

SWI XVIII

EURO Winter Institute XVIII



EURO

**The Association of European
Operational Research Societies**



SVOR / ASRO

**Schweizerische Vereinigung für Operations
Research**

Association Suisse de Recherche Opérationnelle

Associazione Svizzera di Ricerca Operativa



SNF / FNS

Swiss National Science Foundation



CUSO

Conférence Universitaire de Suisse Occidentale

EURO Winter Institute XVIII

Metaheuristics in Combinatorial Optimization

Lac Noir (Switzerland)

5 - 17 March 2000

Summary

This is the detailed report on the 18th EURO Summer/Winter Institute, which took place during the spring 2000 in Switzerland. It was organized by Alain Hertz (Ecole Polytechnique Fédérale de Lausanne) and Marino Widmer (Université de Fribourg) under the auspices of the Association of European Operational Research Societies (EURO) and with the additional support from the Swiss OR Society, the Swiss National Science Foundation and the "Conférence Universitaire de Suisse Occidentale" via the "3e cycle romand de recherche opérationnelle".

The topic of ESWI XVIII, "Metaheuristics in Combinatorial Optimization", was selected due to its great current scientific interest : indeed, in recent years, several metaheuristics have proved to be highly efficient for the solution of combinatorial optimization problems. The Institute was focused more particularly on the development and the use of local search techniques (e.g., tabu search, simulated annealing) and evolutionary algorithms (e.g., genetic algorithms, scatter search). Applications of these metaheuristics on academic or real life problems were also discussed.

Seventeen promising researchers have attended this Winter Institute and fifteen papers have been submitted for publication to a special issue of EJOR. This attests the scientific success of ESWI XVIII.

This detailed report is structured as follows :

- organization
- important dates
- before the ESWI
- the ESWI itself
- conclusion

Organization

A rather particular structure has been chosen for the organization, in order to simplify the whole process. Indeed, to be more efficient, three committees were defined :

- *an organization committee*

composed by Alain Hertz (EPFL) and Marino Widmer (Uni. Fribourg), it was mainly dedicated to the different contacts the organization had with EURO, the national societies, the participants, the hotel, EJOR, etc.

- *a scientific committee*

composed by Maurice Cochand (ETH Zurich), Dominique de Werra (EPFL), Luca Gambardella (IDSIA Lugano), Alain Hertz (EPFL), Manuel Laguna (University of Colorado, Boulder) and Marino Widmer (Uni. Fribourg), its task was to evaluate the candidates selected by the national societies. This committee was created in September 1999 and it was dissolved in April 2000, just after the ESWI

- *a publication committee*

composed by Luca Gambardella (IDSIA), Alain Hertz (EPFL), Manuel Laguna (Uni. of Colorado) and Marino Widmer (Uni. Fribourg), this group will be active in the refereeing process for the special issue of EJOR.

Important dates

In order to respect the planning proposed in the EURO Guidelines, the following schedule was adopted :

<i>17 September 1998</i>	after a first unformal contact in September 1997, the official submission of proposal was sent to EURO.
<i>December 1998</i>	circulation of information among OR Societies via the EURO Bulletin (Volume 7, no 3-4, Winter 1998)
<i>31 March 1999</i>	first reminder of information to OR Societies via e-mail
<i>17 September 1999</i>	submission of the first candidate
<i>11 October 1999</i>	second reminder of information to OR Societies via e-mail; information available on the web site : http://iufpc44.unifr.ch/ESWI_18
<i>31 October 1999</i>	official deadline for submission of candidates by OR societies
<i>7 December 1999</i>	announcement of selected candidates by the scientific committee of ESWI XVIII
<i>29 December 1999</i>	submission of the last candidate (!)
5-17 March 2000	ESWI XVIII in Lac-Noir (CH)
<i>19 May 2000</i>	submission of the final versions of the papers for publication in EJOR (16 papers received)
<i>17 June 2000</i>	submission of a final report on the ESWI by the chair of the Committee to the Executive Committee of EURO

Before the ESWI

In order to organize this ESWI, a huge amount of e-mails were exchanged (433 !). Fortunately, there were mainly short mails concerning details. Everything was simple and efficient in most cases. Let us just mention particular problems :

Anna Mukhatcheva

We have been contacted by this Russian researcher in April 1999. We have answered that she can send an unpublished paper, but we have also informed her this was not a guarantee of participation to ESWI. We did not received any paper and also no answer to an e-mail in December 1999.

