

Charlotte Truchet

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Research and Work Experience

- 2005 / present** : Assistant Professor in the TASC team LINA, UMR 6241, Nantes University
(*Maître de Conférences*)
- 2004 / 2005** : Postdoctoral position at LINA, Nantes University (*demi-ATER*)
Research engineer on the MusiqueLab2 project at IRCAM for four months
- 2003 / 2004** : Research engineer at LIP6 (Computer Science laboratory), Paris 6 University, France
- 2000 / 2003** : Graduate Assistant at LIP6, Paris 6 University (*Allocataire-moniteur*)
- 1997 / 2000** : Journalist, editor for computer science, at La Recherche, the first french scientific magazine, with a circulation of 80 000

Education

2000 / 2004 : PhD in Computer Science, University of Paris 7, France

Title : Constraints, Local Search and Computer Assisted Composition

Defended : on March 19th 2004, with Honors (*Très honorable avec les félicitations du jury*)

Advisors : Pr. Philippe Codognet, Paris 6 University, and Gérard Assayag, IRCAM

Laboratory : Computer Science Laboratory of Paris 6 University (LIP6), in collaboration with the Musical Representation team at IRCAM (Institute for music/acoustic research and coordination)

Abstract : Constraint Programming (CP) allows to modelize and solve combinatorial problems by specifying some partial information on variables, unknowns of the problem. In this thesis, we have studied musical constraint problems, either stated by contemporary composers, or from musical analysis, in collaboration with IRCAM (french Institute for Research and Coordination Acoustics / Music). Fourteen such problems have been modelized and solved, which allowed to give a detailed typology. This has been used to conceive and implement OMClouds, a library in the Computer Assisted Composition environment OpenMusic. It is based on a local search algorithm called adaptive search. Its architecture allows in particular to define a constraint problem visually, to solve it, and eventually to edit partial or approached results during the resolution process.

1997 / 1998 : Master Degree in Computer Science, Semantics, Proofs, Programmation, Paris 7 University and Ecole Normale Supérieure, and Magistère of the Ecole Normale Supérieure

Mention Bien

Research dissertation : *Non-topological Continuity and Calculability*, under supervision of Giuseppe Longo, Ecole Normale Supérieure

Research domain : Theoretical computer science, Semantics, Logic, Category theory

Abstract : Several definitions have been proposed for continuous and computable functions in computer science. One of them, proposed by M. Hyland, uses a mathematical structure called filtered space, which is weaker than topologies. This definition is compared to a more recent definition from A. Eddalat in domain and category theory.

1997 : Forth year of university study in Mathematics, Paris 7 University (*Maîtrise*)

Dissertation : Evolution of large components in random graphs, under supervision of Philippe Biane, ENS

Domain : Graph theory, Probability theory

1996 : Forth year of university study in Computer Science, Paris 7 University (*Maîtrise*)

Dissertation : Formal methods applied to verification and certification of distributed systems, under supervision of Roberto Amadio, Ecole des Mines

Domain : Logic, Distributed languages

1995 : Admission to the Ecole Normale Supérieure in mathematics (*C/S 95*)

Research activities

Research interests

Constraint Programming and local search Constraint Programming (CP) allows to modelize and solve combinatorial problems (Constraint Satisfaction Problems, CSPs) by specifying some partial information on variables, unknowns of the problem. No construction method has to be given. In constraint programming languages, the constraints are stated, and then passed to a solver which gives a solution, hopefully in a reasonable amount of time. My research is focused on local search algorithms, which have been proven very efficient on many academic and industrial CSPs. These methods perform partly random moves in the search space, and I am interested in studying their probabilistic behaviour. I also study extensions of the local search framework, usually defined on discrete constraints, to continuous constraints over the reals. On another axis, I work in collaboration with Nicolas Beldiceanu from LINA on global constraints, a keypoint for extending constraint languages.

Local search techniques are widely used, yet very little theoretical results have been proven. The common goal of my research on local search is to provide theoretical results on their behaviour, in order to be able and improve their efficiency and extend their application range.

