Integrating GIVENness into a structured meaning approach in HPSG

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Abstract

In this article we show how the HPSG approach to information structure of De Kuthy (2002) and De Kuthy and Meurers (2003) can be extended to capture givenness (Schwarzschild, 1999) and make the right predictions for so-called *deaccenting* of given information, a widespread phenomenon (Büring, 2006) not previously dealt with in HPSG.

1 Introduction

The information structure of a sentence captures how the meaning expressed by the sentence is integrated into the discourse. The structured meaning approach (von Stechow, 1981; Jacobs, 1983; Krifka, 1992) provides a compositional semantic mechanism based on separate representations of the semantic contribution of the focus and that of the background – and De Kuthy (2002) and Webelhuth (2007) worked out how a structured meaning approach can be integrated into the HPSG architecture. This opened up the possibility of providing explanations for constraints previously stipulated in syntax by deriving the constraints from the nature of the integration of a sentence into the discourse. For example, De Kuthy (2002) relates the occurrence of discontinuous NPs in German to specific information-structural contexts, and De Kuthy and Meurers (2003) show that the realization of subjects as part of fronted non-finite constituent and its constraints can be accounted for based on independent information-structure conditions. In the same spirit, Bildhauer and Cook (2010) show that sentences in which multiple elements have been fronted are directly linked to specific types of information structure.

While the HPSG approaches successfully capture some aspects of the relation between intonation, syntax, semantics, and information structure, none of the HPSG approaches so far capture the important empirical generalizations established by Schwarzschild (1999) around the notion of *givenness*. In this abstract, we show how the HPSG approach to information structure of De Kuthy (2002) and colleagues can be extended to capture givenness and to make the right predictions for so-called *deaccenting*, which has been shown to be widespread (Büring, 2006). In contrast to Schwarzschild (1999), who spells out his approach in the framework of alternative semantics (Rooth, 1992), we show how the notion of givenness can be couched in a standard structured meaning approach – thereby preserving the explicit, compositional representations of focus and background which have been so fruitful in the work mentioned above.

2 Focus, Focus Projection, and Givenness

Languages differ with respect to how the information structure of an utterance is marked. Linguistic means of marking information structure include word order, morphology, and prosody. English and German are so-called intonation languages

where information structuring is signaled by the intonation of an utterance, including different types of pitch accents. The presence and nature of an accent is an indicator of the discourse function of a particular part of a sentence (cf., e.g., Beckman and Pierrehumbert, 1986; Grice et al., 2002).

The most widely discussed discourse function is the focus, which has been characterized in a variety of ways as the "most important" or "new" information of an utterance (cf. Krifka, 2007). The focus can be defined to be the part of an answer that corresponds to the *wh*-part of a question.[1] The question-answer congruence is not always explicitly expressed in discourse. Instead, a coherent discourse can be structured by implicit *Questions Under Discussion (QUD)* (cf., e.g., Roberts, 1996; Büring, 2003). As a simple example with an explicit question, consider (1a) asking for the object that John is renting.

(1) a. What did John rent?
b. He rented ⟦a BICYCLE⟧$_F$. (narrow NP focus)

The answer in (1b) provides the element asked for, the focus of the utterance marked by ⟦ ⟧$_F$: Out of the various alternative things John could have rented, he picked a bicycle. The word *bicycle* is shown in small caps to indicate that it contains a syllable bearing a nuclear pitch accent. In this most basic case, the focused material thus is marked by a pitch accent and consists of information that is new in the discourse. However, the relation between pitch accent, focus, and new information often is much less direct.

The identical prosodic realization of sentence (1b), with a single pitch accent on the object *bicycle*, is traditionally also assumed to be appropriate in contexts requiring a wider focus (2).