Peter Greistorfer

We have been contacted by this researcher working in Graz (Austria) in November 1999. He did not fulfil two conditions (age : 39 ; no unpublished paper to submit)

Portuguese OR Society

APDIO has selected three candidates. The organizing committee decided to accept only two persons, in order to be fair with the other countries. For this reason, we asked APDIO to propose only two candidates.

French OR Society

The situation was more complex with the French Society. When the deadline for submission occurred, we did not have any French participant. After additional contacts, we received in November 1999 the folder of two candidates. The 29th of January 2000, we received an e-mail of the former president of ROADEF telling us that the selected French candidate was surprised that he did not received any information from the ESWI organizing committee. The origin of the problem was simple to detect : nobody in ROADEF was in charge to inform the ESWI organizing committee ! The situation was the following : we had one "official" candidate and two "unofficial" candidates. Once again, we have asked the French OR Society to select only two candidates. The choice was finally the official one and one of the two "unofficial" ones.

Khalid Allali

We were contacted by this researcher from Morocco in November 1999. Many e-mails have been exchanged with Andres Weintraub, IFORS president, Paolo Toth, IFORS elected president and Christof Schneeweiss, EURO president, in order to find an agreement between EURO and IFORS. Finally, the decisions were the following :

- regarding the IFORS-EURO cooperation, in such a situation, IFORS covers travel costs and EURO covers the cost of participating in ESWIs. But the condition for EURO is that the candidate "should be accepted on the same basis on which other candidates are accepted".
- Khalid Allali did not fulfil one condition (age : 39)

Jozsef Buksar

We have received from this hungarian candidate a paper entitled "Bounds for the multivariate normal distribution function". The scientific committee has examined it carefully but it has considered that this paper did not match the topic of the Institute.

The ESWI itself

a) *The participants*

Finally, the scientific committee has accepted 18 participants. Unfortunately, due to private circumstances, the candidate from Denmark has cancelled his participation two weeks before the beginning of ESWI XVIII.

The 17 promising researchers in Metaheuristics represented 12 countries. The following list contains the addresses of the ESWI participants, including also the three "senior" academics (Alain Hertz, Manuel Laguna and Marino Widmer).

Maria Joao **CORTINHAL**

ISCTE

Av. Forças Armadas

P - 1649-026 LISBOA

Portugal

e-mail : luiscortinhal@sapo.pt

Andreas **FINK**

Technical University of Braunschweig

Information Systems and Information Management

Abt-Jerusalem-Str. 7

D - 38106 BRAUNSCHWEIG

Germany

e-mail : a.fink@tu-bs.de

Nathalie **GRANGEON**

Université Blaise Pascal - Clermont Ferrand II

LIMOS

F - 63177 AUBIERE cedex

France

e-mail : grangeon@iris.univ-bpclermont.fr

Alain **HERTZ**

Ecole Polytechnique Fédérale de Lausanne

Département de Mathématiques

MA - Ecublens

CH - 1015 LAUSANNE

Switzerland

e-mail : alain.hertz@epfl.ch

Andrzej **JASZKIEWICZ**

Institute of Computing Science

Poznan University of Technology

ul. Piotrowo 3a

PL - 60965 POZNAN

Poland

e-mail : jaszkievicz@cs.put.poznan.pl

Ralf **KEUTHEN**

University of Nottingham
School of Computer Science & IT
Jubilee Campus
GB - NOTTINGHAM NG8 1BB
United Kingdom

e-mail : rxk@Cs.Nott.AC.UK

Tamas **KIS**

Ecole Polytechnique Fédérale de Lausanne
Département de Mathématiques
MA - Ecublens
CH - 1015 LAUSANNE
Switzerland

