ACAI'15@CRIL - Advanced Course on Artificial Intelligence

Constraint Solving Techniques in AI

October 26-30, 2015 - LILLE, FRANCE

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
08:00	Registration				
08:30	Welcome Talk				
09:00	COMPILATION	SAT	SAT	SMT	CSP
09:30					
10:00					
10:30					
11:00	EVALUATION	ASP	ASP	ASP	DATA MINING
11:30					
12:00					
12:30					
13:00					
13:30					
14:00	SAT	COMPILATION	CSP	CSP	XCSP
14:30					
15:00					
15:30					
16:00	Presentation of the Participants	COMPILATION	Social Program	WCSP	
16:30					
17:00	Poster Session				
17:30					
18:00		Reception at the Town Hall			
18:30					
19:00	Welcome Reception		Dinner		
19:30					
20:00					
20:30					

SAT: Boolean SATisfiability problems, by Ines Lynce
ASP: Answer Set Programming, by Torsten Schaub
CSP: Constraint Satisfaction Problems, by Ian Gent
COMPILATION: Knowledge Compilation, by Pierre Marquis
EVALUATION: Evaluation & Competitions of Solvers, by Daniel Le Berre and Olivier Roussel
DATA MINING: SAT for Data Mining, by Lakhdar Saïs
SMT: SATisfiability Modulo Theory, by Albert Oliveras
WCSP: Weighted Constraint Satisfaction Problems, by Martin Cooper
XCSP: XCSP 3.0 input format, by Christophe Lecoutre

Programme

Fundamental courses

Boolean SATisfiability problems, by Ines Lynce

Monday 2pm-3:30pm, Tuesday 9am-10:30am, Wednesday 9am-10:30am

Boolean Satisfiability (SAT) is named after George Boole, whose 200th birthday we celebrate this year. The first step towards the use of SAT in real problems was probably taken in the 20's by Claude Shannon, one of the researchers who laid the foundations of AI. His master thesis connected Boolean logic with electrical applications. The next major step was performed by Stephen Cook in his seminal 70's paper on NP-completeness. SAT is now, in the 21st century, a widely used technology. Part of this success is explained by the efficiency of SAT solvers, namely Conflict Driven Clause Learning (CDCL) SAT solvers. In these lectures we will provide the basis for understanding SAT and its extensions (Maximum Satisfiability and Pseudo Boolean Optimization). Practical examples will be given for solving concrete problems with SAT, including all the required steps: encoding a problem into SAT, running a SAT solver and making use of the solution.

Inês Lynce is currently an associate Professor at IST - University of Lisbon and a senior researcher at INESC-ID. She is a well-established researcher in the area of Boolean constraint solving and optimization. Her main contributions refer to the development of search algorithms and the application of those algorithms to solve practical problems. Examples of these problems include software package upgreadability, biological networks, phylogenetic trees and crew scheduling. In 2006, she has pioneered, jointly with Joao Marques-Silva, the use of Boolean satisfiability in Bioinformatics. Since 2010 she is serving in the Editorial Board of the Journal of Artificial Intelligence Research (JAIR). She has been the workshop Chair of the 17th International Conference on Theory and Applications of Satisfiability Testing (SAT'14) and is recurrently member of the programme committees of the IJCAI, AAAI, ECAI, CP and SAT conferences.

Constraint Satisfaction Problems, by Ian Gent

Wednesday 2pm-3:30pm, Thursday 2pm-3:30pm, Friday 9am-10:30am

Constraints can be a very natural way to solve a wide variety of problems, including real world problems like scheduling, puzzles like sudoku, and combinatorial problems in mathematics. The key feature is the availability in modern constraint solvers of a wide variety of semantically rich constraints, which can be reasoned with ("propagated") very efficiently. The fundamental principles of how constraint solvers reason will be covered, but the main focus will be on modelling of constraint problems with practical examples using the constraint modelling and solving tools SavileRow and Minion, both developed in St Andrews.

Ian Gent is Professor of Computer Science at the University of St Andrews, Scotland. Much of his research has been on Constraint Satisfaction, and has included topics such as symmetry in constraint problems, efficient propagation algorithms, the understanding of easy and hard problems in constraints, and modelling of constraint problems. He was Programme Chair of the major Constraint Programming conference, CP 2009 in Lisbon. More recently he founded recomputation.org, a website dedicated to reproducibility of experimental methods.

