

DISCUSSION NOTES

Focus projection and prosodic prominence in nested foci*

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1. INTRODUCTION. What is the relation between focus and pitch accents? The studies of Selkirk (1995) and to a lesser extent Schwarzschild (1999) view pitch accents and focus as directly related to each other via an intermediate distribution of abstract F-marks which link to pitch accents on one end and to the discourse status of syntactic constituents on the other. In this discussion note we argue for the opposite view, showing that pitch accents are unrelated to F-marks and that instead their distribution follows ENTIRELY from the interaction between the constraints that govern the prosodic organization of the clause and the constraints STRESS-FOCUS and DESTRESS-GIVEN that govern the prosodic expression of discourse status.

As we show in §2, identifying pitch accents with F-marks is not possible due to the inescapable cases of pitch accents lacking corresponding F-marks and of F-marks lacking corresponding pitch accents. This result undermines the most appealing aspect of Selkirk's and Schwarzschild's analyses—namely the potential for deriving the prosodic expression of focused and given constituents directly from their F-marking—and makes the constraints governing the prosodic expression of discourse status indispensable.

The relation between F-marks and pitch accents is also called into question by data involving nested foci such as 'farmer' sentences (Rooth 1992; see 19) and 'Superman' sentences (Neeleman & Szendrői 2004; see 36), as well as sentences involving right-node-raising constructions. In all of these cases F-marking cannot distinguish the material inside the innermost focus from the equally focused material immediately outside it and therefore cannot explain the pitch accent's preference for the innermost focus.

Both problems disappear once we maintain that pitch accents express the heads of prosodic constituents (Selkirk 1995, Ladd 1996) and that they are unrelated to F-marks. Their distribution then follows straightforwardly from the interaction of STRESS-FOCUS and DESTRESS-GIVEN with the constraints governing the position of prosodic heads. The same interaction also derives the principles of prosodic economy proposed by Neeleman and Szendrői (2004) and the prosodic consequences of Schwarzschild's AVOIDF constraint. The analysis also contributes to the growing evidence supporting a model of the prosodic expression of focus based on optimality theory (Prince & Smolensky 1993), including among others Truckenbrodt 1995, 1999, Selkirk 2000, Büring 2001, 2003, Szendrői 2001, Büring & Gutiérrez-Bravo 2002, Dehé 2004, Samek-Lodovici 2005, and Féry 2006.

We start with a review of Selkirk 1995 and Schwarzschild 1999 and the reasons why the pitch-accent/F-mark identity cannot be maintained despite its conceptual appeal. We then introduce the prosodic and discourse-status constraints ultimately responsible for the tonal contour of focused sentences and examine their optimality-theoretic interaction with regard to farmer and Superman sentences and right-node-raising constructions. This examination allows the consequences of DESTRESS-GIVEN to be studied in some detail.

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2. THE LIMITS OF F-MARKING. Selkirk's (1995) F-projection model is appealing in its aim to determine at once both the focus marking of a clause and the corresponding prosodic contour. The basic F-rule in 1 ensures that a pitch accent is identified with an F-mark. Once assigned in the form of pitch accents, F-marks are allowed to percolate upward in the tree structure according to the F-projection rules, formulated in 2, eventually providing the tree-structure representation with an F-marking that identifies which constituents count as focused in accord with the principle in 3 (adapted from Selkirk 1995: 555).

- (1) BASIC F-RULE: An accented word is F-marked.
- (2) F-PROJECTION RULES:
 - a. F-marking of the head of a phrase licenses the F-marking of the phrase.
 - b. F-marking of an internal argument of a head licenses the F-marking of the head.
- (3) FOCUS: A focus-marked node is an F-marked constituent not dominated by any other F-marked constituent.

Selkirk's system has come under criticism for its inability to capture the role played by discourse-givenness in constraining the assignment of pitch accents. Büring (1997, 2003) and Schwarzschild (1999) notice how the given status of *convertible* prevents it from being accented in 4A despite the focus status of the object *her blue convertible* determined by the preceding question. The problem is that under the F-projection rules in 2, which are necessary to deal with cases of nonfinal narrow focus, F-marks cannot spread beyond the adjective *blue*, since this adjective is neither a head nor an internal argument of a head, incorrectly predicting narrow focus on *blue*. Further problematic cases are discussed in Schwarzschild 1999 and Büring 2003.

- (4) {John drove Mary's red convertible. What did he drive before that?}
- A: He drove her BLUE convertible.

