges of *f2* and *f3* were specified.






## Persons and Facts

Prof. Bernard Roy, founder of LAMSADE and the EURO working group on MCDA, has been appointed as honorary professor at Université Paris Dauphine, starting September 2001. While he retires from teaching and other academic duties he promised to remain definitely active in research. We all hope he will keep his promise.

Prof. Freerk Lootsma, Delft University, retired in March 2001. He still remains active in research,

namely looking behind the problem of hierarchical structures in decision making.
L’Université Paris-Dauphine a remis le diplôme de Docteur Honoris Causa à notre collègue Roman Slowinski. La présentation de Roman a été faite par Bernard Roy. La cérémonie a eu lieu le lundi 12 novembre 2001. Notre collègue Roman Slowinski est professeur à l’Université de Technologie de Poznan (Pologne) où il dirige le Laboratoire de Systèmes Intelligents d’Aide à la Décision (à l’Institut d’informatique).

## New Emailing List in Multi-criteria and Participatory Evaluations

*by*

**Wendy Proctor**
*CSIRO Sustainable Ecosystems*
*'Gungahlin Homestead'*
*Barton Highway, Canberra*

At the last conference of the European Society for Ecological Economics in Cambridge, UK, a number of people discussed and expressed an interest in setting up an emailing list to enhance communication and discussion in matters associated with multi-criteria and participatory type evaluations related to ecological economics (eg. Multi-criteria Decision Analysis, Citizen's Juries and other social processes of environmental valuation).

Though my own organisation, CSIRO, I have set up such a maling list and I invite all of you to subscribe and join in furthering communication in this field.

The list can be used for many purposes such as advising others of forthcoming related conferences, providing information on studies being undertaken in this field, pointing people in the direction of relevant web sites or even just asking questions and providing answers.

*To subscribe to the list "participatory_mce" you need to:*
1. Start a new message using a program like Outlook, Outlook Express, Eudora, Netscape, etc...
2. Address your message to "majordomo@cse.csiro.au" (without the quotation marks).
3. Leave the subject box blank (don't type anything there).
4.Type the following line (exactly) in the body of the message: subscribe participatory_mce
5. Send the message.
6. You'll be added to the list by the list's administrator (if approved).

*To unsubscribe from the list "participatory_mce" you need to*:

1.Start a new message using a program like Outlook, Outlook Express, Eudora, Netscape, etc...
2. Address your message to "majordomo@cse.csiro.au" (without the quotation marks).
3. Leave the subject box blank (don't type anything there)
4. Type the following line (exactly) in the body of the message: unsubscribe participatory_mce
5. Send the message.

*To send a message to the list "participatory_mce" you need to*:
1. Start a new message using a program like Outlook, Outlook Express, Eudora, Netscape, etc...
2. Address your message to:
"participatory_mce@cse.csiro.au"
(without the quotation marks).
3. Type some meaningful text in the subject line.
4. Type your message in the body of the message.
5. Send the message.

## Summer School “Decision Analysis and Artificial Intelligence”, Toulouse 9-21/9/2001

From the 9 to the 21 of September the XIX EURO Summer Institute took place in Toulouse, France. The subject of this ESI was "Decision Analysis and Artificial Intelligence" and it has been hosted by IRIT, Université Paul Sabatier de Toulouse. As usual the ESI was supported by EURO, plus three research laboratories, namely the IRIT, the LIP6, Université Paris 6 and the LAMSADE, Université Paris Dauphine.

There were 18 participants from 12 different countries (including an IFORS supported scholar) to the ESI, plus 8 tutorials on research subjects of both fields. Fascinating research directions have been highlighted during the ESI mainly on issues such as social choice theory, logic, preference modelling, planning, distributed decision making and learning. On that basis and thanks to the strong frendship relations created during the ESI a permanent working group is under establishment coordinated by Philippe Fortemps ( Philippe.Fortemps@fpms.ac.be) and Leon van der Torre (torre@cs.vu.nl). Interested people may contact them for further information and forthcoming initiatives. Details on the ESI can be still consulted on the web page:
(http://www-poleia.lip6.fr/~perny/ESI2001/)
which will be active for some time.

The ESI chairmen
*Patrice Perny*
*Alexis Tsoukiàs*



# About the 54th Meeting

**Durbuy, Belgique, 4 et 5 octobre 2001**.

Organisateurs :

**Marc Roubens**, *Université de Liège,*
**Philippe Vincke**, *Université de Bruxelles*

La 54e réunion du groupe de travail européen "Aide multicritère à la décision" s'est déroulée à l'hôtel Jean de Bohème dans la petite ville ardennaise de Durbuy les 4 et 5 octobre 2001. Elle a réuni 90 participants de 13 nationalités différentes.

Le thème principal retenu lors de ces journées a été "L'aide à la décision et les systèmes distribués". Ce sujet indique clairement la volonté de débattre au sein de ce groupe à la fois de sujets théoriques et appliqués.
En conformité avec l'esprit du groupe de travail ,une large place a été laissée à la discussion. Les débats qui ont suivi chaque présentation furent riches et animés.

Le thème principal a notamment donné lieu à une communication sur l'aide collaborative à la décision illustrée par un logiciel dénommé FILM-CONSEIL permettant aux cinéphiles de fournir leur avis sur les films qu'ils ont eu l'occasion de regarder et de choisir avec discernement au sein de la production cinématographique.

L'axe de recherche théorique a traité de thèmes actuels tels que l'analyse de la robustesse, l'exploitation d'information de type ordinal ou celle définie sur une échelle d'intervalle, le traitement de l'imprécision affectant les données, l'approche axiomatique de la concordance,...

Comme il est d'usage au sein du groupe, de nombreuses applications ont suscité l'intérêt des membres. Parmi celles-ci on retiendra la simulation dynamique d'un modèle de congestion du trafic, l'évolution environnementale stratégique du plan de transport de Montréal, la gestion des eaux du lac Erie,...

Lors du banquet, offert par CBC, un chaleureux hommage a été rendu à la longue et féconde activité scientifique du Président du groupe, Bernard Roy, dans plusieurs domaines de la recherche opérationnelle et des méthodes quantitatives de gestion tels que la théorie des graphes et l'aide multicritère à la décision. A cette occasion, le premier exemplaire d'un ouvrage publié en son honneur et intitulé "Aiding decisions with multiple criteria. Essays in honour of Bernard Roy" lui a été remis par Eric Jacquet-Lagrèze au nom des éditeurs de l'ouvrage, tous présents à la réunion. Il a souligné avec beaucoup d'émotion l'influence profonde et marquante de Bernard Roy sur la carrière scientifique ou professionnelle de ses anciens ou actuels collaborateurs.

Les activités sociales prévues le samedi ont réuni à Bruxelles une bonne partie des participants clôturant ainsi une fructueuse réunion placée sous le signe de l'amitié et de la bonne humeur. La dégustation du bon chocolat belge et de la gueuze artisanale y furent à l'honneur.