Answer Set Programming, by Torsten Schaub

Tuesday, Wednesday, Thursday, 11am-12:30am

This tutorial presents a practical introduction to Answer Set Programming (ASP), aiming at using ASP languages and systems for solving application problems. Starting from the essential formal foundations, it introduces ASP's modeling language and methodology, grounding and solving technology, and finally details control techniques needed for embedding ASP in complex software environments.

Torsten Schaub is University Professor at the University of Potsdam. His research interests range from the theoretic foundations to the practical implementation of reasoning from incomplete, inconsistent, and evolving information. His current research focus lies on Answer set programming and materializes at potassco.sourceforge.net, the home of the open source project Potassco bundling software for Answer Set Programming.

Knowledge Compilation, by Pierre Marquis

Monday 9am-10:30am, Tuesday 2pm-3:30pm, 4pm-5:30pm

The course will include an introduction to the topic, as well as a presentation of the key notions of compilable problem and of knowledge compilation map. Some languages for the compilation of Boolean functions and of real-valued functions will be investigated. Recent developments, including the application of knowledge compilation techniques to product configuration, will be also overviewed.

Pierre Marquis is a Professor of Computer Science at Artois University. He does his research at CRIL. Pierre Marquis is a specialist of Knowledge Representation. One of his main topics for more than twenty years is Knowledge Compilation. Pierre Marquis authored or co-authored more than 30 papers on the subject in international journals and conferences.

Advanced Courses

SATisfiability Modulo Theory, by Albert Oliveras

Thursday 9am-10:30am

This course will present a basic overview of SMT, mainly focusing on the DPLL(T) approach. We will review the most interesting theories that SMT solvers can deal with and will introduce the basic ingredients of a DPLL(T)-based SMT solver.

Albert Oliveras is associate professor at the Technical University of Caralonia (UPC). His research has been focused on developing theory, techniques and tools for SAT, SMT, decision procedures and program verification. He has co-authored more than 30 papers on these topics in international conferences and journals.

SAT for Data Mining, by Lakhdar Saïs

Friday 11am-12:30am

In this talk, we overview our contribution to data mining and more generally to the cross-fertilization between data mining and propositional satisfiability. We will focus on three contributions. First, we show how propositional satisfiability can be used to model and solve problems in data mining. As an illustration, we present a SAT-based declarative approach for enumerating top-k (closed, frequent) itemsets in transactional databases. Secondly, we show how symmetries widely investigated in Constraint Programming (CP) and Propositional Satisfiability (SAT) can be extended to deal with data mining problems. Finally, we discuss the potential contribution of data mining to propositional satisfiability. In this context, we present a first application of data mining to compress Boolean formulas conjunctive normal form.

Lakhdar Saïs is a Professor of Computer Science at Artois University - CRIL. His research focuses on search and representation problems in Artificial Intelligence. He is especially interested in propositional satisfiability, quantified boolean formula, constraint satisfaction and optimisation problems and data mining.

Weighted Constraint Satisfaction Problems, by Martin Cooper

Thursday 4pm-5:30pm

This course will first present Valued Constraint Satisfaction, a general framework for expressing finite-domain optimisation problems, before going on to discuss aspects such as modelling, search, problem transformations, tractable classes and applications. There will be an emphasis on the theory of valuation structures, soft consistency operations and tractable classes.

Martin Cooper holds a position of professor of Computer Science at Toulouse University. His research covers many aspects of constraint satisfaction, including tractable classes, reduction operations as well as applications in vision and planning. He has published over 30 journal papers on topics related to constraint satisfaction.

XCSP 3.0 input format, by Christophe Lecoutre

Friday 2pm-3:30pm

In this talk, we shall present the new format XCSP3 that allows us to build integrated representations of combinatorial constrained problems. This format is able to deal with mono/multi optimization, many types of variables, cost functions, reification, views, annotations, variable quantification, distributed, probabilistic and qualitative reasoning. Importantly, in this talk, XCSP3 will also serve as a pretext for presenting some facets of problem modelling and solving processes.

Christophe Lecoutre is a Professor of Computer Science at Artois University. He does his research at CRIL. Christophe Lecoutre is a specialist of Constraint Programming. Christophe Lecoutre authored a book about constraint networks and co-developed XCSP.

