Semantics of Propositional Attitudes in Type-Theory of Algorithms

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Natural language (NL) is notorious for various kinds of ambiguities. Among the most difficult ones, for computational handling of NL, are expressions with multiple occurrences of quantifiers, which contribute to quantifier scope ambiguities. Far more difficult for computational linguistics are NL expressions having occurrences of so-called attitude components designating knowledge, believes, statements, and similar semantic information.

Often, the syntactic complement of an attitude lexeme is a sentential expression. The sentential complement may have subexpressions that designate semantic information belonging to varying scopes. Depending on context, some components can be semantic parts of the attitudinal information, which is in the scope of the propositional attitude, or external to it.

The first formal representation of NL attitudes was by Montague, 1973, along with the quantifier scope ambiguities, by the notions of extension and intension, and using extra-syntactic disambiguation of NL expressions. That approach, while unsatisfactory in important aspects, was adopted and adapted by some variants of Montague grammars, for specific purposes. The problem has been largely open, due to its purely semantic nature and computational difficulties, without direct syntactic appearance.

The semantic phenomena of attitudes include statements in natural language, including in the domains of mathematical texts and proofs.

In this presentation of a recent paper, I extend the type-theory of algorithms, to cover algorithmic semantics of some of the major attitude expressions and their semantic underspecification. I provide reduction calculus for deriving semantic specifications in contexts.