The DYANA Integrated Implementation

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(editor)

DYANA-2

Dynamic Interpretation of Natural Language
ESPRIT Basic Research Project 6852

Deliverable R3.7
September 1995

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Dynamic Interpretation of Natural Language

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Introduction

The primary aims of the DYANA Integration Task, in the project's second phase, are to enable convergence of the frameworks which have been utilised in the project and to show that superficially disparate accounts developed in DYANA can be combined with no loss of descriptive power or formal rigour. Computerised implementation serves as an important tool to facilitate this integration, and at the same time serves a prototyping function, pushing novel theoretical ideas towards the stage where they can be utilised in commercial NLP applications.

When we originally planned the final implementation phase, we could not be sure how large the gulfs between various theories developed in the project would be, and thus how far the integration could practically go. In fact, we have been able to take the integration much further than we expected, so much so that it has been possible to combine what were originally scheduled as three different prototypes in three different subtasks into a single uniform implementation. These tasks are 3.3 (Morphology), 3.4 (Semantics in CUF) and 3.7 (Implementing Update Semantics). Perhaps most significant here is the progress made with CUF. Originally 3.4, scheduled for the third year of the project, was intended to 'test the water', to discover what the major problems would be in implementing semantic theories in CUF. However, we were able to push some of his effort back into year 2 of the project, and as a result already had several prototypes running by the end of the year. This is what lead us to decide to use CUF for the largest of the implementation tasks, 3.7, and as a consequence it became quite natural to integrate all three tasks in one CUF grammar.

This report is not a deliverable item: only the prototypes themselves were scheduled as deliverable products, at least for tasks 3.4 and 3.7, which are the tasks with which this report is concerned. However, it has become clear that since one of the the main purposes of the implementation was to serve as a tool to assist, but also to guage, the integration of theories, it would be appropriate to document some of the theoretical progress made in the process of producing the implementation. This should also aid dissemination of results. We will make DII available by public ftp, but since the CUF user-base, whilst growing, is still limited, in the short-term we cannot expect large numbers of researchers to latch onto the implementation itself.

There are five papers in this volume, four of which are authored by personel who have worked directly on DII. The first "The Architecture and Semantic Representation Formats of Dyana's Integrated Implementation", by Peter Krause and myself, provides an overview of DII, as well as technical details which may be of use to those wishing to extend DII further. It is of particular relevance to task 3.4, since it gives a general picture of how implementation of semantics in CUF can proceed.

The next three papers deal with the way in which specific theories have been integrated and implemented. Peter Krause's "Plural Phenomena in Dyana's Integrated Implementation" concerns the way in which Kamp and Reyle's analysis of plurals has been implemented, and how it has been integrated within a general mechanism for treating presupposition and anaphora dynamically.

This work was originally scheduled as the centre-piece of task 3.4. Here the the semantic representation language used in DII is described in detail. This language is designed to allow for use of underspecification techniques whereby, for instance, the precise scoping relation between two quantifiers may be left undetermined. In fact the syntax-semantics interface shares much in common with (and indeed, is a direct development from) the LexGram system developed by Esther Koenig at the Stuttgart site.

The next paper, by Ingrid van der Bovenkamp and myself, concerns the implementation of Valduvi's theory of Information Packaging (see Deliverable R1.3B), and the development of an extension of that theory which allows it to work in tandem with a dynamic analysis of anaphora. The research on Information Packaging in DYANA-2, by Valduvi, Valduvi and Engdahl, and Dekker and Hendriks has qualities which mark it as paradigmatically '*dyanic*'. It is realised within a sign-based grammar, and concerns aspects of language specifically relating to the dynamics of the interpretation process. The work is already sufficiently well developed formally so as to be ripe for certain NLP applications. Most obviously, the model of cross-linguistic realisation of information packaging could be utilised in the *transfer* component of a speech-to-speech machine translation system. [1]

The fourth paper is by Janet Hitzeman. It concerns the implementation of an an analysis of temporal connectives which utilises some theoretical ideas developed in the Esprit project DANDELION, and shows that these ideas may be combined within DII's general architecture. There is specific interaction with the PA (Presupposition and Anaphora) module, since many of the temporal connectives treated carry presuppositions. The PA module is described in the first paper of the report.

The last paper, by Frank Keller, is included because, apart from being an excellent paper, it provides commentary on some aspects of DII. Keller proposes a way in which van der Sandt's theory of presupposition could be implemented using underspecification techniques. The result is that that presuppositional and scope bearing elements are given a quite uniform treatment. Indeed, whilst I have pointed out elsewhere that there is a certain similarity between Russell's scopal account of definite descriptions and van der Sandt's theory of presuppositions, in a sense this only becomes really clear in the context of Keller's paper. Since the paper incorporates a proposal for an alternative treatment of one specific phenomena (i.e. presupposition) within a DII-like architecture, it is to be hoped that it can provide this additional DYANA report with a modicum of balance.

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David Beaver

1. This would assume that the MT system made intonational features available to the transfer component in a suitable form. To our knowledge no current MT system attempts any analysis of intonation, and we hypothesise that there are two reasons for this. Firstly, tracking intonation contours and relating them to the presence of A and B accents is difficult, although there has been significant progress on this problem within DYANA: see the DYANA-1 deliverable R1.4B. Secondly, until now there has been no formal theory of what to do with intonational information having obtained it: there has not been much work (formal or otherwise) on the significance of intonation cross-linguistically, and the relevance of intonation to interpretation has been mostly confined to quite specific phenomena, such as the functioning of *focus-sensitive* operators.

The Architecture and Semantic Representation Formats of Dyana's Integrated Implementation

Peter Krause and David Beaver
(Universität Stuttgart and University of Edinburgh)

Plural Phenomena in Dyana's Integrated Implementation

Peter Krause
(Universität Stuttgart)

Application and Implementation of Information Packaging

David Beaver and Ingrid van der Bovenkamp
(University of Edinburgh and Universiteit van Amsterdam)

Temporal Connectives: A Combined Dyana/Dandelion Implementation

Janet Hitzeman
(University of Edinburgh)

Integrating an Underspecified Account of Presupposition into HPSG

Frank Keller
(University of Edinburgh)