1 Introduction

It is a long-standing observation going back at least to Jackendoff (1972) that the location of focus within the scope of an operator like only can affect the truth-conditional meaning of a sentence. Thus, in the absence of context, (1a) will be taken to mean that the only thing John does with rice is eat it, while (1b) will be taken to mean that the only thing that John eats is rice.

(1) a. John only EATS rice
    b. John only eats RICE

There are several analyses of this kind of fact, most prominent of which is that of Rooth (1985, 1992) in which all expressions have a focus semantic value distinct from and in addition to their normal semantic value, and only generates apparent association with focus because it is sensitive to this focus semantic value in some manner. While this view of focus covers a wide range of examples, Rooth (1992) gives one example which on the face of it challenges this view, a modified version of which is given in (2). (Here and throughout, CAPS indicate presence of a pitch accent, a subscripted B indicates the continuation intonation of Jackendoff's (1972) B accent, and a subscripted A indicates the final fall intonation of Jackendoff's A accent.)

(2) A: Mary grows rice.
    B: JOHN\text{\textsubscript{B}} only EATS\text{\textsubscript{A}} rice. (ambiguous: only EATS, or only rice)

Rooth notes that in the proper context it is possible for only to associate not with the phonologically more prominent EATS but with the contextually given rice in (2). He claims that in this case rice is in fact a focus, so the generalization that only associates with a focused expression can be maintained.

While the analysis of a deaccented expression as a focus is somewhat counterintuitive, there has been a growing body of evidence to support this analysis, including Beaver and Clark (2003) .... Perhaps the clearest supporting evidence comes from the observation that such association is possible only with expressions that can bear focus. The pronoun it is one

\footnote{1 Note that my use of CAPS deviates from the standard convention of marking focus. Minimally, using CAPS to mark a pitch accented expression will mean that topics will be so marked as well as foci.}
\footnote{2 There is some disagreement over what expressions count as bearing a B accent for non-final accented expressions. In this paper I assume that all A accents can induce a fall of \( f_0 \) to the baseline pitch, and take all other falling accents to be B accents. I put non-falling pitch accents aside, though in a more complete theory these need to be related to the more familiar A and B accents as well.}
of a small number of expressions in English that cannot readily do so, and we find that substitution of *it* for *rice* in (2B) makes association with *it* impossible in the exact same context in which association with *rice* is possible.

(3) A: Mary grows rice.  
B′: JOHN_{B} only EATS\textsubscript{A} it.  (unambiguous: only EATS, #only it)

The basic analysis I will assume for this fact is a feature-based version of Rooth's suggested analysis. I will assume that there are three syntactic features at play in these examples, one indicating focus (or more precisely contrast) (+C), one indicating givenness (+G), and a third feature indicating topic marking (+T). +C I take to be interpreted at the syntax-phonology interface as phonological prominence, and +G as absence of a pitch accent. When an expression is +C and –G, I assume the phonological prominence surfaces as a pitch accent by default. When an expression is both +C and +G, the expression lacks any pitch accent and the requirement for phonological prominence is satisfied instead by lengthening or perhaps by a simple absence of reduction. The precise role of ±T will be addressed later, with marking of this feature consequently suppressed until then. With these assumptions, the association of *only* with *rice* will derive from representations that include the CG marking in (4).

(4) B: JOHN\textsubscript{B} only EATS\textsubscript{A} rice\textsubscript{+C,+G}.

The analysis just sketched is the basic analysis I will assume for the case in which *only* associates with *rice* in (2). The central question I address in this paper is what additional assumptions are needed regarding focus marking, both from a phonological perspective and from an interpretational perspective, to make this analysis viable.

2 Theoretical Issues

The idea of marking focus and topic in the syntax and interpreting them at the interfaces with phonology and semantics is far from new (cf. for example Selkirk 1984 and Rooth 1986 for focus, and Buring (1999),… for topic). A question that has received comparatively little explicit attention, however, is the question of how syntactic marking of topic, contrast and givenness (henceforth TCG) interact at these two interfaces to determine their phonological and semantic interpretations. The simplest possible such relation would be one where there

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3 As with most things in linguistics, the situation with *it* is far from black and white. With sufficient coercion and manipulation of examples, it is possible to generate a focused interpretation for this pronoun as well. The difficulty involved, however, sets *it* apart from other pronouns.

4 I use the term *contrast* as a technical term in the analysis of focus-related effects, and use the term *focus* for a theory neutral way of picking out the phenomenon to be analyzed. This decision stems from the fact that the term *focus* has acquired such a wide range of different uses and is associated with such a wide range of distinct phenomena that it has become ill suited for use as a technical term.

5 I adopt the restrictive assumption here that the pragmatic use of focus and topic is a direct function of their semantic interpretation, and only indirectly of their phonological realization.
is a one-to-one relation between syntactic representations of TCG and phonological interpretation, and also a one-to-one relation between syntactic representations of TCG and semantic/discourse interpretation. This would mean that a given phonological pronunciation would unambiguously be associated with a given semantic/discourse interpretation. While this would be the simplest state of affairs from the viewpoint of constructing a theory of focus and topic, however, there is little hope of getting such an analysis off the ground. Looking at focus alone, already in Chomsky (1971) it was argued that a single pitch accent is capable in principle of marking a number of distinct expressions as foci. We can go further and observe that in such cases not only the location of the pitch accent but the pronunciation of the entire sentence as a whole can remain fixed and still be associated with multiple possible identifications of a semantic/discourse focus. I take this to indicate that there is at least a one-to-many relation between the phonology of focus and the identity of an expression as focus for semantic/discourse interpretation.\(^6\) [[What about topic?]]

