

A Linearization-Based Theory of Non-Constituent Focus

Shûichi Yatabe and Seiji Hayakawa

University of Tokyo and Ibaraki University

Proceedings of the ESSLLI'05 Workshop on Empirical
Challenges and Analytical Alternatives to Strict
Compositionality

Heriot-Watt University
Edinburgh, Scotland

Frank Richter and Manfred Sailer (Editors)

2005

<http://www.macs.hw.ac.uk/esslli05/>

Abstract

In this paper, we argue, mainly on the basis of Japanese data, that we need a theory of focus in which a contiguous sequence of expressions that does not form a morphosyntactic constituent is allowed to serve as a single focus, rather than merely as a sequence of two or more foci, and then present such a theory within the framework of linearization-based HPSG. In the proposed theory, prosodic constituents (“domain objects” in the HPSG parlance), rather than morphosyntactic constituents (“signs”), are claimed to be the principal carriers of semantic information, and meaning assembly is carried out on the basis of prosodic, rather than syntactic, structure. This theory, if correct, means that there is a certain dissociation between the morphosyntactic structure of a sentence and the way its parts are semantically put together.

The purpose of this paper is to present a linguistically adequate theory of non-constituent focus. We use the term *focus* in the same way as authors such as Rooth and Krifka; we say that a linguistic expression or a sequence thereof is a focus when it is interpreted as contrasting with some other entity (or entities) of the same type. A *non-constituent focus* is a contiguous sequence of expressions that does not form a morphosyntactic constituent and yet is interpreted as a single focus.

In section 1, we review two existing theories of non-constituent focus, and argue that neither of them is satisfactory. In section 2, we describe a version of HPSG in which semantic composition is carried out largely on the basis of prosodic, rather than syntactic, structure. And in section 3, we present our theory of non-constituent focus, exploiting the key features of the theoretical framework described in section 2. The paper will conclude with an observation regarding whether or not the theory proposed in this paper is consistent with the principle of compositionality.

1 Previous theories of (apparent) non-constituent focus

In this section, we will review two existing theories of non-constituent focus: a theory based on the notion of higher-order unification (Pulman (1997)) and a theory that relies on a sophisticated notion of givenness (Schwarzschild (1999)).

1.1 Pulman (1997)

In Pulman’s theory of focus, it is assumed that we can somehow identify which elements of the sentence meaning are focused, either because of their syntactic configuration or via intonation, and that these elements are available as arguments to focus-sensitive functors such as *only* and *also*. A focus-sensitive functor like *only* takes two arguments: a list consisting of the meaning of each focus contained in its sister node and (roughly speaking) the meaning of that sister node itself. For example, a VP like *only introduced BILL to SUE* is interpreted as follows:

[†]We thank Mark Steedman and the three reviewers for the workshop for their insightful comments. Needless to say, they should not be held responsible for what we say in the present paper.

(1) $\lambda x. \text{only}([\text{Bill}] \bullet [\text{Sue}], \text{introduced}(x, \text{bill}, \text{sue}))$

where $A \bullet B$ is a list consisting of A and B . The result of combining this VP and an NP *John* is interpreted as in (2):

(2) $\text{only}([\text{Bill}] \bullet [\text{Sue}], \text{introduced}(\text{john}, \text{bill}, \text{sue}))$

In interpreting this semantic representation, we first ‘subtract’ the meaning of the two focused elements from the meaning of the S, using the mechanism of higher-order unification. The result of this ‘subtraction’ is a two-place predicate expressing a relation that holds between two NP meanings X and Y if and only if John introduced X to Y . Combining the meaning of the two focused elements and the meaning of this two-place predicate in an appropriate manner, we can state the correct truth condition of this sentence, roughly along the lines suggested in the Structured Meaning approach (Krifka (1991)): the sentence *John only introduced BILL to SUE* is true if and only if Bill and Sue are the only pair of individuals that satisfies the binary relation that holds between two NP meanings X and Y if and only if John introduced X to Y .

Pulman discusses the following example, in an attempt to demonstrate that his theory is capable of dealing with non-constituent focus.

(3) “What happened to Mary?” “JOHN KISSED her.”

Pulman regards the string *JOHN KISSED* in the second sentence of this example as an instance of non-constituent focus. In his analysis of this sentence, he first computes the meaning of the entire sentence and the meaning of the two focused elements, *JOHN* and *KISSED*, and then he subtracts the meaning of the two focused elements from the meaning of the S in order to arrive at the correct truth condition for the sentence.

This analysis is unproblematic for this particular example, but it is not an adequate analysis of non-constituent focus in general. As should be clear even from the brief exposition above, Pulman’s analysis of non-constituent focus is identical to his analysis of an example like *John only introduced BILL to SUE*, which involves two separate foci (which could have been associated with two different focus-sensitive functors). Consequently, his theory has difficulty in dealing with cases where a non-constituent is demonstrably functioning as a single focus, not as a sequence of separate foci. Consider the Japanese examples in (4) and (5), taken from Yatabe (1999). In these examples, prosodically prominent words are capitalized, as in many other examples used in this paper. We say that an expression in a Japanese sentence is *prosodically prominent* (or that it *receives prosodic prominence*) when (i) either the initial mora of the expression has audibly undergone Initial Lowering (i.e., it is pronounced audibly lower in pitch than the second mora)¹ or the initial mora of the expression is accented² and hence incapable of

¹For information on Initial Lowering, see Pierrehumbert and Beckman (1988), Kubozono (1993), and the references cited there.

²Here, and throughout this article, when we say that a Japanese expression is *accented*, what we mean is not that the expression is pronounced higher or louder than usual but that the expression

undergoing Initial Lowering and (ii) none of the high tones associated with the expression is downstepped (i.e., pronounced lower in pitch than the preceding high tone)³ or otherwise subdued.

- (4) ([[Sutanfôdo no KONPYÛTA o] tsukatta] koto wa aru
 ([Stanford GEN computer ACC] use-PAST] NML TOP exist-PRES
 kedo,) [[Sutanfôdo no KYANPASU e] itta] koto wa
 though) [[Stanford GEN campus LOC] go-PAST] NML TOP
 NAI.
 exist.NEG-PRES
 ‘(I’ve used a computer of Stanford University before, but) I’ve never visited
 the campus of Stanford.’

- (5) ([[Hanako no KAO ga] mieta] koto wa aru kedo,)
 ([Hanako GEN face NOM] be visible-PAST] NML TOP exist-PRES though)
 [[Hanako no KOE ga] kikoeta] koto wa ICHIDO mo
 ([Hanako GEN voice NOM] be audible-PAST] NML TOP once even
 nai.
 exist.NEG-PRES
 ‘(There has been a situation in which Hanako’s face was seen, but) there’s
 never been a situation in which Hanako’s voice was heard.’

