

Complex Topic-Comment Structures in HPSG

1 Introduction

Associating sentences like the following with correct semantic interpretations and felicity conditions is a major challenge for any grammatical theory:¹

- (1) What SANDY wanted to see was a RED truck.

(1) can be uttered as part of a "strategy of inquiry" (Roberts 1998, 4) where it is under discussion what members of a contextually given set of people wanted to see. It reports on Sandy's wishes as opposed to those of the other members of the set. The felicity of this sentence under these circumstances can be made to follow from the assumption that the content of *What Sandy wanted to see* is the topic of the overall pseudocleft and that this topic is structured into a contrastive portion, i.e. the meaning of *Sandy*, and a non-contrastive portion. The meaning of the constituent following the copula is analyzed as the comment, again structured into a contrastive portion (the meaning of *red*) and a non-contrastive portion. This structured comment signals that there are alternatives to the actually used comment that could have been predicated of the topic and which differ from the present comment merely in replacing the meaning of *red* with a comparable, contextually salient, meaning. Such an alternative comment could have been expressed by *a BLUE truck*, for instance.

Steedman 2000 also argues for the division of sentence meanings into topic and comment (he uses the terms "theme" and "rheme") in such a way that each of these can be further articulated into focus and background. He gives the following example (p. 107):

- (2) a. Q: I know that Mary envies the man who wrote the musical. But who does she ADMIRE?
b. A: Mary ADMIRES the woman who DIRECTED the musical.

Steedman views the content of *Mary admires* as a topic containing a focus (the meaning of *admires*). The content of the remainder of the sentence is rheme. Like the theme, the rheme is further articulated into focus and background.

At present, there do not seem to be analyses within HPSG that associate sentences like (1) and (2) with the correct combination of truth-conditional content and felicity conditions. Vallduví 1992, Engdahl and Vallduví 1994, and Wilcock 2001 draw a distinction between FOCUS and GROUND and divide the latter further into LINK and TAIL. This does not allow for the FOCUS to be articulated into contrastive and non-contrastive portions. In a review of the MRS-based analysis of Wilcock 2001, Ericsson 2005, 213 moreover comes to the following conclusion: "At a general level, MRS does not provide the representations needed to give appropriate semantic values for the information structure primitives."

de Kuthy 2002, 162 proposes what in my view is the most sophisticated theory of information structure in HPSG to date. She also assumes "a tripartite partition of information structure", into topic, focus, and background. The first two are lists of meaningful expressions. The background is not explicitly represented, as it is derivable from the sign's LF (presumably by replacing the subexpressions which appear on the topic and comment lists by variables). I do not see, however, how such a system can simultaneously represent backgrounded portions of the topic and backgrounded portions of the comment, as there is only a single background. If sentences like (1) and (2) require the simultaneous representation of backgrounded topic and backgrounded comment portions, then the system needs to be extended. A second issue is that de Kuthy does not "want to give an interpretation of what it means for a constituent to be in the focus or in the topic," focusing her investigation instead on "the representation and not the interpretation of information structure" (p. 165).

In the remainder of this abstract, I describe an approach to content and information structure that permits the content of a sentence to be structured into topic and comment, allows both of these to be articulated into focused and backgrounded portions, and can be made compatible with HPSG.

2 Krifka 1991

Krifka 1991 proposes a theory that compositionally derives semantic representations that have the degree of articulation called for at the end of the last section. In addition, Krifka defines a dynamic ASSERT operator with a possible worlds semantics and felicity conditions that embeds his structured semantic

¹Words in small caps are assumed to be accented.

representations as an argument. If his semantic structures can be represented in HPSG, appropriate lexical entries defined, and the composition process driven by an HPSG syntax, then the content and felicity conditions of sentences like (1) and (2) can be derived straightforwardly using an HPSG grammar. In the remainder of this abstract I will sketch out how this can be accomplished.