e-mail : tamas.kis@epfl.ch

Georg **KLIEWER**

University of Paderborn,
Department of Mathematics and Computer Science
Fürstenallee 11
D - 33102 PADERBORN
Germany

e-mail : geokl@uni-paderborn.de

Asaf **LEVIN**

Department of Statistics and Operations Research
School of Mathematical Sciences
Tel Aviv University
IL - TEL AVIV 69978
Israel

e-mail : levinas@math.tau.ac.il

Manuel **LAGUNA**

University of Colorado
Campus Box 419
BOULDER, Colorado 80903-0419
U.S.A.

e-mail : Manuel.Laguna@Colorado.Edu

Alberto **MORAGLIO**

Dipartimento di Automatica e Informatica
Corso Duca degli Abruzzi 24
I - 10129 TORINO
Italy

e-mail : a.moraglio@studenti.to.it

Jelica **PETROVIC**

University of Belgrade
Faculty of Organization Science
Jove Llica 154
YU - 11000 BELGRADE
Yugoslavia

e-mail : caca@panet.bits.net

Inmaculada **RODRIGUEZ MARTIN**
Dpto. de Estadística, I.O. y Computación
Universidad de La Laguna
Astrofísico Francisco Sánchez
SP - 38271 LA LAGUNA
Spain

e-mail : irguez@ull.es

Marc **SEVAUX**
Université de Valenciennes
LAMIH - Génie Industriel et Logiciel
Le Mont-Houy - BP 311
F - 59304 VALENCIENNES cedex
France

e-mail : Marc.Sevaux@univ-valenciennes.fr

Kenneth **SÖRENSEN**
Information Systems &
Operations and Logistics Management
University of Antwerp - RUCA
Middelheimlaan 1
B - 2020 ANTWERP
Belgium

e-mail : ksorensen@ruca.ua.ac.be

Henrico **WANDERS**
University of Groningen
Faculty of Management and Organisation
PO Box 800
NL - 9700 AV GRONINGEN
The Netherlands

e-mail : h.l.t.wanders@bdk.rug.nl

Marino **WIDMER**
Université de Fribourg
IIUF - Regina Mundi
Faucigny 2
CH - 1700 FRIBOURG
Switzerland

e-mail : marino.widmer@unifr.ch

Christelle **WYNANTS**
Institut de Mathématiques
Université de Liège B37
12 Grande Traverse
B - 4000 SART-TILMAN
Belgium

e-mail : cwynants@ulg.ac.be

Ana **XAMBRE**
Secção Autónoma de Gestão e Engenharia Industrial
Universidade de Aveiro
Campus de Santiago
P - 3810-193 AVEIRO
Portugal

e-mail : raquelx@egi.ua.pt

Nicolas **ZUFFEREY**
Ecole Polytechnique Fédérale de Lausanne
Département de Mathématiques
MA - Ecublens
CH - 1015 LAUSANNE
Suisse

e-mail : nicolas.zufferey@epfl.ch

b) The presentations

Concerning the presentations, 90 minutes were dedicated to each participant. This means 45 minutes for the talk and 45 minutes for a discussion. We were positively surprised by the high scientific quality of the presentations, the very fruitful interactivity between the speakers and the audience, and the fantastic work atmosphere. The following list contains the discussed papers :

Maria Joao Cortinhal (P)

A two step tabu search heuristic for the single source capacitated location problem

Andreas Fink (D)

Applications of Modern Heuristic Search Methods to Continuous Flow-Shop Scheduling Problems

Nathalie Grangeon (F)

A contribution to the stochastic flow shop scheduling problem

Andrzej Jaskiewicz (PL)

Developing efficient genetic local search type heuristics on the basis of global convexity tests - vehicle routing example

Ralf Keuthen (UK)

New Local and Variable Neighborhood Search Heuristics for a Sequencing Problem in Printed Circuit Board Assembly applied to the Travelling Salesman Problem

Tamas Kis (CH)

AND-OR graph scheduling

Georg Kliewer (D)

A General Software Library for Parallel Simulated Annealing

Asaf Levin (IL)

