UNIVERSITÉ LIBRE DE BRUXELLES
Faculté des Sciences Appliquées
Institut de Statistique et de Recherche Opérationnelle

Activity Report

January 2003 - December 2003

SERVICE DE MATHEMATIQUES DE LA GESTION
Campus de la Plaine - CP 210/01
Boulevard du Triomphe
B-1050 Bruxelles
http://smg.ulb.ac.be
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>1</td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>2</td>
</tr>
<tr>
<td>2 MEMBERS AND RESEARCH INTEREST</td>
<td>3</td>
</tr>
<tr>
<td>2.1 PERMANENT STAFF</td>
<td>3</td>
</tr>
<tr>
<td>2.2 VISITORS</td>
<td>3</td>
</tr>
<tr>
<td>2.3 RESEARCHERS AND TEACHING ASSISTANTS</td>
<td>4</td>
</tr>
<tr>
<td>2.4 ADMINISTRATION</td>
<td>5</td>
</tr>
<tr>
<td>2.5 EURO OFFICE</td>
<td>5</td>
</tr>
<tr>
<td>2.6 FORMER MEMBERS</td>
<td>5</td>
</tr>
<tr>
<td>3 PUBLICATIONS</td>
<td>8</td>
</tr>
<tr>
<td>3.1 PUBLISHED PAPERS</td>
<td>8</td>
</tr>
<tr>
<td>3.2 SUBMITTED AND FORTHCOMING PAPERS</td>
<td>10</td>
</tr>
<tr>
<td>3.3 PREPRINTS</td>
<td>12</td>
</tr>
<tr>
<td>4 RESEARCH CONTRACTS</td>
<td>13</td>
</tr>
<tr>
<td>5 LECTURES</td>
<td>14</td>
</tr>
<tr>
<td>6 ACADEMIC VISITS AND INVITED CONFERENCES</td>
<td>16</td>
</tr>
<tr>
<td>7 INTERNATIONAL CONFERENCES AND MEETINGS</td>
<td>18</td>
</tr>
<tr>
<td>8 CONFERENCE ORGANISATION ACTIVITIES</td>
<td>20</td>
</tr>
<tr>
<td>9 OTHER ACTIVITIES</td>
<td>21</td>
</tr>
<tr>
<td>10 CONTACT ADDRESS</td>
<td>22</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

This report covers the period from January 1, 2003 to December 31, 2003. During that period, the main research themes of the S.M.G. were:

- Preference modelling and aggregation
- Multicriteria evaluation and decision aid
- Group decision support
- Environmental management
- Robustness in Operations Research
- Queuing theory

We hope this report will generate some interest by the colleagues and fruitful cooperation with other research units.

The S.M.G. staff.
2 MEMBERS AND RESEARCH INTEREST

N.B. On January 1, 2003, the “Service d’Optimisation”, born of the S.M.G. and under the direction of Martine Labbé, joined the Computer Science Department of the Faculty of Sciences. The name of this team is now “Graphes et Optimisation Mathématique”. Their activities can be consulted on www.ulb.ac.be/di.

S.M.G. has also become an associated team of the Computer Science Department of the Faculty of Sciences.

2.1 PERMANENT STAFF

- **Mareschal, Bertrand (Professor)**
  Multicriteria decision aids, statistics, financial applications.
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- **Rémiche, Marie-Ange (Associate Professor)**
  Telecommunication networks, traffic models, queuing theory.
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- **Vincze, Philippe (Professor, Director of S.M.G. and Vice-Rector of ULB)**
  Preference modelling, multicriteria decision aid.
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2.2 VISITORS

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- **Chiera, Belinda (November)**
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- **Crowley, Michel (May and December)**
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- **Perny, Patrice (From May to June)**
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- Rauschmayer, Felix (From March to April)
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- Teich, Jeffrey E. (October)
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- Thiran, Patrick (From July to October)
  Ecole Polytechnique Fédérale de Lausanne, Switzerland
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- Waaub, Jean-Philippe (May and December)
  Université du Québec à Montréal, Canada
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2.3 RESEARCHERS AND TEACHING ASSISTANTS

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2.6 FORMER MEMBERS
If you want to contact one of these people, please send an e-mail to fvanbrus@ulb.ac.be and we will do our best to answer to your request.