In (4), the non-constituent *KYANPASU e itta* ‘went to the campus’ appears to be interpreted as contrasting with another non-constituent *KONPYÛTA o tsukatta* ‘used a computer’, and thus is arguably a non-constituent focus. Likewise, in (5), the non-constituent *KOE ga kikoeta* ‘voice was heard’ appears to be interpreted as contrasting with another non-constituent *KAO ga mieta* ‘face was seen’, and thus is arguably a non-constituent focus.⁴ What is to be noted here is that neither the verb *itta* in (4) nor the verb *kikoeta* in (5) is prosodically prominent, contrary to what Pulman’s theory leads us to expect; according to his theory, what looks like a non-constituent focus in (4) for instance is merely a sequence of a focused noun and a focused verb, so the verb is expected to be prosodically prominent as well as the noun, given the reasonable assumption that each focus must contain at least one prosodically prominent word.

contains a mora that is lexically linked to a high tone. See Pierrehumbert and Beckman (1988) and Kubozono (1993) for more information on this subject.

³See Pierrehumbert and Beckman (1988) and Kubozono (1993) for detailed discussion of downstep (which Pierrehumbert and Beckman refer to as catathesis).

⁴The particle *wa*, which we have glossed as TOP, is in fact functioning not as a topic marker but as a contrastive marker in these examples; for instance, in (4), the two phrases that are marked by *wa* (namely *Sutanfôdo no konpyûta o tsukatta koto* and *Sutanfôdo no kyanpasu e itta koto*) are being contrasted with each other. It seems reasonable to suppose that, in the terminology employed in Krifka (to appear), the phrases marked by the particle *wa* are functioning as “focus phrases”, as opposed to foci. We will ignore complications resulting from the presence of focus phrases in the rest of this paper, for the sake of simplicity.

A number of authors have expressed the view that it is possible for a focus to contain some elements that are contextually bound (“given”) and hence deaccented. If such a view is adopted, it becomes possible to analyze sentences like (4) and (5) in the following way: what is focused in (4) (or (5) respectively) is the VP *Sutanfôdo no kyanpasu e itta* as a whole (or the S *Hanako no koe ga kikoeta* as a whole) and the genitive phrase *Sutanfôdo no* (or *Hanako no*) is part of the focus, although it is contextually bound (“given”) and hence deaccented. We do not know whether Pulman would endorse such an analysis, but this seems to be one possible way to deal with the problematic examples within his theory.

However, we find such an analysis implausible, in light of observations like the following. Even in a context that makes Hanako salient, it is not possible to felicitously utter the unparenthesized portion of (5) if the whole S is to be interpreted as contrasting with an alternative which does not involve any direct or indirect reference to Hanako.

- (6) Hanako wa tonari no ie ni sunde iru. Mado ga aite iru koto wa yoku aru.
Demo, Hanako no koe ga kikoeta koto wa ichido mo nai.
(‘Hanako lives in the house next door. There have been many occasions when the window was open. But there has never been an occasion when Hanako’s voice was heard.’)

The last sentence in (6) is felicitous only if the noun *Hanako* is at least as prosodically prominent as the following noun *koe*, even though Hanako is a salient individual in the given context; the pronunciation indicated in (5) cannot be used in this context. This suggests that what is focused in (5) above is not the same as what is focused in the last sentence of (6). Since what is focused in the last sentence of (6) is arguably the S *Hanako no koe ga kikoeta* as a whole, this means that what is focused in (5) is not the S as a whole.

1.2 Schwarzschild (1999)

Schwarzschild (1999) presents a theory of focus that is based on a sophisticated notion of givenness. In his theory, an expression is considered to be given if there is something in the preceding discourse that corresponds either to that expression itself or to the result of replacing each focused element in that expression with some suitable alternative. Consider the example in (7).

- (7) “Did you go to New York?” “No, I went to [_F CHICAGO].”

In the second sentence in this discourse, the NP *Chicago* is focused, and not given. The PP containing that NP (i.e. *to Chicago*) counts as given, however, according to Schwarzschild’s definition, because replacing the focused element *Chicago* in this PP with a suitable alternative (*New York*) results in a PP (*to New York*) that is identical to the PP that is in the preceding sentence.

Schwarzschild assumes that each node in a syntactic tree is optionally associated with F-marking, and that F-marking is subject to the following set of violable constraints, ranked as shown in (10).

(8) GIVENness: A constituent that is not F-marked is given.

AVOIDF: Do not F-mark.

FOC: A Foc-marked phrase contains an accent.

HEADARG: A head is less prominent than its internal argument.

(9) A Foc-marked node is an F-marked node that is not immediately dominated by another F-marked node.

(10) { GIVENness, FOC } >> AVOIDF >> HEADARG

In Schwarzschild's theory, the second sentence in (11), for example, is dealt with in the following way.

(11) { What will they do if the American President resigns from the OSA? }
They'll [_F [_F nominate] the [_F FRENCH] President]

Within the VP in this sentence, the verb *nominate* and the adjective *French* are both F-marked, but only the latter is accented. This is because the latter is not immediately dominated by another F-marked node and is hence Foc-marked, and is required to contain an accent by FOC, whereas the former (*nominate*) is immediately dominated by an F-marked VP, and hence is not Foc-marked.

In Schwarzschild's theory, as in Pulman's theory, focus is always a syntactic constituent. Thus, in order to deal with example (4) within this theory, for instance, it is necessary to assume that what is focused in the sentence is the VP *Sutanfôdo no KYANPASU e itta* as a whole, and the phrase *Sutanfôdo no* is part of that focus, although it is given. As we stated in the previous subsection, we believe that there is a reason to be skeptical about such an assumption. Moreover, an analysis based on an assumption like this faces an additional problem when embedded within Schwarzschild's theory, if only because his theory is more explicit than Pulman's in the relevant domain. Consider the following example.

(12) — Kimi wa [[Naomi ga suki na] KARÊ o] tsukutta n
you TOP [[Naomi NOM fond COP] curry ACC] make-PAST NML
datte?
COP-COMP

— Ie, boku wa [[Naomi ga suki na] DÔYÔ o] utatta
no I TOP [[Naomi NOM fond COP] children's song ACC] sing-PAST
n desu.
NML COP

'Did you make the curry which Naomi likes?' 'No, I sang a children's song that Naomi likes.'

Intuitively, the non-constituent *DÔYÔ o utatta* seems to be functioning as focus, but suppose that the focus in the second sentence is in fact the VP *Naomi ga suki na DÔYÔ o utatta* as a whole and that the phrase *Naomi ga suki na*, which counts as given, is part of that focus. On such a supposition, the internal structure of that VP must be something like (13).

