

Optimization in Focus Identification¹

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Abstract

This paper investigates which factors are involved in the identification of the focused expression with which a focus particle associates. If a hearer wishes to interpret a sentence containing a focus particle, one of the things she must do is identify the focused expression. In this paper it is argued that the identification of this focused expression is subject to interacting and violable constraints. These constraints are not only syntactic in nature but also prosodic and semantic. It is hypothesized that the focused expression is not identified via a strictly compositional mechanism but rather through a mechanism of optimization. This accounts for the observation that prosodic properties of the sentence can affect quantificational structure more or less independently of the syntactic structure of the sentence. The proposed optimality theoretic account of focus identification also yields an explanation for the well-known observation that the focus-sensitive determiner *only* appears not to be conservative.

1. Association with focus

Let us first define what exactly must be understood by the theoretical notion of focus. Although we are concerned here with bound focus only (i.e., the focus with which a focus particle associates, in the terminology of Jackendoff (1972)), bound focus and free focus are traditionally considered to be essentially the same phenomenon. The dominant view seems to be that focus (bound or free) is an abstract feature on syntactic phrases which is marked by prosodic prominence.² This abstract focus feature has certain effects either in semantics or in pragmatics, depending on the exact theoretical position. A grammaticized account of focus such as the structured meaning approach (e.g., von Stechow, 1991; Krifka, 1991) puts much of focus into syntax and semantics. Degrammaticized accounts of focus such as the alternative semantics approach of Rooth (1992) or the approach of von Stechow (1994), on the other hand, remove focus from the grammar and place it in pragmatics. Under a pragmatic approach, focus is assumed to signal the presence in the context of a certain kind of presupposition, to which focus particles might be anaphorically or presuppositionally related.

Although focus is generally assumed to be marked by prosodic prominence, at the same time it is widely acknowledged that prosodic prominence does not clearly identify and delimit the focus (König, 1991). As an illustration, consider (1) and (2). In these two dialogues, the answers (A) are completely identical. Emphatic stress falls on the direct object (as is indicated by small capitals). However, in (1) focus is generally assumed to be on the direct object *a watch*, whereas in (2) it is assumed to be on the

verb phrase *bought a watch*. These different focus assignments are the result of the questions that the sentence provides an answer to. So rather than unambiguously marking the focus, emphatic stress appears to be merely one of the factors involved in marking the focus.

- (1) Q: What did Mary buy?
A: Mary only bought a WATCH
- (2) Q: What did Mary do?
A: Mary only bought a WATCH

In these sentences, focus is determined on the basis of the linguistic context. In fact, Wh-interrogatives are often used as a test for determining the focus of a given sentence in context. With regard to this test, the focus of a sentence can be defined as that part of the sentence that corresponds to the Wh-phrase in an interrogative to which it provides an appropriate answer. However, this test does not always give us the right result. Consider the following dialogue:

- (3) Q: Who only bought a watch?
A: MARY only bought a watch

Here, the subject *Mary* provides the answer to the preceding question. Although *Mary* might be considered the focus of the entire sentence, it cannot be interpreted as the focus with which *only* associates. Because focus is not always formed by the new information in the sentence, as the dialogue (3) illustrates, context is not able to identify focus correctly in all cases.

More importantly, perhaps, the dialogue in (3) shows that there is no direct tie between emphatic stress and focus. Whereas focus may be on the direct object *a watch* or on the VP *bought a watch* in the answer in (3), the element bearing the main stress of the clause is an entirely different constituent, namely the subject. These cases of so-called second occurrence focus (see, e.g., Partee, 1999) are highly problematic for any theory of focus that assumes focus to be determined mainly by sentence accent, that is, for almost every current theory of bound focus.

Now let us look at syntactic structure. Would it be possible to define focus in terms of syntactic structure, for example, as the material with which the focus particle combines? The generally accepted view is that this is not the case. In (1), the focus particle combines with the VP *bought a watch*, but nevertheless focus is assumed to be on the noun phrase only. Syntactic structure is not able to distinguish between noun phrase focus in (1) and verb phrase focus in (2). But note that if *only* precedes the subject, as in (4), no amount of emphasis on *a watch* will allow us to interpret *a watch* as the focus of *only*.

- (4) Only Mary bought a watch

Apparently, then, syntactic structure restricts the set of possible foci. However, like prosodic prominence and linguistic context, it does not seem to unambiguously identify the focus.

2. Focus as a semantic property of focus particles

If it is impossible to define the focus in focus particle constructions in terms of either prosodic, pragmatic or syntactic properties, how should we define focus then? The view that is adopted in this paper is that the focus with which a focus particle associates must be understood as a semantic property which is introduced by the focus particle. That is, a focus particle such as *only* semantically requires focal material to be present in the sentence. In this respect, focus particles resemble quantificational determiners. Quantificational determiners partition the sentence into a restrictor and a nuclear scope. Similarly, focus particles partition the sentence into two parts: the focal part and the non-focal part or background. In Hendriks & de Hoop (2001), it is argued that the two argument sets of a quantificational determiner are determined through the interaction of violable constraints. The central hypothesis of this paper is that the focus of a focus particle is determined in a similar way.