Computer Music My application domain for CP is Computer Assisted Composition, a research domain providing contemporary composers with modern, powerful programming tools for dealing with symbolic musical representation (at the score level). During my PhD, I have worked in collaboration with composers from IRCAM to model and solve a total of fourteen CSPs, collaborating to a total of eight musical creations. This allowed to give a detailed typology of musical constraint problems and develop OMClouds, a constraint solver for music based on a local search algorithm. I currently focus on adding interaction to musical constraints.

Projects

SUSTAIN, 2011 : a computer-assisted tool for urban planning and evaluation of the energy issues

This project gathers researchers in computer science (LINA, LIMSI, Armines), industries (Areva TA, Artelys, Artefacto) and urbanists (EPA Marne). It is labelled by the *Pôle de Compétitivité Advancity* and funded by french public agencies (DGCIS, Ile de France region and Conseil Général de Seine et Marne). In the process of designing new cities, the early stages of urban planning consist in drawing coarse-grained maps, on which the discussions between the different actors (politics, urbanists, public) are based. Usually, the energy issues (transportation, energy production, energy networks...) are not considered at this stage. Sustain aims at modeling the problem of urban planning, in order to take into account the energy issues as soon as possible, define energy scenarios for the future city, and place the energy decisions at the core of the urban planning process.

RUBIS, 2010 : Recherche locale Unifiée et Benchmarks d'Instances (AtlanSTIC research federation) , **Project Leader**

This project formalized a collaboration between members of the Constraint team at LINA, and from the LERIA (Angers University) on local search, focusing on the probabilistic study of SAT solving algorithms. It allowed in particular to hire an intern for two months, and develop a tool (SAT4SAT) to measure some features of SAT instances. It was funded by the AtlanSTIC research federation for 10 000 euros.

BOOLE, Quantifying Boolean Frameworks, 2009-2013 (ANR *programme blanc, édition 2009*). This project aims at formalizing and studying mathematical structures of several boolean satisfaction problems, in order to quantify a number of phenomena : phase transition for extensions of SAT problems, probability laws of random boolean functions.

The project is headed by Versailles University. It includes researchers in computer science, mathematics and physics from the Universities of Versailles Saint-Quentin, Caen, Paris 8, Nantes, Aix-Marseille 1, Aix-Marseille 2, Paris Nord, Paris 11, and the INRIA, CNRS, ENS Ulm. It has been granted a total amount of 497.000 euros.

Constraints, Music and Interaction, AFIM Research Group, 2008-2010, Project Leader. This Research Group has

been funded by the french Association for Music and Computer Science for an amount of 5.500 euros (<http://www.lina.sciences.univ-nantes.fr/ContraintesMusique/>). The groups includes nine computer scientists from the LINA, IRCAM, Bordeaux University and Orléans University, and four composers. It aims at adding interaction into musical constraints frameworks, with an application to interactive score. A state of the art book on musical constraints for Hermés Science is also under preparation and should appear in 2010.

CO2, Constraints and Conception, 2003 / 2004, funded by the french ministry for industry. The project was headed by Dassault Aviation and used continuous constraint techniques to help designing mechanical components.

Softwares

OMClouds : OMClouds is an OpenMusic library for solving musical constraints. It adds the possibility of defining and solving CSPs to the OpenMusic system, in a visual and intuitive way based on OpenMusic visual language. The library is distributed with OpenMusic since April 2003, version 4.5.6 (<http://recherche.ircam.fr/equipes/repmus/OpenMusic/>).

Guitare : Guitare is an OpenMusic tool to compute all possible fingerings for a succession of chords. Prototypes have been developed in OpenMusic and in Choco, an opensource Java library for solving constraints developed by the Constraint team.

Other activities

Scientific Administration

Program Chair of the JFPC 2013, *Journées Francophones de Programmation par Contraintes*, the french Constraint Conference, which will be held in Marseille in June 2013

Assistant chief of the Constraint Team at LINA (2007-2011). Headed by Nicolas Beldiceanu, the Constraint teams has 13 permanent researchers and a total of 18 members.

