Types for Proofs and Programs

International Workshop, TYPES 2006
Nottingham, UK, April 18-21, 2006
Revised Selected Papers
Preface

These proceedings contain a selection of refereed papers presented at or related to the Annual Workshop of the TYPES project (EU coordination action 510996), which was held April 18–21, 2006 at the University of Nottingham, UK.

The topic of this workshop was formal reasoning and computer programming based on type theory: languages and computerized tools for reasoning, and applications in several domains such as analysis of programming languages, certified software, formalization of mathematics and mathematics education.

The workshop was attended by more than 100 researchers and included more than 60 presentations. We also had the pleasure of three invited lectures, from Bart Jacobs (University of Nijmegen), Hongwei Xi (Boston University) and Simon Peyton Jones (Microsoft Research). Simon Peyton Jones spoke in a joint session with the workshop on Trends in Functional Programming (TFP), which was co-located with the TYPES conference.

From 29 submitted papers, 17 were selected after a reviewing process. The final decisions were made by the editors.

This workshop followed a series of meetings of the TYPES working group funded by the European Union (IST project 29001, ESPRIT Working Group 21900, ESPRIT BRA 6435). The proceedings of these workshop were published in the LNCS series:

- **TYPES 1993** Nijmegen, The Netherlands, LNCS 806
- **TYPES 1994** Båstad, Sweden, LNCS 996
- **TYPES 1995** Turin, Italy, LNCS 1158
- **TYPES 1996** Aussois, France, LNCS 1512
- **TYPES 1998** Kloster Irsee, Germany, LNCS 1657
- **TYPES 1999** Lökeborg, Sweden, LNCS 1956
- **TYPES 2000** Durham, UK, LNCS 2277
- **TYPES 2002** Berg en Dal, The Netherlands, LNCS 2646
- **TYPES 2003** Turin, Italy, LNCS 3085
- **TYPES 2004** Jouy-en-Josas, France, LNCS 3839

ESPRIT BRA 6453 was a continuation of ESPRIT Action 3245, Logical Frameworks: Design, Implementation and Experiments. Proceedings for annual meetings under that action were published by Cambridge University Press in the books *Logical Frameworks* and *Logical Environments*, edited by Gérard Huet and Gordon Plotkin.

We are grateful for the support of the School of Computer Science and Information Technology at the University of Nottingham in organizing the meeting. We should like to thank James Chapman, Wouter Swierstra and Peter Morris,
who helped with the administration and coordination of the meeting. We are also grateful to Peter Morris for help in the preparation of the volume.

March 2007 Thorsten Altenkirch
Conor McBride

Referees

A. Abel
P. Aczel
R. Adams
R. Atkey
S. van Bakel
C. Ballarin
S. Berardi
Y. Bertot
A. Bove
E. Brady
P. Callaghan
J. Carlstrom
J. Cheney
J. Chrzanscz
M. Coppo
J. Courant
C. Coquand
R. Crole
R. Davies
J. Despeyroux
L. Dixon
G. Dowek
R. Dychhoff
M. Escardo
J-C. Filliâtre
M. Fluet
P. Fontaine
N. Gambino
H. Geuvers

N. Ghani
A. Gordon
B. Grégoire
P. Hancock
J. Harrison
M. Huisman
B. Jacobs
S. Jost
T. Kelsey
J. Lipton
Z. Luo
M.E. Maietti
J. McKinna
M. Miculan
A. Miquel
P. Morris
S. Negri
M. Oostdijk
R. Paterson
D. Pattinson
R. Pollack
T. Ridge
G. Sambin
T. Streicher
C. Urban
D. Walukiewicz-Chrzaszcz
S. Weirich
A. Weiermann
B. Werner
F. Wiedijk
# Table of Contents

Weyl’s Predicative Classical Mathematics as a Logic-Enriched Type Theory ......................................................... 1  
*Robin Adams and Zhaohui Luo*

Crafting a Proof Assistant .............................................. 18  
*Andrea Asperti, Claudio Sacerdoti Coen, Enrico Tassi, and Stefano Zacchioli*

On Constructive Cut Admissibility in Deduction Modulo ............ 33  
*Richard Bonichon and Olivier Hermant*

Fast Reflexive Arithmetic Tactics the Linear Case and Beyond .... 48  
*Frédéric Besson*

Combining de Bruijn Indices and Higher-Order Abstract Syntax in Coq .......................................................... 63  
*Venanzio Capretta and Amy P. Felty*

Deciding Equality in the Constructor Theory ............................ 78  
*Pierre Corbineau*

A Formalisation of a Dependentely Typed Language as an Inductive-Recursive Family ........................................ 93  
*Nils Anders Danielsson*

Truth Values Algebras and Proof Normalization ........................ 110  
*Gilles Dowek*

Curry-Style Types for Nominal Terms .................................... 125  
*Maribel Fernández and Murdoch J. Gabbay*

(In)consistency of Extensions of Higher Order Logic and Type Theory .......................................................... 140  
*Herman Geuvers*

Constructive Type Classes in Isabelle .................................... 160  
*Florian Haftmann and Makarius Wenzel*

Zermelo’s Well-Ordering Theorem in Type Theory ..................... 175  
*Danko Ilik*

A Finite First-Order Theory of Classes .................................. 188  
*Florent Kirchner*
Table of Contents

Coinductive Correctness of Homographic and Quadratic Algorithms for Exact Real Numbers ................................................. 203
  Milad Niqui

Using Intersection Types for Cost-Analysis of Higher-Order Polymorphic Functional Programs ........................................... 221
  Hugo R. Simões, Kevin Hammond, Mário Florido, and Pedro Vasconcelos

Subset Coercions in CoQ .......................................................... 237
  Matthieu Sozeau

A Certified Distributed Security Logic for Authorizing Code ........ 253
  Nathan Whitehead

Author Index ............................................................................. 269