(2) a. What did John do?
John ⟦rented a BICYCLE⟧$_F$. (wide VP focus)
b. What happened yesterday?
⟦John rented a BICYCLE⟧$_F$. (wide S focus)

The question in (2a) requires an answer in which the VP *rented a bicycle* is the focus: Out of the alternative actions John could have performed, it is renting a bicycle that he did. And the question in (2b) puts the entire sentence *John rented a bicycle* into focus: Out of everything that could have happened yesterday, it asserts that John renting a bicycle is what happened. Crucially, the exact same realization of the answer is traditionally assumed to be appropriate for either of the three focus interpretations. This flexible relation between pitch accent placement and focus interpretation is generally referred to as as **focus projection**. A number of lexical and syntactic conditions have been formulated in the literature to define when focus can project in this way (e.g., Gussenhoven, 1983; von Stechow and

[1] We only use the term focus in this formal pragmatic sense to avoid confusion with the prosodic notion (pitch accent, focus exponent).

Uhmann, 1986; Uhmann, 1991; Selkirk, 1995) and De Kuthy (2002) showed how they can be integrated into the HPSG architecture.

However, Schwarzschild (1999) observed an important **dissociation of focus and new information** in sentences where some information is ***given* in the discourse**, which so far are not captured by any of the HPSG approaches. To exemplify the phenomenon, we add the context in (3) introducing some conference participants, Bill, the rental of vehicles, and red and blue convertibles into the discourse. Based on this context, we then again consider the question (3a) asking for the object that John is renting as the focus.

(3) The conference participants are renting all kind of vehicles. Yesterday, Bill came to the conference driving a red convertible and today he's arrived with a blue one.
   a. What did John rent?
   b. He (only) rented $[\![$a GREEN convertible$]\!]_F$.

One can now answer this question with sentence (3b), where *a green convertible* is the focus: Out of all the things John could have rented, he picked a green convertible. In this focus, only *green* is new to the discourse, whereas convertibles were already given in the context. That the focus is indeed the full expression *a* GREEN *convertible* can be confirmed by adding the focus-sensitive expression *only* in front of the verb in (3b). Considering the relation between the pitch accent and the focused meaning, example (3b) shows that when focused material is already given in the discourse, the focus includes unaccented substantive material – so-called **deaccenting of given material**. In general, every focused expression must contain a pitch accent. Where given material occurs in the focus, the pitch accent is realized on another, new word in the focus.

Pushing the dissociation of focus and new information to the extreme, it is possible for the focus to consist entirely of material already given in the context, as illustrated by (4b). In this example, the focus contains no new information so that the pitch accent is exceptionally realized on a given element.

(4) In the rental lot, there were two bicycles and a motorcycle.
   a. What did John rent?
   b. He rented $[\![$a BICYCLE$]\!]_F$.

Büring (2006) further explores the perspective of Schwarzschild (1999) and shows that deaccenting of given material is a widespread phenomenon. Yet, currently it is not captured by any HPSG approach. In the remainder of this article, we develop an approach integrating the notion of givenness in a structured meaning approach to information structure which makes the proper predictions for the cases of deaccenting.

3 An HPSG Analysis Incorporating Givenness

We couch our analysis in the HPSG approach to information structure developed in De Kuthy (2002). Her approach builds on the proposal of Engdahl and Vallduví (1996), in which a focus-background structure for every sentence is build up compositionally from the focus-background structures of its subparts. The information structure is encoded in the attribute INFO-STRUC that is appropriate for signs. As discussed in De Kuthy (2002), it leads to unintended consequences to encode the attribute INFO-STRUC as part of local objects (as in Engdahl and Vallduví (1996), where it is included under CONTEXT) since in unbounded dependency constructions the INFO-STRUC values should not be structure shared between a filler and its gap.