The proposed account of focus identification is neither a completely semantic one nor a completely pragmatic one. Although I agree with Vallduví (1992), Schwarzschild (1997) and Williams (1997) that *only* does not associate with focus via a compositional mechanism, I disagree with them in the assumption that the lexical entry for *only* does not encode a dependency on focus. As is hypothesized here, focus particles semantically require a focus set and a background set, between which they establish a relation. Which constituents contribute to each set, however, is not determined in a purely compositional way. Syntax plays a role, but only as a soft (i.e., violable) constraint that can be overruled by other, stronger, constraints. Other constraints playing a role in the identification of focus might be prosodic or contextual. In general, the cues by which focus is signalled are assumed to take the form of soft constraints, which can be overruled by stronger constraints. If the interpretation of focus somehow involves a set of alternatives to the focused material, which is a rather uncontroversial assumption (see, e.g., Rooth, 1985), we can then define focus as the part of the sentence that gives rise to this set of alternatives. For an illustration of the basic idea, consider the following example:

(5) Mary bought only a WATCH

Here, both emphatic stress and syntactic structure point at the phrase *a watch* as the focus of *only*. This focused phrase gives rise to a set of alternatives, for example {a watch, a ring, a book}. The remainder of the sentence yields the other set, here the set of things that Mary bought. So focus particles (FPs) can be seen as establishing a relation between two sets, similarly to quantificational determiners:

(6) $FP_E(A)(B)$

A difference between focus particles and quantificational determiners is that the first argument set of a focus particle (i.e., the set of alternatives) is not simply given by the sentence but rather is construed on the basis of the focal material which is present in the sentence. But note that the first argument set of a determiner is always construed under the influence of context too (Hendriks & de Hoop, 2001). In section 4, we will return to the relation between focus and quantification. In particular, we will look at the relation between the quantificational and focus-sensitive properties of *only*. It will be shown here that the relation which a quantificational determiner establishes between its two argument sets is quite similar to the relation which the focus particle *only* establishes between its two argument sets.

Returning to the present discussion, the two sets which form the arguments of the focus particle in sentence (5) are given in (7):

$$(7) \quad \begin{aligned} A &= \{ \text{a watch, a ring, a book} \} \\ B &= \lambda x. \text{buy}(m, x) \end{aligned}$$

Here, emphatic stress and syntactic structure pick out the same focused phrase. Often, however, not all cues point into the same direction or are able to unambiguously determine the focus. In the answer in (2), for example, focus is generally assumed to be on the verb phrase. The two argument sets of *only* are therefore the following:

$$(8) \quad \begin{aligned} A &= \{ \text{buy a watch, play badminton, read a book} \} \\ B &= \lambda P. P(m) \end{aligned}$$

Although *only* occurs in VP modifier position, emphatic stress falls on the noun phrase object, as in (5). So the assignment of stress is the same in the answer in (2) as in (5). But whereas in the answer in (2) focus is assumed to be on the VP, verb phrase focus does not seem to be possible in (5). An adequate analysis of focus particle constructions will therefore have to explain how the different factors involved in focus identification interact.

In this paper focus identification is viewed as a process of optimization, as is characteristic of Optimality Theory (Prince & Smolensky, 1993, 1997). In Optimality Theory, a grammar consists of a set of well-formedness constraints which apply to structural or semantic representations simultaneously. The constraints are potentially conflicting and are ranked in a hierarchy of relative strength. Conflicts between constraints are resolved because higher ranked constraints have total dominance over lower ranked constraints. Before we turn to the constraints that might be involved in focus identification, let us first look at a number of characteristics of the focus particle *only*.

3. *Only* and conservativity

The main assumption of this paper is that the focus of a focus particle is determined in the same way as the argument sets of a quantificational determiner. Interestingly, *only* has a dual status. On the one hand, it is a focus particle. At the same time, however, *only* has quantificational properties. Since *only* can appear in determiner position, one

would expect *only* to display all properties displayed by quantificational determiners in general. For example, *only* is expected to display the property of conservativity.

- (9) Conservativity:
 $\text{DET}_E(A)(B) \text{ iff } \text{DET}_E(A)(A \cap B)$

As the validity of the following equivalence shows, the determiner *all* is conservative:

- (10) All cats purr \leftrightarrow All cats are purring cats

In general, all natural language determiners are assumed to be conservative. As Barwise & Cooper (1981) put it, determiners live on their first argument set. In contrast to other determiners, however, *only* in determiner position does not allow for the equivalence relation in (9):

- (11) Only cats purr \leftarrow/\rightarrow Only cats are purring cats

If it is true that only cats are purring cats, then it is not necessarily true that only cats purr. Because *only* does not appear to be conservative, it has been argued that *only* cannot be a determiner in (11).³ However, as de Mey (1991) points out, although *only* is not conservative at first sight, it does live on one of its argument sets, namely its second argument set. De Mey therefore distinguishes between conservativity in the traditional sense, which he terms Right-conservativity, and the type of conservativity that is displayed by *only*, which he calls Left-conservativity.

- (12) Right-conservativity:
 $\text{DET}_E(A)(B) \text{ iff } \text{DET}_E(A)(A \cap B)$

- (13) Left-conservativity:
 $\text{DET}_E(A)(B) \text{ iff } \text{DET}_E(A \cap B)(B)$

The following equivalence relation shows that *only* has the property of Left-conservativity and lives on its second argument:

- (14) Only cats purr \leftrightarrow Only purring cats purr

So *only* in determiner position behaves like a determiner in that it lives on one of its argument sets. But whereas other determiners live on their first argument set (i.e., on the set introduced by the N' in the above examples), *only* lives on its second argument set (i.e., on the set introduced by the VP in the above examples). We can now use the notion of conservativity and the property of living on an argument set to define the domain of quantification of a quantifier: the domain of quantification of a quantifier is the argument set the quantifier lives on.

4. Focus and quantification

Now why would the focus-sensitive quantifier *only* be Left-conservative, whereas all other quantifiers are Right-conservative? In this section, this will be shown to follow from the view that the focus of a focus particle is determined by various interacting constraints.