In this paper, I will be adopting a highly simplified idealization regarding the phonology of topic and focus marking. In particular, I will only be considering two distinct pitch contours, a fall contour that ends somewhat above a speaker's baseline \(f_0\) pitch and a fall contour that ends at the baseline \(f_0\). The former I label a B accent, and the latter an A accent, following Jackendoff (1972).\(^7\) These two phonetic pitch accents serve to identify foci and topics, though the identification is far from straightforward. In particular, in the prototypical case a B accent will identify a topic. However, there can only be one A accent per sentence, which among other things means that in the event of association with multiple foci, argued for by Krifka (1992) and many others, at least one of the foci will bear a B accent. Furthermore, it is arguable that thetic judgments represent sentential topics, and yet these are associated with an A accent. Thus even restricting ourselves to these two accent types we already see that the relation between phonetic identification of an accent and its discourse role as focus or topic is one to many. This stands in addition to the one-to-many relation between pitch accents and identification of a particular constituent as focus argued for in Chomsky (1971).

\(^6\) Pierrehumbert and Beckman (1980) and Selkirk (1984) among others observe that there are several different types of pitch accent which can be employed, each of which has a distinct effect on the intonation contour of a sentence. How such distinct types of pitch accent correlate with topic/focus identification, however, has not been made fully clear. The existence of multiple pitch accents strongly suggests that the relation between the phonology of focus and the semantic/discourse identification of focus and topic is more likely many-to-many rather than one-to-many. However, in this paper I will ignore these complications, saving investigation of the distinct discourse roles associated with different pitch accent types for a later occasion.

\(^7\) There is some question about whether this characterization is the one that Jackendoff himself employed. Daniel Buring (p.c.) has suggested that the original intention was for B accents to correlate with unambiguous topic-like uses. The interpretation adopted here, however, lumps such topic uses together with pre-final focus uses. The choice of interpretation is somewhat arbitrary, as there are three readily distinguishable pronunciations that are shoe-horned into two categories by Jackendoff: continuation intonation with a pause, fall to above baseline without a pause, and fall to baseline. Topics can have either of the first two pronunciations, and foci either of the last two.
Within a broadly Chomskyan framework of grammar in which the connection between phonology and semantics is mediated by the syntactic component, the only way for a pitch accent to affect discourse function is for the pitch accent to have some reflex in the syntactic representation, and for this aspect of the syntactic representation to affect semantic interpretation. The syntactic marking I refer to as TCG marking. To account for the one-to-many relation between the phonetics of pitch accents and discourse roles, there are several possible assumptions one could make within a Chomskyan framework. I will concentrate on the two most restrictive possibilities: (i) that TCG marking stands in a one-to-one relation with phonological pronunciation but in a one-to-many relation with semantic/discourse interpretation, and (ii) that TCG marking stands in a one-to-one relation with semantic/discourse interpretation but in a many-to-one relation with phonological pronunciation. I label these two distinct approaches to the problem the Syntax-Phonetics Correlation Theory (5) and the Syntax-Semantics Correlation Theory (6) respectively, and summarize these two theories below.

(5) Syntax-Phonetics Correlation Theory (SPT)
TCG marking (both uniquely determines and)\(^8\) is uniquely determined by representation at Phonetic Form.

(6) Syntax-Semantics Correlation Theory (SDT)
TCG marking both uniquely determines and is uniquely determined by semantic interpretation.

These two classes of approaches to the phonetics-discourse relation are rarely if ever spelled out explicitly. In most analyses that deal with questions regarding the semantics and discourse of topic and focus, syntactic identification of topic and focus is implicitly assumed. Even analyses like Selkirk (1984), designed to account for the ambiguity of focus uncovered in Chomsky (1971) by examining the relation between phonology and syntax, do not address the question of where and how to distinguish between topic and focus. Since both of these can be marked with a pitch accent, simply translating a pitch accent as F-marking as in Selkirk’s work does not suffice to distinguish topics from foci. One of the questions I will address in this paper, then, is which of these two broad approaches is preferable when making such a distinction is paramount.

3 Empirical Problem

It was observed above that the sentence in (2B) is ambiguous. In particular, this sentence allows for an interpretation in which only is associated with rice and also a reading in which only is associated with EATS. Notice now that while the only EATS reading is always possible, the availability of the only rice reading of (2B) depends on the overall role that (2B) plays in the discourse. In particular, if John is being explicitly contrasted with Mary, then the only rice reading is unavailable, as in (7Bi,ii). If, on the other hand, the sentence is being presented as simply another piece of information in the discourse, the relevant reading is available, as in (7Biii).