The appropriate features for INFO-STRUC are FOCUS and TOPIC, with lists of so-called meaningful expressions (semantic terms, cf. Sailer 2000) as values. The background of a sentence is defined to be that part of the logical form (LF) of the sentence which is neither in focus nor in topic. This characterization of background closely resembles the definition of background employed by the so-called *structured meaning* approaches to focus of von Stechow (1981), Jacobs (1983), or Krifka (1992). As an example, Figure 1 shows the INFO-STRUC representation resulting for the example (2a), where the VP is focused.

$$\begin{bmatrix} \text{S|LOC|CONT|LF } \exists x[bicycle'(x) \wedge rent'(j,x)] \\ \text{INFO-STRUC} \left[\text{FOCUS } \langle \lambda y \exists x[bicycle'(x) \wedge rent'(y,x)] \rangle\right] \end{bmatrix}$$

Figure 1: Sign-based representation of information structure for example (2a)

We start our extension of the approach of De Kuthy (2002) by distinguishing the compositional built-up of structured meanings from the information structure as such, which we only want to encode for unembedded signs, i.e., the signs for which it makes sense to encode how they are integrated into the discourse. We therefore introduce the feature STRUCTURED-MEANING and make it appropriate for all *signs*, whereas the feature INFO-STRUC is changed to only be appropriate for *unembedded-signs*. A constraint ensures that the value of INFO-STRUC for unembedded signs is that composed in STRUCTURED-MEANING.

To capture the relation between focus and givenness as introduced in section 2, we add the feature GIVEN to the types *structured-meaning* and *info-struc*. Parallel to the attribute FOCUS, the attribute GIVEN has (lists of) semantic terms as value. Figure 2 sums up the relevant parts of the signature and theory.

To model phenomena such as focus projection and deaccentuation of given material, one also needs to make explicit the relation between pitch accent placement and the interpreted focus. Following De Kuthy (2002), we include an ACCENT attribute to encode whether a word receives an accent or not (and what type of accent it is, an issue ignored here since it is orthogonal to the topic of this article). The relation between pitch accents and the information structure of words is defined by the principle shown in Figure 3 depending on the type of accent the word receives.

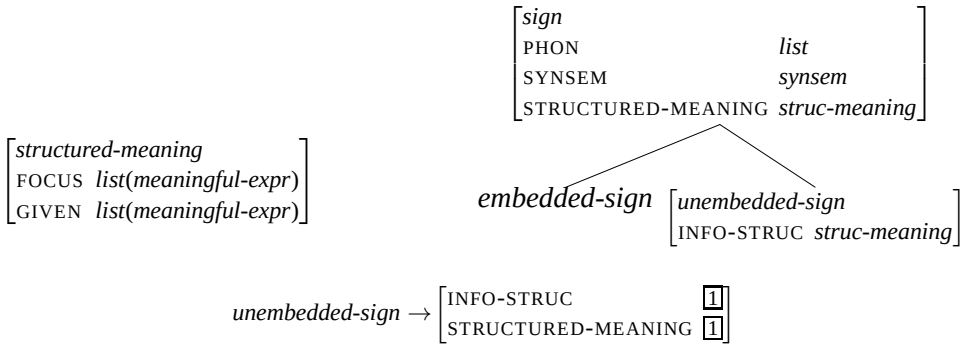

Figure 2: Basic information structure signature and constraint

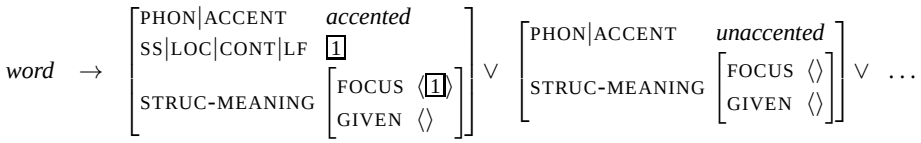

Figure 3: Relating intonation and information structure for words

Now we are ready for the core of the approach, the build-up of the structured meaning representation in phrases. This is the part of the theory which needs to capture focus projection and the impact of given information. We extend the Focus Projection Principle of De Kuthy and Meurers (2003) with a disjunct capturing focus projection in the presence of givenness. Figure 4 shows the resulting principle.[2] The first three disjuncts are adapted from De Kuthy and Meurers (2003). The first disjunct in the consequent of the principle covers the base case in which the focus does not project further; the mother of the phrase just collects the focus values of all her daughters. The second disjunct covers focus projection in the nominal domain, where focus always projects from the rightmost daughter of a phrase. Note how focus is encoded: If a constituent is part of the focus then its logical form is token identical to an element of its FOCUS value.[3] The third disjunct specifies under which circumstances focus can project in the verbal domain: a phrase headed by a verb can only be in the focus (i.e., its entire logical form is token identical to an element of its focus value) if a non-head daughter with focus projection potential (FPP *plus*) is entirely focused itself.