Lexicographic local search and the p-center problem

Alberto Moraglio (I)

Genetic Local Search for Job Shop Scheduling Problem

Jelica Petrovic (YU)

Solving Spread Spectrum Radar Polyphase Code Design Problem by Tabu Search and Variable Neighbourhood Search

Inmaculada Rodriguez (SP)

The Variable Neighborhood Tabu Search for Location/Allocation Problems

Marc Sevaux (F)

Building a Genetic Algorithm for a Single Machine Scheduling Problem

Kenneth Sörensen (B)

Data Mining with Genetic Algorithms on Binary Trees

Henrico Wanders (NL)

The composition of semifinished inventories at a solid board plant

Christelle Wynants (B)

Optimizing Reserve Capacities of Partially Equipped SDH Networks

Ana Xambre (P)

Joint cell formation and operation allocation in cellular manufacturing using simulated annealing

Nicolas Zufferey (CH)

An Adaptation of the Variable Neighborhood Search Method to the Graph Coloring Problem

In addition to these talks, the participants have had also the opportunity to hear three additional dedicated presentations, given by Alain Hertz and Manuel Laguna. Time for general discussion was also scheduled (see the timetable given in Appendix).

c) Annual meeting of the "3e cycle romand de recherche opérationnelle"

Moreover, in order to develop the contacts between the international participants and the Swiss doctoral students, we combined ESWI XVIII with the annual meeting of the "3e cycle romand de recherche opérationnelle", the association of the OR groups of the universities located in West-Switzerland. During this meeting, the following lectures were scheduled :

Martin Grötschel (4 lectures)

Modern Challenges of Combinatorial Optimization

Manuel Laguna (4 lectures)

An Exploration of Metaheuristic Optimization: Tabu Search, Scatter Search and Path Relinking

Jon Lee (2 lectures)

Some Methods for Treating Nonlinearities in Combinatorial Optimization

d) Social programme

The instructions to the organizing committee of an ESWI emphasize the importance of the social aspect of the Institute in facilitating the emergence of a scientific network among the promising researchers. We prepared different kinds of activities :

A welcome party

which was useful to create the first links between the participants ...

A cocktail party

offered by the "3e cycle romand de recherche opérationnelle"

Ski

as Lac Noir is located in the Swiss (Pre-)Alps, it was an excellent opportunity to initiate some participants to the practice of ski ! It was marvelous to see their pleasure. The strongest ones have decided to ski three consecutive afternoons, the wisest ones preferred to walk.

Visit of Fribourg

at the end of the first week, a visit of Fribourg was organized. We have visited the old city, two churches, a funny funicular and two pubs ...

Walk

a two-hours walk was planned. Due to wrong indications concerning the way, the duration was the double, thanks to the snow ...

Excursion

last Wednesday, a one-day excursion was organized. We have visited an electrical power factory, eat a classical cheese "fondue" with some other local specialities, visited the Geiger Museum (the artist who designed the creatures of the "Alien" movie) and concluded with the visit of a cheese factory. What a day !

e) Accommodation

ESWI XVIII took place in the "Primerose Hotel". The participants were dispatched in small flats (3 participants per flat). The conference room was big enough for the ESWI group, as it can contain 50 persons. The hotel have also interesting attributes, as a swimming pool, a sauna and a fitness room (free access for the participants). Moreover, there were some additional possibilities as ping-pong or billiards. Notice that the participants have organized several billiards-contests after the dinners.

As the village is located "in the middle of nowhere", there were not so many opportunities out of the hotel. This was also an advantage to create the "glue" between the participants.

f) Finances

The table below presents the detailed information concerning the finances.