For these reasons, Schwarzschild's own attempt at linking focus and prosody abandons the syntactically driven percolation of F-marks and instead lets them be assigned freely. The resulting F-markings are then filtered by constraints regulating the relationship between discourse status and F-marks. His two main constraints appear in 5.

- (5) a. GIVENNESS: A constituent that is not F-marked is given.
- b. AVOIDF: Do not F-mark.

GIVENNESS posits that non-F-marked constituents are 'given', that is, entailed from context in the precise semantic sense that Schwarzschild (1999) defined. AVOIDF selects the structures with the smallest number of F-marks. In Schwarzschild's example, the F-markings in 6a and 6b both comply with GIVENNESS, but 6a is preferred to 6b because it complies with AVOIDF better than 6b.

- (6) Who did John_i's mother praise?
 - a. She praised [HIM_i]_F
 - b. She [[PRAISED]_F him_i]_F

A major appeal of Schwarzschild's approach is its potential for capturing the generalization that focused constituents are accented while discourse-given ones are not (together with the related systematic exceptions) by means of constraints governing F-marking rather than by additional constraints such as STRESS-FOCUS or DESTRESS-GIVEN. By positing that non-F-marked constituents are given, GIVENNESS ensures that new constituents have to be F-marked, and insofar as F-marked terminal nodes are accented, the interaction between the two constraints in 5 guarantees that focused constituents, which are determined on the base of F-marking as specified in 3, are accented

too. As for the unstressed status of given phrases, AVOIDF ensures that no F-mark, and therefore no accent, is ever assigned to a given constituent except where GIVENness requires it, as shown in 6 above; see Schwarzschild 1999 for discussion.

Even Schwarzschild's model, however, runs into problematic cases that force the reintroduction of constraints like STRESS-FOCUS and DESTRESS-GIVEN. A first case, pointed out by Schwarzschild himself, concerns sentences where a focused constituent consists entirely of given items. In 7, the second occurrence of the DP *the rising of the tides* is F-marked (otherwise the VP *depends upon the rising of the tides* would count as given even though not entailed by the context; see Schwarzschild 1999:172). Crucially, however, all material within the DP is given and should be left unmarked. In particular, *tides* cannot be F-marked because GIVENness does not require it (*tides* is given) and AVOIDF bans any unnecessary F-marks. It follows that the pitch accent on *tides* occurs DESPITE the lack of F-marks on the individual words, showing that the origin and distribution of pitch accents is independent from F-marking. It also follows, as Schwarzschild acknowledges, that a constraint like STRESS-FOCUS cannot be dispensed with as it is the only possible cause for the accent on *tides*.¹

- (7) {The rising of the TIDES depends upon the MOON being full and}
 [the BOAT_F being empty_F]_F depends upon [the rising of the TIDES]_F

A second problematic case is shown in 8. Here the entire VP is focused and GIVENness determines the displayed F-marking (Schwarzschild 1999:155). This particular example is straightforward under Selkirk's analysis, where a single pitch accent on *brother* projects an F-mark first to the selecting head *praised* and then to the entire VP. Selkirk's system also accounts for the different prosodic expression of the F-marks on *praise* and *brother* since in her system F-marks licensed by rule 2 need not be accented.

- (8) {What did Mary do?}
 A: She [praised_F [her BROTHER_F]_F]_F

The same distinction, however, cannot be used when F-marks are assigned freely and therefore independently of one another. Crucially, it cannot be the case that every F-marked terminal is accented, since *praised* here is not, despite being F-marked. It follows that the conditions governing the phonological expression of F-marked terminal nodes must be specified, as Schwarzschild indeed does through his HEADARG constraint governing prosodic prominence within F-marked constituents.

Examples 7 and 8 complement each other, providing one case where a terminal node is accented but not F-marked (*tides*) and another case where a terminal node is F-marked but not accented (*praised*). It follows that F-marks and pitch accents must be treated as independent entities. It also follows that the assignments of F-marks determined by GIVENness and AVOIDF are relevant for computing focused and given status, but cannot directly identify an assignment of pitch accents, supporting the necessity of constraints that govern the relation between prosody and discourse status such as STRESS-FOCUS and DESTRESS-GIVEN.