La 55e réunion aura lieu à Leipzig, Allemagne, du 14 au 16 mars 2002 et la 56e réunion se tiendra à Coimbra, Portugal en octobre 2002.

Ces journées ont été organisées avec le soutien :

- de EURO(The Association of European Operational Societies)

- du Fonds National de la Recherche Scientifique belge

- de l'Organisme National des Déchets Radioactifs et des Matières Fissiles
ONDRAF/NIRAS

- du Ministère de l'Enseignement supérieur et de la Recherche scientifique
de la Communauté française de Belgique

- de la Société DECIS

- de CBC Banque et Assurance

## Programme

**Jeudi 4 octobre / Thursday October 4**

13.30 - 14.15 Accueil Registration

**14.30 - 16.30 SESSION I - Président / Chairman : J.M. MARTEL**
14.30 - 15.30 P. PERNY, J.-D. ZUCKER (Paris) *Aide collaborative à la décision : le système Film-conseil.*
15.30 - 16.00 J. SPRINGAEL, P. KUNSCH, and Y. DE SMET (Brussels) *Modelling of multiple agents with local MCDA intelligence. An application to a dynamic simulation model of traffic congestion.*

16.00 - 16.30 C. DI MAURO, F. RINALDI MAZZEO, and J.-P. NORDVIK (Ispra) *Integrated approach for effective policy planning and monitoring in industrialised areas - an italian case study.*

**17.00 - 19.00 SESSION II - Président / Chairman : Y. SISKOS**

17.00 - 18.00 D. VANDERPOOTEN (Paris) *Différents concepts de solution pour les problèmes en variables 0-1 avec imprécision sur les coefficients de la fonction objectif* .

18.00 - 18.30 V. MOUSSEAU (Paris), L. DIAS (Coimbra) *Fuzzy outranking relations in ELECTRE providing manageable disaggregation procedures* .

18.30 - 19.00 L. DIAS (Coimbra), C. GOMES da SILVA (Leiria), J. FIGUEIRA (Coimbra), V. MOUSSEAU (Paris) and J. CLÍMACO (Coimbra) *Interactive robustness analysis and parameters inference for multicriteria sorting with ELECTRE TRI: software implementation and progress report.*

**Soumis à discussion / Submitted for discussion**

A. RICO, Ch. LABREUCHE, M. GRABISCH, and A. CHATEAUNEUF (Paris) *Parallèle multicritère-incertain.*

B. DE BAETS (Gent) and J. FODOR (Budapest) *Fuzzy preferences structures.*

S. GRECO, B. MATARAZZO (Catania), and R. SLOWINSKI (Poznan) *The axiomatic basis and rule representation of two multicriteria aggregation procedures: ELECTRE I and Sugeno integral*.

A. NGO THE and A. TSOUKIAS (Paris) Preference structures with thresholds: new results.

V.G. POKHILKO (Minsk) *On the radius of strong stability for a multicriteria problem on permutations.*

J. CROSTON (St ALBAN) *General insight into problem arising during modelling multilevel stock control processes in situations of intermittent demand.*

**Vendredi 5 octobre / Friday October 5**

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**09.00 - 10.30 SESSION III - Président / Chairman: R. BISDORFF**

09.00 - 10.00 D. BOUYSSOU, M. PIRLOT (Paris) *Une approche axiomatique de la concordance.*

10.00 - 10.30 S. GAY, F. LEDENTU, F. LOSA, and J. PASQUIER-DORTHE (Fribourg) *Cote de transparence de l'information des entreprises. Agrégation totale ou agrégation partielle ?*

**11.00 - 12.30 SESSION IV - Président / Chairman M.F. NORESE**

11.00 - 12.00 E. GRIGOROUDIS, E. KRASSADAKI, N. MATSATSINIS, and Y. SISKOS (Chania) *A multicriteria accreditation system for information technology skills and qualifications.*

12.00 - 12.30 V. CLOQUELL, C. SANTAMARINA, M. GARCÍA MELÓN, and M. A. SÁNCHEZ (Valencia) *A new procedure for the numerical values normalization in multicriteria decision techniques.*

**Soumis à discussion / Submitted for discussion**

J.M. DE CORTE (Mons), C. BANA e COSTA (Lisbon), and J.C. VANSNICK (Mons) *Exploitation d'une information de type "intervalle" dans MACBETH.*

V. KALIKA (Haifa) *About application of an approach to account for uncertainty in MCDM.*

C. BANA e COSTA (Lisbon) *Decision conferencing and MCDA.*

F. B. LOSA (Biasca) *Notes from a trip...around GMCDA.*

S.-O. LARSSON (Ostersund*) Decision support in a decision process.*

M. WOTTO, and J.P. WAAUB (Montréal*) Processus de participation sociétale restreinte à l'évaluation environnementale stratégique du plan de transport à Montréal dans un contexte de GDSS : proposition méthodologique.*

D. BOLLINGER, and J. PICTET (Lausanne) *Comment fixer des priorités parmi des projets de route de contournement ?*

A. TIKNIOUINE (Marrakech) *Vers une intégration des méthodes multicritères d'aide à la décision au Data web.*

**14.00 - 16.00 SESSION V - Président / Chairman: B. DE BAETS**

14.00 - 14.30 Préparation des futures réunions

14.30 - 15.30 M. GRABISCH (Paris) *Multicriteria decision making by the Sugeno integral in a qualitative setting.*

15.30 - 16.00 C. MOUSSET (Mons) *Représentation numérique à seuils de familles de relations.*

**16.3SESSION VI - Président / Chairman: W. HABENICHT**

16.30 - 17.00 G. MAVROTAS, D. DIAKOULAKI (Athens) *Multicriteria Decision Aid for licencing wind power generation units.*

17.00 - 17.30 J. PICTET, D. BOLLINGER (Lausanne) *Comment fixer des priorités parmi les projets d'un office fédéral ?*

17.30 - 18.00 R. M. ANDERSON and B. HOBBS (Amsterdam) *Using a Bayesian Approach to Quantify Scale Compatibility Bias in MCDM Weight Assessment: Application to Lake Erie Management.*

**Soumis à discussion / Submitted for discussion**

M.F. NORESE and B. JARETTI (Torino) *Participative approach and multicriteria analysis.*

C. GAGNÉ, M. GRAVEL and W. L. PRICE (Québec) *La recherche de solutions de compromis en ordonnancement industriel à l'aide de métaheuristiques.*

M. ROGERS (Dublin) *Using ELECTRE to aid the selection of road schemes within the UK Department of Transport decision framework.*

A. KAKLAUSKAS, E.K. ZAVADSKAS, M. GIKYS and A. GULBINAS (Vilnius) *Efficiency increase of real estate e-business systems by applying multiple criteria decision support systems.*

E.K. ZAVADSKAS, A. KAKLAUSKAS and V. TRINKUNAS (Vilnius) *Construction products multiple criteria e-commerce system.*

E.K. ZAVADSKAS, A. KAKLAUSKAS, R. VISOKAVICIUS AND B. VISOKAVICIENE (Vilnius) *Multiple criteria analysis of products and markets for trade development.*

C. DUJET (Lyon) *Affinity indexes and multicriteria analysis.*

## About the First Young MCDA Meeting

In an pleasant conversation during the MCDA53 meeting in Athens a group of young researchers (Yves De Smet, Mickael Daubie, Patrick Meyer, Céline Mousset, and myself), have pointed out that it might be interesting to organise complementary meetings for young researchers and PhD students on subjects dealing with multicriteria decision aiding. Multiple reasons have been highlighted to justify this attempt to bring together such a team. First of all, it is an opportunity to make critics towards what is commonly seen as established. Ideas that have not been expressed during the official meeting may be discussed in a more unofficial way. Secondly, a new dynamic could emerge from the discussions, to support projects and collaborations between the young members of the group.