Object	Income	Costs
EURO	25'000	
ASRO/SVOR (Swiss OR Society)	5'000	
3e cycle de RO	*	
Swiss National Foundation	8'000	
Accomodation and food (participants)		17'280.00
Accomodation and food (speakers)		4'585.00
Travel expenses (speakers)		650.00
Speaker honoraries		1'650.00
Copies		1'016.60
Social activities		4'062.90
Coffee breaks		1'200.00
Water + coffee (lunches)		1'906.30
Others		767.10
Total	38'000	33'117.90

* 3e cycle takes in charge : one cocktail party, coffee break during 3e cycle meeting and the booklet of the 3e cycle (approximately : 1'380 CHF)

The accounts will be audited till the mid of July 2000. The auditors will be Philippe Solot and Daniel Costa, respectively EURO and ASRO/SVOR treasurer. The report of the auditors will be available for the next EURO Executive Committee Meeting, in Budapest.

The difference between the income and the costs will be restored to the three sponsors proportionally to their contribution.

Conclusion

At the end of ESWI XVIII, everyone was tired but ... happy. We had the impression we have lived a particular moment in our lives. From the organizers point of view, we consider we have reached all our objectives (scientific and social) during this ESWI. As we received many nice messages after the ESWI, we think that the participants share our positive feeling.

But what happens now ?

First point : we will prepare a special issue of EJOR. We received 15 papers. We can now start the refereeing process.

Second point : the participants have decided to create a new EURO working group (EU/ME : European Chapter on Metaheuristics, to be pronounced You and Me). Preliminary contacts have been taken with Raymond Bisdorff, the EURO Vice-president in charge of EWG.

The first meeting of EU/ME is already scheduled, which is a very positive point for the future.

EURO Winter Institute XVIII

	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THU 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THU 16	FRI 17	SAT 18	
08.30-09.00			Georg	Marc	Manuel	Martin	Manuel	Jon		Alain	Inmaculada	e				Alain
09.00-09.30			break	break	break	break	break	break		break	break	x				break
09.30-10.00			Kenneth	Alberto	Manuel	Manuel	assist.	Jon		disc.	Nicolas	c				break
10.00-10.30			break	break	break	break	break	break		break	break	u				
10.30-11.00												r				
11.00-11.30												s				
11.30-12.00												i				
												o				
12.00-13.30												n				
13.30-14.00			Asaf	Tamas	F r i b o u r g								Ana			
14.00-14.30			break	break						w	Ralf					
14.30-15.00			Henrico	assist.						a	break					
15.00-15.30			break	break						l	Jelica					
15.30-16.00			Christelle	intro						k	break					
16.00-16.30																
16.30-17.00	welcome	ESWI XVIII														
17.00-17.30			break													
17.30-18.00																
18.00-18.30																
18.30-19.00																
19.00-19.30																
19.30-20.00																

debriefing

3 e cycle

ESWI

EURO Winter Institute XVIII

Metaheuristics in Combinatorial Optimization

Lac Noir (Switzerland)

5 - 17 March 2000

This is the report on the 18th EURO Summer/Winter Institute, which took place during the spring 2000 in Switzerland. It was organized by Alain Hertz (Ecole Polytechnique Fédérale de Lausanne) and Marino Widmer (Université de Fribourg) under the auspices of the Association of European Operational Research Societies (EURO) and with the additional support from the Swiss OR Society, the Swiss National Science Foundation and the "Conférence Universitaire de Suisse Occidentale" via the "3e cycle romand de recherche opérationnelle".

The topic of ESWI XVIII, "Metaheuristics in Combinatorial Optimization", was selected due to its great current scientific interest : indeed, in recent years, several metaheuristics have proved to be highly efficient for the solution of combinatorial optimization problems. The Institute was focused more particularly on the development and the use of local search techniques (e.g., tabu search, simulated annealing) and evolutionary algorithms (e.g., genetic algorithms, scatter search). Applications of these metaheuristics on academic or real life problems were also discussed.

Seventeen promising researchers have attended this Winter Institute and seventeen papers have been submitted for publication to a special issue of EJOR. This attests the scientific success of ESWI XVIII.