I will implement Krifka’s system with one modification. Anticipating that articulated topic-comment structures will ultimately have to be a part of a comprehensive system that can capture the various semantic relations (e.g. presuppositions, discourse oldness, salience, rhetorical relations) that hold between the content of a sentence and the context in which it is uttered, I will actually create an interface between HPSG and Compositional DRT as developed in Muskens 1996.² To this end, the type *local* is defined as follows:

$$(3) \left[\begin{array}{l} local \\ CAT \quad cat \\ CONT \quad meaningful-expr \\ ISTR \quad istr \end{array} \right]$$

The value of CONT is a single expression of Muskens’ 1996 compositional DRT representation language. In contrast, the value of ISTR is an information structure formulated in terms of compositional DRT that is internally articulated along the lines of Krifka 1991. The internal structure of *istr* is shown below:

$$(4) \left[\begin{array}{l} loc \\ CAT \quad cat \\ CONT \quad meaningful-expr \\ ISTR \quad \left[\begin{array}{l} istr \\ COMM \quad \left[\begin{array}{l} comm-str \\ TOP-BIND \quad list-of-var \\ FOC-BIND \quad list-of-var \\ BG \quad meaningful-expr \\ FOC \quad list-of-meaningful-expr \end{array} \right] \\ TOP \quad list-of- \left(\left[\begin{array}{l} top-str \\ FOC-BIND \quad list-of-var \\ BG \quad meaningful-expr \\ FOC \quad list-of-meaningful-expr \end{array} \right] \right) \end{array} \right] \end{array} \right]$$

As expected, there is a primary division between topic and comment. Since it is assumed that there has to be a comment (even if it is just a variable), but that topics are optional, the attribute TOP is typed to a (possibly empty) list of topic structures (*top-str*). The comment is represented by a data structure of type *comm-str*. The attributes BG and FOC are appropriate for both topic and comment structures. This allows topics and comments to each be articulated further into background and focus, thus meeting the goal set at the end of the previous section. Within each topic/comment structure, the background is obligatory (perhaps just a variable again) and foci are optional. Therefore, the background is a meaningful expression and the value of FOC is a (possibly empty) list. In sum, this makes the background of the comment the only obligatory part of the structure in the sense that all other values are lists which may be empty.

In contrast to de Kuthy, Krifka directly represents the structures that can be interpreted semantically. Therefore, each focus is represented by a variable inside the corresponding background and this “focus” variable is bound by a lambda operator. In the present system, the “focus” variables are contained in a list that is the value of the attribute FOC-BIND. The background of the comment also contains a variable for each element on the topic list. These “topic” variables are kept track of by TOP-BIND.

Given this architecture, the truth-conditional content of a complex expression can be computed from its information structure in two steps: (i) within each topic/comment structure, each “focus” variable is replaced by the corresponding focus; (ii) within the comment, each “topic” variable is replaced by the corresponding topic.

At the base of this system lies the realization principle (5) which requires that the information structure of words belong to the type *lex-istr* (lexical information structure) whose type hierarchy is shown in (6):

$$(5) \textit{word} \implies [\textit{SYNSEM}|\textit{LOC}|\textit{ISTR} \textit{lex-istr}]$$

²For the example analysis to be given later, the DRT portion is not specifically needed, however.

$$(9) \left[\begin{array}{c} \text{TOP-BIND } \langle \rangle \\ \text{FOC-BIND } \langle Z \rangle \\ \text{BG} \\ \text{FOC} \\ \text{TOP} \end{array} \left[\begin{array}{c} \langle \rangle \\ Z \\ \langle \text{apply}(F1, F2) \rangle \end{array} \right] \right]$$

$$\left[\begin{array}{c} \text{COMM} \\ \text{TOP} \end{array} \left[\begin{array}{c} \text{TOP-BIND } \langle \rangle \\ \text{FOC-BIND } \langle X1 \rangle \\ \text{BG} \\ \text{FOC} \end{array} \left[\begin{array}{c} \langle X1 \rangle \\ X1 \\ \langle F1 \rangle \end{array} \right] \right] \right] \left[\begin{array}{c} \text{COMM} \\ \text{TOP} \end{array} \left[\begin{array}{c} \text{TOP-BIND } \langle \rangle \\ \text{FOC-BIND } \langle X2 \rangle \\ \text{BG} \\ \text{FOC} \end{array} \left[\begin{array}{c} \langle X2 \rangle \\ X2 \\ \langle F2 \rangle \end{array} \right] \right] \right]$$

There is an analogous principle for the case where the subconstituents are interpreted as parts of a single topic.

3 An Example

I will sketch an analysis of the initial sentence of the following example of what Gundel 1974 calls “topic topicalization:”

(10) A GREEN *light* you IGNORE. But when there is a RED light, you turn off the machine.