(13) [[[Naomi ga suki na] _[F DÔYÔ]] o] _[F utatta]]

It must be the case that the noun *DÔYÔ* and the verb *utatta*, and nothing else, is F-marked. What is of particular importance here is that the VP as a whole cannot be F-marked. This is because the VP counts as given, according to Schwarzschild's definition (and AVOIDF prevents an expression that counts as given from being F-marked unless some higher-ranking constraint demands that it be F-marked); it counts as given because the VP becomes identical to another VP in the discourse (*Naomi ga suki na karê o tsukutta*) when the two focused elements in it are replaced by *karê* and *tsukutta* respectively. This is problematic for the theory, for the following reason. Since the verb *utatta* is F-marked and is not immediately dominated by another F-marked node, it is Foc-marked and is required by the constraint FOC to contain a prosodically prominent element. Thus, Schwarzschild's theory predicts, wrongly, that the verb in an example of this type must be prosodically prominent.⁵

2 Compaction-driven meaning assembly

We believe that the facts that we have surveyed in section 1 call for a theory in which a non-constituent (in the morphosyntactic sense) is allowed to serve as a single focus, rather than merely as a sequence of two or more foci. If that is so, we need a theoretical framework in which what is not a morphosyntactic constituent can be given semantic interpretation.⁶ There are two theories of semantic composition that fit the bill: Combinatory Categorical Grammar (CCG), extensively discussed in Steedman (2000), and the version of linearization-based Head-Driven Phrase Structure Grammar (HPSG) proposed in Yatabe (2001). Both these theories embody the idea that semantic composition is carried out largely on the basis of prosodic, rather than syntactic, structure. In Steedman's theory, each sentence is associated with a single representation which closely resembles what is usually assumed to be its prosodic structure, and semantic interpretation is carried out according to that single representation. On the other hand, in Yatabe's theory, each sentence is associated with multiple representations, only one of which resembles what is usually assumed to be its prosodic structure, and semantic interpretation is carried out mainly on the basis of that structure. The theory can be seen as an attempt to capture Steedman's insights without denying the existence of what

⁵Krifka (in press) makes an analogous criticism of Schwarzschild's theory, using English examples that do not involve non-constituent focus.

⁶Artstein (2004) advocates a view similar to ours for focus below the word level but not for focus above the word level.

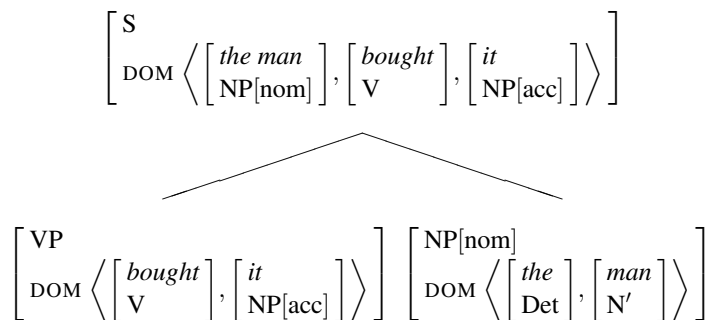


Figure 1: Total compaction of an NP

is widely assumed to be the morphosyntactic structure of each sentence. In the remainder of this paper, we rely on Yatabe’s theory of semantic composition, as we feel that CCG, though attractively simple, may not allow us to attain descriptive adequacy with regard to phenomena such as those discussed in Yatabe (2003). However, of the two theories, Steedman’s theory is clearly the more elegant, and it is entirely conceivable that a theory analogous to ours could be implemented within CCG as well.

Since the theory advanced in Yatabe (2001) builds on the theory of extraposition proposed in Kathol and Pollard (1995), we will sketch the latter theory before describing the former.

In Kathol and Pollard’s theory, the portion of a syntactic structure that determines grammatical dependency relations is represented by means of an unordered tree, that is, a tree with no specifications as to the ordering of its constituents. The information as to the linear order between the constituents is contained in what are called *order domains*, each of which is associated with a node in the unordered tree. An order domain is a list of *domain objects*, and is given as the value of the DOM feature. A domain object is very much like a sign; unlike a sign, however, it does not carry any information as to its internal morphosyntactic structure.

Let us take a concrete example. Figure 1 shows part of the structure assigned to the English sentence *The man bought it*. What is shown in this figure is an unordered tree. There is actually no linear precedence relation between the VP node and the NP node; we placed the VP node to the left of the subject NP node in order to underscore the insignificance of the apparent linear order between the two. The order domain (i.e. the DOM value) of the VP node consists of two domain objects, one that is pronounced *bought*, and the other one that is pronounced *it*. The order between these two domain objects *is* significant; it indicates that this VP is to be pronounced *bought it*, rather than *it bought*. Likewise, the order domain of the NP node tells us that this NP is to be pronounced *the man*, and the order domain of the S node tells us that the S node is to be pronounced *The man bought it*.

Let us take a closer look and see how the order domain of the S node is related to the order domains of the NP node and the VP node in Figure 1. The two domain objects in the order domain of the VP node are both integrated, unaltered, into

the order domain of the S node. Notice that the domain object that is pronounced *bought* precedes the domain object that is pronounced *it* in the order domain of the S as well as in the order domain of the VP. This is a consequence of the constraint given in (14) (see Kathol (1995)).

(14) The Persistence Constraint:

Any ordering relation that holds between domain objects α and β in one order domain must also hold between α and β in all other order domains that α and β are members of.

Next, let us see how the order domain of the NP is related to the order domain of the S in Figure 1. The order domain of the NP node contains two domain objects, but this NP node contributes to the order domain of the S node only one domain object, which is pronounced *the man*. What is at work here is an operation called *total compaction*. (15) illustrates the way the total compaction operation takes a sign and turns it into a single domain object.

$$(15) \left[\begin{array}{c} \alpha_0 \\ \text{DOM} \left\langle \left[\begin{array}{c} \beta_1 \\ \alpha_1 \end{array} \right], \dots, \left[\begin{array}{c} \beta_n \\ \alpha_n \end{array} \right] \right\rangle \end{array} \right] \Rightarrow \left[\begin{array}{c} \beta_1 \circ \dots \circ \beta_n \\ \alpha_0 \end{array} \right]$$

What is shown on the left of the arrow is the input to the operation; the input is a sign. The first line of a sign (“ α_0 ” in this case) is its SYNSEM value; the second line (“DOM ...”) shows what its order domain looks like. On the right of the arrow is shown the output of the operation; the output is a domain object. The first line of a domain object (“ $\beta_1 \circ \dots \circ \beta_n$ ” in this case) is its PHON value. (The small circle is an operator that concatenates strings.) The second line of a domain object (“ α_0 ” in this case) is its SYNSEM value.

The domain object that is created by totally compacting a sign X is placed in the order domain of the mother of X . In Figure 1, the domain object that is created by totally compacting the subject NP has been placed in the order domain of the S.

The order between the domain object that comes from the subject NP and the domain objects that come from the VP is determined by a linear precedence statement that states that a V must follow its subject in English. Although domain objects coming from two or more daughter nodes can be stringed together in any order as long as they do not violate any constraints explicitly stated in the grammar, the order between the three domain objects is completely determined in this case, due to the Persistence Constraint and the linear precedence statement concerning subject NPs.

So far, we have seen two processes whereby the order domain of a given node is integrated into that of its mother. First, a node can be totally compacted. Second, a node may undergo no compaction whatsoever. Henceforth we are going to describe the latter situation by saying that the node in question has been *liberated*. The VP in Figure 1 has been liberated.