Elected member of the laboratory council at LINA, 2008-2012. The council is the laboratory organ where all the research decision are discussed. It depends of the Head of the Laboratory for whom it has an advisory role.

Member of the Recruitment Commission for Computer Science at Nantes university in 2008 and in 2009, *section 27* : computer science. This commission is in charge of the recruitments of Assistant Professors in Computer Science at Nantes University's Science Faculty. Secretary of this commission in 2009.

Member of the *vivier externe* (possible members) for the Recruitments Commissions of Caen and Bordeaux 1 Universities, *section 27* : computer science.

Secretary of the AFPC, french-speaking Constraint Programming Association, 2009-2012, and elected member of the *Conseil d'administration*, 2006-2012. The secretary is in charge of the management of the members, and participates to the association's board (*bureau*), in charge of the scientific and administrative management of the association.

Member of the ACP (Association for Constraint Programming).

Program Committees

ECAI 2012, *European Conference on Artificial Intelligence*

JFPC, *Journées Francophones de Programmation par Contraintes*, the french Constraint Conference, since 2004 (except in 2008 when I was conference chair).

MCM (*Mathematics and Computation in Music*, in 2009).

ICMC, International Computer Music Conference, session "Languages for Computer Music, in 2005

Musical Constraints Workshop of the Constraint Programming Conference CP01

Secondary reviewer for Constraint (Springer journal) in 2009, ISMIR (International Conference on Music Information Retrieval) in 2008, ICMC in 2009, CP (International Conference on Principles and Practice of Constraint Programming), and CP-AI-OR (International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems) since 2003

Talks

NII Shonan Meeting on "Parallel Methods for Constraint Solving and Combinatorial Optimization", Shonan, Kamakura pref., Japan : in June 2012, I attended and gave a talk at the Shonan Seminar (a Dagstuhl-style meeting) on recent works on local search and parallelism.

Invited talk, JFPLC : In June, 2004, I have been invited as a plenary speaker for the opening of the *Journées Francophones de Programmation en Logique et de programmation par Contraintes*, the french constraint conference, to present my PhD work on musical constraints.

Seminars for Mathematical Music Theory : I have been invited at the second and third Seminars for Mathematical Music Theory in 2001 and 2002, to present my works on musical constraints for contemporary composition and musical analysis.

Aléa Workshop : In 2008 I have attended the Aléa workshop (*Journées du Groupe de Travail Aléa 2008*) to present my current work on local search and probability theory. Aléa is a research group in mathematics and computer science, dedicated to the analysis of algorithms, and funded by CNRS and INRIA. The Aléa workshop gathers every year around 80 researchers from the computer sciences and mathematics community.

Other seminars I have also been invited for seminars at Caen University, France, in 2008, Essex University, Great Britain, in 2007 by Professor Edward Tsang, the Universidad Tecnica Federico Santamaria of Valparaiso, Chile, in 2007 (visiting Eric Monfroy), the Chinese University of Hong Kong, China, in 2004 (visiting Jimmy H.M. Lee), and Orleans University, France, in 2003.

Organization

Seminar of the LINA, 2010 I have organized, with the help of three other LINA members, the first internal seminar of the laboratory. It took place on the Berder Island, on October 19th and 20th, and gathered 55 LINA members. The webpage can be found at <http://www.lina.univ-nantes.fr/conf/SiteSemAuVert/>.

JFPC08 Chair of the organizing committee for the JFPC08, which has been held in Nantes in June 2008. The conference gathered a hundred researchers in constraint programming, mostly from Europe and North America, and had a budget of 25.600 euros. The website can be found at <http://www.lina.sciences.univ-nantes.fr/JFPC08/jfpc08/index.php>.

Musical Constraints workshop, CP01 Organizer of a workshop on musical constraints at the Constraint Programming international conference in 2001. The web site is available at <http://recherche.ircam.fr/equipes/repmus/cpws/>.