Our idea was to organise a meeting that would take place on Thursday morning (4th October 2001) in Brussels, juste before the 54th official meeting of the group in Durbuy (Belgium).

The structure of the meeting was designed during an electronic chat. It was decided that several subjects had to be proposed and each participant had to choose one. He then had to participate actively in the discussions about the chosen topic. A senior researcher had to lead the workshop and, at the end, a report had to be written and presented by a delegate to the other participants.

The subjects proposed during the meeting were the following:

- Representation of the decision-maker's preferences.
- Classification - What is a class in MCDA? How to build classes?

The idea has been widely approved and 22 young researchers participated in the discussions. They came from six differents countries (Austria, Belgium, France, Greece, Italy, and Spain).

Denis Bouyssou (LAMSADE) was chosen to lead the discussions about the first subject and Patrice Perny (LIP6) for the second. We are grateful for their substantial collaboration in this first YMDA meeting. An important support in the organisation also came from Philippe Vincke and Marc Roubens who were the organisers of the *54th* MCDA meeting and we thank them for this.

This meeting was a first experience to gather young researchers interested in MCDA. It was without any doubts a successful experience, and it led extremely interesting discussions! We can say that most of the objectives were successfully reached.

It would be great if this experience could be repeated during the next MCDA reunions. We would like to underline the importance of these meetings and we would be glad if the young researchers, living in the countries where the following MCDA conferences will take place, could organise similar events.

Linett Montano Guzmán

**Program**

8:00 : Meeting of the participants in the meeting room of the SMG
8:00-8:30 : Welcome Session with breakfast
8:30: Separation in two groups
8:30 - 10:30: Discussion about the chosen subject and elaboration of a brief presentation
10:30 - 10:45 : Coffee break
10:45 - 11:45 : Presentation of some ideas worked out by each group
11:45 : Closing Session
12:00: End of the meeting - The participants of the meeting in Durbuy will be driven there by car

**Organizers**

Yves De Smet (SMG-Université Libre de Bruxelles)
Mickael Daubie (FUCAM)
Patrick Meyer (Université de Liège, Stat-MQG)
Linett Montano-Guzmán (SMG-Université Libre de Bruxelles)
Céline Mousset (Université de Mons-Hainaut)

## Recruitment advertisement

**One Postdoctoral Research fellowship** available for the **Marie-Curie** research project "**Development of transferable multi-criteria decision tools in environmental management**".

The Department Economics, Sociology and Law of the UFZ – Centre for Environmental Research Leipzig-Halle is seeking a **post doctoral decision analyst** with experience in multi-criteria decision analysis. You will be working as a for 24 months, starting in march 2002 (assuming the final consent of the EU).

You will work within an interdisciplinary research team on multi-criteria analysis of environmental conflicts. Our aim is to develop decision support tools that may be used in a whole range of similar conflicts (e.g., EU Water Framework Directive). The core research group you will be working in is a young team of mainly economists who have experience with multi-criteria analysis. Strong co-operation with ecologists, hydrologists, sociologists, and specialists in ecological modelling is essential.

Your main task is to design a transferable structure of the decision making process, and to elaborate criteria for the transferability of the decision tools. For the case study on the EU Water Framework Directive, a manual will be a concrete product of your work.

People with experience in the requested field and being interested in an ecologically, socially and economically integrated assessment of environmental conflicts are strongly invited to apply. Experience in environmental assessment would be appreciated. Your background Ph.D. might be in: Economics, planning sciences, geography, engineering, operations research.

The candidates have to be members of the EU or associated-state nationals, or have resided in the EU for at least five years, and have not to be older than 35 (37) years (see for more detail www.cordis.lu/improving/fellowships/home.htm). Salary will be 4.550 €/month (liable to taxation) plus mobility allowance of 400 €/month provided according to EU regularities. Equal opportunities are warranted particularly between women and men.

For further information, see www.ufz.de, and contact:

- Dr. Bernd Klauer (klauer@alok.ufz.de, Tel. 0049-341/235-2204), or
- Dr. Felix Rauschmayer (rauschma@alok.ufz.de, Tel. 0049-341/235-2074).

Applicants should send an application letter, a CV, and a list of publications to the Centre for Environmental Research Leipzig-Halle (UFZ), Personnel Department, No. 58/2001, P.O. Box 500135, 04301 Leipzig. Limit for applications is the 20th December 2001.



## Forthcoming Meetings

(This section is prepared by Luís Dias)

AIRO 2001, XXXII Annual Conference of the Operational Research Society of Italy, Cagliari, September 4-7, 2001. E-mail: airo2001@cinque.unica.it. Web page: http://pcserver.unica.it/AIRO2001.

EURO Summer Institute (ESI) XIX. Toulouse, France, 9-22 September 200, Subject: Decision Analysis and Artificial Intelligence. Contact: http://www-poleia.lip6.fr/~perny/ESI2001.

ORP3 – EURO Peripatetic Post-graduate Programme, September 26-29, 2001, Paris, France. Contact: Denis Bouyssou: bouyssou@essec.edu.fr. Web site: http://mapage.noos.fr/orp3.

**54th Meeting of the EWG "Multicriteria Aid for Decisions", Durbuy, Belgium,** 4-5, October 2001, organized by Marc Roubens (M.Roubens@ulg.ac.be) and Philippe Vincke (PVincke@smg.ulb.ac.be). Thème : "Aide multicritère à la décision et systèmes distribués".

INFORMS Fall 2001 Meeting, Miami Beach, FL, November 3-7, 2001, Fontainebleau Hotel. Web site: http://128.227.36.67/Informs2001/index2.html.

The First MCDM Winter Conference will be held on February 18-22, 2002 at Hotel Panhans, Semmering near Vienna, Austria. Important dates: Deadline for submissions of abstracts: September 30, 2001; Acceptance of papers: December 1st, 2001. Registration and submission of papers will be possible via the conference website (http://orgwww.bwl.univie.ac.at/mcdm2002).

IO 2002, Guimarães, Portugal, 24-27 Março 2002. Web site: http://www.apdio.pt/~apdio/main.html.