3. CONSTRAINTS AFFECTING THE POSITION OF PITCH ACCENTS. The results above offer the foundations for the analysis proposed in the following sections. We maintain that pitch accents are unrelated to F-marks and instead identify them with the heads of prosodic constituents. The position of these heads is affected by two sets of conflicting constraints, the constraints on head-alignment and phrasal stress introduced in §3.1, and the constraints STRESS-FOCUS and DESTRESS-GIVEN discussed in §3.2. The relevant

¹ Schwarzschild's analysis eventually does assign an F-mark to *tides*. This F-mark is not required by GIVENness and AVOIDF, however (in fact it violates AVOIDF). It is assigned only to satisfy Schwarzschild's version of STRESS-FOCUS and following Selkirk's basic F-rule requiring accented words to be F-marked.

prosodic constituents are determined along the lines of Selkirk 1984, 2000, Nespor & Vogel 1986, Ghini 1993, and others, which derive them from the syntactic structure, modulo certain rhythmic adjustments. Function words, like pronouns and prepositions, do not form their own phonological phrases, and prosodically light arguments or adjuncts are readily integrated into adjacent phrases.

3.1. CONSTRAINTS ON THE PROSODIC STRUCTURE. We assume that the position of prosodic heads is governed by the constraints listed in 9, adapted from McCarthy & Prince 1993 and Truckenbrodt 1995, 1999. The constraints HP and HI push stress rightmost in a sentence by requiring prosodic heads to align with the right boundary of the corresponding phonological and intonational phrases (henceforth respectively called ‘P-phrases’ and ‘I-phrases’). STRESSXP requires lexical projections to express prosodic prominence by attracting a prosodic head on one of their lexical items.

- (9) a. HP: Align the right boundary of every P-phrase with its head(s).
- b. HI: Align the right boundary of every I-phrase with its head(s).
- c. STRESSXP: Each lexically headed XP must contain a phrasal stress (where ‘phrasal stress’ refers to the head of a P-phrase).

Assuming that clauses are parsed within single I-phrases (Halliday 1970, Pierrehumbert 1980, Selkirk 1984, Gussenhoven 2004), the above constraints subsume the NUCLEAR STRESS RULE (Chomsky & Halle 1968) by assigning stress rightmost whenever no other constraint interferes with them. This is the case in sentence 10, for example, also repeated as candidate (a) in tableau 11 below, which satisfies all of the above constraints.

Failing to place stress rightmost incurs the violation of one or more of the above constraints, yielding suboptimal structures. For example, nuclear stress on the subject in candidate (b) violates HI, while stress on the verb in candidate (c) violates HP on top of violating STRESSXP on the object. Note how the same constraints also determine a secondary prominence peak on the subject, since parsing the entire sentence into a single P-phrase as in (d) violates STRESSXP.

- (10) (x) I
 (x) (x) P
 Ms. Dalloway will buy the flowers.

(11)	Ms. Dalloway will buy the flowers.	STRESSXP	HP	HI
a.	(x) I (x) (x) P Ms. Dalloway will buy the flowers.			
b.	(x) I (x) (x) P Ms. Dalloway will buy the flowers.			*
c.	(x) I (x) (x) P Ms. Dalloway will buy the flowers.	*	*	
d.	(x) I (x) P Ms. Dalloway will buy the flowers.	*		

3.2. CONSTRAINTS ON THE EXPRESSION OF FOCUSED AND GIVEN STATUS. The prosodic prominence of syntactic constituents is also affected by their given or focused status. The latter follows from the discourse context and is therefore part of the input of the optimality-theoretic evaluation of each sentence. We assume it to be determined according to Schwarzschild's (1999) analysis amended as follows.

First, F-marks do not translate into pitch accents, and neither do pitch accents translate into F-marks, for the reason discussed in §2. Consequently, the constraining action of AVOIDF on the distribution of F-marks will never directly determine the presence or absence of pitch accents.

Second, we need to ensure the appropriate marking of contrastive focus in sentences involving nested foci, like in 12 (from Rooth 1992:80), where the adjective *American* occurs within a nongiven DP and is focused by its contrast with *Canadian*.

(12) An AMERICAN farmer was talking to a CANADIAN farmer.

Schwarzschild's model is unable to deal with cases like this. The GIVENness constraint mandates the F-marks shown in 13 because all constituents are new except for the second instance of *farmer* and the corresponding DP (the DP is not new because its existential F-closure, roughly $\exists X[X \text{ farmer}]$, is entailed by *American farmer*). Under Schwarzschild's focus rule (1999:170), every F-marked node not immediately dominated by another F-marked node counts as focused. This correctly determines the focused status of the entire sentence and of the adjective *Canadian*, but not of the adjective *American*, which is immediately dominated by the F-marked DP. Yet as we show in §4, the focused status of *American* is an essential factor in determining the overall prosodic contour of the sentence.