Evaluation & Competitions of Solvers, by Daniel Le Berre and Olivier Roussel

Monday 11am-12:30am

This course will focus on the difficulties met in assessing the performance of different solvers (software) on current computers. In a first part, the most relevant notions of computer architecture will be recalled (memory hierarchy, cores, SMP/NUMA architectures, ...). Then, some issues regarding the input format of the benchmarks and their selection will be presented. The experience gathered during the SAT, PB and CSP competitions will be shared in the third part. At last, different ranking methods used during the SAT competitions will be discussed.

Olivier Roussel is associate professor in computer science at Artois University, France. He has organized many competitions (Pseudo-Boolean, SAT and CSP) and is the author of runsolver, a tool to control the resources used by a solver.

Daniel Le Berre is professor in computer science at Artois University, France. He initiated the SAT competitive events in 2002, and took part of them in various roles (co-organizer, technical advisor) until 2011. As one of the authors of Sat4j, an open source Boolean satisfaction and optimization library, he also participated as competitor to many competitive events.

Poster session

The following posters will be presented during the poster session on Monday afternoon.

1. Masoumeh Mansouri (masoumeh.mansouri@oru.se)
   Hybrid knowledge representation and reasoning in robots, a constraint-based approach
2. Sibylle Moehle (sibylle.moehle@tu-dresden.de)
   Improving Propositional Model Counting and Enumeration
3. Ghizlane El Khattabi (elkhattabi.ghizlane@gmail.com)
   Contribution to approaches of privacy and ethical behavior in a multi-cooperative agent system: constraint programming approach
4. Sorina Chisca (sorina.chisca@insight-centre.org)
   CP - Based Approach for Popular Matching
5. Stefano Germano (germano@mat.unical.it)
   Bridging the gap between Answer Set Programming and Real Evolving World
6. Jonas Vlasselaer (jonas.vlasselaer@cs.kuleuven.be)
   Anytime inference in probabilistic logic programs with Tp-compilation
7. Matthias Vanderhallen (matthias.vanderhallen@cs.kuleuven.be)
   Higher Order Support in Logic Specification Languages for Data Mining Applications

8. Sara Maqrot (sara.maqrot@gmail.com)

   Approximation methods of combinatorial optimization in mathematical programming. Application to the design of vegetable orchards

9. Samuel Thomas (samuel.thomas@cril.fr)

   Compiling Constraint Networks into Multivalued Decomposable Decision Graphs

Social program

Monday: Welcome reception

To end the first day of the conference, we invite you to taste some flavors of a local beer, Page 24.

Conference Room, 6:30pm

Tuesday: Town Hall reception

A reception at the Town Hall, Place Augustin Laurent, will start at 6:00pm.

The meeting point is at 5:30pm at the conference room.

Wednesday: City tour

A guided tour of the city will start at 4pm in front of the Tourist information center, Place Rihour, Lille. The tour will last approximately 2 hours.

Description of the tour:

Immerse yourself in Lille's most charming district, where architecture, shops, and museums will seduce you! Stroll around the streets and squares to discover the heritage, the history and "art of living" of the town through its main sites and monuments: the Palais Rihour, the Main Square, the old stock exchange, the Opera House, the Chamber of Commerce, and the Notre-Dame de la Treille cathedral. After a tour that reveals the architectural aspects of the city, we will visit the museum "Hospice Comtesse", founded in 1237 by Jeanne de Flandre, which displays works from Lille's past (objects from every day life, wood sculptures, earthenware, furniture and paintings).

Wednesday: Social dinner

- L'assiette du marché

```
61 Rue de la Monnaie
```

Meeting point there at 7pm.

Restaurants

There are plenty of restaurants in Lille. If you look for a specific kind of restaurant look at tripadvisor. Here is a short selection of some of our favorite places. All are close enough from ACAI place to be reached for lunch. Nonetheless we indicate with **(Lunch)** the closest places.

Note also that in the *Euralille* shopping center just on the other side of the street there are many food places (burgers, sandwiches, pastas, chinese food, . . .).

To locate the restaurants on a map see here.