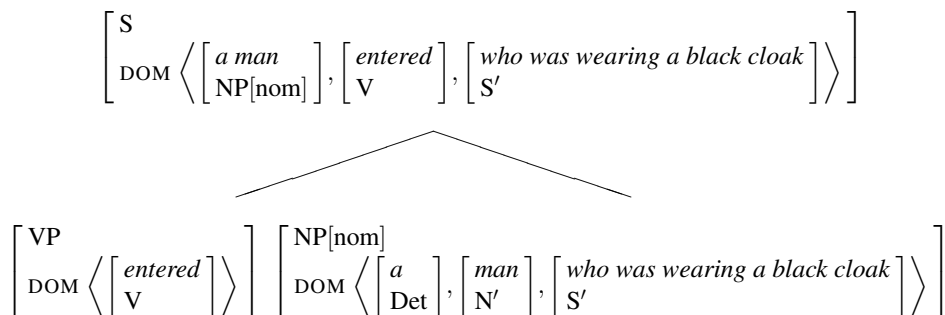


Figure 2: Partial compaction of an NP

There is a third process allowed by the theory: a given node can be *partially compacted*. Partial compaction takes a sign and turns it into one or more domain objects, as opposed to total compaction, which always produces a single domain object. (As will become clear shortly, total compaction can be seen as a special case of partial compaction.) (16) and (17) illustrate the way the partial compaction operation takes a sign and turns it into one or more domain objects, which are to be placed in the order domain of the mother of that sign.

(16) Partial compaction for head-first languages:

$$\left[\begin{array}{c} \alpha_0 \\ \text{DOM} \left\langle \left[\begin{array}{c} \beta_1 \\ \alpha_1 \end{array} \right], \dots, \left[\begin{array}{c} \beta_n \\ \alpha_n \end{array} \right] \right\rangle \end{array} \right] \Rightarrow \left[\begin{array}{c} \beta_1 \circ \dots \circ \beta_i \\ \alpha_0 \end{array} \right], \left[\begin{array}{c} \beta_{i+1} \\ \alpha_{i+1} \end{array} \right], \dots, \left[\begin{array}{c} \beta_n \\ \alpha_n \end{array} \right]$$

(17) Partial compaction for head-last languages:

$$\left[\begin{array}{c} \alpha_0 \\ \text{DOM} \left\langle \left[\begin{array}{c} \beta_1 \\ \alpha_1 \end{array} \right], \dots, \left[\begin{array}{c} \beta_n \\ \alpha_n \end{array} \right] \right\rangle \end{array} \right] \Rightarrow \left[\begin{array}{c} \beta_1 \\ \alpha_1 \end{array} \right], \dots, \left[\begin{array}{c} \beta_{i-1} \\ \alpha_{i-1} \end{array} \right], \left[\begin{array}{c} \beta_i \circ \dots \circ \beta_n \\ \alpha_0 \end{array} \right]$$

In (16), the DOM value of the sign that is fed to the operation as the input has n domain objects in it. Of those domain objects, the first (i.e. leftmost) i domain objects are bundled together and turned into a single domain object, while the remaining domain objects, if any, are left out of the bundle and continue to be separate domain objects. (17) is a mirror image of (16). Roughly speaking, partial compaction of a sign α is achieved by first obtaining a sign α' by deleting a certain number of domain objects in the DOM value of α (the rightmost $n - i$ domain objects in the case of (16) and the leftmost $i - 1$ domain objects in the case of (17)) and then totally compacting α' .

Various types of extraposition constructions result when an expression is partially compacted and surfaces as a discontinuous constituent. Figure 2 shows how the English extraposition construction can be generated via partial compaction. Here, the subject NP has been partially compacted. The relative clause has been left out of the bundle and appears in the sentence-final position. What puts the relative clause in this particular position is an English-particular linear precedence statement, which we do not formulate in this paper.

We assume that the compaction operation is applied in accordance with the constraints given in (18) (see Yatabe (2001)).

- (18) a. In a head-complement structure whose head is verbal, the head is liberated and the non-head is partially compacted.
- b. In a head-adjunct structure whose head is verbal, the head and the adjunct are both partially compacted.
- c. In a headed structure whose head is nominal and whose non-head is not a marker, the head is totally compacted and the non-head is partially compacted.
- d. In a head-marker structure, the head and the marker are both liberated.
- e. In a coordinate structure, each of the conjuncts is totally compacted.

On these assumptions, domain objects turn out to correspond rather closely to what have been identified as prosodic constituents in the relevant literature.

We are now in a position to describe the theory of semantic composition presented in Yatabe (2001). The key idea of this theory is that domain objects, and not signs (i.e. morphosyntactic constituents), are the principal carriers of semantic information and that semantic composition (including ‘quantifier retrieval’) takes place not when some signs are syntactically combined to produce a new, larger sign but when some domain objects are bundled together by the compaction operation to produce a new domain object. In order to implement this idea, the framework of Minimal Recursion Semantics (MRS) (Copestake et al. (1999)) is adopted, and the *total compaction* operation is redefined as in (19).

$$\begin{array}{l}
 (19) \quad \left[\begin{array}{l}
 \text{sign} \\
 \text{SYNSEM} \left[\begin{array}{l}
 \text{CAT} \quad \boxed{3} \quad \text{[TO-BE-STORED} \quad \boxed{4}] \\
 \text{CONT} \left[\begin{array}{l}
 \text{LTOP} \quad \boxed{0} \\
 \text{INDEX} \quad \boxed{1} \\
 \text{SEMHEAD} \quad \boxed{2} \\
 \text{EP} \quad \boxed{a_0} \\
 \text{H-CONS} \quad \boxed{b_0} \\
 \text{H-STORE} \quad \boxed{c_0}
 \end{array} \right] \\
 \text{PHON} \quad \boxed{d_1}
 \end{array} \right] \\
 \text{DOM} \left\langle \left[\begin{array}{l}
 \text{SYNSEM|CONT} \left[\begin{array}{l}
 \text{EP} \quad \boxed{a_1} \\
 \text{H-CONS} \quad \boxed{b_1} \\
 \text{H-STORE} \quad \boxed{c_1}
 \end{array} \right] \\
 \text{PHON} \quad \boxed{d_1}
 \end{array} \right], \dots, \left[\begin{array}{l}
 \text{SYNSEM|CONT} \left[\begin{array}{l}
 \text{EP} \quad \boxed{a_n} \\
 \text{H-CONS} \quad \boxed{b_n} \\
 \text{H-STORE} \quad \boxed{c_n}
 \end{array} \right] \\
 \text{PHON} \quad \boxed{d_n}
 \end{array} \right] \right\rangle
 \end{array} \right] \\
 \Rightarrow \left[\begin{array}{l}
 \text{dom-obj} \\
 \text{PHON} \quad f(\boxed{d_1}, \dots, \boxed{d_n}) \\
 \text{SYNSEM} \left[\begin{array}{l}
 \text{CAT} \quad \boxed{3} \\
 \text{CONT} \left[\begin{array}{l}
 \text{LTOP} \quad \boxed{0} \\
 \text{INDEX} \quad \boxed{1} \\
 \text{EP} \quad \boxed{a_0} \oplus \dots \oplus \boxed{a_n} \\
 \text{H-CONS} \quad \boxed{b_0} \cup \dots \cup \boxed{b_n} \cup \{ \boxed{0} \geq \{ \boxed{2} \} \uplus \boxed{c_0} \uplus \dots \uplus \boxed{c_n} \} \\
 \text{H-STORE} \quad \boxed{4}
 \end{array} \right]
 \end{array} \right]
 \end{array} \right]
 \end{array}
 \end{array}$$