Standardly, semantic relations such as the argument sets of a determiner are assumed to be based on syntactic structure. The first argument set of a determiner, i.e. the domain of quantification, is supplied by its noun and possible modifiers of the noun. The predicate supplies the second argument set. However, stress can also be a factor in determining the two argument sets of a quantificational determiner:

- (15) a. Most ships unload AT NIGHT
b. Most people SLEEP at night

The preferred reading of (15a) under the assignment of stress as indicated is that most ships that unload, do it at night. So the first argument set is given by the noun and the verb, whereas the second argument set is given by the adverbial phrase in focus. The preferred reading of (15b), on the other hand, is that what most people do at night is sleep. Here, the first argument set is given by the noun and the adverbial phrase, whereas the second argument set is given by the focused verb. In both examples, non-focal material yields the first argument set of the determiner, i.e., the domain of quantification or restrictor. Focal material yields the second argument set of the determiner, i.e., the scope of quantification or nuclear scope. If the stress patterns are reversed, we still find this effect:

- (16) a. Most ships UNLOAD at night
b. Most people sleep AT NIGHT

Here, the domains of quantification are given by the set of ships that do something at night and the set of people that sleep, respectively. That is, the non-focal part of the sentence gives us the first argument set of the determiner. The focal part of the sentence, *unload* and *at night*, respectively, gives us the second argument set of the determiner. This generalization corresponds to Partee's (1991) correlation regarding the relation between focus structure and tripartite quantificational structure: background corresponds to restrictive clause and focus to nuclear scope. According to Partee, this correlation has the status of a default strategy, which can be overridden by explicit syntactic rules in the case of quantificational determiners. In particular, the noun and possible modifiers of the noun always supply the domain of quantification, even if one of these elements is stressed. We will return to this issue in more detail in the next section.

For focus particles, the first argument set is determined by the phrase in focus. So here we have a conflict between the demands of focus and the demands of quantification. The first argument set of a quantificational determiner (the domain of quantification) is given by non-focal material and the second argument set (the scope of quantification) by focal material. In contrast, the first argument set of a focus particle is given by focal material and the second argument set by non-focal material. Because

only is both a quantificational determiner and a focus particle, this conflict has to be resolved somehow.

Resolution of the conflict between the two roles of *only* can be modeled as a process of optimization. Ideally, hearer optimization proceeds from a contextually enriched acoustic input (the acoustic form of the utterance in combination with the linguistic and extra-linguistic context of the utterance, world knowledge, etcetera) and yields a complete semantic representation as its output. For the sake of simplicity, however, I will assume that the hearer has already recognized the speech sounds and assigned a global syntactic structure to the input. Thus, the input of an OT tableau is a syntactically structured sentence in which sentence accents are indicated. The output (i.e., each of the candidates in an OT tableau) is also very much simplified in the analysis presented below and merely consists of a characterization of the quantificational and information structure of the sentence. A final simplification concerns the process of optimization. Although speaker information may also play an important role in hearer optimization (as is formalized in bidirectional OT, cf. Blutner, 2000; Zeevat, 2000), in this paper interpretation will simply be taken to be a process of unidirectional optimization.

The process of hearer optimization is guided by, among others, the following three soft constraints:

- (17) SYNTACTIC STRUCTURE (DET)
If there is an N' that constitutes an NP together with a determiner, use this N' to restrict the domain of quantification of that determiner and use the rest of the clause to restrict the scope of quantification of that determiner.
- (18) SYNTACTIC STRUCTURE (FP)
If there is an XP to which a focus particle is adjoined, use this XP to restrict the focus of that focus particle and use the rest of the clause to restrict the background of that focus particle.
- (19) FOCUSING
If a constituent contributes to the focus of a focus particle, use this constituent to restrict the scope of quantification of that focus particle and use the rest of the clause to restrict the domain of quantification of that focus particle.

The constraint SYNTACTIC STRUCTURE (DET) is adapted from Hendriks & de Hoop (2001).⁴ It requires all material in the N' to end up in the first argument set of a determiner and the rest of the clause to end up in the second argument set. In a similar fashion the constraint SYNTACTIC STRUCTURE (FP) makes explicit the role of syntactic structure with respect to the arguments sets of a focus particle. It requires all material in the XP sister of the focus particle to yield the focus and all material which is not in the c-command domain of the focus particle to end up in the background set of the focus particle. These two constraints thus partition the sentence into two parts (domain-scope of quantification and focus-background, respectively) on the basis of syntactic structure. Note that it is possible for both constraints to apply to *only* in determiner position because the phrase to which *only* is attached is structurally ambiguous between an N'

and an NP with a null determiner. If *only* appears in some other position than a determiner position, as in *Mary only swims*, the constraint SYNTACTIC STRUCTURE (DET) does not apply. The constraint FOCUSING, finally, reflects the general tendency not to express salient material or introduce new material in the domain of quantification.

If it is assumed that input information such as syntactic structure and sentence accent reappears in the output, these constraints can all be viewed as members of the subclass of markedness constraints. They express the fact that semantic output forms that violate these constraints are more marked than semantic output forms that do not. To determine whether these constraints are violated or not, then, only possible output forms have to be considered.

Given the ranking as in (20), the property of Left-conservativity of *only* follows. According to this ranking, FOCUSING is ranked higher than SYNTACTIC STRUCTURE (FP), and SYNTACTIC STRUCTURE (FP) is ranked higher than SYNTACTIC STRUCTURE (DET).

(20) FOCUSING >> SYNTACTIC STRUCTURE (FP) >> SYNTACTIC STRUCTURE (DET)

Consider the following input:

(21) Only CATS purr

To interpret this sentence, the lexical-semantic properties of *only* require that a certain quantificational structure and information structure be assigned to it. Given the input in (22), we have four possibilities regarding the quantificational structure and informational structure. The noun *cats* may contribute to the domain of quantification or to the scope of quantification. Assuming that constituents must either contribute to the domain or to the scope of quantification and that these two sets may not be empty, this exhausts all possibilities with respect to the quantificational structure of the sentence.⁵ In addition, the noun *cats* may either restrict the focus or the background. Since the choice for the noun leaves us no options for the verb and the other way around, this gives us four candidate outputs.