(13) [An [AMERICAN_F farmer_F]_F [was talking_F to a [CANADIAN_F farmer]]_F]_F

An appropriate integration of this kind of contrastive focusing into Schwarzschild's analysis is not the aim of this discussion note and we therefore leave it open to further research. We therefore follow Schwarzschild in assuming that any F-marked phrase that is not immediately dominated by another F-marked phrase counts as focused, but we also allow any additional focus marking mandated by the condition in 14.

(14) CONTRASTIVE FOCUS: Two distinct constituents YP and ZP are focused whenever they share the same background (i.e. they occur in the same discourse or sentence in two disjoint phrases [... YP ...]_{XP} and [... ZP ...]_{XP} that match on every node other than YP and ZP).

The final focus marking for sentence 12 is provided in 15. The entire sentence and the second adjective are focused in the manner explained above. The adjective *American* is focused too, but only through the contrastive-focus condition in 14. Focus is henceforth marked as 'f' (rather than 'FOC' as in Schwarzschild 1999) and where relevant, we also mark discourse-given constituents as 'G'. We no longer represent the F-marks necessary for their determination, however.

(15) [An AMERICAN_f farmer was talking to a CANADIAN_f farmer]_f

We may now define the constraints DESTRESS-GIVEN and STRESS-FOCUS.

- (16) a. DESTRESS-GIVEN (DG): A given phrase is prosodically nonprominent.
 b. STRESS-FOCUS (SF): A focused phrase has the highest prosodic prominence in its focus domain.

The DG constraint denies prosodic prominence to discourse-given constituents, capturing the unstressed status of given phrases discussed in Ladd 1980, 1996, Selkirk 1984, Rochemont 1986, and Gussenhoven 1992. DG is necessary to account for the difference between A1 and A2 in cases like 17, where it ensures that discourse-given *John* remains

nonprominent in A2 even though VP-final objects in a focused VP are normally stressed, as shown in A1.

(17) Q: What did John's mother do?

A1: She [praised BILL]_f

A2: She [PRAISED John]_f

As for the SF constraint, it is widely present under different names in the literature on focus prosody; see among others Jackendoff 1972, Selkirk 1995, Zubizarreta 1998, Schwarzschild 1999, Büring 2003, and Samek-Lodovici 2005.

The formulation in 16 follows Truckenbrodt (1995:165) in requiring that the highest prominence be assigned only relative to the focus domain. The focus domain always contains the focused phrase and identifies the background information relevant to the semantic denotation of focus; it is thus defined in semantic terms and does not necessarily coincide with a single prosodic constituent (for a brief discussion see example 18 and n. 1 below, and see also chapter 4 in Truckenbrodt 1995). Truckenbrodt's definition makes SF sensitive to the extension of the focus domain. For example, in a simple Q/A pair like 18 the domain of the focused subject in answer A encompasses the entire clause, whereas in the nested-focus case in 19 the domains of the contrastively focused adjectives are restricted to the DPs containing them.² In each example the focus domain is marked as 'fd'.

(18) Q: Who left?

A: [JOHN_f left]_{fd}

(19) ((x) I
 (x) (x) P
 [[An AMERICAN_f farmer]_{fd} was talking to [a CANADIAN_f farmer]_{fd}]

Consequently, in 18 SF requires *John* to receive the highest prosodic prominence in the entire clause, whereas in 19 it requires only the focused adjectives to be most prominent in their DPs. This in turn enables main stress in 19 to fall on *Canadian* without violating SF relative to *American*, since the latter is not required to be most prominent in the entire sentence.

² The focus domain for the focused adjectives in 19 is calculated along Truckenbrodt's (1995) definition, where it coincides with the maximal constituent that abides to Rooth's (1992) conditions on focus scope. In particular, if D is chosen as the domain of focus in relation to a context C, then the following three conditions must hold.

- (i) $\llbracket D \rrbracket^0 \in \llbracket D \rrbracket^f$ (the semantic denotation of the domain must be included in the focus denotation)
- (ii) $\llbracket C \rrbracket^0 \in \llbracket D \rrbracket^f$ (the semantic denotation of the context must be included in the focus denotation of the domain)
- (iii) $\llbracket C \rrbracket^0 \neq \llbracket D \rrbracket^0$ (the semantic denotation of the context cannot coincide with that of the domain)

In the case of 19 consider first the choice D = 'an American farmer' and C = 'a Canadian farmer'. Condition (i) is satisfied because the semantic denotation of D, roughly 'an American farmer', is contained in its focus denotation, roughly 'X farmer'. Condition (ii) is also satisfied, since the semantic denotation of C, roughly 'a Canadian farmer', is also contained in 'X farmer'. Condition (iii) is satisfied as well because 'an American farmer' does not coincide with 'a Canadian farmer'.

