

**EUTypes WG 1:
Theoretical foundations
(May 2018 – June 2019)**

Reporting: Andrej Bauer

WG1 in one sentence

Type theory as a foundational language for expressing concepts from computer science and mathematics with the specific aim to improve programming and to enhance the certification of computer systems.

Some publications

- B. Ahrens, D. Frumin, M. Maggesi, N. van der Weide: *Bicategories in Univalent Foundations* (FSCD 2019, supported by STSM)
- H. Basold: *Coinduction in Flow: The Later Modality in Fibrations* (CALCO 2019) – also relevant to WG2
- J. Sterling, B. Spitters, *Normalization by gluing for free λ -theories.*
- R. Clouston, B. Manna, R.E. Møgelberg, A. M. Pitts, B. Spitters, *Modal Dependent Type Theory and Dependent Right Adjoints* (MSCS)
- D. R. Licata, I. Orton, A. M. Pitts, B. Spitters: *Internal Universes in Models of Homotopy Type Theory* (FSCD 2018)
- A. Lynge, B. Spitters: *Universal Algebra in HoTT* (TYPES 2019)
- D. Gratzer, J. Sterling, and L. Birkedal. *Implementing a modal dependent type theory* (ICFP 2019)
- A. Bizjak, D. Gratzer, R. Krebbers, and L. Birkedal. *Iron: managing obligations in higher-order concurrent separation logic* (POPL 2019)

Some publications

- L. Birkedal, A. Bizjak, R. Clouston, H.B. Grathwohl, B. Spitters, A. Vezzosi: Guarded cubical type theory. Journal of Automated Reasoning, special issue of HoTT/UF, 2018.
- A. Bizjak and L. Birkedal. A model of guarded recursion via generalised equilogical spaces. (TCS 772:1–18, 2018)
- A. Aguirre, G. Barthe, L. Birkedal, A. Bizjak, M. Gaboardi, D. Garg: Relational reasoning for Markov chains in a probabilistic guarded lambda calculus. (ESOP 2018)
- U. Berger, A. Setzer: Undecidability of Equality for Codata Types (CMCS 2018)
- A. Kaposi, A. Kovács. A Syntax for Higher Inductive-Inductive Types (FSCD 2018)
- A. Kaposi, A. Kovács, T. Altenkirch. Constructing Quotient Inductive-Inductive Types (POPL 2019)
- A. Kaposi, S. Huber, C. Sattler. Gluing for type theory (FSCD 2019)

Ongoing work

- M. Escardó: Compact ordinals, injective types in Univalent mathematics
- B. van den Berg, E. Faber: models of homotopy type theory in simplicial sets based on a new notion of uniform Kan fibration
- A. Bauer, P. Haselwarter, P. Lumsdaine: an account of general type theories with meta-theorems (uniqueness of typing, substitution elimination, presupposition theorem)
- (Please tells us what you have worked on.)

Schools & lectures

- *School and Workshop on Univalent Mathematics* Birmingham, April 2019: 12 mentors, 60 participants
- **Upcoming:** EUTypes summer school, Ohrid, August–September 2019
- Teaching materials:
 - M. Escardó: Introduction to Univalent Foundations of Mathematics with Agda
 - A. Bauer, J. Smrekar: Homotopy (type) theory (with video lectures)
- (Please tell us about your school or material)