Scientific programme

Ninety minutes were dedicated to each participant. This means 45 minutes for the talk and 45 minutes for a discussion. We were positively surprised by the high scientific quality of the presentations, the very fruitful interactivity between the speakers and the audience, and the fantastic work atmosphere. The following list contains the discussed papers :

Maria Joao Cortinhal (Portugal)

A two step tabu search heuristic for the single source capacitated location problem

Andreas Fink (Germany)

Applications of Modern Heuristic Search Methods to Continuous Flow-Shop Scheduling Problems

Nathalie Grangeon (France)

A contribution to the stochastic flow shop scheduling problem

Andrzej Jaskiewicz (Poland)

Developing efficient genetic local search type heuristics on the basis of global convexity tests - vehicle routing example

Ralf Keuthen (United Kingdom)

New Local and Variable Neighborhood Search Heuristics for a Sequencing Problem in Printed Circuit Board Assembly applied to the Travelling Salesman Problem

Tamas Kis (Switzerland)

AND-OR graph scheduling

Georg Kliewer (Germany)

A General Software Library for Parallel Simulated Annealing

Asaf Levin (Israel)

Lexicographic local search and the p-center problem

Alberto Moraglio (Italy)

Genetic Local Search for Job Shop Scheduling Problem

Jelica Petrovic (Yugoslavia)

Solving Spread Spectrum Radar Polyphase Code Design Problem by Tabu Search and Variable Neighbourhood Search

Inmaculada Rodriguez (Spain)

The Variable Neighborhood Tabu Search for Location/Allocation Problems

Marc Sevaux (France)

Building a Genetic Algorithm for a Single Machine Scheduling Problem

Kenneth Sörensen (Belgium)

Data Mining with Genetic Algorithms on Binary Trees

Henrico Wanders (The Netherlands)

The composition of semifinished inventories at a solid board plant

Christelle Wynants (Belgium)

Optimizing Reserve Capacities of Partially Equipped SDH Networks

Ana Xambre (Portugal)

Joint cell formation and operation allocation in cellular manufacturing using simulated annealing

Nicolas Zufferey (Switzerland)

An Adaptation of the Variable Neighborhood Search Method to the Graph Coloring Problem

In addition to these talks, the participants have had also the opportunity to hear three additional dedicated presentations, given by Alain Hertz and Manuel Laguna. Time for general discussion was also scheduled.

Moreover, in order to develop the contacts between the international participants and the Swiss doctoral students, we combined ESWI XVIII with the annual meeting of the "3e cycle romand de recherche opérationnelle", the association of the OR groups of the universities located in West-Switzerland. During this meeting, the following lectures were scheduled :

Martin Grötschel (4 lectures)

Modern Challenges of Combinatorial Optimization

Manuel Laguna (4 lectures)

An Exploration of Metaheuristic Optimization: Tabu Search, Scatter Search and Path Relinking

Jon Lee (2 lectures)

Some Methods for Treating Nonlinearities in Combinatorial Optimization

Social programme

The instructions to the organizing committee of an ESWI emphasize the importance of the social aspect of the Institute in facilitating the emergence of a scientific network among the promising researchers. We prepared different kinds of activities :

A welcome party

which was useful to create the first links between the participants ...

A cocktail party

offered by the "3e cycle romand de recherche opérationnelle"

Ski

as Lac Noir is located in the Swiss (Pre-)Alps, it was an excellent opportunity to initiate some participants to the practice of ski ! It was marvelous to see their pleasure. The strongest ones have decided to ski three consecutive afternoons, the wisest ones preferred to walk.

Visit of Fribourg

at the end of the first week, a visit of Fribourg was organized. We have visited the old city, two churches, a funny funicular and two pubs ...

Walk

a two-hours walk was planned. Due to wrong indications concerning the way, the duration was the double, thanks to the snow ...

Excursion

last Wednesday, a one-day excursion was organized. We have visited an electrical power factory, eat a classical cheese "fondue" with some other local specialities, visited the Geiger Museum (the artist who designed the creatures of the "Alien" movie) and concluded with the visit of a cheese factory. What a day !

Accommodation

ESWI XVIII took place in the "Primerose Hotel". The participants were dispatched in small flats (3 participants per flat). The conference room was big enough for the ESWI group, as it can contain 50 persons. The hotel have also interesting attributes, as a swimming pool, a sauna and a fitness room (free access for the participants). Moreover, there were some additional possibilities as ping-pong or billiards. Notice that the participants have organized several billiards-contests after the dinners.