\(^8\) The part in parentheses represents the idealization made in this paper of ignoring the multitude of available types of pitch accent.
A: Mary grows rice.
B: i: In contrast, JOHN$_B$ only EATS$_A$ rice. (only EATS, #only rice)
   ii: JOHN$_B$ on the other hand only EATS$_A$ rice. (only EATS, #only rice)
   iii: What a coincidence. JOHN$_B$ only EATS$_A$ rice. (ambiguous: only rice preferred)

The first thing to note about this example is that it argues against the SPT. The contrast between (i) and (iii) in particular is clear even when the pronunciation of the target sentence *John only eats rice* is kept exactly identical in the two cases. If the TCG representation of this sentence were determined entirely by its phonetics, it would follow that the sentence would have the exact same TCG representation in (i) and (iii). On the working assumption that only the syntax is visible at the conceptual/intentional interface, indistinguishability in the syntax makes it impossible to account for the difference in possible interpretations found in these two cases. If an ambiguity is found in one of them, then, it follows that the same ambiguity should be found in the other. Taking (iii) to show that there is such an ambiguity, it is then predicted that (i) should be identically ambiguous.

Of course if there were an independent reason why the *only rice* reading of (i) should be blocked, for example if it were independently incompatible with a contrast between Mary and John, then it would be too hasty to conclude that the SPT is incorrect. However, the examples in (8) strongly suggest that no such independent incompatibility exists.

(8) A: Mary grows rice.
   B: i: In contrast, JOHN$_B$ EATS$_B$ ONLY$_A$ rice.
      ii: JOHN$_B$ on the other hand EATS$_B$ ONLY$_A$ rice.
      iii: What a coincidence. JOHN$_B$ EATS$_B$ ONLY$_A$ rice.

The examples in B here are informationally identical to the intended *only rice* interpretation of their counterparts in (7), and yet in (8) the B examples are all acceptable. This shows that there is nothing wrong with the intended interpretation in the context given, leaving only the possibility that the contrast between the (7Bi,ii) on the one hand and (7Biii) on the other has a syntactic component to it. If we adopt the SDT as the most restrictive alternative available for restricting the correlation between phonetics and discourse, it follows that the sentences in (7Bi) and (7Biii) will differ syntactically and that this difference will correlate with a corresponding difference in their semantic interpretation, and hence in their discourse role. Below I give an informal SDT explanation to the contrast in (7), and then proceed to evaluate distinct ways of trying to spell this informal analysis out formally.

4 The Framework

4.1 TCG Marking

I take it as a working hypothesis that the restricted range of interpretation available for (7Bi,ii) comes from a restriction imposed by explicit contrast. I take *JOHN* in all sentences in (7) to act as a topic, and assume that its particular topic role is orthogonal to the question of what *only* can associate with. Instead I propose that it is the TCG marking on *EATS* that affects the range of possible associates for *only*, and in particular that setting up an explicit
contrast forces there to be a discourse antecedence relation between the B sentences and the A sentence, which forces \textit{EAT} to be a contrastive focus (+C). When there is no overt contrast being forced, as in (8), I take it that \textit{EAT} is not required to be a contrastive focus, so it can also be analyzed as a topical element (+T) instead. The association behavior will follow if \textit{only} is unable to skip a contrastive focus, as argued in Tancredi (1997), but able (and in fact required) to skip a topic.\footnote{The interaction of \textit{only} with focus and topic will follow from the semantic analysis of focus proposed by Rooth (1992) combined with that proposed for topic by Buring (1999) if and only if it is assumed that focus (here +C) and topic (here +T) marking are mutually exclusive. I will be arguing against this assumption below, and so will also be arguing for revisions to these analyses.}

To work this hypothesis out formally, I take the syntactic TCG features to correlate with the discourse roles given in (9) through their semantics.

\begin{align*}
(9) & \quad +C \text{ correlates with contrastiveness} \\
& +T \text{ correlates with topichood} \\
& +G \text{ correlates with givenness}
\end{align*}

These three roles are mutually independent, making it possible in principle for an expression to have any combination of values for these features. This gives us the possibility of syntactically encoding up to 8 different discourse roles in the syntax. In Table I, I give plausible discourse interpretations for these 8 combinations of features as well as their potential pitch-accent realizations.\footnote{The choice of pitch accent in the top two rows of the table can be made based on properties of the sentence distinct from the discourse role played by an expression, including whether the expression in question bears the final pitch accent of the sentence, whether it is followed by an A accent, etc.}

While the features themselves are all assumed to be binary, I will often simplify representation by using bare letters to indicate positively valued features, as indicated in parentheses in the first column.

<table>
<thead>
<tr>
<th>TCG marking</th>
<th>Discourse Role</th>
<th>Accent realization</th>
</tr>
</thead>
<tbody>
<tr>
<td>+T,+C,+G (TC)</td>
<td>contrastive topic, partial topic (cf. Buring (1999))</td>
<td>A, B</td>
</tr>
<tr>
<td>+T,+C,+G (TG)</td>
<td>contrastive old topic???</td>
<td>none?</td>
</tr>
<tr>
<td>+T,+C,+G (TG)</td>
<td>new topic, (thetic judgment?)</td>
<td>A, B</td>
</tr>
<tr>
<td>+T,+C,+G (TG)</td>
<td>old topic (Buring's purely implicative topic) (?)</td>
<td>B</td>
</tr>
<tr>
<td>+T,+C,+G (TG)</td>
<td>given (second occurrence) focus</td>
<td>none</td>
</tr>
<tr>
<td>+T,+C,+G (TG)</td>
<td>given</td>
<td>none</td>
</tr>
<tr>
<td>+T,+C,+G (TG)</td>
<td>new information???</td>
<td>A?</td>
</tr>
</tbody>
</table>
represented in (10a), and the focus option in (10b). In the presentational context, again we have a choice of representations, though this time a broader choice. Though contrast of JOHN and EATS is not forced upon us, it is not incompatible with the context, making (10a,b) again potential representations. In addition, however, there is now a third option of analyzing JOHN as a (presumably) new topic, EATS as a topic as well, and rice as a given focus. If the topic marking on EATS is that of a new topic (T), with JOHN ... EATS functioning as a single, discontinuous topic, this leads to the TCG representation in (10b).