**55th Meeting of the EWG "Multicriteria Aid for Decisions", Leipzig, Gemany,** From 14th to 16th of March 2002 in Leipzig. Organisers: M. Drechsler (martind@pinus.oesa.ufz.de) and F. Rauschmayer (rauschma@alok.ufz.de). Web page: http://www.oesa.ufz.de/mcda55.

Northeast Decision Sciences Institute, 2002 Annual Meeting: March 20-22, 2002, caribe Hilton Hotel & Casino, San Juan, Puerto Rico, Call for papers deadline: october 1, 2001; submissions are ti be sent to: Barbara Withers (bwithers@SanDiego.edu).

Western Decision Sciences Institute, Thirty-First Annual Meeting, April 2-6, 2002, MGM Grand, Las Vegas, Nevada.

12th Mini Euro Conference Brussels-Belgium-April 2-5,2002 themes: -decision support systems-elecronic and mobile commerce -multicriteria decision aid -human centered processes-ethical dilemmas in decision making deadline for sumitting abstracts: november 15,2001. PLEASE VISIT OUR SITE:http://www.DSS.Brussels-2002.vub.ac.be

Special Track on Evolutionary Multi-Objective Optimization (EMO) at Congress on Evolutionary Computation (CEC), Hilton Hawaiian Village Hotel, Honolulu, Hawaii, May 12-17, 2002. URL: http://www.tik.ee.ethz.ch/emotrack.

MOPGP'02 The Fifth International Conference on Multi-Objective Programming and Goal Programming: Theory & Applications, Nara, Japan, June 4-7, 2002. URL: http://vanilla.eie.eng.osaka-u.ac.jp/mopgp02/index.html.

The 30th International Conference on "Computers and Industrial Engineering", Theme: Information Technology and Engineering: Theory and Applications,Tinos Island, Greece, June 29 – July 3, 2002. http://cda2.imse.lsu.edu/tinos2002/index.htm.

International conference on Decision Making and Decision Support Systems in the Internet Age (DSI-Age 2002). University College Cork (Cork, Irland), 4th-7th July 2002. http://afis.ucc.ie/DSIAge2002.

IFORS 2002, Edinburgh, Scotland, UK, 8-12 July 2002. URL: www.ifors.org. barrett@orsoc.org.uk, tel: +44 212 233 9300; fax: +44 121 233 0321.

The 7th Asia Pacific Decision Sciences Institute (APDSI) Annual Meeting Bangkok, Thailand, July 24-27, 2002. Web page: http://www.apdsi2002.com.

**56th Meeting of the EWG "Multicriteria Aid for Decisions", September-October 2002, Coimbra, Portugal.** Organizers: Carlos Henggeler Antunes (cantunes@inescc.pt), João Clímaco (jclimaco@inescc.pt) and José Figueira (figueira@fe.uc.pt).

The 3rd International Conference on Decision Making in Urban and Civil Engineering, London - November 2002, http://www.serenade.org.uk/.



## Books

(This section is prepared by Luís Dias)

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### Aiding Decisions with Multiple Criteria Essays in Honor of Bernard Roy

**PREFACE**

This volume is a Festschrift in honor of **Bernard Roy** at the occasion of his retirement.

Bernard Roy is Professor at the Université Paris Dauphine. He is the founder and former director of LAMSADE, a research group centered on the theme of decision aiding. Bernard Roy holds a Doctorate in Mathematics from the Université de Paris (1961). After an extensive consulting experience at SEMA, he joined the Université Paris-Dauphine in 1972 and created LAMSADE. He founded in 1975 the EURO Working Group "Multicriteria Aid for Decisions" which invariably held two annual meetings since then. He is Doctor Honoris Causa from several prestigious Universities. He received the « EURO Gold medal » (the highest distinction granted by EURO, the Association of European Operational Research Societies) in 1992 and the « MCDM Gold Medal » granted by the International MCDM Society in 1995. He is the author of several books and hundreds of research papers. Bernard Roy has been the advisor of numerous graduate and doctoral students.

The main contributions of Bernard Roy are focused on two broad themes:

- Graph Theory with path-breaking contributions on the theory of flows in networks and project scheduling,
- Multiple Criteria Decision Making with the invention of the family of ELECTRE methods and methodological contribution to decision-aiding which lead to the creation of the so-called "European School of MCDM".

This extremely brief biographical sketch does not do much justice to the real influence of Bernard Roy. He is one of the early promoters of Operational Research techniques in France. Everyone who approached him during his career has certainly been impressed by the clarity and the rigour of his thoughts combined with a passion for real-world applications.

We think that the influence of Bernard Roy is well reflected by the quality and the variety of the contributions that are gathered in this volume. In order to make a volume of reasonable size, the editors chose not to solicit contributions from the Graph Theory community. Had it not been the case, two volumes would probably have been necessary. We were really impressed by the willingness of everyone who was contacted to participate in the project. This reflects the real impact of Bernard Roy on the scientific community of his time – in our opinion much better than a long list of various distinctions.

Besides this Preface which is immediately followed by a list of Bernard Roy's main publications, this volume has five main parts.

Part one contains two papers related to the early career of Bernard Roy when, working at SEMA, he developed many new techniques and concepts in Graph Theory in order to cope with complex real-world problems. **Jacques Lesourne**, former director of SEMA, recalls the role of Bernard Roy in popularizing Operational Research techniques in France as well as his role in the development of SEMA. **Dominique de Werra** and **Pierre Hansen** reflect on the influence of Bernard Roy's contribution in Graph Theory. More than 30 years after the publication of his well-known books, this influence is still present.

The rest of the book consists of contributions related to the second part of the career of Bernard Roy – to "Multi-Criteria Decision-Aiding".

Part II of the book is devoted to Philosophy and Epistemology of Decision-Aid. **Albert David** explores two questions related to decision aiding in organizations: what decision aiding tools are, and which concepts can be used to analyse and understand the dynamics of their introduction into organizations. **Valerie Belton** and **Jacques Pictet** chose an original form of dialogue between a MCDA practitioner and a potential client in order to address many issues of philosophy and process being of relevance to the practice of MCDA. **Jean-Luis Genard** and **Marc Pirlot** reflect on the epistemological status of models and recommendations, and situate decision-aid within a philosophical perspective basing on Habermas' theory of orders of validity.

Part III includes contributions on Theory and Methodology of Multi-Criteria Decision-Aiding. Based on general framework for conjoint measurement that allows intransitive preferences, **Denis Bouyssou** and **Marc Pirlot** characterize strict concordance relations used in outranking methods. **Alexis Tsoukiàs**, **Patrice Perny** and **Philippe Vincke** present a possible generalization of Roy's concordance/discordance principle by introducing concepts of positive and negative reasons of preference formulated in terms of four valued logic. **Luis Dias** and **Joao Climaco** propose a method for getting robust recommendations with ELECTRE Is when DM specifies a set of multiple acceptable combinations of values of such parameters like weights or veto thresholds. **Daniel Vanderpooten** emphasizes the central role of modeling in decision aiding and proposes to adopt a perspective justifying, in a given decision context, choices at different stages of the modeling process. **Michael Doumpos** and **Constantin Zopounidis** show in a simulation study that the preference disaggregation approach is also attractive for multicriteria classification problems. **Marc Roubens** is using the Choquet integral to deal with ordinal multiattribute sorting and ordering problems in the presence of interactive points of view and compares this approach with a rule based methodology.