(22) *Quantificational structure and information structure of (21)*

Input: Only [N/NP CATS] [VP purr]	FOCUSING	SYNTACTIC STRUCTURE (FP)	SYNTACTIC STRUCTURE (DET)
Q-domain: CATS Focus: CATS	*!*		
Q-domain: CATS Focus: purr		*!*	
☞ Q-domain: purr Focus: CATS			**
Q-domain: purr Focus: purr	*!*	**	**

In the first and the fourth candidate of the tableau, the focused constituent (*cats* and *purr*, respectively) restricts the domain of quantification. Hence, these candidates violate the constraint FOCUSING twice. To see this, consider the first candidate. Here, the focused noun *cats* does not restrict the scope of quantification, thus violating FOCUSING. In addition, the backgrounded verb *purr* does not restrict the domain of quantification. A constraint violation is indicated by an asterisk in the cell belonging to the row of the candidate and the column of the constraint. An exclamation mark indicates a fatal violation of a constraint. A violation is fatal if it renders the candidate suboptimal. A crucial characteristic of the constraints in OT is that they are ranked hierarchically and strictly dominate each other. This means that one violation of a stronger constraint is worse than many violations of a weaker constraint.

In the second and fourth candidate, the verb *purr* restricts the focus of *only*, while the sister of *only* (the noun phrase *cats*) restricts the background of this focus particle. This results in two violations of the constraint SYNTACTIC STRUCTURE (FP): one for the verb and one for the noun.

Because they violate one of the two stronger constraints, the first, second and fourth candidate are all suboptimal. This leaves us with only one candidate, namely the third candidate. This candidate is the optimal candidate, which is indicated by the pointing finger. According to this candidate, the noun *cats* contributes to the focus of the focus particle. Thus, this candidate satisfies SYNTACTIC STRUCTURE (FP). This third candidate also satisfies FOCUSING because *cats* does not contribute to the domain of quantification of *only*. However, in order to be able to satisfy these two constraints, the weaker constraint SYNTACTIC STRUCTURE (DET) must be violated. This explains why the noun *cats* does not supply the domain of quantification of the quantifier *only*. So the interaction among the three constraints introduced above yields an explanation for why *only* lives on its second rather than on its first argument set or, in the terminology of de Mey (1991), why *only* is Left-conservative rather than Right-conservative.

The three constraints introduced in this section also yield an explanation for the interpretation of quantificational sentences with focus-insensitive determiners. If the determiner is focus-insensitive, it does not require a partitioning of the sentence into a focal part and a background part. Hence, the constraints SYNTACTIC STRUCTURE (FP) and FOCUSING do not apply. As the tableau in (24) illustrates, the optimal candidate for (23) is a candidate which complies with the syntactic structure of the sentence.

(23) Most cats PURR

The result is that the noun *cats* restricts the domain of quantification, while the verb phrase *purr* restricts the scope of quantification.

(24) *Quantificational structure and information structure of (23)*

Input: Most [N/NP cats] [VP PURR]	FOCUSING	SYNTACTIC STRUCTURE (FP)	SYNTACTIC STRUCTURE (DET)
☞ Q-domain: cats			
Q-domain: PURR			*!*

In this section, an optimality theoretic account was presented of the way in which the quantificational structure and information structure of a focus particle construction are determined. At this point, the proposed analysis does not make any reference to sentential stress. However, as was pointed out in the previous sections, sentential stress does play a role in the identification of focus. Therefore, the next section is concerned with the effects of sentential stress on focus identification.

5. Accenting versus deaccenting

Although determiners such as *most* are believed to be focus-insensitive, emphatic stress can affect the interpretation of quantificational sentences involving these determiners. The effects of stress can be modeled by the following constraint:

- (25) DEACCENTING
If a constituent is anaphorically deaccented, it must contribute to the domain of quantification of a quantifier.

Concerning the status of this constraint, the same considerations that hold for the three constraints that were introduced in the previous section also hold for this constraint. If it is assumed that input information such as sentence accent reappears in the output, this constraint can be viewed as a member of the subclass of markedness constraints as well.

The basic idea with respect to deaccenting is that an element can only be anaphorically deaccented if its sister is contrastively accented (cf. Williams, 1997). So contrastively accenting *large* in the noun phrase *the large ships* gives rise to the anaphoric deaccenting of *ships*. Similarly, contrastively accenting *unload* in the verb phrase *unload at night* gives rise to the anaphoric deaccenting of *at night*. Note that being deaccented is not the same as not bearing any accent. An element is deaccented only if it is the sister of a contrastively accented element. If no contrastive accenting occurs, also no deaccenting occurs. Note furthermore that a default accent does not give rise to deaccenting. In cases where default accent is indistinguishable from contrastive accent we expect potential ambiguity, which can only be resolved by contextual information.

The constraint DEACCENTING predicts that in quantificational sentences such as (15a) and (16a), repeated below for convenience, the deaccented part of the VP helps to restrict the domain of quantification.

- (15) a. Most ships unload AT NIGHT
(16) a. Most ships UNLOAD at night

And indeed, this prediction is borne out by the interpretation of these sentences, as was already pointed out in the previous section. These results follow from the interaction between DEACCENTING and SYNTACTIC STRUCTURE (DET). This is shown in the tableau in (26). Here, candidates differ with respect to whether the phrases *ships*, *unload* and *at night* contribute to the domain of quantification or to the scope of quantification.