(10)

a. JOHN_{TC} (in contrast) only EATS_{C} rice_{G}
b. JOHN_{TC} (in contrast) only EATS_{C} rice_{CG}
c. (Oh yeah?) JOHN_{T} only EATS_{T} rice_{CG}

With the TCG representations in (10) are justified in part by the discourse roles of the various expressions, we now have to show how to derive obligatory association with EATS in (10a,b) and at least possible association with rice in (10c). To do so, I will develop an analysis of these examples based on the semantic analysis of topic developed in Buring (1999), which itself is based on the alternative semantic analysis of focus in Rooth (1992). I turn now to an outline and partial extension of these analyses.

4.2 Topic and Focus Semantics

Following Rooth (1992), Buring (1999) takes the interpretation of focus to generate a focus semantic value, or simply focus value, for every constituent of a sentence. Focus values are sets of normal (semantic) values. If an expression is unfocused, then its focus value is a singleton set containing only its normal value. If the expression is focused, then the focus value is a subset of the set of alternatives to the normal value, where alternatives are semantic objects of the same type as the normal value. Thus an unfocused name John will give rise to the singleton set \{john\} as focus value, while a focused name JOHN will give rise to a set of individuals such as \{john, bill, mary, …\}. The precise membership of this set will be determined in part contextually. Rooth's only semantic restriction on the set is that it must contain the normal value, here john, and also one other object other than the normal value. The focus value of a syntactically complex expression is calculated compositionally from the focus values of the parts by applying function application pointwise to the members of the two sets. For a sentence like JOHN left, this will result in the set \{\lambda x.w. left (x,w): x \in \{john, bill, mary, …\}\}, or more informally \{left(x): x \in \{john, bill, mary, …\}\}. The semantics of only is taken to be sensitive to focus values. In particular, the sentence Only JOHN left will be true just in case the sole member of the focus value of JOHN left that is true is the normal value of this sentence, i.e. just in case John left and nobody else did.

The semantics for topic that Buring develops is parallel to and built upon Rooth's

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11 As far as I can see, nothing would prevent its being analyzed as a contrastive topic unless there is some necessary connection between the TCG marking on JOHN and that on EATS.

12 Other possible TCG markings are of course conceivable, and in the end it is necessary to determine all those markings that produce felicitous results and to show how to block all unwanted possibilities as well. While I will address this problem partially below, my main concern here is to establish the proposed role of TCG marking as plausible, and hence I start with only the two representations given here.
semantics for focus. However, the topic (semantic) value of an expression is a set not of normal values but rather of focus values. For a non-topic, this set is the singleton set containing the focus value of the expression. For a topic, it is the set of all alternatives to the focus value that can be generated by substituting for the interpretation of the topic expression an object of the same semantic type. Thus the topic value for an un-focused non-topic John is the singleton set {{john}}, the topic value for focused JOHN is the singleton set {{john, bill, mary, ...}}, and the topic value for topic JOHN is the set {{john}, {bill}, {mary}, ...}. For a complex expression, the topic value is computed by pointwise composition of focus values. Thus for a sentence such as JOHN saw MARY, with topic JOHN and focus MARY, the topic value will be the set {{john saw mary, john saw sue, ...}, {bill saw mary, bill saw sue, ...}, ...}, where each member of the outer set is the focus value of a sentence of the form x saw MARY. Buring equates focus values with questions, making it possible to simplify the representation of the topic value of the sentence above as a set of questions, namely the set \{who did John see?, who did Bill see?, ...\}.

Together with a formal semantics of topic, Buring (1999) also proposes the two conditions below on the occurrence of topic in discourse. The first is a condition on the question/answer relation, and the second a general condition on topic use.

(11) Question/Answer Condition: The meaning of a question Q must match one element in the Topic value of the answer A.

(12) Given a sentence A, containing [a Topic], there is an element Q in the Topic value of A such that Q is still under consideration after uttering A.

This view of topics was developed to account for the relation between a question and an answer, such as the following:

(13) A: Which book would Fritz buy?  
B: Well, I would buy THE HOTEL NEW HAMPSHIRE.

In (13B), I functions as a topic, and THE HOTEL NEW HAMPSHIRE as focus. The focus gives rise to sets of alternatives: I would buy The Hotel New Hampshire, I would buy War and Peace, etc. These alternatives can be seen as equivalent to a question, in this case the question What would I buy? The topic then generates a set of related questions by putting alternatives in place of the topic. In this case, the relevant set of questions would include What would I buy?, What would Fritz buy?, etc.

These two conditions on topics are too narrow to apply directly to the cases we have considered here. To see why, consider a simple discourse like that in (14).

