Preface

This thesis develops an open design for a reflective object-oriented programming language. The focus of the thesis is on how programming language concepts, rather than mere implementations thereof, can be made explicit for refinement, extension and recombination in their fullest abstract form. Therefore a mixture of techniques is studied. For the particular case of developing an open design for an object-oriented language, we look at object-oriented frameworks and how they can be used to make explicit the major design issues of a programming language. Emphasis is put on those specialisations of a framework that respect the design of the framework. In particular, concretisation into a computational system and, additionally, refinement and extension of a framework are discussed. The notions of full abstraction and compositionality are adopted from programming language semantics to judge whether programming language concepts are represented in their fully abstract form in the framework. The notion of reflection is studied in order to make the open design self-contained.

As a case study, a two layered framework is developed in which two object-oriented languages are expressed. The first language (Simple) is an object-based programming language. Its semantics is given by a calculus for objects. The second language (Agora) is an object-oriented programming language that features a generalised form of mixin-based inheritance. Simple is defined in the context of a framework that essentially features encapsulated polymorphic objects that accept a well defined set of messages. For the definition of Agora it is shown that a layer can be added to the framework to include the generalised form of mixin-based inheritance. Descriptions of extensions to Agora are given. Among others, extensions are described that allow flexible, controllable and dynamic construction of multiple inheritance hierarchies.

In a final stage the framework is extended with reflection. The link between open systems and reflection is studied. Open designs and linguistic symbiosis replace the conventional meta-circular interpreters in the account of reflective systems presented in the dissertation. It is concluded that systems with an open design form an excellent basis for the definition of reflective systems. Moreover it is concluded that they are an important step in the demystification of reflection.