Just Say No!
The Transformational Approach to Negation in a Logical Framework

Alberto Momigliano

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Department of Philosophy
Carnegie Mellon University
Pittsburgh, PA 15213

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Thesis Committee:
Frank Pfenning, Chair
Dana Scott
Dale Miller, Pennsylvania State University

Abstract

We address the issue of endowing a logical framework with a logically justified notion of negation. Logical frameworks with a logic programming interpretation such as hereditary Harrop formulae cannot directly express negative information, although negation is a useful specification tool. Since negation-as-failure does not fit well in a logical framework, especially one endowed with hypothetical and parametric judgments, we adapt the idea of *elimination* of negation from Horn logic to a fragment of higher-order hereditary Harrop formulae. The idea is to replace occurrences of negative predicates with positive ones which are operationally equivalent. This entails two separate phases.

Complementing terms, i.e in our case higher-order patterns. Due the presence of *partially applied* lambda terms, intuitionistic lambda calculi are not closed under complementation. We thus develop a strict lambda calculus, where we can directly express whether a function depends on its argument.

Complementing clauses. This can be seen as a negation normal form procedure which is consistent with intuitionistic provability. It entails finding a middle ground between the Closed World Assumption usually associated with negation and the Open World Assumption typical of logical frameworks. As this is in general not possible, we restrict ourselves to a fragment in which clause complementation is viable and that has proven to be expressive enough for the practice of logical frameworks. The main technical idea is to isolate a set of programs where static and dynamic clauses do not overlap.

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Contents

List of Figures