• Prof. Moncef Abbas
• Prof. Brahim Aghezzaf
• Chafik Allal
• Bernard Amerlynck
• Véronique Bastin
• Nabil Belacel
• Prof. Khalid Belkeziz
• Samuel Bouckenooghe
• Prof. Jean-Pierre Brans
• Prof. Luce Brotoorne
• Ahmed Bufardi
• Prof. Stéphane Chrétien
• Prof. Peter Cowling
• Anne De Jongh
• Prof. Daniel De Wolf
• Prof. Corinne Feremans
• Prof. Bernard Fortz
• Frédéric Geurts
• Eric Gourdin
• Philippe Grégoire
• Rachid Khamliche
• Annie Laforet
• Tsippy Lotan
• Ida Longton
• Prof. Thierry Marchant
• Prof. Linett Montano-Guzman
• Alain Mosmans
• Christophe Musaraganyi
• Hugo Mwanza
• Charles Nocq
• Jean-Luc Ottinger
• Valéry Paternotte
• Prof. Mustafa C. Pinar
• Prof. Marc Pirlot
• Prof. Brenda Rayoo
• Vianney Rebetez
• Wafa Rezig
• René Seguin
• Prof. Patrick Soriano
• Nikolaj van Omme
• Christelle Wynants
3 PUBLICATIONS

3.1 PUBLISHED PAPERS

- **De Smet Y.**


  Auctions are well-known mechanisms for buying and selling items. Some authors have even reported their use since the early ages. Nowadays we are witnessing an important evolution in the field: "classic" auctions involving one potential seller and several buyers or, one potential buyer and several sellers, trading one single item are being extended. We now speak about auctions on multiple homogeneous or heterogeneous objects involving both several buyers and sellers. Multicriteria auctions in which each object is characterized by multiple criteria and not only by the price, appear to be one of the last frontiers in the generalization of these mechanisms. The purpose of this paper is to briefly present some theoretical extensions of classic auctions to the multicriteria framework. If some authors have already studied multi-attribute auctions, where total comparability between bids is assumed, our attention will be more precisely drawn on the management of incomparability, which is, to our point of view, a cornerstone of this multicriteria problematic.

- **De Smet Y.**


  In procurement auctions, the items traded are often so complex that restricting the competition to the price may be hazardous because of the potential neglect of some important attributes. This distinctive feature has led several authors to develop auctions incorporating other issues than solely the price. These are referred as multi-dimensional, multi-attribute or multiple issue auctions. However the pairwise comparison of bids of which the multi-dimensional nature may be very different, may also be hazardous. Our belief is that different bidding categories may simultaneously exist within the same multi-dimensional bidding space, even tough these categories are not well-known or difficult to define prior to the auction. Butterfly auctions, a superset of multi-attribute auctions, permit to take into account this aspect of the problem. Furthermore the parameters characterizing our model are partially fitted during the auction process.

- **Latouche G., Remiche M.-A., and Taylor P.**


  We define the family of transient Markov arrival processes (transient MAPs) which combine features of transient (or terminating) renewal processes and of the well-known MAPs: transient MAPs are point processes on the line, controlled by a finite Markov chain, which almost surely comprise a finite number of points. We analyze their basic properties.
• Risse N., Crowley M., Vincke P. and Waaub J.P.


Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment was officialised in July 2001. It establishes a basic framework for the assessment of the effects of certain plans and programmes on the environment, which should be adopted by the Member States of the European Union. In accordance with the principle of subsidiarity, the responsibility of developing a detailed procedure is left to the Member States. Within this context, this paper aims to assist the Member States with decisions concerning the implementation of a strategic environmental assessment (SEA) process conforming to the Directive by defining briefly some operational issues related to the Member State’s discretionary margin and by analysing their consequences regarding the objectives stated by the Directive (in terms of protection of the environment, contribution to the integration of environmental considerations into the preparation and adoption of plans and programmes, and contribution to more transparent decision-making).

• Risse N., Crowley M., Vincke P. and Waaub J.P.


This paper exposes preliminary relations between strategic environmental assessment (SEA) and decision aid. It makes reference to the role of SEA, the structure of the process, the actors implied, the tools used and the transposition of the Directive 2001/42/CE of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

• Tsoukiás A. and Vincke P.


We provide an answer to an open problem concerning the representation of preferences by intervals. Given a finite set of elements and three relations on this set (indifference, weak preference and strict preference), necessary and sufficient conditions are provided for representing the elements of the set by intervals in such a way that (1) two elements are indifferent when the interval associated to one of them is included in the interval associated to the other; (2) an element is weakly preferred to another when the interval of the first is “more to the right” than the interval of the other, but the two intervals have a non-empty intersection; (3) an element is strictly preferred to another when the interval of the first is “more to the right” than the interval of the other and their intersection is empty.
3.2 SUBMITTED AND FORTHCOMING PAPERS

- Bouyssou D. and Vincke P.


The paper presents a survey of the main relational structures which are used as preference models in the decision-aid tools. Their properties are described and commented in the perspective of their applications in decision models.


Risk processes analysed as fluid queues. Submitted.

This paper presents the Laplace transform of the time until ruin for a fairly general risk model. The model includes both the classical and most Sparre Andersen risk models with phase-distributed claim amounts as special cases, it also allows for correlated arrival processes. The paper exploits the relationship between the surplus process and fluid queues, where a number of recent developments have provided the basis for our analysis.

- De Smet Y. and Montano Guzman L.


The research within the multicriteria classification field is focused on the assignment of actions in predefined classes. Nevertheless the building of multicriteria categories remains a theoretical question still not studied in detail. In this paper, we present an extension of the k-means algorithm with a multicriteria methodology. The main intuition behind the method is the following: each action inside one cluster has a similar system of preferences. They are dominated or they dominate more or less the same actions. For measuring this behavior we introduce a multicriteria distance based on the preference structure. The originality of this approach is the application of this new measure within the well-known k-means framework. To conclude, the algorithm is tested on artificial and real-world datasets.

- De Smet Y., Springael J. and Kunsch P.


Many real life situations result from decisions taken by a very large number of decision makers. Among them, we may cite road traffic congestion, crowding during shopping, equity market behaviour, distribution of holiday destinations, etc. Furthermore, these decisions often depend on the optimization of several conflicting criteria. In this paper, we introduce a new multicriteria tool based on Markov Chains to model and manage these macroscopic phenomena. The road traffic congestion problem will be further studied in order to give some empirical evidence of our approach.
• Hites R., De Smet Y., Risse N., Salazar-Neumann M. and Vincke P.

A comparison between multicriteria and robustness frameworks. Submitted.

A parallelism can be established between multicriteria and robustness concepts, notably if we consider that in both cases the solutions are rarely optimal in all criteria or scenarios. This parallelism leads us to compare the fields of multicriteria decision aid and robustness by studying their similarities and differences. The distinguishing characteristics brings us to introduce new problematics like the multicriteria multiscenarios problem and the multicriteria evaluation of robustness.

• De Smet Y.

Multi-criteria auctions: a few basics. Submitted.