Inform 03, Ifors 05 Session chair at Inform 03 and Ifors 04, for tracks on local search and musical applications.

Communication toward the general public I have participated to the organization of a musical and scientific event for the *Nuit des chercheurs*, funded by the European Union, in 2007. We organized a concert where two professional jazz musicians played with the OMax automatic improvisation system, and then two of the OMax research team then proposed a conference to explain the public how the system, based on the factor oracle, works.

Others I have organized several other scientific events, among others, the "Constraint, Music and interaction" workshop in January 2008 and a seminar of the french Constraint Programming Association in 2002. I have organized several LINA seminars, inviting Jimmy H.M. Lee, Professor at the Chinese University of Hong Kong, Patrick Cousot, Professeur at the ENS, and Gérard Assayag, Chef d'équipe at IRCAM.

Other skills

Music Graduate in Musical Studies from the National Conservatory of Music of Rennes, with Honors (*mention très Bien*).

Violin : good amateur level. Student of Nicolas Risler (Quatuor Arpeggionne) for two years. Member of the OCEAN orchestra, amateur and student orchestra of Nantes Conservatory of Music, 2004-2007.

ENSEIGNEMENT

Administration

Relations internationales, Département d'informatique Depuis septembre 2010, je suis responsable des Relations Internationales au Département d'Informatique, en binôme avec Yann Busnel. Il s'agit notamment d'assurer la gestion des échanges Erasmus.

Elected member of the *Conseil de Gestion* at the Faculty of Sciences and Techniques, 2009-2013. The council manages all the administrative questions of the Faculty, with a particular focus on teaching and administrative issues (although this often overlaps with research issues).

Activités d'enseignement

ATER et MCF, Université de Nantes

En 2004/2005, j'ai occupé un poste de demi-ATER au département informatique de l'Université de Nantes, avec un service de 96 heures eqTD. Depuis, je suis Maître de Conférences dans ce même département. J'y ai notamment pris la charge de plusieurs enseignements : Programmation impérative en M2Pro CCI (Connaissances Complémentaires en Informatique), Programmation par Contraintes en Maîtrise (avec Laurent Granvilliers), Statistiques en M2Pro Bioinfo, Conception par ordinateur : Sons et images en M2Pro ALMA (avec Christophe Jermann, chargé de la partie Images - je suis chargée de la partie Sons), Ingénierie du web en Licence 1. Je suis également chargée des CM de C2i en Faculté de Lettres-LLCE qui ouvrent cette année. Certains de ces enseignements sont proches de mes domaines de compétences (Contraintes, Conception). Les autres ne le sont pas (Web, Bioinfo, Programmation impérative) et je m'y suis investie pour les besoins du service. J'ai également encadré plusieurs stages en M1 et M2, notamment en TER.

Monitorat, Université de Paris 6 Durant les trois premières années de ma thèse, j'ai été monitrice au département informatique de l'Université de Paris 6, avec un service de 64h équivalent TD par an. J'y ai réalisé des enseignements en programmation fonctionnelle en première année de DEUG MIAS¹ (TP de programmation en Scheme). Dans ce module j'ai également effectué les TPs de soutien pour les étudiants en difficulté, qui n'étaient pas obligatoires et offraient aux étudiants motivés la possibilité de reprendre certaines bases à leur rythme. Pour raisons de service, j'ai assuré des enseignements spécifiques liées à ma recherche (TD/TP de programmation par contraintes en Maîtrise).

Enseignements antérieurs

J'ai enfin une expérience des colles en Classes Préparatoires aux Grandes Ecoles aux Lycées Fénélon puis Louis-le-Grand à Paris, en mathématiques. Il s'agissait d'entraîner les étudiants aux épreuves orales, en particulier de proposer des exercices et d'évaluer les étudiants.

1. Mathématiques et Informatique Appliquées aux Sciences

Publications

BOOK EDITION

Constraint Programming in Music (2011).
Charlotte Truchet and Gérard Assayag (ed.),
ISTE/Wiley, ISBN 978-1-84821-288-6
<http://iste.co.uk/index.php?f=x&ACTION=View&id=413>
Also author and co-author of two chapters.