Before concluding that the focus domain is the DP we must also check whether this is the maximal domain consistent with conditions (i)–(iii). Consider, for example, setting the domain D equal to the entire clause in 19. Condition (i) remains satisfied because 19 is contained in its focus value, roughly 'an X farmer was talking to a Y farmer'. In order to satisfy (ii) we must set the context C equal to the entire clause as well. Condition (ii) is then satisfied too because C is now identical to D and therefore it too is entailed by the focus value of 19. But the identity of C with D violates condition (iii), proving that the focus domain of the focused adjectives cannot coincide with the entire sentence.

4. NESTED FOCI. Under specific circumstances the constraints on discourse status conflict with the prosodic constraints. One such case occurs under nested foci with overlapping domains when the contained focus is not rightmost with respect to the containing focus, as in the schema in 20. In this case, SF requires both foci to bear the highest prosodic prominence and can be satisfied by assigning local prominence to the innermost focus (here 'X'). This, however, violates HP and HI whenever the innermost focus is not rightmost in the corresponding phrasal and intonational phrases.

(20) . . . [. . . [X]_f Z]_f . . .

In this section and the following ones, we discuss several instances of nested foci of this kind, starting with farmer sentences.

4.1. NESTED FOCI IN FARMER SENTENCES. The first example of nested foci occurs when two constituents are contrasted within the same sentence. This is illustrated by 21 and 22 below, where round brackets represent P-phrasal boundaries. The first instance of the noun *farmer* is new in both sentences, but it is prosodically prominent within its P-phrase only in 21 where the adjective is not contrastively focused.

(21) (An American FARMER) (was talking to BILL).

(22) (An AMERICAN farmer) (was talking to a CANADIAN farmer).

Hartmann (2000) derives the prosodic contour of cases like 22 by attributing discourse-given status to both occurrences of *farmer* due to their repetition. This triggers their destressing, leaving the adjective as the only possible location for phrasal stress.

A potential problem for this analysis emerges in example 23, where the noun *car* occurs twice in the sentence and yet shows phrasal stress on its first instance and none on its second. If repetition of a DP were sufficient to trigger discourse-given status on both occurrences, we would expect *car* to be destressed throughout.

(23) [(A farmer without a CAR) (is likely to BUY a car)]_f

The same point can be made by extending 22 as shown in 24, where the PP *with a purple Chevrolet* like *farmer* occurs twice in the sentence, and yet the first instance of *Chevrolet* is stressed. Once again if the first instance were genuinely discourse-given we would expect it to be destressed like the second.

(24) [(An AMERICAN_f farmer) (with a purple CHEVROLET) (was talking to a CANADIAN_f farmer) (with a purple Chevrolet)]_f

It follows that the first instance of *farmer* in 22 is not given either, which in turn calls for an explanation for its nonprominent status. We are facing the nested-foci configuration schematized in 20 above, where the nested focus does not occur rightmost in the P-phrase encompassing the DP but the material at its right is not given. The adjective is focused relative to the DP (i.e. its focus domain), and the DP is itself part of the focus encompassing the entire sentence (see 25). This focus configuration triggers a conflict between SF, which requires the adjective to receive the highest prominence within the DP and would assign a lower prominence to *farmer*, and HP, which favors rightmost prominence within the P-phrase and would assign a higher prominence to *farmer*. SF overrides HP, placing prominence on the adjective.

(25) (x) P
 [[An AMERICAN_f farmer]_{fd} . . .]_f

The corresponding optimality-theoretic analysis is illustrated in 26 and 27. For the sake of clarity we omit the focus marking of the entire sentence from the competing structures and postpone the discussion of sentence accent to §4.2. When the adjective is not contrastively focused, HP requires phrasal stress to occur rightmost in the

P-phrase, favoring structure (a) over structure (b) as shown in 26. Focusing of the adjective, however, attracts phrasal stress due to the higher rank of SF with respect to HP; see 27.

(26)	[An American farmer was talking to Bill] _f	SF	HP
a.	(x) P An American farmer		
b.	(x) P An American farmer		*!