I analyze the content of a *green light* as topic and the content of *you ignore* as comment. Both topic and comment are partially focused. I assume that English contains a topic-preposing phrase type which is constrained as follows:

$$(11) \text{topic-preposing-ph} \Rightarrow \begin{array}{c} [hd\text{-fill-ph}] \\ \text{F} \qquad \qquad \qquad \text{H} \\ \left[\begin{array}{c} \text{PHON|ACCS } list \oplus top\text{-acc} \oplus list \\ \text{S|L|ISTR } top\text{-istr} \end{array} \right] \qquad \left[\begin{array}{c} \text{S|L|ISTR } comm\text{-istr} \end{array} \right] \end{array}$$

Topic preposing phrases are head-filler phrases whose filler constituent’s accent structure (for simplicity, here conceived of as a list of accents) contains a topic accent. We assume a general constraint that every root utterance must have at least one subconstituent (i) whose information structure belongs to the type *comm-istr* (= comment information structure) and (2) whose accent structure contains an accent marked as nuclear. The combination of (11) and this constraint derive the accentuation that Gundel associates with “topic topicalization.”

Assuming all the words of (10) to have the appropriate information structures [cf., for example, (7)], step by step application of the composition principles yields (12) as the information structure and (13) as the content of the root node of the first sentence in (10):

$$(12) \left[\begin{array}{c} \text{COMM} \\ \text{TOP} \end{array} \left[\begin{array}{c} \text{TOP-BIND } \langle R \rangle \\ \text{FOC-BIND } \langle T \rangle \\ \text{BG} \\ \text{FOC} \end{array} \left[\begin{array}{c} T(R)(\text{hearer}) \\ \langle \lambda Q \lambda x. Q(\lambda y \left[\begin{array}{c} e' \\ e':ignore(x,y) \end{array} \right]) \rangle \end{array} \right] \right] \right]$$

$$\left[\begin{array}{c} \text{FOC-BIND } \langle M \rangle \\ \text{BG} \\ \text{FOC} \end{array} \left[\begin{array}{c} \lambda N \left(\left[\begin{array}{c} u \\ \quad \end{array} \right] + M \left(\lambda Z \left[\begin{array}{c} \text{light}(z) \end{array} \right] \right) (u) + N(u) \right) \\ \langle \lambda P \lambda v \left(\left[\begin{array}{c} \quad \end{array} \right] + P(v) \right) \rangle \end{array} \right] \right]$$

$$(13) \left[\begin{array}{c} \text{CONT} \\ \left[\begin{array}{c} e'z \\ \text{light}(z) \\ \text{green}(z) \\ e':\text{ignore}(\text{hearer},z) \end{array} \right] \end{array} \right]$$

The + sign in (12) represents the merge-operator of compositional DRT. Starting from the bottom, we see that the information structure contains one topic component which in turn is articulated into background and focus: the focus of the topic contains the meaning of the modifier *green*. The background of the topic contains the meanings of the determiner *a* and the noun *light*, in addition to the focus-bound variable *M* of the type of the modifier meaning of the word *green*.

The comment is structured into background and focus as well. The background contains two variables and the designated term *hearer* contributed by the word *you*. The variable *R* is type-identical (types are not shown) with the element on the topic list. The variable *T* is a “focus” variable which represents the focused portion of the comment, the meaning of the expression *ignore* which is stored in the focus list of the comment.

According to the semantics of Krifka’s ASSERT operator, a sentence like (10) can be used to assert of the topic *a green light* the comment that this generalized quantifier applies to the property of being ignored by the hearer. In addition, the representation encodes two contextual appropriateness conditions for utterances of (10): (i) there are salient alternatives to the topic expression of the form *a M light* where the content of M is comparable to the content of *green* and (ii) there are salient alternatives to the comment that specify actions other than ignoring the green light that the hearer could have taken. These are the desired usage conditions for utterances of (10).

4 Summary

Sentences like (1), (2), and (10) seem to require topic-comment structures where both the topic and the comment are further articulated into background and focus. Previous HPSG designs of information structure do not make all the distinctions that are required and/or provide no interpretations for their information-structural concepts. I have proposed that both of these problems can be solved by modeling the information structure component of HPSG along the lines of Krifka 1991. Lexical entries and principles were presented that show how such Krifka-style representations can be composed using HPSG and how the truth-conditional content of a sign can be derived by replacing the “topic” and “comment” variables in the background of the comment. It was shown that the overall system yields appropriately complex topic-comment and content structures for examples such as (10). As another added bonus, the Krifka-style system comes with a sophisticated theory of association with focus.

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