(14) John saw Sue. Then BILL saw MARY.

In this discourse, there is no question/answer relation, and hence (12) is inapplicable. Furthermore, there is no implication that some question is still under consideration, despite the topic-like pronunciation of BILL. While the second sentence of (14) would leave a question under consideration if uttered discourse initially, intuitively the presence of the preceding sentence is enough to answer such a question. A similar effect can be seen in
(15), which differs from (13) only in that a complete answer to the question is inserted prior to the topic-containing sentence.

(15) A: Which book would Fritz buy?  
    B: Fritz would buy \textit{WAR AND PEACE}_A.  \textit{I}_B would buy \textit{THE HOTEL NEW HAMPSHIRE}_A.

Here once again there is no feeling of a question left open. To account for the use of topic marking in these examples, I modify Buring's analysis slightly, maintaining the core semantics of topic marking and the Question / Answer Condition, but changing the general condition on S-topics in (12) as in (16).

(16) Given a sentence A containing a Topic, there is an element Q in the topic value of A that is not answered by A itself.

This formulation subsumes the cases that Buring was concerned with, namely cases of question-answer pairs, and also makes it possible to account for uses of topic marking in simple declarative discourse. In (14), for example, the second sentence gives rise to a topic semantic value which in the context could be taken to contain the questions \textit{Who did Bill see? Who did John see?} The second sentence of (14) itself answers the first of these questions, but not the second question. The first sentence of the discourse, however, already answers the second question, so that question need not remain under consideration. I propose that this is all that is required of a topic.

5 Analysis

5.1 Distinctions in Focus Types

Before giving a formal analysis of the examples in (10), we need to first determine how to identify Buring-style foci and topics within the TCG framework proposed. Given our assumptions regarding TCG marking in (10) combined with the corresponding interpretations available for those sentences, it follows that for the purposes of association with focus it is necessary to identify a CG expression as a (given) focus. It also follows that association skips a T expression. The simplest explanation for this state of affairs is to assume that +C marking is necessary for identifying a focus for the purpose of focus semantics and hence of association with \textit{only}. If we assume that it is also sufficient for this purpose, then any +C marked expression in a sentence will be treated as a focus in generating focus semantic values and topic semantic values for the sentence.

To account for the association possibilities for \textit{only} in (7Bi:ii), nothing more needs to be said. Within the scope of \textit{only} in the TCG-marked representation of (7Bi:ii) given in (10c), \textit{rice} is the only expression that bears the feature +C. It follows under our analysis, then, that \textit{rice} will be the apparent associate of \textit{only}. The possibility of \textit{only} associating exclusively with \textit{EATS} in (7Bi:ii) can also be accounted for by assigning the representation in (10a) to this example. For (7Bi:ii), in contrast, the analysis cannot be correct. By assumption, only the representations in (10a,b) are compatible with the discourse requirements imposed by the explicit contrast in these examples. The problem is to explain how association of \textit{only} with \textit{EATS} is the only option available. The representation in (10a) has just such an
interpretation. The only expression bearing +C within the scope of only is EATS, and hence this is the only expression that can possibly associate with only. The problem comes from the representation in (10b). Here, there are two expressions bearing the feature +C within the scope of only. Under the analysis being considered, both of these +C-marked expressions are interpreted as (separate) foci leading to their automatic association with only. Not only does this representation fail to generate the desired interpretation, the interpretation it does generate is in fact an interpretation that the sentence in (2B) altogether lacks, in any context. That is, despite the fact that EATS and rice can independently associate with only, it is not possible for both associations to occur at the same time. This can be shown with the following discourse.

(17) A: Mary grows corn.
   B: Oh yeah? TOMB sells RICEA.
   C: That's interesting. JOHNB only EATSÀ rice.
   C': That's interesting. JOHNB only EATSÀ.
   C'': That's interesting. JOHNB only EATSÀ BEANSÀ.

(17C) can be taken to imply that John does not sell rice, which is compatible with only associating either narrowly with EATS, associating multiply with EATS and with rice or associating broadly with the VP. However, it cannot be taken to imply that John also does not grow corn, suggesting that the latter two associations are not an option. This conclusion is strengthened by (17C') and (17C'') in the same context, each of which can very readily be taken to imply that John neither grows corn nor sells rice. This shows that there is no problem in principle with the contrast set for (17C) containing both relevant sentences from (17A) and (17B), so the absence of a reading in which both antecedents are taken to be contrasted with (17C) requires a separate explanation.

There are two general approaches that one could imagine taking to this problem. The first is to restrict the possible syntactic representations that can serve as input to the semantics. If (10b) and any similar representations can be blocked in the syntax, for example, then the question of how to interpret such representations never arises, and multiple association could potentially be blocked as well. The second approach is to assume that only is sensitive to the distinction between distinct types of contrasting expressions, differentiating, for example, CG expressions from C expressions in the semantics. If we take these TCG markings to act as complex indices, then we could summarize this property of only by saying that any occurrence of only binds exactly one index.