(27)	[An American _f farmer was talking to a Canadian _f farmer] _f	SF	HP
a.	(x) P An American _f farmer	*!	
b.	(x) P An American _f farmer		*

The analysis extends to the prosodic contour of the two *with a purple Chevrolet* adjuncts in 24. The first instance of the PP contains neither given nor contrastively focused items, and therefore phrasal stress falls rightmost on *Chevrolet* due to HP. The alternative destressed candidate, which leaves the adjunct free of phrasal stress as in structure (b) in 28, satisfies HP trivially because no phrasal head is misaligned, but it violates the constraint STRESSXP one more time than (a) because the lexical phrases *purple* and *Chevrolet* are both left unstressed. No reranking will ever make (b) optimal relative to (a), deriving the universal obligatoriness of phrasal heads for any P-phrase containing nongiven constituents.

(28)	[An American _f farmer with a purple Chevrolet . . .] _f	SF	DG	STRESSXP	HP
a.	(x) P . . . with a purple Chevrolet			*	
b.	() P . . . with a purple Chevrolet			**!	

The second instance of the adjunct *with a purple Chevrolet* is discourse-given, and therefore placing phrasal stress anywhere within it violates the higher-ranked constraint DG, as shown in 29. This also demonstrates the ranking DG >>> STRESSXP, since the optimal candidate violates STRESSXP one more time than the alternative candidate in (a).

(29)	[. . . a Canadian _f farmer with a purple Chevrolet] _f	SF	DG	STRESSXP	HP
a.	(x) P . . . [with a purple Chevrolet] _G		*!	*	
b.	() P . . . [with a purple Chevrolet] _G			**	

It remains to be analyzed why in 24 above *American* is prosodically slightly more prominent than *Chevrolet* in the initial DP *An American farmer with a purple Chevrolet*. Once again the adjective is more prominent by virtue of SF, which is assessed with respect to the adjective's focus domain which in this sentence coincides with the entire DP, adjunct included. A formally precise representation requires a recursive P-phrase encompassing the entire DP as in structure (a) in 30. This structure ensures that the adjective receives the higher prominence required by SF while still allowing for a prosodic peak on *Chevrolet*. The alternative in (b), lacking recursive phrasing and suppressing phrasal stress on *Chevrolet*, violates STRESSXP and HP more times than (a). The alternative in (c), lacking recursive phrasing but with phrasal stress on *Chevrolet*, violates SF. (The prosodic domains comprising *an American farmer* and *with a purple Chevrolet* could also be lower prosodic domains, such as Selkirk's MINOR PHRASES, in which case prosodic recursion becomes unnecessary. We do not decide between these two options here.)

(30)	[An American _f farmer with a purple Chevrolet . . .] _{fd}	SF	STRXP	HP
a.	(x) P (x)(x) P [An American _f farmer with a purple Chevrolet] _{fd}		**	**
b.	(x) P [An American _f farmer with a purple Chevrolet] _{fd}		***	***
c.	(x)(x) P [An American _f farmer with a purple Chevrolet] _{fd}	*	**	*

The different prominence assigned to *farmer* and *Chevrolet* in 24 above thus follows from the way focus interacts with their prosodic phrasing. Both are new, yet *farmer* is destressed because the head of its P-phrase is attracted by the focused adjective at its left, whereas *Chevrolet* still receives the prosodic prominence associated with the prosodic head of its P-phrase.

4.2. MULTIPLE PHRASAL STRESSES. Our analysis must also exclude the multiple-headed prosodic contour shown in 31, with one accent on *American* and one on *farmer*.³ Under the focus context at issue this contour is ungrammatical.

(31) (x x) P
*[an American_f farmer]_{fd}

The crucial constraint is once again SF, which requires the focused adjective to carry the highest prominence within the DP. SF must outrank STRESSXP, since its satisfaction leaves the noun phrase unstressed: compare the optimal structure in (a) with its multiheaded alternative in (b) in 32. Note furthermore how the constraint HP cannot distin-

³ Bantu languages such as Chichewa appear to display prosodic constituents with multiple prosodic peaks too, providing evidence for the existence of these structures (Kanerva 1990a,b, Downing 2003, Samek-Lodovici 2005).

guish between (a) and (b) because the phrasal stress on the adjective remains misaligned independently of the stressed or unstressed status of the noun.

(32)	[An American _f farmer was talking to a Canadian _f farmer] _f	SF	STRESSXP	HP
a.	(x) P An American _f farmer		*	*
b.	(x x) P An American _f farmer	*!		*

Finally, we need to derive the position of sentential stress on *Canadian*; the corresponding structure is shown in 33.