REFEREED JOURNAL PUBLICATIONS

C. Truchet, P. Codognet

Solving Musical Constraints with Adaptive Search, *Soft Computing*, volume 8, numéro 9, pages 633-640, septembre 2004, Springer Verlag.

M. Chemillier, **C. Truchet**

Computation of words satisfying the "rhythmic oddity property", *Information Processing Letters*, volume 86, numéro 5, pages 255 - 261, 15 juin 2003, Elsevier Science.

REFEREED INTERNATIONAL CONFERENCES

1 - WITH PROCEEDINGS

Truchet C., Richoux F., Codognet P.

Prediction of Parallel Speed-ups for Las Vegas Algorithms, *Proceedings of the 2013 42nd International Conference on Parallel Processing - 42nd International Conference on Parallel Processing*, Lyon, France, October 2013.

Arbelaez A., Codognet P., **Truchet C.**

Using Runtime Distributions for the Analysis and Parallelization of Local Search for SAT, *Proc. 29th International Conference on Logic Programming - ICLP'13*, Istanbul, Turkey, August 2013.

Pelleau M., Miné A., Truchet C., Benhamou F.

A Constraint Solver based on Abstract Domains, *Proceedings of VMCAI 2013 - 14th International Conference on Verification, Model Checking, and Abstract Interpretation*, Rome, Italie, January 2013.

Du Boisberranger J., Gardy D., Lorca X., **Truchet C.** When is it worthwhile to propagate a constraint? A probabilistic analysis of AllDifferent, *Proceedings of the 10th Meeting on Analytic Algorithmics and Combinatorics, ANALCO 2013*, New Orleans, USA, January 2013.

Marie Pelleau, **Charlotte Truchet** and Frédéric Benhamou

Octagonal Domains for Continuous Constraints, *Proceedings of the 17th International Conference on Principles and Practice of Constraint Programming (CP'11)*, Perrugia, Italy.

Best student paper award

Charlotte Truchet, Marie Pelleau and Frédéric Benhamou,

Abstract Domains for Constraint Programming, with the Example of Octagons, *Proceedings of the 12th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, pp. 72-79, Timisoara, Romania

Magnus Ågren, Nicolas Beldiceanu, Mats Carlsson, Mohamed Sbihi, **Charlotte Truchet**, and Stéphane Zampelli
Six Ways of Integrating Symmetries within Non-Overlapping Constraints *Proceedings of CP-AI-OR, 2009*, Pittsburgh, USA

Marie Pelleau, Pascal Van Hentenryck, **Charlotte Truchet**

Sonet Network Design Problems *Proceedings 6th International Workshop on Local Search Techniques in Constraint Satisfaction, held in conjunction with CP 2009, Lisbon, Portugal*

Charlotte Truchet, Marc Christie, Jean-Marie Normand

A Tabu Search method for interval constraints, *CP-AI-OR, Paris, 2008 (short paper)*

Nicolas Beldiceanu, Mats Carlsson, Jean-Xavier Rampon, **Charlotte Truchet**
Graph Invariants as Necessary Conditions for Global Constraints, *Proceedings of CP'05, Barcelona, 2005*

M. Chemillier, **C. Truchet**
Two Musical CSPs, in *Proceedings of the CP01 Musical Constraints Workshop, International Conference on Principles and Practice of Constraint Programming, Paphos, Chypre, Décembre 2001.*

C. Truchet, C. Agon, P. Codognet
A Constraint Programming System for Music Composition, Preliminary Results, in *Proceedings of the CP01 Musical Constraints Workshop, International Conference on Principles and Practice of Constraint Programming, Paphos, Chypre, Décembre 2001.*

C. Truchet, G. Assayag, P. Codognet
Visual and Adaptive Constraint Programming in Music, in *Proceedings of ICMC01, International Computer Music Conference, La Havane, Cuba, Septembre 2001.*

2 - ON ABSTRACTS

Alejandro Arbelaez, **Charlotte Truchet**, Philippe Codognet
Estimating the Runtime of Parallel SAT Local Search, *Metaheuristics International Conference (MIC 2013)*, Singapore, August 2013

Bruno Belin, Marc Christie and **Charlotte Truchet**,
Interactive Urban Planning with Local Search Techniques : the SUSTAINS Project, *CompSust'12 : 3rd International Conference on Computational Sustainability*, Copenhagen, Denmark, July 2012.