To allow for separate association with distinct types of focus while blocking simultaneous cross-type association, I propose to generate distinct focus values for each combination of TCG values that can act as a focus. Continuing with our assumption that +C is a necessary feature for focus interpretation, this makes for a maximum of 4 distinct focus values for any expression.13 Schematically, these values will look as follows: For a sentence S of the form Ac Bcz Czε Dzε Ez, where subscripts indicate the positively marked TCG features, the set of all focus values will be:

\[
\{ [[x B C D E] : x \in \text{Alt(A)}] ,
\{ [[A x C D E] : x \in \text{Alt(B)}] ,
\]

13 If it is empirically determined that +T marked expressions are never analyzed as foci, then the set of focus semantic values can be reduced to having only 2 members.
\[\{[A\ B\ x\ D\ E] : x \in \text{Alt}(C)\},\]
\[\{[A\ B\ C\ x\ E] : x \in \text{Alt}(D)\}\}

Since *only* is sensitive to focus values, it has to choose one from among this set to generate an associative interpretation. Since no focus value within the set includes alternates of two expressions with different TCG marking, it follows that simultaneous association with distinct focus types is blocked, as desired.

5.2 Ordering of Focus Types

The analysis just sketched is still incomplete in that it fails to give a way of deciding which focus value to select, giving us no account yet of the fact that in the contrastive reading in (7Bi) and (7Bii), association with the deaccented *rice* is impossible. If the representation in (10b) is a possible one for these examples, then the analysis sketched predicts that either focus \(EATS \) or \(riceCG\) — could be the associate of *only*, contrary to what is observed. Something additional is thus needed to block the possibility of association with *rice* in these examples. The easiest solution to this problem is to impose an ordering on the various focus values depending on the TCG marking that gives rise to them. The desired outcome will be derived by taking C-based values to precede CG-based ones, and having *only* select the highest non-trivial focus value available within this ordering. With this addition, *only* will always associate with a C-marked accented focus in its scope if there is one, resorting to association with a CG-marked given focus only in the absence thereof.

To see how this analysis accounts for the facts presented in (7), consider once again the representations given in (10), where (10a,b) are the only representations available for (7Bi,ii), but (10c) is available in addition to (10a,b) for (7Biii), as discussed above.

(10)a. JOHN \(_{TC}\) (in contrast) only \(EATS \_c\) \(riceG\)
b. JOHN \(_{TC}\) (in contrast) only \(EATS \_c\) \(riceCG\)
c. (Oh yeah?) JOHN \(_T\) only \(EATS \_T\) \(riceCG\)

In (10b), both \(EATS\) and \(rice\) are foci, though of different types. The ordered set of focus values for this VP will then be the following:

(19) \(<\{\lambda x. x \text{ rice: } R \in \text{Alt}(EATS)\},\>
\{\lambda x. x \text{ eats y: } y \in \text{Alt}(rice)\},\>
\{\lambda x. x \text{ eats rice}\},\>
\{\lambda x. x \text{ eats rice}\}>\)

Within this ordering, the highest ordered focus value that has more than one member is the very first one, in which alternatives to eating are introduced. By hypothesis, then, it is this element that *only* obligatory chooses for calculating the semantics of the sentence, giving rise to apparent association with \(EATS\). Despite the fact that *rice* is analyzed as a focus, since the alternatives it introduces are later in the ordering than the alternatives introduced by \(EATS\), the focus value based on analyzing *rice* as a focus cannot be selected as the contrast set for *only*, making it impossible to generate a reading in which *only* appears to associate with *rice*. Association of *only* with \(EATS\) in (10a) follows in roughly the same way, with *only* again selecting the highest focus value from the ordering of focus values.

While association of *only* with *rice* is blocked in (10a,b), in (10c) it still comes out as
obligatory under the analysis outlined. The reason for this is that \textit{EATS} in (10b) is $-C$, and hence not a potential focus. This means that the $-T,+C,-G$ induced focus semantic value, which is the highest in the hierarchy of focus semantic values, will be a singleton set, as shown in the ordering of focus values generated for (10) given below, making the focus value induced by \textit{rice}_{CG} the highest non-trivial focus value in the ordering.

\[(20) \{ \{ \lambda x. x \text{ eats } \text{rice} \} > \{ \lambda x. x \text{ eats } y: y \in \text{Alt(\text{rice})} \} > \{ \lambda x. x \text{ eats } \text{rice} \} > \{ \lambda x. x \text{ eats } \text{rice} \} \}\]

By selecting the highest non-trivial focus value from this ordering, \textit{only} will effectively associate with \textit{rice} as desired.

### 5.3 Movement and Association

The analysis sketched above presupposes that association with \textit{only} does not involve movement of any constituent to \textit{only}. This assumption has been questioned in the literature by Tancredi (1990,1992,1997), Drubig (1994), and Wagner (2005) among others. It is thus worth taking a moment to address the possibility of combining the proposed analysis with a movement-based analysis of association. I take as a starting point the analysis of Wagner, according to which a maximal projection moves to an internal argument position of \textit{only} prior to LF. Movement of a head is crucially disallowed in this analysis. For the sentence in (2B), this means that the only options are movement of the VP \textit{EATS rice} or of the NP \textit{rice}. Movement of the VP will simply duplicate the \textit{in situ} analysis already examined, and so need not be examined in detail. Movement of the NP, however, would wreak havoc on the predictions of the analysis. In particular, if we start with a representation like (10b), in which \textit{EATS} is an accented focus and \textit{rice} a given focus, movement of \textit{rice} to \textit{only} will result in an unwanted association between the two, leading us to expected an unobserved interpretation for the sentences in (7Bi,ii). The assumption that movement is involved in association thus comes with a requirement of restricting that movement when the moved element is a given focus. While this objection looks devastating at first glance, I will show below that in fact a very natural restriction can be adopted which will block the offending derivation.