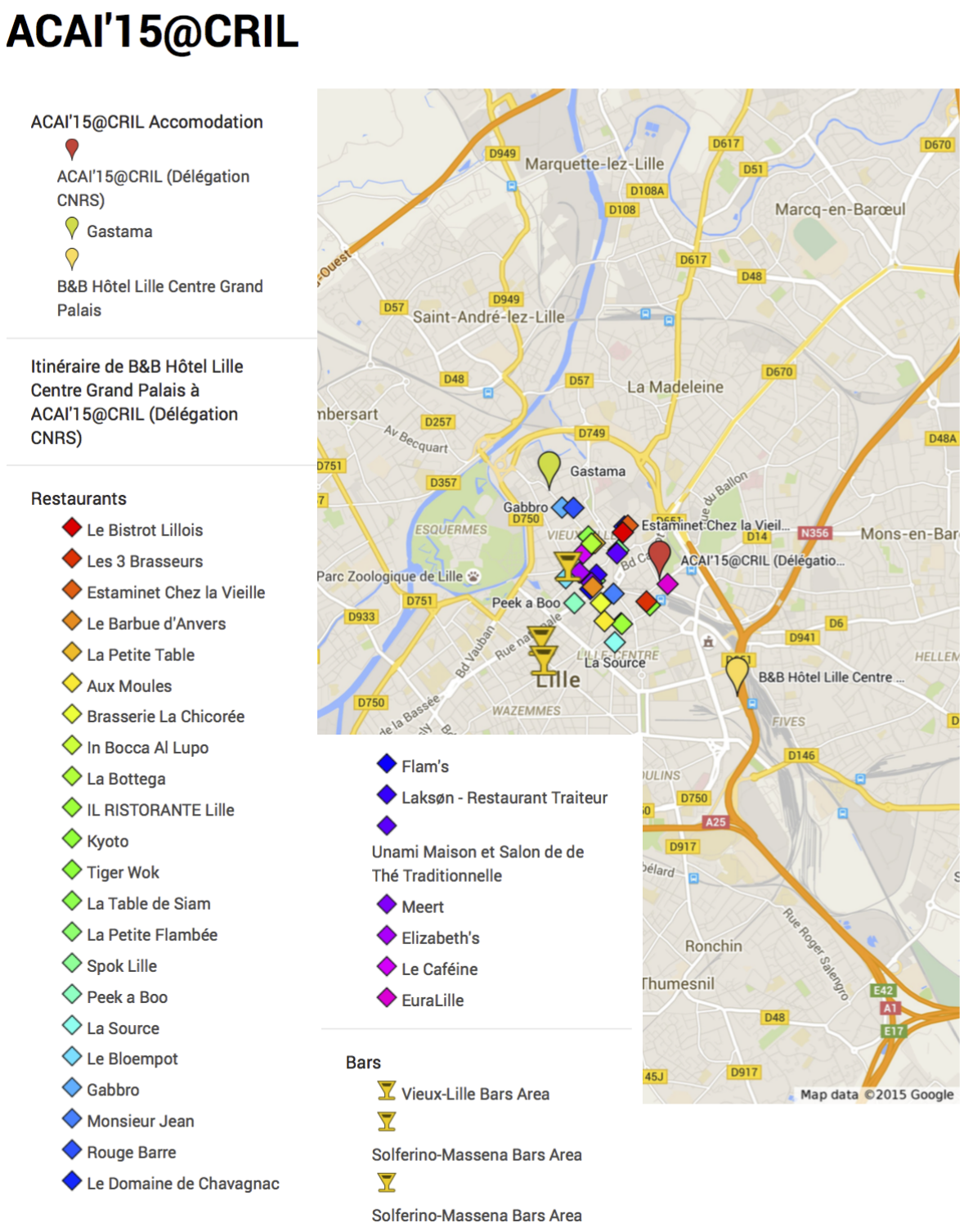

Figure 1: Location of the proposed bars and restaurants

Estaminets / Regional / Bistrot

- Les 3 Brasseurs **(Lunch)**

```
22 place de la Gare
03 20 06 46 25
```

Good choice for lunch: quick and cheap - They brew their own Beers.