The emergence of auction mechanisms that support bids characterized by several attributes is one of the most recent evolutions within auction theory. These mechanisms, referred as multi-attribute, multiple issue or multi-dimensional auctions, are at the intersection between multi-criteria decision and auction theories. The purpose of this paper is to introduce multi-criteria auctions of which the originality is to not require full comparability between bids. We claim that this distinctive feature is of great interest especially in procurement situations. Furthermore the management of incomparability between multi-dimensional offers will permit us to define different bidding categories coexisting within the same bidding space. A theoretical framework based on a general (PLJ) preference structure will be introduced and then referenced to existing approaches such as multi-attribute auctions or new ones such as dominance based auctions or butterfly auctions. Finally, the location, in the space of bids, where multi-criteria auctions end will be further studied.

• Hites R.

The aggregation of preferences method for solving combinatorial problems with uncertainty. Forthcoming in Proceedings of the 56th Meeting of the European Working Group “Multiple Criteria Decision Aiding”.

We present a new method for finding robust solutions for certain combinatorial problems in the presence of uncertainty. The problem of finding $p$ elements with the minimum total cost out of $m$ elements, as well as the minimum spanning tree problem, is discussed in the case where the uncertainty is represented by intervals of costs. The proposed method determines solutions that are relatively good in the best case scenario without overly compromising the worst case scenario. Therefore, it gives solutions that are robust but, at the same time, less pessimistic than the classical measures of robustness, which only look at finding the solution with the best worst case (such as the minmax regret or the minmax cost).

• Salazar-Neumann M.


We consider the robust minimum spanning tree problem where edges costs are on a compact subset of a cartesian product of intervals. Considering that the evaluating function is the sum of edge costs or the weighted sum, we show that to find absolute robust, robust deviation and relative robust solutions, it is not necessary to seek the worst scenario in all the set of scenarios but in a subset considerably smaller. This subset is defined in the main theorem of this paper.
3.3 PREPRINTS

2003/02 Relations binaires et modélisation des préférences
Bouyssou, D. and Vincke, P.

2003/03 The robust minimum spanning tree problem
Salazar Neumann, M.

2003/04 Implementing the European SEA Directive: the Member States' margin of discretion
Risse, N., Crowley, M., Vincke, P. and Waaub, J.-P.

2003/07 Conjoint measurement tools for MCDM: a brief introduction
Bouyssou, D. and Pirlot, M.

2003/08 Multi-criteria auctions: a few basics
De Smet, Y.

2003/09 Les indicateurs en perspective
Marchant, T., Bouyssou D. and Perny P.

2003/10 Preferences for multi-attributed alternatives: Traces, Dominance, and Numerical Representations
Bouyssou, D. and Pirlot, M.

2003/11 Following the traces: An introduction to conjoint measurement without transitivity and additivity
Bouyssou, D. and Pirlot, M.

2003/12 'Additive difference' models without additivity and subtractivity
Bouyssou, D. and Pirlot, M.

2003/14 Butterfly auctions: clustering the bidding space
De Smet, Y.

2003/16 A comparison between Multicriteria and Robustness frameworks
Hites, R., De Smet, Y., Risse, N., Salazar-Neumann, M. and Vincke, P.
4 RESEARCH CONTRACTS

- *Proposition of a methodology for the application of strategic environmental assessment to the Brussels Capital Region. Prospective Research for Brussels Programme, Brussels Capital Region (January 2001/December 2004)*
  
  Risse N. and Vincze P.

  This project aims to define a methodology for the application of strategic environmental assessment (SEA) to the city level. This methodology tries to fulfill three main objectives: to be coherent with the planning system, to be improved in terms of decision aiding and to be pertinent for an urban context.

  
  Cailloux O., Markowitch O., Vincze P. and Pirlot M.

  This project aims to build a generic software in the domain of group decision support. It will allow to instantiate softwares to solve particular decision problems, considering multiple criteria, possibly in a multi-user environment. It will be possible to protect the interactions between the users and between the users and the system, using various cryptographic techniques, against eavesdropping, tampering, message forgery, etc.