[2]The auxiliary relations are defined as:

$$\textit{any-dtr}\left(\boxed{1}\right) := \left[\text{HEAD-DTR } \boxed{1}\right].$$
$$\textit{any-dtr}\left(\boxed{1}\right) := \left[\text{NON-HEAD-DTRS } \textit{element}\left(\boxed{1}\right)\right].$$
$$\textit{collect-focus}\left(\langle\rangle\right) := \langle\rangle.$$
$$\textit{collect-focus}\left(\left\langle\left[\text{STRUC-MEANING|FOCUS } \langle\boxed{1}\rangle\right] \mid \boxed{2}\right\rangle\right) := \left\langle\boxed{1} \mid \textit{collect-focus}\left(\boxed{2}\right)\right\rangle.$$

[3]FOCUS is list valued to account for sentences with multiple foci, cf. De Kuthy (2002, p. 164).

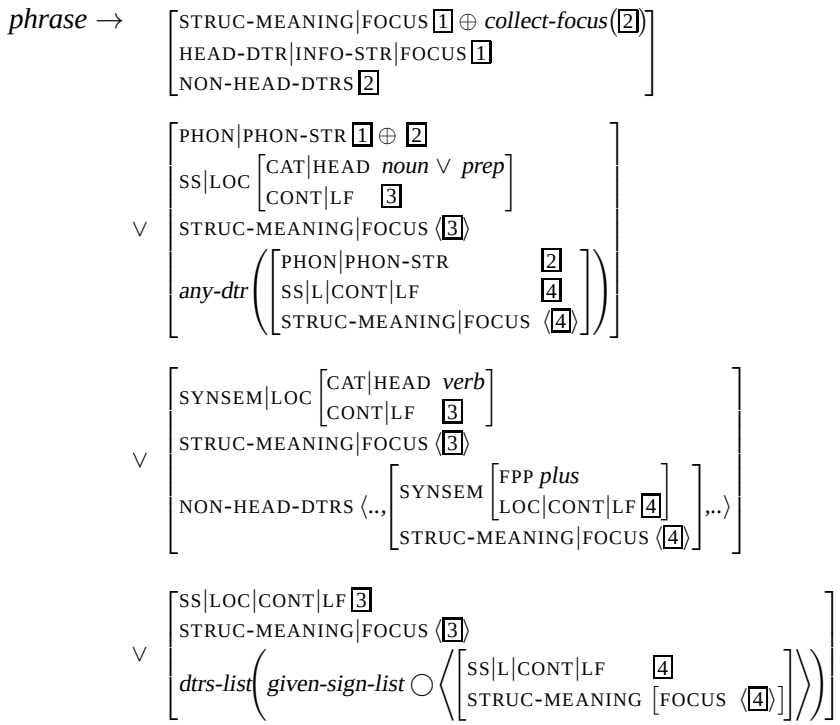

Figure 4: Focus Projection Principle

The FPP lexically encodes from which elements focus can project for a given verb, encoding the lexical subregularities discussed in the literature (cf., e.g., von Stechow and Uhmann, 1986). For example, a transitive verb such as *rent* specifies in the lexical entry or as the result of a lexical principle that its subject argument is FPP *minus* whereas its object is FPP *plus* to encode that this verb supports focus projection only from the object.