- Le Bistrot Lillois **(Lunch)**

```
40 rue de Gand
03 20 14 04 15
```

(our favorite Estaminet, main course around 15 euros)

- Chez la vieille **(Lunch)**

```
60 rue de Gand
03 28 36 40 06
```

Main course around 15 euros

- Le Barbue d'Anvers

```
1 bis rue Saint Etienne
03 20 55 11 68
```

Menu 15 euros (lunch) / 34 euros (dinner)

- La petite table

```
59 rue de la monnaie
```

Main around 14 euros

- Aux moules

```
34 Rue de Bethune
03 20 57 12 46
```

Mussels - The typical meal of « Braderie de Lille »

*La Chicorée **(Lunch)**

```
15 place Rihour
03 20 54 81 52
```

Bistrot - open 24/24 - quick - ideal for lunch (Menu start at 12.50 euros)

Italian

- In Bocca al Luppo

```
1 rue des vieux murs
03 20 06 39 98
```

The best Italian restaurant in town. Main course around 15 euros.

- La Bottega (Pizzeria)

```
7 bis rue au Peterinck
03 20 74 33 12
```

Clearly the best Pizzas in town. Pizzas around 12 euros.

- Il Ristorante **(Lunch)**

```
51 rue des tanneurs
03 20 07 21 12
```

Main from 13 euros

- Asian

Kyoto (Japonese) **(Lunch)**

```
44 place de la Gare
03 20 74 53 60
```

Menus from 10 euros

- Tiger Wok (Wok - Choose & Cook) **(Lunch)**

```
45 rue des Tanneurs
03 20 14 91 60
```

- La Table du Siam (Thai)

```
79 rue de la monnaie
03 20 55 75 57
```

Crêperie (Pancakes)

- La petite flambée

```
4 rue du Cure St Etienne
03 20 55 64 34
```

Menu 13 euros (lunch) / 16 euros (dinner)

Sandwiches / Soups / Burgers

- Spok **(Lunch)**

```
15 rue saint Jacques
09 54 51 73 22
```

Gourmet Burgers, Salad, Daily lunches - Small but good place.

- Peek a Boo **(Lunch)**

```
92 rue de l'Hôpital Militaire
03 20 57 05 15
```

Gourmet Burgers / Bagels, Soups.

Vegetarian/Bio

- La Source **(Lunch)**

```
13 rue du plat
03 55 40 30 45
```

Main (vegetables/cereals) 13.40 euros. Open only for Lunch.

Français / Gastronomic

- Bloempoet

```
22 Rue des Bouchers
```

Menu 25 euros (lunch) / 34 euros (dinner)

- Gabbro

```
55 rue saint Andre
03 20 39 05 51
```

Menu 26 euros (lunch) / 36 euros (dinner)

- Monsieur Jean **(Lunch)**

```
12 rue de Paris
03 28 07 70 72
```

Menu 32 euros (25 euros for Main + (Starter or Dessert))

- Rouge Barre

```
50 rue de la Halle
03 20 67 08 84
```

Menu 28 euros (21 euros for Main + (Starter or Desert))

- Le Domaine de Chavagnac **(Lunch)**

```
43 rue de Gand
03 20 06 53 51
```

From South-West of France: cassoulet, duck, etc. Menu 24 euros - cassoulet 15 euros.

All you can Eat

- Tiger Wok (Wok - Choose & Cook) **(Lunch)**

```
45 rue des Tanneurs
03 20 14 91 60
```

- Le Flam's

```
8 rue du Pas
03 20 54 18 38
```

Flammekueche. From 12.40 euros.

Other

- Lakson (Scandinavian) **(Lunch)**

```
21 rue du curé Saint-Etienne
03 20 31 19 96
```

Nordic Plate 16 euros

- Unami (Tea and Chinese lunches) **(Lunch)**

```
8 rue Saint-Jacques
```

Bars

There are two main areas with a high bar density. The first one is the « Vieux-Lille », at the intersection between Rue Royale and Rue Esquermoise. The second one is Solferino/Massena, that is the whole rue Massena and the part of the Rue Solferino near the intersection with rue Massena. So you have plenty of possibilities. We just give you some suggestions

Beer Bar

- La Capsule

25 Rue des trois Mollettes

- L'illustration

1 Rue Doudin

- L'autrement dit

14 Rue Royale

- Gastama

109 Rue Saint-André

- Au Carre Des Halles

3 Rue des Primeurs

Vodka Bar

- Le Kremlin

51 Rue Jean Jacques Rousseau

Rhum Bar

- La Pirogue

16 Rue Jean Jacques Rousseau

Wine Bar

- La part des anges

50 Rue de la Monnaie

Tea

- Unami

8 rue Saint-Jacques
Best Chinese/Japonese Teas

- Meert

27 rue Esquermoise
English Tea place
(a little bit expensive, but a typical place)

- Elisabeth's

71 rue basse
English Tea and Cakes place

Coffee

- Caféine

20 Rue des trois Mollettes

- Meo

Grand Place

Cultural events in Lille

There are plenty of museums, expositions, concerts and theatres in Lille and surrounding cities. Here is a small selection of things you can do this week.

