Integrating Semantic Theories

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(editor)

DYANA-2

Dynamic Interpretation of Natural Language
ESPRIT Basic Research Project 6852

Deliverable R2.1.A
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Dynamic Interpretation of Natural Language

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Introduction

This deliverable is concerned with the integration of various semantic theories represented in the DYANA project. Anybody who works with these theories on a day-to-day basis has the feeling that there are major similarities between the various proposals that are current in the field and that where there are substantial differences there might nevertheless be a great deal to be gained from bringing the differences within one system, either because they represent complementary features of the approaches or because they represent alternatives which could be more usefully compared if presented within a single formal approach.

This work is of considerable importance given the different approaches that are available currently and the considerable investment involved in learning them, not to mention creating implementations based on them. The work on theory integration in DYANA is important because it increases our understanding of the individual approaches and gives us a more coherent view of the current state of the field of formal semantics. From a more practical perspective it can be seen as necessary preparation for a more ambitious project, however. This involves investigating the feasibility of bringing the various approaches within a single formal framework which would facilitate the development of computational tools which could be reused in implementations based on the different approaches. It would also allow analyses taken from the different approaches to be combined in a single implementation while maintaining confidence that the system remains within one coherent framework.

In order to move in the direction of such a project it necessary to do detailed preliminary work comparing and integrating the various approaches on a more-or-less pairwise basis and to study some of the detailed aspects of the way the various proposals relate. It is this kind of detailed work which is represented in this deliverable.

Dekker's paper brings together Veltman's update semantics and dynamic semantics as represented in Groenendijk and Stokhof's dynamic predicate logic. It illuminates the relationship between the logical properties of the two and formulates a new version of dynamic predicate logic which has a semantics in the style of update semantics. This is more than simply a formal exercise in comparison. It represents a step away from the parsimonius view of information states as variable assignments as they are conceived in dynamic predicate logic towards the richer notion of information state associated with update semantics. The changes involved in integrating dynamic semantics with update semantics have empirical consequences as well. They facilitate a treatment of adverbs of quantification which was not possible in either update semantics or the original dynamic semantics.

Cooper's paper explores how the notion of abstraction recently developed by Aczel and Lunnon can be used to draw parallels between Montague's semantics and discourse representation theory. The basic idea is that a theory of abstraction which allows simultaneous abstraction over several parameters and arbitrary indexing of the resulting roles in the abstract gives us the tools we need to see discourse representation structures as abstracts. The development from Montague's semantics to discourse representation theory in the early eighties can be seen as in part involving a generalization of abstraction from unary to simultaneous abstraction. Simultaneous abstraction is seen as lying at the heart of unselective binding. The ideas are made precise in terms of the situation theory presented in connection with extended Kamp notation by Barwise and Cooper in an earlier DYANA deliverable.

Day's paper describes an implementation by him and Philip Kime of one of the fragments presented in Cooper's paper, a DRT fragment presented in terms of situation theory. The main aim of the implementation at present is to allow us to check that the somewhat complex fragment does what it in fact claims. However, it can also be seen as the beginning of a prolog system based on extended Kamp notation that will allow the implementation, comparison and integration of various different semantic approaches. In this way it relates to the lisp based language ASTL developed by Black which is presented elsewhere in the current deliverables.

Black's paper describes a number of versions of discourse representation theory from a computational perspective. The comparison is mainly in terms of how the discourse representation structure is computed from the input string or the parse tree and contrasts the construction algorithm with threading approaches and discusses the role of λ-abstraction. The discussion indicates that when it comes to implementation even a single one of the semantic theories which we are concerned provides a number of choices which have to be resolved. These choices are not purely implementational but have to do with the precise way that the theory is presented.

Altogether two main threads are represented in this deliverable. One is the merging of update and dynamic semantics to produce a more powerful semantic theory. The other is the use of situation theory to point up relationships between Montague's semantics and discourse representation theory and merge them into a theory which has the advantages of both. Currently some of our interest concerns how updates might be usefully incorporated into a situation theoretic approach.

Robin Cooper

Task 2.1, subtask 1

Dynamic Quantification and Update Semantics 1

Updates in Dynamic Semantics

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Paul Dekker on the proportion problem

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Task 2.1, subtask 3

Situation Theory as a General Semantic Metatheory

Towards a General Semantic Framework

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Task 2.1, subtask 3

Situation Theory as a General Semantic Metatheory

Some Different Approaches to DRT

Alan Black

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The STDRT Implementation

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