Figure 5 illustrates how the principles interact in licensing a regular VP focus example, such as the one we saw in (2a). The pitch accent in example (2a) is on the noun *bicycle* so that according to the information-structure principle for words of Figure 3 it contributes its LOGICAL FORM (LF) value to its FOCUS value. The Focus Projection Principle of Figure 4 ensures that the focus can project over the entire NP *a bicycle*, i.e., its FOCUS element is identical to its LF value. Since *a bicycle* as the object of *rented* in the tree in figure 5 is lexically marked as FPP *plus*, the principle governing focus projection in the verbal domain in figure 4 licenses the focus to project over the entire verb phrase *rented a bicycle*. The VP thus contributes its LF value to its FOCUS value. In this example, the focus does not project further. In the head-subject phrase the focus values of the two daughters thus is simply collected as specified by the first disjunct of the principle of Figure 4. As a result, the FOCUS value of the overall sentence is the FOCUS value of the VP, which here is the LF of the VP.

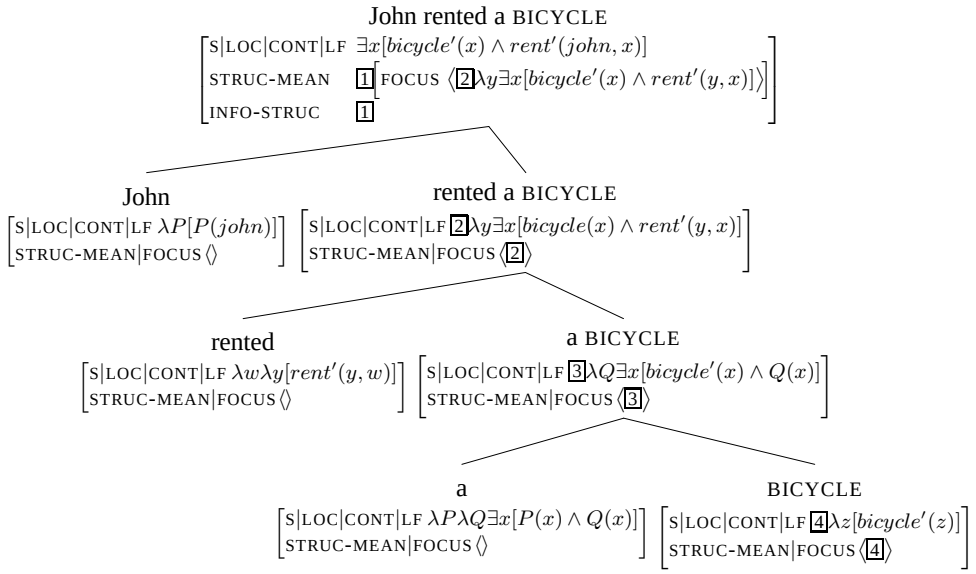

Figure 5: Structured meaning and information structure in VP focus example (2a)

We now turn to the fourth disjunct of the Focus Projection Principle.[4] It captures the previously unaccounted cases where given material in a focused phrase is deaccented, as discussed in section 2. Focus in those examples can project from a focused daughter in a position which normally does not allow focus projection. This only is an option if all other daughters in that focused phrase are *given*. Spelling this out, the fourth disjunct of the principle in Figure 4 specifies that the mother of a phrase can be in the focus (i.e., the entire LF value of the mother's CONTENT is token identical to an element on the mother's FOCUS list) if it is the case that the list of all daughters (provided by *dtrs-list*) consists of *given* signs into which a single *focused* sign is shuffled ($\bigcirc$).[5] As before, a sign is focused if its LF value is token identical to an element of its FOCUS value; and a sign is given if its LF value is token identical to an element of its GIVEN value.

Figure 6 provides an example showing the INFO-STRUC and STRUCTURED-MEANING values of the example (3b), a case involving deaccentuation of given material in the focus domain.