The definition in (19) is admittedly somewhat complicated, and we have to refer the reader to Yatabe (2001) for a full explication of its details. Fortunately, in this paper, we can all but ignore all the CONT features except EP and INDEX, since the CONT features other than EP and INDEX are there to determine the semantic scope of things like quantifiers in an appropriate manner and determination of scope is not one of the main issues that we are concerned with in the present paper. The feature EP is essentially what is called RESTR in Sag et al. (2003), and corresponds to what is called LZT in Copestake et al. (1999); the value of this feature is the list of *elementary predications* that make up the meaning of a given linguistic unit, be it a sign or a domain object. The feature INDEX in the proposed theory plays the same role as it does in Sag et al. (2003), and is assumed to be subject to what is called the Semantic Inheritance Principle in Sag et al. (2003).

If we pay attention only to the EP feature, it is apparent that the definition of total compaction above closely resembles what is called the Semantic Compositionality Principle in Sag et al. (2003). The Semantic Compositionality Principle states that the RESTR value of a phrase must be the concatenation of the RESTR values of its daughters. (19) above states, roughly, that the EP value of a domain object that results from totally compacting a sign α must be the concatenation of the EP values of the domain objects inside the order domain of α .⁷

Partial compaction of a sign α is, again, assumed to be achieved by first obtaining a sign α' by deleting a certain number of domain objects (the rightmost one(s) in the case of head-first languages like English) in the DOM value of α and then totally compacting α' . For example, in the structure depicted in Figure 2, partial compaction of the subject NP can be seen as involving the following ‘steps’. First, the rightmost domain object in the order domain of the subject NP, namely the domain object that is to be pronounced *who was wearing a black cloak*, is deleted. This gives us a sign like (20).

$$(20) \left[\begin{array}{l} \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad \text{NP[nom]} \\ \text{CONT} \left[\begin{array}{l} \text{INDEX} \quad \boxed{3} \\ \text{EP} \quad \langle \rangle \end{array} \right] \end{array} \right] \\ \text{DOM} \quad \left\langle \left[\begin{array}{l} \text{PHON} \quad a \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad \text{Det} \\ \text{CONT|EP} \quad \langle \boxed{1} \rangle \end{array} \right] \end{array} \right], \left[\begin{array}{l} \text{PHON} \quad \textit{man} \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad \text{N'} \\ \text{CONT|EP} \quad \langle \boxed{2} \rangle \end{array} \right] \end{array} \right] \right\rangle \end{array} \right]$$

Second, this sign undergoes total compaction, and is turned into a domain object like (21), which is to be placed in the order domain of the mother node together with the domain object that was deleted in the first ‘step’ as well as the domain object that comes from the VP node.

⁷To be more precise, (19) says that the EP value of a domain object that results from totally compacting a sign α must be the concatenation of the EP value of α itself and the EP values of the domain objects inside the order domain of α . In the theory under discussion, the EP value of a sign ($\overline{a_0}$ in (19)) is assumed to represent only constructional meaning, that is, meaning that is expressed not by individual words but by grammatical constructions. In the present paper, we make reference to constructional meaning only in (27).

$$(21) \left[\begin{array}{l} \text{PHON} \quad a \text{ man} \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad \text{NP[nom]} \\ \text{CONT} \left[\begin{array}{l} \text{INDEX} \quad \boxed{3} \\ \text{EP} \quad \langle \boxed{1}, \boxed{2} \rangle \end{array} \right] \end{array} \right] \end{array} \right]$$

In (20) and (21), the referent of $\boxed{1}$ is something like (22a) and the referent of $\boxed{2}$ is something like (22b). They are the semantic contributions of the word *a* and the word *man* respectively.

$$(22) \text{ a. } \left[\begin{array}{l} \text{HNDL} \quad \boxed{4} \\ \text{RELN} \quad a \\ \text{BV} \quad \boxed{5} \\ \text{RESTR} \quad \boxed{6} \\ \text{BODY} \quad \boxed{7} \end{array} \right] \quad \text{b. } \left[\begin{array}{l} \text{HNDL} \quad \boxed{6} \\ \text{RELN} \quad \textit{man} \\ \text{INST} \quad \boxed{5} \end{array} \right]$$

It is assumed in this theory that the root node of a sentence always undergoes total compaction to produce a single domain object corresponding to the entire sentence. This assumption is necessary to ensure that the meaning of the root node is in fact computed. For instance, the root node of the tree shown in Figure 2 has three domain objects in its order domain, each with its own interpretation (not shown in the figure), but none of these three domain objects represents the meaning of the entire sentence. The meaning of the sentence as a whole is represented only by the SYNSEM|CONT(ENT) value and the SYNSEM|CONTEXT value of the domain object that is obtained by totally compacting the root node.

In the proposed theory, it is not signs but domain objects that are assigned interpretation; domain objects, but not signs, are associated with CONT values that can be said to represent their meaning. Since domain objects are essentially prosodic constituents and do not necessarily correspond to morphosyntactic constituents because of the possibility of partial compaction, it follows that it is possible in this theory for a string that is not a morphosyntactic constituent to be assigned interpretation. It is this feature of the theory that we are going to exploit in the next section.

3 An MRS-based theory of focus

In this section, we will use the theoretical machinery just described to construct a theory of focus that is capable of dealing with non-constituent focus. We will achieve this goal by incorporating into our theory a version of the Structured Meaning approach to the interpretation of focus (see Krifka (in press) and the references cited there).

We propose to enrich the CONT values of domain objects with two new features, FOCI and PROMINENCE (FOC and PROM for short). The FOC value of a domain object is a set whose members are the EP values of all the foci that are contained in that domain object. PROM is a binary-valued feature that is used to

deal with focus projection; a domain object is marked as +PROM if and only if (i) it contains (or is) a prosodically prominent element and (ii) it is a part of a focus but is not a focus in itself. (33) and (34) in the Appendix state the constraints that implement what has just been said about these two features.

In the case of an example like (23), the FOC value of the domain object corresponding to the entire sentence will be something like (24), if focus projection does not take place at all; it is a set consisting of two members, the EP value of the first focus *Paris* and the EP value of the second focus *hates*.