C. Truchet, G. Assayag, P. Codognet
OMClouds, a heuristic solver for musical constraints , *MIC03, Metaheuristics International Conference, Kyoto, Japon, August 2003.*

P. Codognet, D. Diaz, **C. Truchet**
The Adaptive Search Method for Constraint Solving and its Application to musical CSPs, in *IWH02, International Workshop on Heuristics, Beijing, China, Juillet 2002 .*

Charlotte Truchet, Jérémie Bourdon, Philippe Codognet
Tearing Customers Apart for solving PSP-SOS, *IJCAI'05 Constraint Modelling Challenge entry, Edinburgh, Great Britain, 2005*

BOOK CHAPTERS

C. Truchet
Some Constraint Satisfaction Problems in Computer Assisted Composition and Analysis, chapter of *Perspectives of Mathematical and Computer-Aided Music Theory*, Editors : Emilio Lluís-Puebla, Guerino Mazzola and Thomas Noll
Publié par epOs Music, Osnabrueck 2003.

M. Chemillier, **C. Truchet**
Computation of words satisfying the "rhythmic oddity property", chapter of *Perspectives of Mathematical and Computer-Aided Music Theory*, Editors : Emilio Lluís-Puebla, Guerino Mazzola and Thomas Noll
Publié par epOs Music, Osnabrueck 2003.

NATIONAL CONFERENCES

Marie Pelleau, Antoine Miné, **Charlotte Truchet** et Frédéric Benhamou

Un solveur de contraintes basé sur les domaines abstraits, Proceedings of the *9èmes Journées Francophones de Programmation par Contraintes (JFPC'13)*, Aix-en-Provence, France, Juin 2013.

Bruno Belin, Marc Christie et **Charlotte Truchet** La recherche locale pour la pré-programmation d'environnements urbains durables, Proceedings of the *9èmes Journées Francophones de Programmation par Contraintes (JFPC'13)*, Aix-en-Provence, France, Juin 2013.

Marie Pelleau, **Charlotte Truchet** and Frédéric Benhamou, Au-delà des produits cartésiens de domaines : l'exemple des octogones, Proceedings of the *7èmes Journées Francophones de Programmation par Contraintes (JFPC'11)*, Caen, France.

Charlotte Truchet, Damien Nogués, Narendra Jussien,
Un modèle markovien pour GSAT et WalkSAT, résultats préliminaires, *Proceedings of JFPC'08, Nantes, France, 2008*

Marc Christie, Jean-Marie Normand, **Charlotte Truchet**,
Calcul d'approximation intérieure pour la résolution de CSPs numériques, *Proceedings of JFPC'06, Nîmes, France, 2006*

C. Truchet, Gérard Assayag, P. Codognet
OMClouds, petits nuages de contraintes dans OpenMusic *JIM03, Journées d'Informatique Musicale, Juin 2003*.
M. Chemillier, **C. Truchet**, L-M. Rousseau
Analyse musicale et contraintes *JIM02, Juin 2002*.

C. Truchet, C. Agon, G. Assayag, P. Codognet
CAO et Contraintes *JIM01, Mai 2001*.

C. Truchet, C. Agon, P. Codognet
Recherche Adaptative et contraintes musicales *JFPLC01, Journées Françaises de Programmation Logique par Contraintes, Avril 2001*.

P. Codognet, D. Diaz, **C. Truchet**
Résolution de Contraintes par Recherche Adaptative et Application à des CSPs musicaux *ROADEF03, Congrès de la Société Française de Recherche Opérationnelle et d'Aide à la Décision, Février 2003*.