### 6 Extensions

#### 6.1 TCG Marking of \textit{only}

We now turn to one of the more complex issues involved in determining the correct pronunciation and interpretation of the sentence \textit{John only eats rice}, namely the TCG analysis of \textit{only}. In our original example in (2B), \textit{only} surfaces without any accent. However, from brief inspection of the context it is clear that \textit{only} cannot be analyzed as given, since there is no possible antecedent in the context that could license it. This means that from the perspective of discourse \textit{only} has to be $+T$ and/or $+C$, but $-G$. The problem this poses is one of explaining the lack of accent on \textit{only}.

Selkirk (1984) observes similar behavior in verbs selecting internal arguments. In
particular, when an internal argument is accented, the focus can be interpreted either narrowly on the argument or more broadly on both the argument and the verb. Furthermore, in neither case does the verb itself have to bear an accent. The analysis Selkirk proposes is that the verb in this case inherits focus marking from its internal argument. This proposal, however, presupposes that syntactic focus marking is determined by phonological accent location, an assumption that makes it impossible to distinguish certain occurrences of focus and topic from one another. Here I will re-interpret Selkirk's analysis in purely interpretive terms, both semantically and phonologically. What is needed is the assumption that when a theta-marking head and its internal argument share their TCG marking, the TCG marking is phonologically realized obligatorily on the argument, and only optionally on the head. I assume that the default phonetic realization for an expression that does not realize its TCG marking is one lacking a pitch accent, accounting for the observed non-accentuation of a focused verb with a focused and accented object.

Combining this revised version of Selkirk's analysis of the argument–accent connection with Wagner's analysis of only leads to a natural account of the accenting of only: when only shares the TCG marking of its internal argument, then that TCG marking only needs to be realized on the raised argument, making it possible for only itself to remain unaccented. When the TCG marking of only differs from that of its internal argument, then both TCG markings must be phonetically realized. To complete the analysis, we need only one more piece. If we assume that the VP is a potential internal argument for only, as appears necessary under present assumptions in order to derive association with the verb EATS, then in order for the analysis sketched to make it possible for a T/C-marked only to remain unaccented when associated with the verb it is necessary to assume that the VP itself has some TCG marking. For this we can once again adapt Selkirk's analysis, in which syntactic marking of focus on a head percolates to the maximal projection of the head. The only change required is to take percolation to apply to TCG marking rather than to the undifferentiated F-marking that Selkirk employed. This means that whatever marking appears on the head verb EATS will appear as well on the VP.

With the analysis now in place, let us see how the lack of accent on only in (2B) can be explained. Noting that this same lack of accent is observed in all of the contexts considered in (7), it follows that modified versions of all three representations given in (10) need to be considered. Let us look at (10a) first. On an in situ analysis of association, this analysis generated an apparent association only with the verb EATS, and not with the object rice. Under the movement analysis, however, we have to consider two possible LF representations that can be derived from (10a), given in (21),

(21)a. JOHN_{TC} (in contrast) only_{C} [EATS_{C} rice_{G}]_{C,t} t_i 

(21)b. JOHN_{TC} (in contrast) only_{TC} [rice]_{G,t} EATS_{C} t_i

In both representations, the verb EATS as well as the VP it heads are taken to be C-marked and rice is G-marked. Furthermore, only is discoursally required to not be G-marked. The bracketed expressions are assumed to be the internal arguments of only at LF. With the representation in (21a), the TCG marking of only matches that of its internal argument EATS.
This configuration makes it possible to phonetically realize the TCG marking on the argument and pronounce the head *only* by the default rule, spelled out as a lack of accent. In (21b), in contrast, the TCG marking on *only* is distinct from that on its internal argument *rice*, blocking default pronunciation of *only*. Regardless of the TCG marking assumed for *only*, then, given that it cannot contain +G, whatever marking it does have – T, C, or TC – will result in its being phonetically accented.

Allowing TCG marked constituents to contain other TCG marked constituents makes it necessary to reconsider how the semantics interprets TCG marking. In the example given in (21), the desired answer is for *EATS* to be analyzed as a focus for the purpose of calculating focus values but for the VP not to be. To obtain this result, I assume that only TCG-marked expressions that do not dominate other TCG-marked expressions can be considered to be foci or topics. With this assumption, the semantics of (21a) will come out identical in all relevant respects to that of (10a) with *in situ* interpretation of focus, hence deriving the desired apparent association with *EATS*.

The two LF representations that can be derived from (10b) do not add any further problems. The only differences between those LF representations and the ones in (21) will be that *rice* will be CG-marked instead of only G-marked. Since the VP will remain C-marked, as will *EATS*, nothing changes in the interpretation or phonetic realization compared to (21a). Similarly, since *only* cannot be G-marked, nothing relevant changes in the interpretation or phonetic realization compared to (21b). An unaccented *only* will be able to associate with *EATS* but not with *rice*, or put the other way, an *only* that associates with *EATS* will be able to surface without an accent, but one that associates with *rice* will not.