(26) *Quantificational structure of (15a)*

Input: Most [_N ships] [_{VP} unload AT NIGHT]	DEACCENTING	SYNTACTIC STRUCTURE (DET)
Q-domain: ships	*!	
Q-domain: unload		**!
Q-domain: AT NIGHT	*!	**
 Q-domain: ships & unload		*
Q-domain: ships & AT NIGHT	*!	*
Q-domain: unload & AT NIGHT		**!*

Because the adverbial phrase *at night* is accented in (15a), the verb *unload* is deaccented. The deaccented phrase *unload* does not contribute to the domain of quantification in the first, third and fifth candidate, so these candidates violate DEACCENTING. The constraint SYNTACTIC STRUCTURE (DET) prefers the noun *ships* to contribute to the domain of quantification and the constituents in the verb phrase to contribute to the scope of quantification. Therefore, all but the first candidate violate this constraint once or several times. For example, the second candidate violates this constraint twice because *ships* does not contribute to the domain of quantification and *unload* does not contribute to the scope of quantification. Since the fourth candidate violates only the weaker constraint SYNTACTIC STRUCTURE (DET) and only violates this constraint once, this is the optimal candidate. The interpretation of (15a) therefore is the interpretation according to which the noun *ships* and the deaccented verb *unload* restrict the domain of quantification. This can be paraphrased as: most ships that unload, do it at night.

In addition to this interpretation, (15a) has another interpretation. This second interpretation arises if the accent on *at night* is interpreted as a default accent. This is possible because default accents are usually on the rightmost element of a constituent in English. If *at night* bears default accent, no other elements are deaccented, so interpretation simply follows syntactic structure. The resulting interpretation is that what most ships do is unload at night. This interpretation surfaces if no contrast can be established in the context with the accented constituent *at night*.

A similar tableau could be drawn for (16a). The interaction between DEACCENTING and SYNTACTIC STRUCTURE (DET) yields as the optimal interpretation of (16a) the interpretation according to which the noun *ships* and the deaccented phrase *at night* restrict the domain of quantification. The interpretation thus is that what most ships do at night is unload. No other interpretations are predicted to be possible.

Given these two constraints, it is predicted that even if an item in the N' is accented, this accented item is interpreted as contributing to the first argument set. There is no tendency to interpret an accented item in the N' as contributing to the second argument set.

(27) Most LARGE ships unload at night

The sentence in (27) cannot be interpreted as meaning that most ships that unload at night are large, or that most ships unload at night and are large. In the proposed analysis, this follows from the fact that the constraint DEACCENTING is formulated as a constraint on deaccented rather than accented material. Because DEACCENTING is formulated as in (25), it does not make any claims about the interpretation of accented material. Therefore, all accented material has to conform to the weaker constraint SYNTACTIC STRUCTURE (DET).

(28) *Quantificational structure of (27)*

Input: Most [_N LARGE ships] [_{VP} unload at night]	DEACCENTING	SYNTACTIC STRUCTURE (DET)
Q-domain: LARGE	*!	*
Q-domain: ships		*!
Q-domain: unload at night	*!	***
 Q-domain: LARGE & ships		
Q-domain: LARGE & unload at night	*!	**
Q-domain: ships & unload at night		*!*

In this tableau, candidates differ with respect to whether the phrases *large*, *ships* and *unload at night* contribute to the domain of quantification or to the scope of quantification. Many more candidates are possible if *unload* and *at night* are allowed to contribute to the argument sets of the determiner separately. The only deaccented element in (27) is *ships*, which is deaccented because *large* is accented. Since no element in the VP is accented, the phrases *unload* and *at night* are not deaccented. The constraint DEACCENTING requires *ships* to be interpreted as contributing to the domain of quantification. All candidates in which *ships* does not contribute to the domain of quantification therefore violate this constraint. Because DEACCENTING does not make any claims about material that is not deaccented or about material that is accented, all other constituents in the sentence have to conform to the constraint SYNTACTIC STRUCTURE (DET). So *large* should contribute to the domain of quantification, whereas *unload* and *at night* should contribute to the scope of quantification. The optimal interpretation therefore is that most ships that are large, unload at night.

Interestingly, a similar effect can be observed with *only*, as was already noted by de Hoop (1995). But here the result is exactly the other way around. Consider the following sentence:

(29) Only LARGE ships unload at night

This sentence means that only large entities are such that they are ships and unload at night. Because *only* is the inverse of *all*, this corresponds to: all ships that unload at night are large. So deaccented material in the XP to which *only* is adjoined is interpreted as contributing to the domain of quantification. This is exactly as predicted by our constraints, as is illustrated by the tableau below. Note that only a few of the candidates are shown here.

(30) *Quantificational structure and information structure of (29)*

Input: Only [_{N/} NP LARGE ships] [_{VP} unload at night]	DE- ACCENTING	FOCUSING	SYNTACTIC STRUCTURE (FP)	SYNTACTIC STRUCTURE (DET)
Q-domain: LARGE & ships Focus: unload at night			**!*	
Q-domain: unload at night Focus: LARGE & ships	*!			***
Q-domain: ships Focus: LARGE & ships		*!		*
Q-domain: ships Focus: LARGE		*!	*	*
☞ Q-domain: ships & unload at night Focus: LARGE			*	**
Q-domain: ships & unload at night Focus: LARGE & ships		*!		**
etc.				

Both with focus-insensitive determiners and with *only* we find that deaccented material occurring in a position where it should according to syntactic structure contribute to the scope of quantification contributes to the domain of quantification instead. If a focus-insensitive determiner is a determiner of the subject NP, deaccented material in the VP contributes to the argument set expressed by the NP. Since the domain of quantification of *only* as a determiner of the subject NP is provided by the VP rather than the NP, the effect is in the opposite direction. Here, deaccented material in the NP contributes to the argument set expressed by the VP. Under the formulation of DEACCENTING as in (25), this pattern is as expected.

Accented material, on the other hand, is predicted not to contribute to the domain of quantification if it occurs in a position where it should according to syntactic structure contribute to the scope of quantification, and vice versa. This prediction seems to be borne out by the following data:

- (31) a. Only ships unload AT NIGHT
b. Only ships UNLOAD at night

If *only* adjoins to the subject NP, the VP generally yields the domain of quantification. If a constituent in this VP is accented, as in (31), this accented element does not seem to be interpreted as contributing to the scope of quantification. That is, (31a) does not seem to have the interpretation that only ships that do something at night, unload.