Part IV is devoted to Preference Modeling. **Peter Fishburn** opens this part with a paper characterizing a simple additive-utility threshold representation for preferences on multiattribute alternatives in which the marginal preference relation on each attribute is an interval order. **Salvatore Greco**, **Benedetto Matarazzo** and **Roman Słowiński** investigate the equivalence of preference representation by general conjoint measurement and by decision rule model in multicriteria choice and ranking problems; in order to represent hesitation in preference modeling, two approaches are considered: dominance-based rough set approach and four-valued logic for which an axiomatic foundation is given. **Salem Benferhat**, **Didier Dubois** and **Henri Prade** relate three different ways of expressing preferences: by particular types of constraints on utility function, by an ordered set of prioritized goals revealed by logical propositions, and by an ordered set of possible choices reaching the same level of satisfaction; these different expression modes can be handled by possiblistic logic. **Oscar Franzese** and **Mark McCord** investigate the performance of direct rating, probability equivalent, and lottery equivalent assessment techniques for a set of individuals in terms of the ability of the techniques to reproduce indifference between two-criteria outcomes previously judged to be indifferent. **Bertrand Munier** examines the risk attitude appraisal and cognitive coordination in decentralized decision system using as a supporting example the maintenance system in nuclear power plants. **Raymond Bisdorff** introduces a semiotical foundation of the concordance principle which allows to extend it and its associated coherence axioms imposed on the family of criteria to redundant criteria and to missing evaluations.

Part V groups Applications of Multi-Criteria Decision-Aiding. **Carlos Henggeler Antunes**, **Carla Oliveira** and **Joao Climaco** present a study of interactions between the energy system and the national economy using the TRIMAP interactive environment. **Carlos Bana e Costa**, **M. da Costa-Lobo**, **I. Ramos** and **Jean-Claude Vansnick** present a case study of strategic planning for the town of Barcelos using multicriteria decision-aiding approach. **Yannis Siskos** and **Evangelos Grigoroudis** describe applications of a preference disaggregation model based on the principle of ordinal regression analysis to measuring customer satisfaction in different types of business organizations. **Jean-Pierre Brans**, **Pierre Kunsch** and **Bertrand Mareschal** propose a decision-aiding procedure based on PROMETHEE-GAIA and system dynamics to select appropriate management strategies for socio-economic systems.

Part VI includes contributions on Multi-Objective Mathematical Programming. **Jacques Teghem** presents an overview of approaches developed by his research team to deal with multi-objective combinatorial optimization problems; exact (direct and two-phase) methods are followed by metaheuristic methods based on Simulated Annealing and Tabu Search. **Walter Habenicht** presents an enumerative approach based on quad trees to discrete vector optimization; different neighborhood concepts in outcome space are considered from the viewpoint of convergence and complexity. This part and the whole book ends with the paper by **Pekka Korhonen** on free searching over the efficient frontier in Data Envelopment Analysis; the search is useful when preference information is desired to incorporate into efficiency analysis.

The editors wish to extend their warmest thanks to all the contributing authors. This book is a fruit of friendly co-operation between editors and authors, motivated by a joint will of celebrating Bernard Roy. The editors had the privilege of working closely with Bernard Roy during many years. The authors invited to contribute a paper are also close to him for various reasons.

We also wish to acknowledge the valuable help of **Dominique François** and **Dominique Champ-Brunet** who prepared the list of publications of Bernard Roy, and to **Barbara Wołyńska** who prepared the camera-ready manuscript.

Denis Bouyssou
Eric Jacquet-Lagrèze
Patrice Perny
Roman Słowiński
Daniel Vanderpooten
Philippe Vincke

Paris-Poznań-Brussels, July 2001

**CONTENTS**

Preface.
Selected Publications of Bernard ROY.
**Part I Memories of Early Career and Impact of Early Works of Bernard ROY**. Bernard ROY, Forty Years of Esteem and Friendship, *J. Lesourne*. Connectivity, Transitivity and Chromaticity: The pioneering Work of Bernard ROY in Graph Theory, *P. Hansen, D. de Werra*.
**Part II Philosophy and Epistemology of Decision-Aiding**. Decision-Aid Between Tools and Organisations, *A. David*. Talking About the Practice of MCDA, V. *Belton, J. Pictet*. Multi-Criteria Decision-Aid in a Philosophical Perspective, *J.L. Genard, M. Pirlot*.
**Part III Theory and Methodology of Multi-Criteria Decision-Aiding**. A characterization of Strict Concordance Relations, *D. Bouyssou, M. Pirlot*. From Concordance/Discordance to the Modelling of Positive and Negative Reasons in Decision Aiding, *A. Tsoukiàs, P. Perny, P. Vincke*. Exploring the Cosnequences of Imprecise Information in Choice Problems Using ELECTRE, *L.C. Dias, J. Clímaco*. Modelling in Decision Aiding, *D. Vanderpooten*. On the Use of Multicriteria Classification Methods: A Simulation Study, M. *Doumpos, C. Zopounidis*. Ordinal Multiattribute Sorting Methods and Ordering in the Presence of Interacting Points of View, *M. Roubens*.
**Part IV Preference Modeling**. Multiattribute Interval Orders, *P.C. Fishburn*. Preference Representation by Means of Conjoint Measurement and Decision Rule Model, *S. Greco, B. Matarazzo, R. Slowinski*. Towards a Possibilistic Logic Handling of Preferences, *S. Benferhat, D. Dubois, H. Prade*. Empirical Comparison of Lottery- and Rating-Based Preference Assessment, *O. Franzese, M.R. McCord*. Risk Attidtudes Appraisal and Cognitive Coordination in Decentralized Decision Systems, *B. Munnier*. Logical Foundation of Multicriteria Preference Aggregation, *R. Bisdorff*.
Part V Applications of Multi-Criteria Decision-Aiding. A Study of the Interactions Between the Energy System and the Economy Using TRIMAP, *C. H. Antunes, C. Oliveira, J. Clímaco*. Multicriteria Approach for Strategic Town Planning, *C.A. Bana e Costa, M.L. da Costa Lobo, I.A. Ramos, J.-C. Vansnick*. Measuring Customer Satisfaction for Various Services Using Multicriteria Analysis, *Y. Siskos, E. Grigoroudis*. Management of the Future, *J.P. Brans, P.L. Kunsch, B. Mareschal*.
**Part VI Multi-Objective Mathematical Programming**. Methodologies for Solving Multi-Objective Combinatorial Optimization Problems, *J. Teghem*. Outcome-Based Neighborhood Search (ONS), *W. Habenicht*. Searching the Efficient Frontier in Data Envelopment Analysis, *P. Korhonen*.