- *Quality of service and electro-smog in mobile wireless ad-hoc networks. Research in Brussels 2002, Brussels Capital Region (July/October 2003)*
  
  Remiche M.-A. and Thiran P.

  The aim of the project was twofold. First, Patrick Thiran gave a series of seminar in Network Calculus. Secondly, the aim was to propose a model that could serve as a reference to the analysis of connectivity in sensor networks, as deployed in cities for example. Such an analysis is of particular interest in order to optimize the use of sensors and ways of deploying them with regards to the reduction of electro-smog activity in cities, among other applications.

- *Building of an IEEE 802.11 laboratory for experience and teaching. National Bank of Belgium (October 2003/September 2004)*
  
  Remiche M.-A.

  Within this project, we aim to study the effect of the presence of wireless links on the TCP session duration. Such an analysis will help in building more accurate models for TCP session behavior. The obtained funding is devoted to start the construction of the testing laboratory.
5 LECTURES

February 2003

- *Robustesse dans les problèmes d’optimisation combinatoire*
  
  Hites R. (Université Libre de Bruxelles, Brussels, Belgium)

- *Dénombrer et visualiser les biordres*
  
  Doignon J.P. and Christophe J. (Université Libre de Bruxelles, Brussels, Belgium)

- *On clear choices from an ordinal valued binary relation*
  
  Bisdorff R. (Centre Universitaire Luxembourg, Luxembourg, Grand Duchy of Luxembourg) and Roubens M. (Université de Liège, Liège, Belgium)

- *Suivre les traces*
  
  Bouyssou D. (Université Paris-Dauphine, Paris, France) and Pirlot M. (Faculté Polytechnique de Mons, Mons, Belgium)

- *Enchères multicritères*
  
  De Smet Y. (Université Libre de Bruxelles, Brussels, Belgium)

May 2003

- *Le mesurage de l’appartenance*
  
  Marchant T. (Universiteit Gent, Ghent, Belgium)

- *Bi-capacities for decision-making on bipolar scales*
  
  Grabisch M. (Université Paris VI, Paris, France)

- *Robustesse d’une solution dans les problèmes combinatoires: une approche axiomatique et son exploitation algorithmique*
  
  Perny P. (Université Paris VI, Paris, France) and Spanjaard O. (Université Paris-Dauphine, Paris, France)
• Aide Multicritère à la décision pour évaluer les indices de qualité de règles de décision et application

Meyer P. (Université de Liège, Liège, Belgium)

• Cycle-Transitivity

De Baets B. (Universiteit Gent, Ghent, Belgium)

October 2003

• Multiple Issue Auctions and Markets: MCDM Applied

Teich J.E. (Rotterdam School of Management, Rotterdam, The Netherlands and New Mexico State University, Las Cruces, United States of America)

November 2003

• What is a unit of capacity worth?

Chiera, B. (The University of Adelaide, Australia)
6 ACADEMIC VISITS AND INVITED CONFERENCES

January 2003

- LAMSADE, Université Paris-Dauphine, Paris, France.
  Hites R., Salazar-Neumann M. and Vincke P.

February 2003

- Centre Universitaire du Luxembourg, Faculté d’Economie, Université du Luxembourg, Luxembourg, Grand Duchy of Luxembourg.
  Vincke P.

March 2003

- Centre Universitaire du Luxembourg, Faculté d’Economie, Université du Luxembourg, Luxembourg, Grand Duchy of Luxembourg.
  Vincke P.

- Institut de Gestion de l’Environnement et d’Aménagement du Territoire, Université Libre de Bruxelles, Brussels, Belgium.
  Risse N.

April 2003

- Centre Universitaire du Luxembourg, Faculté d’Economie, Université du Luxembourg, Luxembourg, Grand Duchy of Luxembourg.
  Vincke P.

- ICN and Ecole des Mines de Nancy, Nancy, France.
  Mareschal B.
September 2003

- LAMSADE, Université Paris-Dauphine, Paris, France.
  Hites R., Salazar-Neumann M. and Vincze P.