Similarly, (31b) does not seem to have the interpretation that only ships that unload, do it at night. These interpretations follow from the proposed constraints, as is shown by the tableau below.

(32) *Quantificational structure and information structure of (31a)*

Input: Only [N'/NP ships] [VP unload AT NIGHT]	DE- ACCENTING	FOCUSING	SYNTACTIC STRUCTURE (FP)	SYNTACTIC STRUCTURE (DET)
Q-domain: ships Focus: unload & AT NIGHT	*!		***	
Q-domain: ships & unload Focus: unload & AT NIGHT		*!	***	*
Q-domain: ships & unload Focus: AT NIGHT			*!*	*
Q-domain: unload Focus: ships & AT NIGHT			*!	**
Q-domain: unload Focus: ships		*!		**
☞ Q-domain: unload & AT NIGHT Focus: ships				***
etc.				

Indeed, the optimal interpretation of (31a) is that only ships are such that they unload at night or, in other words, that all entities that unload at night are ships.

Summarizing, the following predictions of the proposed analysis were shown to be borne out by the interpretation of relevant examples in English:

- (33) Predictions of the proposed analysis:
- a. Deaccenting within the second argument of a determiner can affect interpretation.
 - b. Deaccenting within the first argument of a determiner does not affect interpretation.
 - c. Deaccenting within the first argument of a focus particle can affect interpretation.
 - d. Deaccenting within the second argument of a focus particle does not affect interpretation.
 - e. Accenting never affects interpretation, except indirectly through the deaccenting of other constituents.

The examples presented in this section were all examples with the determiner *most* and the focus particle *only*. However, not all determiners are equally sensitive to sentence accent and not all focus particles have quantificational force. The above analysis therefore only provides a very rough sketch of how the interpretation of quantified expressions and focus particle constructions might proceed. Clearly, more research is needed to determine and explain possible differences between determiners and possible differences between focus particles.

Additional support for our analysis might be provided by data discussed in Beaver & Clark (2001). In general, it is assumed that negative polarity items (NPIs) are licensed in the domain of quantification of a universal quantifier, but not in its scope. Interestingly, NPIs may occur in non-focal VP positions of the VP modifier *only*, which can be analyzed as a universal quantifier. This is illustrated by the examples below (taken from Beaver & Clark, 2001; see also Horn, 1996, and Herburger, 2000, for a discussion of similar data), where the NPIs *bother*, *give a damn* and *lift a finger* occur inside the VP sister of *only*. Small capitals are mine.

- (34) a. People *only* bother with the MILEAGE
 b. I *only* gave a damn because I thought YOU did
 c. Faeries would *only* lift a finger to save their best FRIEND

The possibility of these NPIs to occur inside the VP sister of *only* follows from the proposed analysis. In these examples, *only* is adjoined to VP. According to the constraint SYNTACTIC STRUCTURE (FP), then, this VP is the focus of *only*. The constraint FOCUSING prefers focal material to be interpreted as restricting the scope of quantification. Hence, the VP is preferably interpreted as contributing to the scope of quantification. In the examples in (34), however, a constituent in the VP is accented. Now suppose the result is that the rest of the VP is deaccented. Deaccented material is interpreted as contributing to the domain of quantification, according to the constraint DEACCENTING. Therefore, the deaccented part of the VP in these examples contributes to the domain of quantification of *only*, despite its occurrence in the scope of *only*. Because NPIs are licensed in the domain of quantification of a universal quantifier, this explains why NPIs are licensed here. So these data seem to support our hypothesis that syntactic constraints on quantificational structure are violable and can be overridden by prosodic constraints.

But note that this explanation of the data in (34) rests on the assumption that the NPIs in the VP are deaccented because some other element in the VP is accented. By using deaccenting in this way, however, we seem to have stretched our earlier definition of deaccenting somewhat. Clearly, *their best friend* is not a sister of *lift a finger* in (34c). But in English, usually only the rightmost element of a contrastively accented constituent is marked prosodically. Therefore, it might very well be that not just *their best friend* but in fact the entire infinitival clause bears contrastive accent. This would then explain why *lift a finger* is deaccented. Although this might yield a satisfactory explanation for the presence of the NPIs in the focus particle constructions in (34), the exact conditions under which accenting and deaccenting can take place certainly require further investigation.

6. Implications of the proposed account

In this paper it was argued that the concept of optimization, as it features in Optimality Theory, provides us with a fruitful way of looking at issues of interpretation. As was shown in the previous sections, the conflict that arises as a result of the two different roles of *only* (namely as a quantificational determiner and as a focus particle) can be resolved by viewing the constraints on determiner interpretation and focus identification as violable. Under the assumption that the constraints governing what goes into the two sets of a focus particle are stronger than the constraint that governs what goes into the two sets of a determiner, it is explained why *only* lives on its second argument set rather than on its first argument set. As was mentioned earlier, the requirement of a determiner or focus particle to establish a relation between two argument sets is part of its lexical-semantic specification. Because of this semantic requirement, sentences containing these elements must have a certain quantificational structure or information structure. How this abstract semantic/pragmatic structure exactly looks like in the output is the result of the interaction among constraints pertaining to quantificational or information-structural aspects of the sentence. Quantificational structure and information structure thus need not be specified as separate levels of semantic representation. Rather, they are evoked by certain lexical items and compete for their specification in the semantic representation of the sentence.

The proposed account of focus identification results in a different view on the relation between the focus particle and its focus. Many analyses of focus distinguish between the syntactic domain of the focus particle and the focus with which the focus particle associates. The syntactic domain of a focus particle is defined as the phrase which is c-commanded by the focus particle. In the simplest case, the syntactic domain is assumed to coincide with the focus. However, it is also assumed to be possible for the focus to be a proper subpart of the syntactic domain.