**Kluwer Academic Publishers, Forthcoming.**

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**The book A-MCD-A, selected papers from the 49th and the 50th meeting of the EURO working group on MCDA**, appeared recently as EUR 19808 EN report of the JRC at Ispra. the book has been edited by *A. Colorni, M. Paruccini, B. Roy* with the support of an editorial committee *including D. Bouyssou, S. Muratori, A. Tsoukiàs, D. Vanderpooten, R. Wolfler-Calvo*. The book is available throught the secretary of the EURO WG.

**CONTENTS**

Cécile Arondel 1-12. Grille d'aide multicritère à l'analyse et à la conception de mécanismes incitatifs destinés à promouvoir une agriculture durable.
Riad Azibi, Daniel Vanderpooten 13-30. Elaboration de critères agrégeant des conséquences dispersées : deux exemples concrets.
G. Balestra, M.F. Norese, M. Knaflitz 31-46. Model structuring to assess the progression of muscular dystrophy.
M. Eugénia Captivo, João Clímaco 47-58. Multicriteria location analysis Discussion on some models and algorithms.
Alberto Colorni, Eliot Laniado, Simona Muratori 59-68. The distance between vectors in sensitivity and conflict analysis for multicriteria decision making.
Gérard Colson, Jean-Marie Hauglustaine 69-80. MCDA applied to the architectural sketch design: an aid to conception of the building envelope.
Didier Dubois, Jean-Luc Marichal, Henri Prade, Marc Roubens, Régis Sabbadin 81-98. The use of the discrete Sugeno integral in decision-making: a survey.
Hélène Fargier, Patrice Perny 99-116. Modélisation des préférences par une règle de concordance généralisée.
Salvatore Greco, Benedetto Matarazzo, Roman Slowinski 117-144. Conjoint measurement and rough set approach for multicriteria sorting problems in presence of ordinal criteria.
P.L. Kunsch, J. Springael, J.P. Brans 145-162. An adaptive control methodology based on system dynamics and MCDA case study: the CO2 energy tax in the residential sector.
Sven-Olov Larsson 163-170. Multi-criteria decision support in a road planning process a Swedish case.
Giuseppe Las Casas, Nicola Tamma 171-182. Une procédure de rangement multicritère d'un ensemble d'interventions.
intégrées de valorisation touristique de la région Basilicata.
Fabio B. Losa, Jacques-Pasquier Dorthe 183-194. Comment sortir de l'impasse ? Note pédagogique sur l'incomparabilité Approche conceptuelle et à partir de cas.
Nathalie Molines, Jean-Jacques Chevallier 195-212. Système d'information géographique et analyse multicritère : une association novatrice au service du processus d'évaluation des grandes infrastructures linéaires.
Vincent Mousseau, Bernard Roy, Isabelle Sommerlatt 213-230. Development of a decision aiding tool for the evolution of public transport ticket pricing in the Paris region.
Stéphanie Oberti-Baltolu, Pascal Oberti 231-244. Révélation et protection du patrimoine historique dans une optique de développement durable.
Jacques Pictet, Valerie Belton 245-256. ACIDE : Analyse de la compensation et de l'incomparabilité dans la décision Vers une prise en compte pratique dans MAVT.
Eric Plottu 257-272. Aide multicritère à la décision et développement durable du territoire : De la relation d'incomparabilité à l'intégration d'un objectif de préservation de la liberté de choix au sein de la théorie de la décision.
Felix Rauschmayer 273-280. How to consider ethics in MCA?
Martin Rogers, Lucien Maystre 281-296. Analysis and comparison of two location choice problems from environmental engineering using ELECTRE III.
Y. Siskos, E. Grigoroudis, Y. Politis, Y. Malandrakis 297-314. Customer satisfaction evaluation: some real experiences.
R. Soncini-Sessa, F.B. Losa, D. Canuti, A. Colorni, E. Laniado, A. Rizzoli, L. Villa, B. Vitali, E. Weber 315-328. Multicriteria analysis in the planning and management of a multipurpose transnational water system: the case of Lake Maggiore, Italy-Switzerland.
B. Urli, J.C. Michaud, C. Rioux 329-342. Une aide à la décision collective dans le développement local : le Québec-Côtier.
Philippe Vincke 343-354. Preferences and numbers.
Roberto Wolfler Calvo, Massimo Paruccini 355-372. Applying MCDA to water management: The Basento case study.
Constantin Zopounidis, Michael Doumpos 371-381 INVESTOR: A decision support system based on multiple criteria for portfolio selection and composition.

Ce livre sera envoyé à tous les membres du groupe. Pour tous ceux qui souhaiteraient un exemplaire supplémentaire ou voudraient le faire commander, il vous sera envoyé moyennant des frais s'élevant à 15 Euros pour l'Europe et 20 Euros pour les autres pays. Contact: Madame Dominique François (LAMSADE, Université Paris-Dauphine, Place du Maréchal De Lattre de Tassigny, 75775 Paris Cedex 16, France. E-mail : francois@lamsade.dauphine.fr).

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## Multiple Criteria Decision Analysis: An Integrated Approach

*by*

**Valerie Belton**
*Dept. of Management Science, University of Strathclyde, Glasgow, UK*
**Theodor J. Stewart**
*Dept. of Statistical Sciences, University of Cape Town, Rondebosch, South Africa*

The field of multiple criteria decision analysis (MCDA) - also sometimes termed multiple criteria decision aid, or multiple criteria decision making (MCDM) - has developed rapidly over the past quarter century and in the process a number of divergent schools of thought have emerged.

Multiple Criteria Decision Analysis:: An Integrated Approach provides a comprehensive yet widely accessible overview of the main streams of thought within MCDA.
Two principal aims are:

- To provide sufficient awareness of the underlying philosophies and theories, understanding of the practical detail of the methods, and insight into practice to enable researchers, students and industry practitioners to implement MCDA methods in an informed manner;
- To develop an integrated view of MCDA, incorporating both integration of different schools of thought within MCDA and integration of MCDA with broader management theory, science and practice, thereby informing the development of theory and practice across these areas.

It is felt that this two-fold emphasis gives a book which will be of value to the following three groups: Practicing decision analysts or graduate students in MCDA for whom this book should serve as a state-of-the-art review, especially as regards techniques outside of their own specialization; Operational researchers or graduate students in OR/MS who wish to extend their knowledge into the tools of MCDA; Managers or management students who need to understand what MCDA can offer them.

CONTENTS: List of Figures. List of Tables. List of Example Panels. Preface. Acknowledgments. 1. Introduction. 2. The Multiple Criteria Problem. 3. Problem Structuring. 4. Preference Modelling. 5. Value Function Methods: Practical Basics. 6. Value Function Methods: Indirect and Interactive. 7. Goal and Reference Point Methods. 8. Outranking Methods. 9. Implementation of MCDA: Practical Issues and Insights. 10. MCDA in a Broader Context. 11. An Integrated Approach to MCDA. Appendices. References. Index.
Kluwer Academic Publishers. Hardbound, ISBN 0-7923-7505-X, October 2001, 400 pp.