(23) George only likes PARIS and he HATES New York.

$$(24) \left\{ \left\langle \left[\begin{array}{l} \text{HNDL} \boxed{1} \\ \text{RELN} \textit{Paris} \\ \text{INST} \boxed{2} \end{array} \right] \right\rangle, \left\langle \left[\begin{array}{l} \text{HNDL} \boxed{3} \\ \text{RELN} \textit{hate} \\ \text{HATER} \boxed{4} \\ \text{HATED} \boxed{5} \end{array} \right] \right\rangle \right\}$$

Likewise, if focus projection takes place only in the first conjunct and the pitch accent on *Paris* is taken to focus the VP *likes Paris*, then the FOC value of the domain object corresponding to (23) as a whole will be something like (25), a set consisting of the EP value of the first focus *likes Paris* and the EP value of the second focus *hates*.

$$(25) \left\{ \left\langle \left[\begin{array}{l} \text{HNDL} \boxed{6} \\ \text{RELN} \textit{like} \\ \text{LIKER} \boxed{7} \\ \text{LIKED} \boxed{2} \end{array} \right] \right\rangle, \left\langle \left[\begin{array}{l} \text{HNDL} \boxed{1} \\ \text{RELN} \textit{Paris} \\ \text{INST} \boxed{2} \end{array} \right] \right\rangle, \left\langle \left[\begin{array}{l} \text{HNDL} \boxed{3} \\ \text{RELN} \textit{hate} \\ \text{HATER} \boxed{4} \\ \text{HATED} \boxed{5} \end{array} \right] \right\rangle \right\}$$

We follow Pulman (1997) in assuming that focus-sensitive operators such as *only* and *even* take the following two arguments: (i) a list of focused elements that are to be interpreted in association with the operator, and (ii) what the meaning of the scope of that operator would have been if the focused elements that are to be interpreted in association with that operator had not been focused (see subsection 1.1 above). We represent these two arguments as the values of the ASSOCIATED-FOCI (A-FOC) feature and the SCOPE feature respectively inside elementary predications corresponding to focus-sensitive operators. In such an approach, we need to have a mechanism that ensures that each focus-sensitive operator is correctly associated with those focused elements that are to be interpreted in association with it, and another mechanism that ensures that each focus-sensitive operator is correctly linked to its scope. We will specify these mechanisms next, starting with the latter.

Unlike the scope of a quantifier, the scope of a focus-sensitive operator such as *only* is rigidly fixed; the scope of a focus-sensitive adverb like *only* and *even* is arguably always the meaning of its sister node, and the scope of an illocutionary operator like the assertion operator *assert* (see Krifka (1991)) is the meaning of the clausal node at which the operator is introduced. These constraints can be enforced via the canonical HPSG machinery. For instance, a lexical entry like (26)

is sufficient to ensure that focus-sensitive adverbs are assigned the correct scope. LTOP, one of the CONT features that we ignored in section 2, provides a label (a ‘handle’) by which to refer to the meaning of a sign or a domain object. Thus, the identity requirement indicated by $\boxed{1}$ in (26) forces the scope of the word *only* (i.e. its SYNSEM|CONT|EP|FIRST|SCOPE value) to be the meaning of the VP that it modifies.

$$(26) \left[\begin{array}{l} \text{SYNSEM} \\ \text{PHON} \end{array} \left[\begin{array}{l} \text{CAT|VALENCE|MOD} \left\langle \left[\begin{array}{l} \text{CAT} \\ \text{CONT|LTOP} \end{array} \right] \right\rangle \\ \text{CONT|EP} \left\langle \left[\begin{array}{l} \text{RELN } \textit{only} \\ \text{A-FOC } \boxed{F1} \\ \text{SCOPE } \boxed{1} \end{array} \right] \right\rangle \end{array} \right] \right]$$

Likewise, the assertion operator *assert* can be assigned the correct scope by a unary rule like (27).

$$(27) \left[\begin{array}{l} \text{SYNSEM} \\ \text{DOM} \end{array} \left[\begin{array}{l} \text{CAT} \boxed{1} \\ \text{CONT} \left[\begin{array}{l} \text{LTOP} \boxed{3} \\ \text{INDEX} \boxed{4} \\ \text{EP} \left\langle \left[\begin{array}{l} \text{HNDL} \boxed{3} \\ \text{RELN } \textit{assert} \\ \text{A-FOC} \boxed{F2} \\ \text{SCOPE} \boxed{2} \end{array} \right] \right\rangle \\ \text{MODE } \textit{assertion} \end{array} \right] \end{array} \right] \right] \rightarrow \left[\begin{array}{l} \text{SYNSEM} \\ \text{CAT} \boxed{1} \text{S} \\ \text{CONT} \left[\begin{array}{l} \text{LTOP} \boxed{2} \\ \text{INDEX} \boxed{4} \\ \text{MODE } \textit{proposition} \end{array} \right] \end{array} \right]$$

Condition: $\boxed{5}$ is a result of partially compacting the sole daughter.

The identity requirement indicated by $\boxed{2}$ forces the scope of the assertion operator (the SYNSEM|CONT|EP|FIRST|SCOPE value associated with the mother node) to be the meaning of the sole daughter node, which is required to be an S node. In the case of (23), there are three S nodes at which the assertion operator can be introduced: the root node, the first conjunct, and the second conjunct. We are not certain whether introduction of the assertion operator is entirely optional at each S node or not, but here we assume that it is, for the sake of concreteness.

As a mechanism for ensuring appropriate association between foci and focus-sensitive operators, we suggest the following. The MRS-based semantic representation of an utterance (namely the CONT value of the domain object obtained by totally compacting the entire sentence) leaves the association between foci and focus-sensitive operators completely unspecified. Thus, in the proposed theory (as in many other theories that incorporate the idea of underspecified semantic representations), each semantic representation corresponds not just to a single interpretation of a given sentence but rather to a set of its possible interpretations. The set

of possible interpretations of a given sentence is computed from its underspecified semantic representation in accordance with the constraints given in (28).

- (28) a. Every focus-sensitive operator must be associated with one or more foci, and every focus must be associated with a focus-sensitive operator.
- b. A focus can be associated with a focus-sensitive operator only if it is within the scope of that focus-sensitive operator.

Both (28a) and (28b) are stated in informal terms, and need some further elaboration. (28a) presupposes that it is possible to identify focus-sensitive operators in a given semantic representation. In order to make this possible, we assume that only elementary predications corresponding to focus-sensitive operators have the A-FOC feature. Given that assumption, (28a) can be construed as requiring each A-FOC feature to be linked to one or more of the foci contained in a sentence. (28b) as it stands may seem somewhat vague because the phrase *within the scope of* has not been given a definition. The phrase is intended to mean what it means in the case of the more traditional types of semantic representation. A more precise definition of the phrase is given in (36) in the Appendix.

We will illustrate the way these constraints work in the case of example (23). Let us assume that no focus projection has taken place, and that the FOC value of the entire sentence is therefore something like (24). Let us also assume that the assertion operator has been introduced at the second S node and nowhere else. In that case, we have two foci and two focus-sensitive operators in the semantic representation of the sentence. Although the semantic representation does not indicate which focus is associated with which focus-sensitive operator, the constraints in (28) entail that there is only one possible way to link the foci and the operators. Due to (28a), we know that each operator needs to be associated with exactly one focus in the present case. Furthermore, (28b) does not allow the focus *Paris* to be associated with the assertion operator which takes the second S as its scope, as the focus is not within that scope. The two constraints are satisfied if and only if *Paris* is associated with *only* and *hates* is associated with the assertion operator.⁸ A similar result will follow if we assume that the assertion operator is introduced at the root node and nowhere else. If the assertion operator is introduced in any other way, the resultant semantic representation will have no possible interpretation, and the representation will be ruled out as ill-formed.

