

# Internship proposal at the University of Copenhagen

Thomas Seiller

Title	Effects in Interaction Graphs
Topics	Semantics of Programs
Location	Copenhagen, Denmark
Lab	Department of Computer Science University of Copenhagen
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**Context.** Denotational semantics were introduced by Scott [5] as a mathematical model of programs, based on the principle that a program should be representable by a function from its input data type to its output data type. In this *theory of domains*, program constructs become algebraic operations. Categorical semantics [2] abstract these using Category Theory and axiomatise the algebraic structures needed to interpret a given typing discipline. However, one difficulty in providing mathematical models of computation is to deal with computational effects, e.g. exceptions, input/output. The initial work on a unified semantic account of computational effects is due to Eugenio Moggi [3, 1]. Later, Plotkin and Power [4] proposed a theory of *algebraic effects* in which they represent effects by (1) a set of operations that represent the sources of effects, and (2) an equational theory for these operations that describes their properties.

**Aim of the internship.** Recently, a graph-based model of (a fragment of) linear logic was introduced under the name "Interaction Graphs", and it was shown that it allowed to model quantitative information [6]. The aim of the internship is to study how the interaction graphs construction can be used to model computational effects, and compare it with the theory of algebraic effects.

**Workplace.** This internship will be supervised by Thomas Seiller, Marie Curie fellow at the University of Copenhagen (KU). The intern will be working at the Department of Computer Science of the University of Copenhagen (DIKU), as part of an international team working on different aspects of computability theory, rewriting, and complexity theory, lead by Prof. Jakob Grue Simonsen.

## References

- [1] Nick Benton, John Hughes, and Eugenio Moggi. *Monads and Effects*, pages 42–122. Springer Berlin Heidelberg, Berlin, Heidelberg, 2002.
- [2] William F. Lawvere. *Functorial Semantics of Algebraic Theories*. PhD thesis, Columbia University, 1963. Published in Volume 4 of Reprints in Theory and Applications of Categories, pp. 1–121.
- [3] Eugenio Moggi. Notions of computation and monads. *Information and Computation*, 93(1):55 – 92, 1991.
- [4] Gordon Plotkin and John Power. Computational effects and operations: An overview. *Electronic Notes in Theoretical Computer Science*, 73:149 – 163, 2004.
- [5] Dana Scott. Outline of a mathematical theory of computation. Technical Report PRG02, OUCL, November 1970.
- [6] Thomas Seiller. From dynamic to static semantics, quantitatively. Submitted, 2015.