Pierre Boulez vs Hector Berlioz

- What: concert.
- Where: Orchestre National de Lille, 30 Rue Mendès France, 59000 Lille.
- When: 29 October 2015 at 8 pm.
- Ticket price: from 10 to 50 €.
- Details: Evening concerts characterised by two enfants terribles of French music ! Berlioz with a founding work for the modern orchestra, between passionate love and opium vapours. Boulez, whose 90th birthday is being celebrated, reinvents a spatialised orchestra for a moving tribute to the Italian composer Maderna.
- Link: http://www.onlille.com/event/pierre-boulez-vs-hector-berlioz/

Marc Chagall : Les Sources de la Musique

- What: exposition.
- Where: Musée de la Piscine, 23 Rue de l'Espérance, 59100 Roubaix.
- When: 24 October 2015 - 16 January 2016. Tuesday - Thursday 11 am - 6 pm; Friday 11 am - 8 pm; Saturday - Sunday 1 pm - 6 pm.
- Ticket price: 10 / 7 €.
- Link: http://www.renaissance-lille.com/event/marc-chagall-les-sources-de-la-musique

Joie de vivre

- What: exposition.
- Where: Palais des Beaux-Arts, Place de la République, 59000 Lille.
- When: from 26 September 2015 to 17 January 2016. Monday 2 - 6 pm; Tuesday - Friday 10 am - 6 pm; Saturday - Sunday 10 am - 7 pm.
- Ticket price: 10 / 8 €.
- Link: http://www.renaissance-lille.com/event/joie-de-vivre-exposition

Séoul, VITE, VITE!

- What: exposition.
- Where: Tripostal, Avenue Willy Brandt, Lille, France.
- When: 26 September 2015 - 17 January 2016. Wednesday - Sunday 10 am - 7 pm.
- Ticket price: 8 / 4 €.
- Link: http://www.renaissance-lille.com/event/seoul-vite-vite

Là où commence le jour

- What: exposition.
- Where: LaM, 1 Allée du Musée, 59650 Villeneuve-d'Ascq, France.
- When: 2 October 2015 - 10 January 2016. Tuesday - Sunday 10 am - 6 pm.
- Ticket price: 10 / 7 €.
- Link: http://www.renaissance-lille.com/event/la-ou-commence-le-jour

Atelier de la ferme urbaine : Les insects avec réalisation de gîte à insects

- What: Workshop.
- Where: Gare Saint Sauveur, Boulevard Jean-Baptiste Lebas, Lille.
- When: 31 October 2015 at 3 pm.
- Ticket price: Free.

- Details: Discover the world of insects. Attract them by making a shelter for them that you can bring with you after the workshop.
- Link: http://www.renaissance-lille.com/event/des-herbes-folles-a-la-ferme-urbaine-7

Faire du son - TAPETRONIC

- What: Performance.
- Where: Maison Folie Moulins, 49 Rue d'Arras, 59000 Lille.
- When: 31 October 2015 at 9 pm.
- Ticket price: Free.
- Link: http://www.renaissance-lille.com/event/faire-du-son-performance-mfm-tapetronic

World final tour 2005 hip hop games

- What: Hip hop competition between 5 teams.
- Where: Grand Sud, 50 Rue de l'Europe, 59000 Lille, France.
- When: 31 October 2015 at 5 pm.
- Ticket price: 12 / 8 €.
- Link: http://www.renaissance-lille.com/event/world-final-tour-2005-hip-hop-games-concept-5

Thierry Fournier: Sous-ensemble

- What: Installation art.
- Where: Eglise Sainte-Marie Madeleine, 27 Rue du Pont Neuf, 59800 Lille, France.
- When: 26 September 2015 - 17 January 2016. Wednesday - Sunday 3 pm - 7 pm.
- Ticket price: Free.
- Link: http://www.renaissance-lille.com/event/thierry-fournier

Notes