Let us see what interpretations the proposed theory assigns to sentences containing foci. We will take the second conjunct of (23) (*he HATES New York*) as an example. As shown at length in Rooth (1992), the truth condition of a sentence containing foci can be determined only relative to what alternatives the foci are interpreted as contrasting with. Supposing that the focus *hates* (the second member

⁸The HNDL value of the proper noun *Paris* must be allowed to be different from the top handle of the entire sentence. If the HNDL value of a proper noun is always required to be the same as the top handle of the whole sentence, a focused proper noun will never be able to be within the scope of any focus-sensitive operator.

in (24) as well as in (25)) is interpreted as contrasting with something like (29) (and supposing also (i) that the assertion operator is interpreted roughly as in Pulman (1997) and (ii) that all underspecifications are resolved before foci are interpreted), the interpretation of the clause is predicted to be something like “The proposition that he hates New York, as opposed to the proposition that he likes it, is true”, which is arguably what the clause actually means in (23).

$$(29) \left\langle \begin{bmatrix} \text{HNDL} & \boxed{3} \\ \text{RELN} & \textit{like} \\ \text{LIKER} & \boxed{4} \\ \text{LIKED} & \boxed{5} \end{bmatrix} \right\rangle$$

However, here we encounter a problem. Nothing in the theory ensures that the “correct” alternative shown in (29) is properly made salient by the context. For instance, nothing in the theory as it stands prevents the focus *hates* from being interpreted as contrasting with (30) instead of (29).

$$(30) \left\langle \begin{bmatrix} \text{HNDL} & \boxed{3} \\ \text{RELN} & \textit{hate} \\ \text{HATER} & \boxed{4} \\ \text{HATED} & \boxed{2} \end{bmatrix} \right\rangle$$

Since the indices $\boxed{4}$ and $\boxed{2}$ refer to George and to Paris respectively, (30) carries the meaning of George hating Paris. Consequently, if *hates* in the second clause of (23) is interpreted as contrasting with this alternative, the interpretation of the clause will end up being something like “The proposition that George hates New York, as opposed to the proposition that he hates Paris, is true”. This interpretation is a possible interpretation of a sentence like *George hates NEW YORK*, but it is not a possible interpretation of the clause under discussion, where it is not the object NP but the transitive verb that is under focus.

In order to circumvent this problem and some other related problems, we introduce two constraints on the kinds of alternatives that a focus can be contrasted with. One is stated in (31) below and the other is stated in (37) in the Appendix. (We defer stating the latter constraint until the Appendix because it makes reference to aspects of MRS that we chose not to introduce in section 2.)

- (31) Suppose that a focus X , which is a non-empty list of elementary predications, is to be interpreted as contrasting with another non-empty list of elementary predications, Y . Then any tag that appears both in an elementary predication inside X and in an elementary predication outside X must appear in one or more elementary predications inside Y .

According to this constraint, (30) is not a valid alternative to the second member of (24) because it does not contain the tag $\boxed{5}$. Notice that, in the MRS representation of the meaning of (23), $\boxed{5}$ appears both in an elementary predication that comes

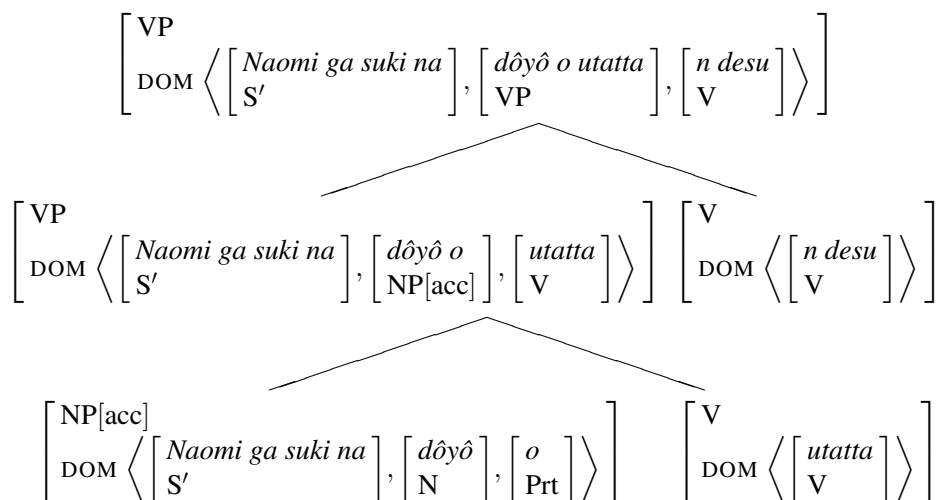


Figure 3: One possible structure of part of (12)

from the focused verb and in the elementary predication that comes from the object NP *New York*.

Furthermore, we assume that no two NPs are assigned the same index; even a reflexive pronoun and its antecedent must be given different indices in our theory. We assume that what is achieved by coindexation in other theories is achieved by introducing into meaning representations (into the `SYNSEM|CONTEXT` values of domain objects corresponding to pronouns, more specifically) statements to the effect that an index α and another index β are to be mapped to the same object by every value assignment function. This assumption enables our theory to deal with an example like the following, where a reflexive pronoun is focused. If it were not for this assumption, the verb *criticized* would contribute to the MRS representation of the second sentence as a whole an elementary predication that says “He criticized himself”, and that would rigidly fix the meaning of the sentence no matter what alternative is substituted for the elementary predication that comes from the object NP *himself*.

(32) John didn’t criticize Thomas. He criticized HIMSELF.

We finally come back to the issue of non-constituent focus. In the proposed account, the value of the `FOC` feature is a set consisting of the `EP` values of domain objects. Domain objects are prosodic constituents, and do not necessarily correspond to morphosyntactic constituents, due to the possibility of partial compaction. Therefore the theory entails that a string can be focused even if it does not form a morphosyntactic constituent, as long as it forms a prosodic constituent. Thus, the theory has no difficulty handling cases like (4), (5), and (12). Here we use (12) to illustrate the way the theory handles non-constituent focus. Figure 3 shows one possible structure of the VP *Naomi ga suki na dôyô o utatta* in (12). Note how repeated applications of partial compaction give rise to a domain object

pronounced *dôyô o utatta*, which does not correspond to any morphosyntactic constituent. When the noun *dôyô* is prosodically prominent, this domain object as a whole can be interpreted as a single focus, as a result of focus projection.