As the village is located "in the middle of nowhere", there were not so many opportunities out of the hotel. This was also an advantage to create the "glue" between the participants.

Conclusion

At the end of ESWI XVIII, everyone was tired but ... happy. We had the impression we have lived a particular moment in our lives. From the organizers point of view, we consider we have reached all our objectives (scientific and social) during this ESWI. As we received many nice messages after the ESWI, we think that the participants share our positive feeling.

But what happens now ?

First point : we will prepare a special issue of EJOR. We received 17 papers. We have started the refereeing process.

Second point : the participants have decided to create a new EURO working group (EU/ME : EUROpean Chapter on Metaheuristics, to be pronounced You and Me). Preliminary contacts have been taken with Raymond Bisdorff, the EURO Vice-president in charge of EWG.

The first meeting of EU/ME is already scheduled, which is a very positive point for the future.

Alain HERTZ and Marino WIDMER



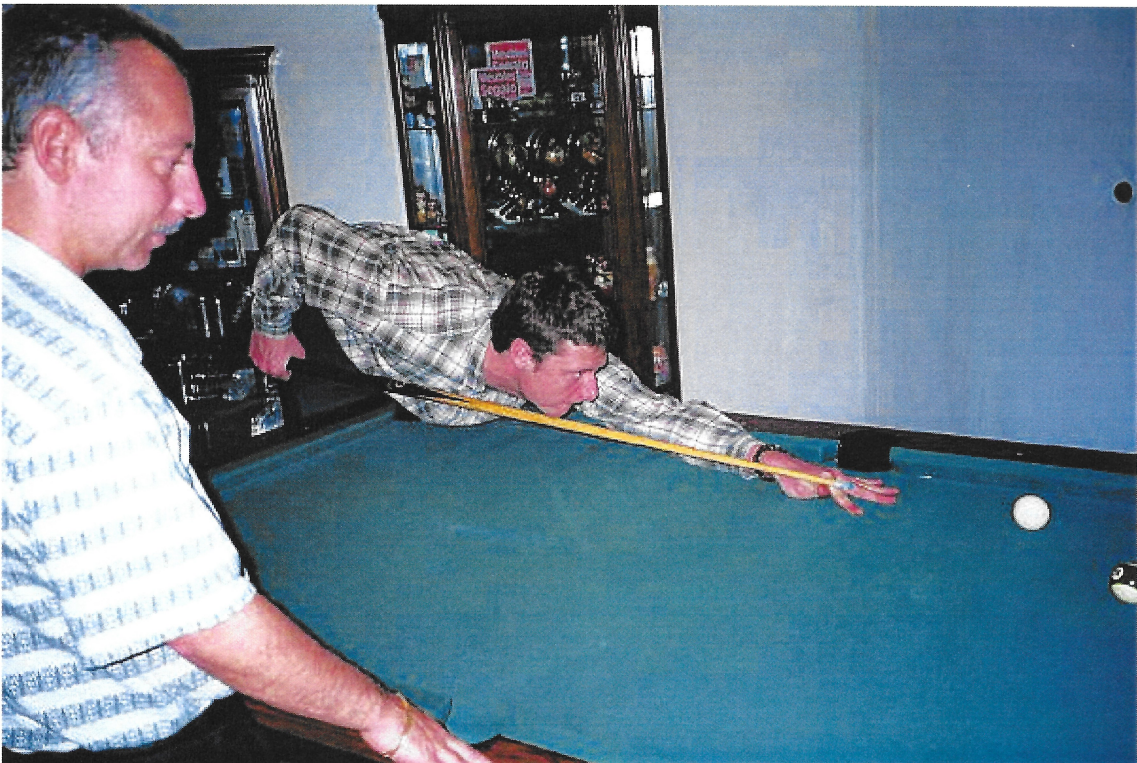
Ski time !



Visit of Fribourg



The classical cheese "fondue"



Billiards-contest



The audience



The participants