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## Les nouvelles fondations des sciences de gestion : Eléments d'épistémologie de la recherche en management

*edité par*

**Albert David, Armand Hatchuel et Romain Laufer**

**Sommaire**. Introduction. 1. Quel horizon pour les sciences de gestion? Vers une théorie de l'action collective (Armand Hatchuel). 2. Les institutions du management : légitimité, organisation et nouvelle rhétorique (Romain Laufer). 3. Logique, épistémologie et méthodologie en sciences de gstion : trois hypothèses revisitées (Albert David). 4. Epistémologie de la connaissance practical : exigences et vertus de l'indiscipline (Alain-Charles Martinet). 5. Management et complexité : comment importer en gestion un concept polysémique ? (Jacques Girin). 6. L'aide à la décision aujourd'hui : que devrait-on en attendre ? (Bernard Roy). 7. Le paradigne retrouvé : la réthorique (Romain Laufer). 8. La recherche-intervention, cadre général pour la recherche en management ? (Albert David). Présentation des autheurs.

Collection FNEGE, Librairie Vuibert – mars 2000, ISBN 2 7117 7998 X.

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## Multi-Objective Optimization Using Evolutionary Algorithms

*by*

**Kalyanmoy Deb**
(deb@iitk.ac.in)

The above book is now available from John Wiley & Sons. One of the niches of evolutionary algorithms in solving search and optimization problems is the elegance and efficiency in which they can solve multi-objective optimization problems. Multi-objective optimization deals with multiple and often conflicting objectives, thereby resulting in a set of optimal solutions instead of a single optimal solution. This book is the first comprehensive book introducing multi-objective optimization, classical multi-objective optimization methods, evolutionary algorithms, multi-objective evolutionary algorithms, and immediate research topics in the emerging field of multi-

objective evolutionary algorithms. The main strength of multi-objective evolutionary algorithms is their ability to find multiple Pareto-optimal (or near-Pareto-optimal) solutions in one single simulation run with a good spread among them.

The highlights of the book:

- Comprehensive coverage of the growing area of multi-objective evolutionary algorithms.
- Carefully introduces each algorithm with examples and in-depth discussion o Includes a number of real-world problems from engineering and sciences o Includes discussion of advanced topics and future research o Includes an extensive reference list of current research studies o Accessible to those with limited knowledge of classical multi-objective optimization and evolutionary algorithms

The integrated presentation of theory, algorithms and examples will benefit those working and researching in the areas of optimization, optimal design and evolutionary computing. This text provides an excellent introduction to the use of evolutionary algorithms in multi-objective optimization, allowing its use as a graduate course text or for self-study.

**Contents**. Foreword by David E. Goldberg. Preface. Prologue. Multi-Objective Optimization. Classical Methods. Evolutionary Algorithms. Non-elitist multi-objective evolutionary algorithm. Elitist multi-objective evolutionary algorithms. Constrained multi-objective evolutionary algorithms. Salient Issues of multi-objective evolutionary algorithms. Applications of multi-objective evolutionary algorithms. Epilogue. References. Index

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ISBN: 0471 87339 X.

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## Multiple Criteria Analysis in Strategic Siting Problems

*by*

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The purpose of Multiple Criteria Analysis in Strategic Siting Problems is to demonstrate how multiple criteria can be used in analysis of facility location problems. The book begins with an overview, explains the internationally most popular multiple objective analysis methods, and demonstrates their applications on real problems. Siting problems reviewed include nuclear waste disposal in the U.S., solid waste management in Finland, pipeline location in India, and pipeline location in Russia. Methods covered are multiattribute utility analysis, analytic hierarchy process, the ELECTRE outranking method, and verbal decision analysis. The book concludes with a comparative review of methods.

The book uses the multi-attribute, multi-party framework of Kunreuther to present the decision context, to include parties with interests in the decisions, as well as the sequence of project events. This perspective is valuable in identifying the qualitative backgrounds of siting problems that need to be considered.

The book demonstrates the importance of multiple criteria in hazardous facility site selection. It also shows how each of the four methodologies covered operate, both in terms of demonstration problems worked with numbers, and how these methods have been applied in the real applications. The real applications were taken from refereed journal documentation, with the exception of Russian pipeline analysis decisions in which Professor Larichev participated. The book is recommended for those interested in decision-making involving problems with social import. This includes environmental aspects, as well as international aspects of decision making.

CONTENTS: 1. Introduction. 2. Methods and Decision Processes: Descriptive and Normative. 3. High Level Waste
Repository Selection. 4. Analysis of Alternative Methods to Dispose of Plutonium. 5. Project Selection and Control. 6. Solid Waste Management System Selection. 7. Pipeline Location Decisions. 8. Problems and Tools. 9. Support to the Multiattribute Decision Process. Author Index. Subject Index.

Kluwer Academic Publishers
Hardbound, ISBN 0-7923-7379-0, June 2001, 226 pp.

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## Feasible Goals Method. Search for Smart Decisions

*by*

**Alexander V. Lotov,**
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**Vladimir A.Bushenkov,**
*University of Evora, Evora, Portugal*
**Georgij K.Kamenev**
*Russian Academy of Sciences, Moscow, Russia*

The book is a shortened and updated translation into English of the book "Feasible Goals Method. Mathematical Foundations and Environmental Applications" (Edwin Mellen Press: Lewiston, NY USA, 1999, 400 pp., in Russian). It is devoted to the graphic computer-based approach, the Feasible Goals Method (FGM) that helps to find preferred decisions from an infinite number of feasible decision alternatives. The main feature of the FGM is provided by visualization of the variety of feasible criterion vectors, which can be considered as the variety of feasible goals, i.e. such goals that may be a result of feasible decisions. The display of the variety of feasible criterion vectors is carried out on-line with the help of the Interactive Decision Maps (IDM) software. The FGM combines ideas of both goal approach and multiple criteria decision theory: user can identify a preferred feasible goal on the efficiency frontier directly on display.

Applications of the FGM described in the book are related to environmental decision problems. Illustrative applications include searching for strategies of sea dumping of sluges in the Lower bight of the New York City, of agricultural development in a small region in the Netherlands, of long-time national economy growth taking environmental issues into account, of international atmosphere pollution abatement and of smart response to global climate change. Real-life applications are related to decision and negotiation support systems that include searching for efficient and effective water quality plans in large river basins.

Mathematical foundation of the FGM, which consists in explicit approximation of the variety of the feasible goals, is described in a simplified form. Current and future applications of the FGM in computer networks are outlined. Since the FGM/IDM technique provides decision information in a colorful graphic form and can be assessed by any computer-literate person, it can be used in the framework of Internet resources, which help to implement new democratic paradigm of environmental decision making.

The book is recommended for the broad audience of computer-literate people interested in application of visualization and other elements of the new information technology in public, especially environmental decision problems.

