

Special Issue in honor of Alain Colmerauer's sixtieth birthday - Guest Editors' Introduction

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Alain Colmerauer, father of Prolog and pioneer of constraint programming, will be sixty this year. It is a great honor and a great pleasure for us to edit a *festschrift* celebrating this event on behalf of his contemporary fellow scientists.

We have known Alain for many years. Both of us are from a generation of researchers who were largely inspired by Alain's research on logic and constraint programming. We began our work in the same years, one as a PhD student in Alain's Prolog III project and one as a PhD student in the ECRC CHIP project. We have had many opportunities to meet Alain, to witness the emergence of his ideas in constraint (logic) programming, and to appreciate how much they contributed in creating and fostering a fascinating and challenging research area which is, in our opinion, a fundamental tool for computer science research.

The mid-eighties witnessed the start of three projects on the design and implementation of constraint logic Programming languages: Prolog III in the Groupe d'Intelligence Artificielle (Marseilles), CHIP in European Computer-industry Research Centre (Munich), and CLP(R) in IBM Watson Research Center (Yorktown Heights, NY). These three teams were led by Alain Colmerauer, Mehmet Dincbas, and Jean-Louis Lassez respectively. An entire chapter would be, and hopefully will be, necessary to describe the creative energy, the scientific contributions, the new and bold ideas, the human interactions, and the system developments which took place in these pioneering years. It is now largely accepted that most of these developments were initiated by Alain's seminal work on the semantics of Prolog II, which captures the actual behaviour of the interpreter using equations and disequations over infinite trees. This move from unification to constraints paved the way to incorporating constraint solving over various domains as the main operation of (constraint) logic programming.

It is probably impossible to describe Alain's unique approach to computer science

research; but we will use this opportunity to risk a couple of comments that may shed some light on why so many of us were inspired by his work and were seeking his advice. Probably most impressive is Alain's ability to strike the right balance between semantic simplicity and practical applicability in language design. Many of his seminal results were driven by a constant will of superposing mathematically elegant semantics on practical and innovative systems for fundamental application areas. To see this balance at work, it suffices to mention Prolog, the design and specification of Prolog-II with its rational trees and its constraint-based semantics, the design of Prolog III, and the introduction of a non-standard semantics for real numbers capturing delay-based multiplications. Alain also broke into new territories many times, crossing frontiers, exploring unusual theoretical realms, and exhibiting an amazing creativity over four decades. But, beyond his scientific papers and his systems, his ability of building elegant theories and practical innovative systems together remains his landmark and an inspiration for those of us who were fortunate enough to interact closely with him.

It was not easy to find the right format for this special issue. After some long discussions, we decided to go for a book and to edit part of it as a special issue in *Theory and Practice of Logic Programming*. This newly (re-)born forum for logic and constraint programming researchers is definitely a very appropriate medium for this event. Without unveiling the book project, we selected from its prospective content an introductory paper specially contributed for the event as well as several research articles. To meet the overall flavor of this special issue, we wanted these articles to be particularly prospective and to cover, as much as possible, the many research areas Alain has been interested in. We believe that the contributed papers of this issue fit nicely with our initial view.

We invited Jacques Cohen to contribute the first paper. Jacques is one of Alain's closest colleagues and friends. We thought he was the perfect person to give his own view on Alain's research path and achievements, starting from the very beginning, when they were both PhD students in Grenoble. We particularly thank him for this contribution. The idea of listing the numerous PhD theses supervised by Alain is also his.

The remaining papers cover various topics, reflecting some of Alain's research areas, including logic programming, nonmonotonic logic, constraint programming, and constraint solving.

The paper by Roberto Bruni, Ugo Montanari, and Francesco Rossi concerns the semantics of logic programming. It introduces a new interactive semantics integrating novel ideas from the reduction-based communication systems. The new semantics makes explicit hidden interactions and coordination mechanisms of the language.

The paper by Michael Maher considers defeasible logic, a class of ruled based nonmonotonic logic. It shows that inference in this logic can be performed in linear time, which contrasts with the intractability of most logics in this area.

The paper by Krzysztof Apt and Eric Monfroy studies constraint programming over finite domains and shows that it can be entirely reduced to rule-based pro-

gramming using equality and membership rules. It also demonstrates how these rules can be automatically derived.

The paper by Francois Fages and Emmanuel Coquery presents a prescriptive type system with parametric polymorphism and subtyping for constraint logic programs. It supports modules, coercion between constraint domains, and meta programming. The paper also discusses type checking and type inference.

The paper by Yves Caseau, Glenn Silverstein, and François Laburthe considers how hybrid algorithms, described through an algebraic language, can be optimized by a generic learning technique. The potential of learning for hybrid optimization is demonstrated on vehicle routing problems.

We took the opportunity of this special issue to provide a bibliography of Alain's principal articles and various research contributions, as well as a list of the PhD he has supervised.

It is now time to conclude the introduction to this special issue. We hope that it will help the computer science community appreciate the depth, the breadth, and the implications of Alain's research. Alain is clearly one of the most creative and influential computer scientists of his generation. But we also believe that the research areas he pioneered in the last four decades will continue to bring new, exciting, and deep research results and insights and that they will help young computer scientists to build, as he did, new and popular programming languages and paradigms.

Acknowledgments

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