[4]The auxiliary relations are defined as:

$$\textit{dtrs-list}\left(\left\langle \boxed{1} \middle| \boxed{2} \right\rangle\right) := \begin{bmatrix} \text{HEAD-DTR} & \boxed{1} \\ \text{NON-HD-DTRS} & \boxed{2} \end{bmatrix}$$

$$\textit{given-sign-list} := \langle\rangle.$$

$$\textit{given-sign-list} := \left\langle \begin{bmatrix} \text{SS|L|CONT|LF} & \boxed{1} \\ \text{STRUC-MEANING} & \begin{bmatrix} \text{GIVEN} & \langle \boxed{1} \rangle \end{bmatrix} \end{bmatrix} \middle| \textit{given-sign-list} \right\rangle.$$

[5]If only binary structures are assumed, as in the examples in this paper, the principle can be simplified. We here kept the general version with recursive relations following De Kuthy and Meurers (2003), which also support flatter structures.

Figure 6: Example involving givenness deaccenting and focus projection

The pitch accent in this example is on the adjective *green* so that the principle in Figure 3 licenses structure sharing of the adjective's content with its FOCUS value. In the context of the question (3a), the entire NP *a green convertible* of example (3b) is in the focus. In the phrase *green convertible*, the clause licensing focus projection in NPs does not apply since the adjective *green*, from which the focus has to project in this case, is not the rightmost element of the phrase. What does apply is the fourth disjunct of the principle licensing focus projection in connection with givenness. Since the noun *convertible* is given, the adjective *green* is the only daughter in the phrase that is not given and focus is allowed to project to the mother of the phrase. In the phrase *a green convertible*, focus projection is again licensed via the clause for focus projection in noun phrases, since the focused phrase *green convertible* is the rightmost daughter in that noun phrase.

We note in closing that the first three disjuncts of the Focus Projection Principle also apply when elements are given. This is intentional since pitch accent placement in complex focused phrases only containing given material follows the same regularities as pitch accent placement in focused constituents only containing new material. For example, the pitch accent in a focused given NP occurs on the rightmost element in that NP as the example (5b) illustrates.

(5) Mary rented a blue motorcycle.
   a. What did John rent?
   b. He also rented $[\![$ a blue MOTORCYCLE$]\!]_F$.

Related work Despite its importance for the syntax-pragmatic-intonation interface, focus projection and the issue of deaccenting has received only little attention in the HPSG architecture. Engdahl and Vallduví (1996) discussed aspects of information packaging in HPSG and included an INFO-STRUC instantiation principle for English licensing focus projection from the most oblique object in a VP. Our approach is inspired by their work, but it provides a more explicit formalization in the HPSG architecture and it significantly extends the empirical coverage to include the verbal and nominal domain, cases where focus does not project, and the deaccenting phenomenon tackled in this article.

4 Summary and Outlook

We showed in this article how the HPSG approach to information structure of De Kuthy (2002) and De Kuthy and Meurers (2003) can be extended to capture givenness (Schwarzschild, 1999) and make the right predictions for so-called *deaccenting* of given information, a widespread phenomenon (Büring, 2006) not previously dealt with in HPSG.

Our approach captures the relation of pitch accentuation, syntax, and information structure on the sentence level. To be able to interpret notions such as focus and givenness as part of a theory of discourse, the approach naturally needs to be

integrated into a formal pragmatic theory of how explicit and implicit questions under discussion arise and are addressed (cf., e.g., Roberts, 1996; Büring, 2003).

Complementing the issue of givenness in the context of focus projection discussed in this paper, there seems to be a related issue warranting attention, namely the nature of the material projected over in the cases of focus projection. Consider, for example, the following examples in (6a) and (6b) in the out of the blue context given.

(6) Hi John, good to see you here in the department! But why are you so pale?
   a. ⟦I just saw a man with an AXE!⟧$_F$
   b. ⟦I just saw a chicken with an AXE!⟧$_F$

In such a wide focus context, the sentence (6a) is unremarkable, whereas the almost identical one in (6b) appears problematic with the given intonation. The intuitive explanation is that seeing *chicken* in a department is so unexpected that it needs to be introduced as new information by its own accent. This is not the case for men, which roam around departments all the time. Relatedly, axes are typically carried by men as in (6a). It remains to be explored whether the kind of non-accenting of material projected over in focus projection cases (such as (6a)) is related to the deaccenting of given material discussed in this paper.

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