(33)	(x) I
	(x) (x) P
	an AMERICAN farmer was talking to a CANADIAN farmer

As mentioned earlier, SF requires only *American* and *Canadian* to be most prominent in their focus domains, that is, relative to their DPs (Rooth 1992, Truckenbrodt 1995: 165). The main stress of the entire sentence is pushed onto *Canadian* by the constraint HI which requires rightmost alignment within the IP, hence for purely prosodic reasons unrelated to focus. This is shown in 34, where all of the prosodic aspects discussed so far are brought together. The empirically attested structure, shown in (a), satisfies DG, SF, and HI, but violates HP due to the misaligned P-phrasal heads. SF is satisfied relative to each focus domain, and main stress falls on the rightmost available position in the I-phrase, *Canadian*, due to HI. Indeed, placing main stress on *American* instead as in (b) has no effect on any constraints other than violating HI, which is sufficient to rule out this structure.

(34)	An American farmer was talking to a Canadian farmer	SF	DG	STRXP	HP	HI
a.	(x) I (x) (x) P an American _F farmer was talking to a Canadian _F farmer _G			**	**	
b.	(x) I (x) (x) P an American _F farmer was talking to a Canadian _F farmer _G			**	**	*!
c.	(x) I (x) (x) P an American _F farmer was talking to a Canadian _F farmer _G	*!		**	*	
d.	(x) I (x) (x) P an American _F farmer was talking to a Canadian _F farmer _G	*!*	*	**		

The remaining competitors show alternative allocations of phrasal stress that reduce the violations of HP but increase those of the higher-ranked DG or SF. Structure (c)

violates HP one less time than (a) by assigning prosodic prominence to *farmer* in the first P-phrase, but that violates SF since *American* should be most prominent within its DP. Structure (d) eliminates all violations of HP by assigning stress to both instances of *farmer*, but that violates SF for the reason just pointed out, and it also violates DG because the second instance of *farmer* is discourse-given and should remain unstressed.

5. SUPERMAN SENTENCES AND THE NSR.

5.1. NESTED FOCI IN SUPERMAN SENTENCES. A second instance of nested foci is found in Superman sentences. In example 35, from Neeleman & Szendrői 2004:149, the final clause in the mother's sentence contains three nested foci. The entire final clause is part of the overall new-information focus encompassing the whole answer to the father's question. Its VP is contrastively focused against the earlier VP *doing his homework* with the clause as its focus domain. The stressed DP *Superman* is contrastively focused against *decent books* and appears to take the entire VP as its focus domain.⁴ The overall focus marking is given in 36.

- (35) a. Father: What happened?
 b. Mother: You know how I think our children should read decent books.
 Well, when I came home, rather than doing his homework,
 Johnny was reading SUPERMAN to some kid.

(36) [Johnny [was reading SUPERMAN_{f3} to some kid]_{f2}]_{f1}

What needs to be explained is why stress does not fall rightmost in the clause since *some kid* is not discourse-given. The answer, suggested by Neeleman and Szendrői's own analysis, once again lies in the conflict between SF, which requires all foci—*Superman* included—to be most prominent in their focus domain, and the prosodic constraint HI, which is responsible for rightmost stress within the intonational phrase. As shown in 37, placing main stress on *Superman* as in (a) violates HI but satisfies SF with respect to all three focused constituents relative to their domains: the object, the VP, and the entire clause. Placing main stress rightmost, as in (b), satisfies HI but it satisfies SF only with respect to foci f1 and f2, violating it with respect to f3. The ranking SF >> HI thus correctly predicts that stress falls on the innermost focus, overriding HI.

(37)	[... Johnny was [reading Superman _{f3} to some kid] _{f2}] _{f1}	SF	HP	HI
a.	$\begin{array}{c} (\quad \quad \quad x \quad \quad \quad) I \\ (x \quad) \quad (\quad \quad x \quad) (\quad \quad x \quad) P \\ \text{Johnny was [reading Superman}_{f3} \text{ to some kid]}_{f2} \end{array}$			*
b.	$\begin{array}{c} (\quad \quad \quad \quad \quad \quad x \quad) I \\ (x \quad) \quad (\quad \quad \quad x \quad) (\quad \quad \quad x \quad) P \\ \text{Johnny was [reading Superman}_{f3} \text{ to some kid]}_{f2} \end{array}$	*!		

⁴ Under Truckenbrodt's definition, *some kid* should be outside the focus domain, as the context *read decent books* is not contained in the focus denotation *read X to some kid*. The fact that *some kid* is less prominent than *Superman* nevertheless suggests that the focus domain is here pragmatically extended to the entire VP.