December 2003

- CORE, Université Catholique de Louvain, Louvain-la-Neuve, Belgium.
  De Smet Y.

- LAMH - Recherche Opérationnelle et Informatique, Université de Valenciennes, Valenciennes, France.
  Vincze P.

- LAMSADE, Université Paris-Dauphine, Paris, France.
  Vincze P.
7 INTERNATIONAL CONFERENCES AND MEETINGS

January 2003

- Second Doctoral Meeting in Decision Aid, Han-sur-Lesse, Belgium.
  De Smet Y., Hites R. and Rissee N.

- ORBEL 17, Brussels, Belgium.
  De Smet Y.

February 2003

- 3ème Cycle du FNRS en Aide à la Décision et Modélisation des Préférences, Brussels, Belgium.
  Hites R., Rissee N., Salazar-Neumann M. and Vincze P.

March 2003

- NATO/CCMS Working Group meeting on Environmental Decision-Making for Sustainable Development in Central Asia, Brussels, Belgium.
  Rissee N. and Mareschal B.

  Remiche M.-A.

May 2003

- 14th Mini-EURO Conference, HCP 2003, Human Centered Processes: Distributed decision making and man-machine cooperation, Luxembourg, Grand Duchy of Luxembourg.
  De Smet Y.
• 3ème Cycle du FNRS en Aide à la Décision et Modélisation des Préférences, Brussels, Belgium.

De Smet Y., Hites R., Salazar-Neumann M. and Vincke P.

• International Summer School On Multiple Criteria Decision Aid 2003, Montreal, Canada.

Hites R. and Rissee N.


Rissee N.

July 2003

• EURO - INFORMS Joint International Meeting 2003, Istanbul, Turkey.

De Smet Y. and Vincke P.

October 2003

• 58th Meeting of the European Working Group “Multiple Criteria Decision Aid- ing”, Moscow, Russia.

Hites R.

• 6th International Conference on Electronic Commerce Research, Dallas, United States of America.

De Smet Y.

November 2003

• Journées PM20/FRO, Tours, France.

Vincke P.
8 CONFERENCES ORGANISATION ACTIVITIES

February 2003

- 3e Cycle du FNRS en Aide à la Décision et Modélisation des Préférences, Brussels, Belgium.
  Vinck P.

March 2003

  Risse N. and Vinck P.

May 2003

- 3e cycle du FNRS en Aide à la Décision et Modélisation des Préférences, Brussels, Belgium.
  Vinck P.

- Evaluation Environnementale Stratégique: Enjeux et Défis, Brussels, Belgium.
  Risse N. and Vinck P.

September 2003

- RTN Meeting, Brussels, Belgium.
  Vinck P.
9 OTHER ACTIVITIES

• *Mareschal B.*

  Professor at EDHEC (France) and Université de Lille 3 (France)
  President of the Informatique et Sciences humaines (Computer Science and Human Sciences) section of the Faculty of Economics, ULB
  Creator and President of the ULB spin-off IDM (Innovative Decision for Management)

• *Vincke P.*

  Vice-Rector of Université Libre de Bruxelles
  Past-President of EURO (European Federation of O.R. National Societies)
  Chairman of the Permanent Scientific Committee of the International Summer Schools in Multicriteria Decision Aid
  Coordinator of the Interuniversity programme of FNRS in Operations Research and Decision Aid
  Vice-President of IFORS
  President of DiSC project
  Associate editor of Theory and Decision and of Ricerca Operativa
  Co-editor of Journal of Multicriteria Decision Analysis
10 CONTACT ADDRESS

If you want to receive information concerning our activities,
please send back this form.

Surname: ........................................................................

First Name: ........................................................................

Organisation: ........................................................................

Address: ........................................................................

........................................................................

e-mail: ........................................................................

Comments:

Date ........................................................... Signature

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