4 Conclusion

In this paper, we have argued, mainly on the basis of Japanese data, that we need to have a theory of focus in which a non-constituent (in the morphosyntactic sense) is allowed to serve as a single focus, rather than merely as a sequence of two or more foci, and then presented such a theory within the framework of linearization-based HPSG. In the proposed theory, prosodic constituents (domain objects), rather than morphosyntactic constituents (signs), are claimed to be the principal carriers of semantic information, and meaning assembly is carried out on the basis of prosodic, rather than syntactic, structure. This theory, if correct, means that there is a certain dissociation between the morphosyntactic structure of a sentence and the way the meaning of the sentence is assembled. Thus, to the extent that morphosyntactic structure is viewed as “the way the parts of a sentence are put together”, the theory is inconsistent with the principle of compositionality, which states that the meaning of a complex expression is a function of the meaning of its parts and the way they are put together; in order to maintain the principle of compositionality, we need to regard prosodic constituents, as opposed to morphosyntactic constituents, as building blocks of sentence meanings.

Appendix

(33) and (34) state the constraints that govern the FOC value and the PROM value of a domain object.⁹ The term *d-argument*, used in (34), is defined in (35). The details of these definitions apply only to Japanese, and are not meant to be universal.

- (33) Suppose that a domain object d is a member of the order domain of a word (i.e. a leaf node in a syntactic tree).
- a. If the word is not prosodically prominent, then the FOC value of d is an empty set and the PROM value of d is $-$.
 - b. If the word is prosodically prominent, then either
 - i) the FOC value of d is a set whose sole member is identical to the EP value of d , and the PROM value of d is $-$, or
 - ii) the FOC value of d is an empty set and the PROM value of d is $+$.

- (34) Suppose that a sign whose order domain is $\langle d_1, \dots, d_n \rangle$ has undergone total compaction to produce a new domain object d_0 , that the FOC value of d_i

⁹What is stated in (34) can, and probably should, be incorporated into the definition of the total compaction operation.

($0 \leq i \leq n$) is F_i (when defined), that the PROM value of d_i ($0 \leq i \leq n$) is P_i (when defined), and that the EP value of d_0 is M .

- a. If $P_1 = \dots = P_n = -$, then $F_0 = F_1 \cup \dots \cup F_n$ and $P_0 = -$.
- b. If $n = 2$, d_1 is a d-argument of d_2 , $P_1 = +$, and $P_2 = -$, then either
 - i) $F_0 = F_1 \cup F_2 \cup \{M\}$ and $P_0 = -$, or
 - ii) $F_0 = F_1 \cup F_2$ and $P_0 = +$.
- c. Otherwise, the FOC value and the PROM value of d_0 are undefined (and the given structure is therefore ill-formed).

(35) A domain object X is a *d-argument* of another domain object Y if and only if

- a. The SYNSEM|CAT|HEAD value of X is token-identical to the CAT|HEAD value of a member of a VALENCE list (either the COMPS list or the SUBJ list) of Y , and
- b. the PHON value of Y does not contain more than one prosodic word.

The following is the definition of the phrase *within the scope of*, used in (28b).

(36) A focus X , which is a non-empty list of elementary predications $\langle x_1, \dots, x_n \rangle$ ($n \geq 1$), is *within the scope of* a focus-sensitive operator Y if and only if for each i ($1 \leq i \leq n$), the HNDL value of x_i is identical to or outscoped by the SCOPE value of Y .

The following is the second of the two constraints on the kinds of alternatives that a focus can be contrasted with. (The first one is stated in (31).)

(37) Suppose that a focus X , which is a non-empty list of elementary predications, is to be interpreted as contrasting with another non-empty list of elementary predications, Y . Then none of the HNDL values of the elementary predications inside Y can be a handle h such that (i) h is not the HNDL value of any of the elementary predications in X and (ii) h is the HNDL value of an elementary predication outside X .

References

- Artstein, Ron. 2004. Focus Below the Word Level. *Natural Language Semantics* 12(1), 1–22.
- Copestake, Ann, Flickinger, Dan, Sag, Ivan A. and Pollard, Carl. 1999. Minimal Recursion Semantics: An Introduction. Ms., Stanford University.
- Kathol, Andreas. 1995. *Linearization-Based German Syntax*. Ph.D.thesis, Ohio State University, Columbus.

- Kathol, Andreas and Pollard, Carl. 1995. Extraposition via Complex Domain Formation. In *33rd Annual Meeting of the Association for Computational Linguistics*, pages 174–180, San Francisco: Morgan Kaufmann.
- Krifka, Manfred. 1991. A Compositional Semantics for Multiple Focus Constructions. In Steven Moore and Adam Zachary Wyner (eds.), *Proceedings of the First Semantics and Linguistic Theory Conference*, pages 127–158, Ithaca: Cornell Working Papers in Linguistics.
- Krifka, Manfred. in press. The Semantics of Questions and the Focussation of Answers. In Chungmin Lee, Matthew Gordon and Daniel Büring (eds.), *Topic and Focus: A Cross-Linguistic Perspective on Intonation and Meaning*, pages 139–151, Dordrecht: Kluwer Academic Publishers.
- Krifka, Manfred. to appear. Association with Focus Phrases. In Valerie Molnar and Susanne Winkler (eds.), *Architecture of Focus*, Berlin: Mouton de Gruyter.
- Kubozono, Haruo. 1993. *The Organization of Japanese Prosody*. Tokyo: Kuroshio.
- Pierrehumbert, Janet and Beckman, Mary. 1988. *Japanese Tone Structure*. Cambridge, Mass.: MIT Press.
- Pulman, Stephen G. 1997. Higher Order Unification and the Interpretation of Focus. *Linguistics and Philosophy* 20, 73–115.
- Rooth, Mats. 1992. A Theory of Focus Interpretation. *Natural Language Semantics* 1, 75–116.
- Sag, Ivan A., Wasow, Thomas and Bender, Emily M. 2003. *Syntactic Theory: A Formal Introduction*. Stanford: CSLI, second edition.
- Schwarzschild, Roger. 1999. Givenness, AvoidF and Other Constraints on the Placement of Accent. *Natural Language Semantics* 7, 141–177.
- Steedman, Mark. 2000. *The Syntactic Process*. Cambridge, Mass.: MIT Press.
- Yatabe, Shûichi. 1999. Particle Ellipsis and Focus Projection in Japanese. In *Language, Information, Text*, volume 6, pages 79–104, Department of Language and Information Sciences, University of Tokyo.
- Yatabe, Shûichi. 2001. The Syntax and Semantics of Left-Node Raising in Japanese. In Dan Flickinger and Andreas Kathol (eds.), *Proceedings of the 7th International Conference on Head-Driven Phrase Structure Grammar*, pages 325–344, Stanford: CSLI, <http://csli-publications.stanford.edu/HPSG/>.
- Yatabe, Shûichi. 2003. A Linearization-Based Theory of Summative Agreement in Peripheral-Node Raising Constructions. In Jong-Bok Kim and Stephen Wechsler (eds.), *Proceedings of the 9th International Conference on Head-Driven Phrase Structure Grammar*, pages 325–344, Stanford: CSLI, <http://csli-publications.stanford.edu/HPSG/>.