- (35) a. John would invite only [NP MARY]
b. John would only [VP invite [NP MARY]]

In (35a), *only* is adjoined to an NP which is assumed to be both the syntactic domain and the focus of the focus particle. In (35b), on the other hand, where *only* is adjoined to the VP *invite Mary*, the focus may be on *Mary*, although it need not. Because focus may project to a higher node, *only* could also be taken to associate with the entire VP in (35b). If the syntactic domain does not coincide with its focus, semantic accounts of focus require some mechanism to relate the focus particle to its focus, for example through complex semantic types (e.g., Rooth, 1985) or through LF movement (e.g., Bayer, 1996).

In the proposed account, on the other hand, the syntactic domain of the focus particle and its focus in principle coincide. This is expressed by the constraint SYNTACTIC STRUCTURE (FP). If a focus particle is adjoined to a phrase, this phrase in principle yields the focus. However, through the interaction of SYNTACTIC STRUCTURE (FP) and DEACCENTING deaccented material in the syntactic domain may be interpreted as contributing to the background rather than to the focus. So optimization over violable constraints provides us with a mechanism which is strong enough to explain how the

focus particle associates with its focus even though the focus particle and its focus might not be adjacent in surface structure. Once we view syntactic constraints as being violable, we do not need any order destroying devices such as movement to explain association with focus. We predict that the distance between the focus particle and its focus and the nature of the material intervening between the focus particle and its focus are only restricted by the possibility of the intervening material to be deaccented and not by constraints on LF movement or semantic restrictions. This might explain why there is some disagreement about the possibility of a narrow focus interpretation if the accented phrase occurs inside a syntactic island. In (36), the accented phrase *a watch* occurs inside a complex noun phrase. Many speakers of English find that this sentence has an interpretation according to which Mary did not revise her decision to buy something else, say a book.

(36) Mary only revised her decision to buy a WATCH

For other speakers of English, however, such a narrow focus interpretation is impossible. Overt movement out of a complex noun phrase is generally disallowed for all speakers of English. These varying judgements with respect to cases like (36) yield a complication for an LF movement account of association with focus. Alternatively, if the acceptability of sentences like (36) were dependent on the possibility of deaccenting, this variation might be due to subtle differences in (implicit or explicit) context.

In many optimality theoretic analyses of semantic and pragmatic phenomena, syntactic constraints appear to be undominated by non-syntactic constraints. In this paper, it was argued the syntactic constraints SYNTACTIC STRUCTURE (DET) and SYNTACTIC STRUCTURE (FP) must be dominated by the prosodic constraint DEACCENTING. Since prosodic constraints are able to outrank syntactic constraints, interpretation need not proceed in a strictly compositional fashion. Thus the proposed theory of focus identification corroborates the findings of Hendriks & de Hoop (2001), who argue that the interpretation of quantified expressions is not strictly compositional.

A related issue concerns the modularity of the grammar. If most syntactic constraints are undominated by non-syntactic constraints, and if at the same time the prosodic constraint DEACCENTING outranks the syntactic constraints SYNTACTIC STRUCTURE (DET) and SYNTACTIC STRUCTURE (FP), then linguistic constraints cannot be ordered in a strictly modular fashion. Also problematic for this reason is the currently prevailing view in Optimality Theory that interpretational optimization is a pragmatic mechanism for completing underspecified linguistic meanings. This view implies that syntactic constraints are always stronger, or more important, than other constraints. However, prosody and context appear to be as important as syntax for the interpretation of a sentence. Interestingly, nothing in the architecture of Optimality Theory prohibits cross-modular constraint interaction. In fact, a strictly modular interaction among constraints would require extra restrictions on the architecture of the theory, so it seems. The proposed analysis assumes a very simple architecture for the grammar: the generator and the simultaneously applied constraints establish a mapping between an input representation, which is a syntactic-prosodic form, and an optimal output representation, which is a semantic form. No intermediate levels of

representation are assumed or required. The constraints on interpretation refer to syntactic, prosodic or lexical-semantic aspects of the output and can hence be said to be syntactic, prosodic or semantic in nature. However, they do not correspond to different levels of representation, nor are they necessarily ordered in a modular fashion. From an empirical perspective, abandoning the modularity hypothesis might lead to interesting results in other areas of semantics and pragmatics as well. However, these questions with respect to compositionality and modularity crucially depend on whether an alternative analysis is possible of the data discussed here in which syntactic constraints are not violated by prosodic ones.

Finally, although the role of linguistic context was not explicitly discussed here, it was pointed out in section 1 that linguistic context also is an important factor in the identification of focus. Under the proposed account, linguistic context plays an indirect role because it partly determines whether lexical material can be deaccented. A constituent can be deaccented if its neighbour is accented and if it represents ‘given’ information. When information exactly counts as given is not an easy matter, but see Schwarzschild (1999) for a formalization.

7. Conclusions

In this paper, an optimality theoretic account was proposed of focus identification. Under the proposed account, focus is understood as a semantic property which is introduced by the focus particle. The focus which the focus particle requires to be present in the output is determined through the interaction among various soft constraints. An important role is played by the prosodic constraint DEACCENTING, which requires anaphorically deaccented constituents to contribute to the domain of quantification of a quantifier. Under the assumption that this prosodic constraint dominates the syntactic constraints which require the argument sets of a determiner or focus particle to be determined strictly compositionally, an explanation can be provided for the interpretation of focus particle constructions and quantified expressions. In particular, it is explained why certain lexical material in the c-command domain of a quantificational focus particle and in the second argument set of a quantificational determiner can be interpreted as contributing to the domain of quantification. Because focus is taken to be only indirectly related to sentence accent, a clear advantage of this approach is that cases of second occurrence focus do not pose any problems. Also, an explanation can be offered for the well-known observation that the focus-sensitive determiner *only* is not conservative in the standard sense.

