

REFERENCE RESOLUTION AND SEMANTIC COHERENCE

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The problem of how to define semantic coherence in a semantic net is a least twofold:

- (a) how should we structure the semantic net as to permit the combination of lexical meanings with the semantic structure of the vocabulary as such
- (b) how do we go on from here when we want to explicate semantic coherence within clauses and texts?

For this specific problem it is important to show how - and how far - semantic coherence tallies with syntactic coherence and whether we need certain transformations in order to insure tallying.

For our purpose, namely, to develop a conceptual natural language understanding system for German (VIE-LANG) we used Brachman's (Brachman 1978) outline of a semantic net to construct a conceptual knowledge base. We included ideas from a 'semanticized' valence theory, a 'semanticized' dependency grammar, and linguistic semantics in general.

We will now give a short description of the semantic net as used in our project. There is, at first, a hierarchical 'layer' of concepts, corresponding to a categorical thesaurus system. Each concept is structured via so-called roles through other concepts and it is here where the lexical meanings find their place. Roles either resemble deep cases

in a case grammar - so far, we have identified about 50 cases - or they are other vital 'constituents' of the semantic concept to which they belong (e.g. properties). Whereas in the hierarchical 'layer' the relations are those of hyponymy/hyperonymy, the relations which lead from concepts via roles to conceptual restrictions may be interpreted as relations of semantic compatibility (selectional restrictions), to be specified.

There is no explicit dichotomy between syntax and semantics. Syntax is seen as a 'coarse' semantic (pre-)ordering - with loopholes which have to be bridged by transformations. Each concept in the semantic net, including its roles and conceptual restrictions, can, therefore, be interpreted either as a semantic definition, or as a semantic sentence pattern. The latter approach accounts for the applicability of a 'semanticized' valence theory and a 'semanticized' dependency grammar.

How do we apply this system to the problem of semantic coherence in clauses and texts? The first practical step consisted in classifying the forms of semantic coherence and integrating them into our system. Accordingly, semantic coherence is expressed via

1. Proforms
- 1.1. Proforms which can be identified morphologically and morphologically/syntactically
- 1.1.1. Purely morphologically: lexemes which can be identified as proforms on a purely morphological basis (personal pronouns, certain adverbial proforms).
- 1.1.2. Morphologically/syntactically: lexemes which can be identified as possible proforms on a morphological basis but we need syntactic evidence for the decision of whether they really are proforms: possessive pronouns (function as proforms only when isolated - non-attributive), certain adverbs which may also funct-

ion as conjunctions, certain interrogative pronouns which have the same morphological shape as relative pronouns.

- 1.2.1. Borderline cases, bordering on 1.1.: lexemes and syntagmas which cannot be identified morphologically/syntactically as proforms, but of which we know from experience that they do occur as proforms: Ding, tun, geschehen, aus diesem Grund, etc.
- 1.2.2. Semantic proforms per se: this group consists (mainly) of 'synonyms', and, perhaps, all those lexemes which stand in a certain subconcept/superconcept relation to one another, e. g., like Engl, car and vehicle.
2. Semantic coherence without proforms. These are demonstrated best by an example: In
(1) Das Haus gehoert mir. Leider ist das Dach
 (This is my house. Unfortunately the roof is

schon baufaellig.
in bad shape.)

we cannot apply any of the abovementioned classification criteria, although it is obvious that semantically Haus and Dach belong together.

After having established this classification a matrix was developed which codifies all the available morphological and syntactical information, plus information delivered by the concept-role structure of the net. In the matrix we find information such as whether a proform substitutes for a noun phrase, a dependent clause, an independent clause, a text, an adverb etc., or a combination of them, which preposition to expect in an answer to a question using a specific interrogative pronoun, etc.

It has already been established (Hobbs 1978) that the information contained in the morphological-syntactic part of the matrix is not sufficient to identify semantic coherence in

a clause or text. Even for the proforms of 1.1. it is not sufficient to rely on the gender of the proform to find the correct antecedent. In the example:

- (2) Der Fisch wird auf den Teller gelegt. Dann esse ich ihn.
(The fish is put on the plate. Afterwards I eat it.)

Identification via gender provides us with the information that either Fisch or Teller may be the antecedent of ihn. Our concept-role structure, on the other hand, informs us that - given ordinary circumstances - only fish are to be eaten, whereas plates are not. This is to say that morphological and syntactical knowledge give us an indication where to look for semantic coherence in a clause or text (syntax as 'coarse' semantic (pre-) ordering!), but that we need criteria from the semantic net in order to be reasonably certain of what the proform stands for, or where semantic coherence is to be found in case there are no proforms.

A good example of how the system VIE-LANG works is delivered by those syntagmatic adverbial proforms which stand for sentences or texts and which belong to 1.2.1.:

- (3) Das Restaurant ist heute geschlossen. Aus diesem Grund essen wir zu Hause. (The restaurant is closed. For this reason we have dinner at home.)

On the semantic 'surface' there is nothing which relates Grund (reason) to anything else in either one of the two clauses. However, from our matrix we do know that aus diesem Grund may belong to 1.2.1 and, moreover, that its antecedent can only be a main clause or a text which immediately precedes aus diesem Grund. The system also recognizes that Restaurant and essen belong to the same semantic neighborhood. Thus it follows that Das Restaurant ist {heute geschlossen assume the role +CAUSE with respect to essen wir zu Hause.

From these examples it should be obvious that semantic coherence according to 2, has to be based exclusively on the

concept-role structure of the net. F.i., in example (1) semantic coherence can be made clear only when we know that Haus and Dach belong together semantically. How can we achieve that? Some scholars assume that a kind of inferencing guides us from Haus to Dach. In our system the lexeme 'Haus' would be connected with the concept BUILDING, in which there exists a role ROOF, which is the net-structure the lexeme 'Dach' would lead to. Instantiation of a role always comprises the instantiation of the concept it belongs to and the value-restriction respectively. The relationship between 'Haus' and 'Dach' becomes clear by merely accessing the net, without any inferences at all.

References:

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