CONTENTS: Introduction. 1. Introduction of the FGM. 2. Illustrative applications. 3. Real-life applications of the FGM/IDM technique. 4. Computational algorithms of the FGM. Conclusion: on a new Internet-based paradigm of environmental decision making.

Computing Centre of Russian Academy of Sciences
Softbound, ISBN 5-201-09772-3, July 2001, 240 pp.

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**Actes de la Conférence Internationale sur l'Aide à la Décision dans le Domaine Génie Civil et Urban/ Proceedings of the second International Conference "Decision Making in Urban Civil Engineering"**

*edité par*

**Jean-Claude Mangin et Marcel Miramond**

*en collaboration avec :*

*CUST Clermond-Ferrand,*
*LIP6 Paris,*
*Université Valenciennes.*

Ces actes contiennent plusieurs applications multicritères.

Conférence réalisée Grand Hôtel Mercure Saxe-Lafayette, 20-22 Nov. 2000, Lyon, France. ISBN: 2 868 34 117 9.

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## Genetic Algorithms and Fuzzy Multiobjective Optimization

*by*

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*Graduate School of Engineering, Hiroshima University,*
*Japan*

Since the introduction of genetic algorithms in the 1970s, an enormous number of articles together with several significant monographs and books have been published on this methodology. As a result, genetic algorithms have made a major contribution to optimization, adaptation, and learning in a wide variety of unexpected fields. Over the years, many excellent books in genetic algorithm optimization have been published; however, they focus mainly on single-objective discrete or other hard optimization problems under certainty. There appears to be no book that is designed to present genetic algorithms for solving not only single-objective but also fuzzy and multiobjective optimization problems in a unified way.

Genetic Algorithms And Fuzzy Multiobjective Optimization introduces the latest advances in the field of genetic algorithm optimization for 0-1 programming, integer programming, nonconvex programming, and job-shop scheduling problems under multiobjectiveness and

fuzziness. In addition, the book treats a wide range of actual real world applications. The theoretical material and applications place special stress on interactive decision-making aspects of fuzzy multiobjective optimization for human-centered systems in most realistic situations when dealing with fuzziness.

The intended readers of this book are senior undergraduate students, graduate students, researchers, and practitioners in the fields of operations research, computer science, industrial engineering, management science, systems engineering, and other engineering disciplines that deal with the subjects of multiobjective programming for discrete or other hard optimization problems under fuzziness. Real world research applications are used throughout the book to illustrate the presentation. These applications are drawn from complex problems.
Examples include flexible scheduling in a machine center, operation planning of district heating and cooling plants, and coal purchase planning in an actual electric power plant.

CONTENTS: Preface. 1. Introduction. 2. Foundations of Genetic Algorithms. 3. Genetic Algorithms for 0-1 Programming. 4. Fuzzy Multiobjective 0-1 Programming. 4. Fuzzy Multiobjective 0-1 Programming. 5. Genetic Algorithms for Integer Programming. 6. Fuzzy Multiobjective Integer Programming. 7. Genetic Algorithms for Nonlinear. 8. Fuzzy Multiobjective Nonlinear Programming. 9. Genetic Algorithms for Job-Shop Scheduling. 10. Fuzzy Multiobjective Job-Shop Scheduling. 11. Some Applications. References. Index.

Kluwer Academic Publishers, Hardbound, ISBN 0-7923-7452-5, October 2001, 304 pp.

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### Fuzzy and Multiobjective Games for Conflict Resolution.

*by*

**Nishizaki, I**. and **Sakawa, M**.
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*Graduate School of Engineering,*
*Hiroshima University*

Contents of the book are follows: Introduction: Introduction and historical remarks; Outline of the books. Fundamentals of two-person noncooperative games and n-person cooperative games: Two-person noncooperative games; n-person cooperative games.- Multiobjective fuzzy two-person zero-sum games: Multiobjective two-person zero-sum games with fuzzy goals; Multiobjective two-person zero-sum games with fuzzy payoffs and fuzzy goals.- Multiobjective fuzzy two-person non-zero-sum games: Multiobjective fuzzy two-person non-zero-sum games with fuzzy goals; Multiobjective fuzzy two-person non-zero-sum games with fuzzy payoffs and fuzzy goals.- Fuzzy n-person cooperative games: The least core and the nucleolus in games with fuzzy coalitions; Lexicographical solutions in games with fuzzy coalitions; n-person cooperative games with fuzzy coalition values; Fuzzy linear programming games.- Multiobjective n-person cooperative games: Cooperative games with multiple scenarios; Multiobjective n-person cooperative games; Multiobjective linear production programming games.

Physica Verlag, A Springer Verlag Company (Series: Studies in Fuzziness and Soft Computing.VOL. 64), Hardcover 3-7908-1360-5, 258pp.



## Articles Harvest

(This section is prepared by Maria João Alves with the help of Carlos Henggeler Antunes)

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### Séminaires du LAMSADE

"MODÉLISATION DES PRÉFÉRENCES ET AIDE MULTICRITÈRE À LA DÉCISION"
Responsables: Bernard ROY et
Daniel VANDERPOOTEN
(le mardi, de 14:00 à 17:00, en salle P510)

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| **6 novembre 2001** | Conférence de Patrice PERNY (Université Paris VI, LIP6)et Olivier SPANJAARD (LAMSADE) :<br>Recherche basée sur les préférences dans les problèmes combinatoires. |
| **4 décembre 2001** | Conférence de Benedetto MATARAZZO (Université de Catane, Italie) :<br>Règles de décision et intégrale de Sugeno en aide multicritère à la décision. |
| **15 janvier 2002** | Conférence de Roman SLOWINSKI (Université de Technologie de Poznan, Institut d'Informatique, Pologne) :<br>Axiomatisation d'un modèle de préférences de type ELECTRE I et sa représentation sous forme de règles de décision |
| **26 février 2002** | Conférence de Marc PIRLOT (Faculté Polytechnique de Mons, Belgique) :<br>A propos des familles cohérentes de critères. |

## Other Works

(Communicated by the authors)

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J. CLIMACO, L. DIAS, J. FIGUEIRA, C. GOMES DA SILVA, V. MOUSSEAU. Resolving inconsistencies among constraints on parameters of an MCDA model (avril 2001). Cahier du LAMSADE nº 178, 24 p.

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## Dissertations

MARIA JOÃO ALVES, Decision aid on multiobjective integer and mixed-integer programming problems: methodologic contributions [in Portuguese], Ph.D Dissertation, University of Coimbra, May 2001. Jury: Domingos Cardoso (Dep. of Mathematics, Univ. Aveiro), Joaquim Júdice (Dep. of Mathematics, Univ. Coimbra), Jorge Pinho de Sousa (Fac. of Engineering, Univ. Porto), João Clímaco (Supervisor, Fac. of Economics, Univ. Coimbra), Paulino Teixeira (Fac. of Economics, Univ. Coimbra), Pedro Ferreira (Fac. of Economics, Univ. Coimbra), João Paulo Costa (Fac. of Economics, Univ. Coimbra).