We come finally to the LF representations associated with (10c). Given the same two raising options as we had for the other two representations in (10), the LF representations to consider are those in (22).

(22)a. \[\text{JOHN}_{\text{T}} \, \text{only}_{\text{T}} \, [\text{EATS}_{\text{T}} \, \text{rice}_{\text{CG}}]_{\text{T:i}} \, t_{\text{i}}\]

b. \[\text{JOHN}_{\text{T}} \, \text{only}_{\text{T:C}} \, [\text{rice}_{\text{CG:i}} \, \text{EATS}_{\text{T}}] \, t_{\text{i}}\]

Of these two representations, only with that in (22a) can *only* surface without an accent. There it shares the TCG marking of its internal argument, and hence can be assigned a default pronunciation. In (22b), in contrast, the TCG marking on *only* and its internal argument differ, making it necessary for the TCG marking on *only* to be realized on *only*. Since *only* cannot be +G for familiar discourse reasons, it follows that with the representation in (22b) *only* would have to bear an accent. This means that (22b) cannot be the LF representation of (2B) as it occurs in (7Biii), leaving only (22a) as a remaining possibility. However, we have already seen that the *in situ* counterpart to (22a), i.e. (10c), gives rise to apparent association with *rice*, and given how we have chosen to interpret TCG marking in the semantics on our new account, the same analysis will essentially carry over to (22a). Thus, even without moving *rice* to *only* as in (22b), we can still account for the apparent association between these two expressions.

### 6.2 A Bonus

The original paradigm constructed in section 1 makes it appear as if association with a given focus should always be possible. In fact, however, making a minor change in the example
shows that this is not the case. Compare the original example in (2) with (23).

(2) A: Mary grows rice.
   B: JOHN\textsubscript{B} only EATS\textsubscript{A} rice. (ambiguous: only EATS, or only rice)

(23) A: Mary eats corn.
   B: JOHN\textsubscript{B} only eats RICE\textsubscript{A}. (unambiguous: #only eats, ok only RICE)

In both examples it appears on the surface as if there are two potential foci in the scope of only, one a given focus and the other an accented focus. While we have already argued that this is the right way of viewing (2B), however, it does not look like the right way to view (23B), since there is no reading of this sentence with accents only on JOHN and RICE in which only is associated with eats.

If the focus structure of the sentence included only focus markings on each of the individual words in this sentence, it is difficult to see how the difference between (2) and (23) could ever be accounted for in a non-stipulative way. However, on the analysis constructed above, the difference between these two examples falls out directly. To see this, consider the possible LF representations for (23B).

(24) a. JOHN\textsubscript{I} only\textsubscript{T/C} [eats\textsubscript{CG} RICE\textsubscript{C/G}]\textsubscript{C/G} i\textsubscript{t} 
   b. JOHN\textsubscript{I} only\textsubscript{C} [RICE]\textsubscript{C/G} eats\textsubscript{CG} i\textsubscript{t}

As with (2B), only in (23B) cannot be +G since there is no licensing antecedent for it in the discourse. And again as with (2B) we have to consider the possibility of raising either the VP as in (24a) or the object NP as in (24b). The LF representation in (24b) is unproblematic. It generates a reading in which only is associated with RICE, and since only and RICE share their TCG marking only can be given a default, unaccented pronunciation. In (24a), however, things are different. Since the VP is headed by the CG-marked eats, it follows on our analysis that the VP as a whole will be CG-marked. Since only cannot be G-marked, it further follows that only cannot share the TCG marking of its internal argument, blocking a default pronunciation for only in this example. The only other options all lead to only being pronounced with an accent, an option that is available and that does allow for only to associate with rice in the minimal variant to (23) incorporating this accent. However, association of only with rice in (23B) remains blocked.

7. Conclusion

In this paper I have been concerned with the phonetic realization and interpretation of one sentence in a narrow range of contexts. I have proposed a new framework for the syntactic representation of topic, focus and givenness in which each of these discourse phenomena give rise to its own binary syntactic feature, T, C and G respectively. The relation between syntax and discourse is mediated by a modified version of Buring's (1999) semantics for topic, while the phonological realization of these features is derived in a manner parallel to that of Selkirk (1984). This framework was used to give an explicit analysis of the sentence

\^15 This problem was pointed out independently by Makoto Kanazawa and by David Beaver during separate presentations of this material.
JOHN only EATS rice, showing how changes in the TCG marking simultaneously affect the phonological realization of accents, the possibility of semantic association with focus-sensitive only, and appropriateness in discourse. Each of these three areas by themselves involve a depth of complexity that I have not been able to even scratch the surface of. It is thus to be expected that the details of the analysis presented will have to undergo perhaps extensive modification, or at least extensive elaboration, before it can be used to account for everything in this domain that requires explanation. The purpose in putting these three areas all together in one paper, however, has been to show that it is possible to address all aspects of topic, focus and givenness in a unified manner, using a single syntactic framework as a base. The framework of TCG marking in this sense plays a unifying role in making it possible to present analyses of one aspect of focus interpretation – for example the phonology of Topics – that will have testable consequences for other related theories, such as the semantics of Givenness.

References


Schwarzschild, Roger (1999) "Givenness, AVOIDF and other constraints on the placement of accent," Natural Language Semantics 7:141-177