Notes

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² For example, Hoeksema & Zwarts (1991, p.52) define a focused expression as an expression which “has an accentual peak or stress which is used to contrast or compare this item either explicitly or implicitly with a set of alternatives”. According to Beaver & Clark (2002, p.15), focus is “a perceptible pitch rise on

a stressed syllable, in English or Dutch”. In many other articles, focus is simply indicated by small capitals, which is implicitly or explicitly assimilated with emphatic stress. In this paper, we will be careful to distinguish focus from sentential stress.

³ As one of the reviewers remarks, another reason for not considering *only* a determiner is that *only* does not have the same syntactic distribution as determiners. *Only* can combine with proper names (*only Mary*), definite descriptions (*only the women*) and numerals (*only three women*), whereas a determiner such as *most* cannot (**most Mary/*most the women/*most three women*). However, the determiner *all* is also able to combine with definite descriptions (*all the women*) and numerals (*all three women*). Hardly anyone would like to conclude on the basis of these facts that *all* is not a determiner.

⁴ The original formulation of this constraint is: “If there is an N' that constitutes an NP together with a determiner, use this N' to restrict the domain of quantification of that determiner” (Hendriks & de Hoop, 2001, p.22). Under this formulation, however, the constraint is too weak. It would allow for the possibility that focused material or other non-deaccented material in the VP contributes to the domain of quantification too, contrary to the facts. In this paper, I have chosen to slightly modify the original constraint. However, another (and perhaps preferable) option would have been to add a weaker constraint stating that all constituents must be used to restrict the scope of quantification of the determiner. A similar choice can be made with respect to the syntactic constraint on focus, SYNTACTIC STRUCTURE (FP).

⁵ This assumption might be formulated as a constraint on interpretation as well: The argument sets of a determiner or a focus particle may not be empty. This constraint remains undominated in the examples under discussion.

References

- Barwise, J., & Cooper, R. (1981). Generalized Quantifiers and Natural Language. *Linguistics and Philosophy*, 4, 159-219.
- Bayer, J. (1996). *Directionality and Logical Form*. Dordrecht: Kluwer Academic Publishers.
- Beaver, D., & Clark, B. (2002). The Proper Treatment of Focus Sensitivity. In C. Potts & L. Mikkelsen (Eds.), *Proceedings of WCCFL 21* (pp. 15-28). Cascadia Press.
- Beaver, D., & Clark, B. (2001). “Always” and “Only”: Why not all Focus Sensitive Operators are Alike. Unpublished manuscript, Stanford University, Stanford, CA.
- Blutner, R. (2000). Some Aspects of Optimality in Natural Language Interpretation. *Journal of Semantics*, 17, 189-216.
- Fintel, K. von (1994). *Restrictions on Quantifier Domains*. PhD dissertation, University of Massachusetts, Amherst, MA.
- Hendriks, P., & Hoop, H. de (2001). Optimality Theoretic Semantics. *Linguistics and Philosophy*, 24, 1-32.
- Herburger, E. (2000). *What Counts: Focus and Quantification*. Cambridge, MA: MIT Press.
- Hoeksema, J., & Zwarts, F. (1991). Some remarks on focus adverbs. *Journal of Semantics*, 8, 51-70.
- Hoop, H. de (1995). “Only” a matter of context? In M. den Dikken & K. Hengeveld (Eds.), *Linguistics in the Netherlands 1995* (pp. 113-124). Amsterdam/Philadelphia: John Benjamins.

- Horn, L. R. (1996). Exclusive Company: Only and the Dynamics of Vertical Inference. *Journal of Semantics*, 13, 1-40.
- Jackendoff, R. (1972). *Semantic Interpretation in Generative Grammar*. Cambridge, MA: MIT Press.
- König, E. (1991). *The meaning of focus particles: A comparative perspective*. London/New York: Routledge.
- Krifka, M. (1991). A compositional semantics for multiple focus constructions. *Linguistische Berichte*, Sonderheft 4, 17-53.
- Mey, S. de (1991). "Only" as a Determiner and as a Generalized Quantifier. *Journal of Semantics*, 8, 91-106.
- Partee, B. H. (1999). Focus, Quantification, and Semantics-Pragmatics Issues. In P. Bosch & R. van der Sandt (Eds.), *Focus: Linguistic, Cognitive, and Computational Perspectives* (pp. 213-231). Cambridge: Cambridge University Press.
- Partee, B. H. (1991). Topic, Focus and Quantification. In S. Moore & A. Wyner (Eds.), *Proceedings of SALT 1* (pp. 159-187). Cornell University, Ithaca, NY.
- Prince, A., & Smolensky, P. (1997). Optimality: From Neural Networks to Universal Grammar. *Science*, 275, 1604-1610.
- Prince, A., & Smolensky, P. (1993). *Optimality Theory: Constraint Interaction in Generative Grammar*. Technical Report 2. Center for Cognitive Science, Rutgers University, New Brunswick, NJ.
- Rooth, M. (1992). A Theory of Focus Interpretation. *Natural Language Semantics*, 1, 75-116.
- Rooth, M. (1985). *Association with Focus*. PhD dissertation, University of Massachusetts, Amherst, MA.
- Schwarzschild, R. (1999). GIVENness, AvoidF and other Constraints on the Placement of Accent, *Natural Language Semantics*, 7, 141-177.
- Schwarzschild, R. (1997). *Why Some Foci Must Associate*. Unpublished manuscript, Rutgers University, New Brunswick, NJ.
- Stechow, A. von (1991). Current Issues in the Theory of Focus. In A. von Stechow & D. Wunderlich (Eds.), *Semantik/Semantics: An International Handbook of Contemporary Research* (pp. 804-825). Berlin: De Gruyter.
- Vallduví, E. (1992). *The Informational Component*. New York: Garland.
- Williams, E. (1997). Blocking and Anaphora. *Linguistic Inquiry*, 28, 577-628.
- Zeevat, H. (2000). The Asymmetry of Optimality Theoretic Syntax and Semantics. *Journal of Semantics*, 17, 243-262.