Neeleman and Szendrői also note that it is not possible to stress both *Superman* and *some kid* at the IP level as in 38 in order to simultaneously provide stress to f3 and rightmost stress to f2.

$$(38) \left(\begin{array}{c} x \\ \text{[Johnny [was reading SUPERMAN}_{f3} \text{ to some KID}]_{f2}} \end{array} \right) I$$

This too follows immediately from the proposed analysis. Assigning multiple heads to the I-phrase encompassing the entire clause, as in (b) in 39, violates SF on f3 because *Superman* is no longer the most prominent item in the VP. HI is violated too, because the right boundary of the I-phrase remains misaligned relative to the head on *Superman*. Structure (b) thus earns a superset of the violations of (a) and is therefore inevitably beaten by it under any constraint ranking; that is, it is predicted impossible across all grammars.

(39) [. . . Johnny was [reading Superman _{f3} to some kid] _{f2}] _{f1}	SF	STRXP	HP	HI
a. $\left(\begin{array}{c} x \\ \left(\begin{array}{c} x \end{array} \right) \left(\begin{array}{c} x \end{array} \right) \left(\begin{array}{c} x \end{array} \right) P \\ \text{Johnny was [reading Superman}_{f3} \text{ to some kid}]_{f2} \end{array} \right) I$				*
b. $\left(\begin{array}{c} x \\ \left(\begin{array}{c} x \end{array} \right) \left(\begin{array}{c} x \end{array} \right) \left(\begin{array}{c} x \end{array} \right) P \\ \text{Johnny was [reading Superman}_{f3} \text{ to some kid}]_{f2} \end{array} \right) I$	*!			*

5.2. THE FALLACY OF THE UNDECOMPOSED NSR. Nested foci show in the clearest possible way that the requirements that focus be stressed and that stress be rightmost (or edgemoat, if languages with leftmost stress are taken into account) are independent and potentially in conflict with one another.

They also expose a crucial problem associated with the undecomposed NSR rule that was posited by many earlier analyses of the focus-prosody relation. In order to capture the simplest cases of stress assignment, the NSR must necessarily be defined as assigning the highest prominence to the rightmost nongiven item within focus. But this definition fails in nested foci matching schema 20 above. In this case the nested focus attracts stress away from the rightmost item in the containing focus even when this item is new.

No version of the NSR can handle the conflict between the rightmost assignment of prosodic prominence within the containing focus and the attraction of prosodic prominence by the nested focus. The optimality model proposed here provides a principled way to deal with this conflict by defining the two requirements as independent constraints and governing their interaction via constraint ranking.

Replacing the NSR with the corresponding prosodic constraints also avoids having to state new principles that are already entailed by their interaction. Consider for example the two economy principles proposed by Neeleman and Szendrői (2004:153) listed in 40. The first minimizes the number of prosodic peaks and the second the instances where prosodic prominence fails to occur rightmost within a focused constituent.

- (40) a. Minimize the number of prosodic peaks (given the targeted interpretation).
 b. Minimize stress shift (given the number of prosodic peaks).

Neeleman and Szendrői use these principles together with the NSR to derive the nonrightmost stress of the Superman sentence repeated in 41. Minimizing the number of peaks ensures that only one peak is used for all three nested foci, thus avoiding the additional peak on *some kid* requested by the NSR for f2 and f1. Minimizing stress shift ensures that stress remains rightmost in any focused phrase free of nested foci (i.e. forcing stress on *Wonderland* if *Superman* were replaced with *Alice in Wonderland*).

(41) [Johnny [was reading SUPERMAN_{f3} to some kid]_{f2}]_{f1}

Both principles are entailed by the constraints responsible for the NSR and in particular by HP and HI. Minimization of prosodic peaks in 40a follows because any additional prosodic peak within a P- or I-phrase counts as misaligned relative to the phrase's right boundary and hence increases the violations of HP or HI. Likewise any prosodic shift sanctioned by principle 40b places a prosodic peak into a misaligned position relative to the right boundary of the relevant P- or I-phrase, again failing either HP or HI. Stress shifts are of course possible when forced by SF but are kept to a minimum to avoid any unnecessary violations of HP and HI.

Neeleman and Szendrői (2004) also repeatedly appeal to the need to 'maximize the NSR effects', which is satisfied when prosodic peaks are assigned as close to the right edge of focused constituents as possible without violating the condition that focus be most prominent in its domain. This notion too is immediately subsumed by the HI and HP constraints. According to these constraints, the structures with the best-aligned peaks are preferred.

The two economy principles listed above and the notion of NSR maximization thus offer correct descriptive generalizations of the distribution of prosodic peaks but do not constitute theoretical primitives independent of the NSR. Once the NSR is properly modeled in terms of its core constraints and their interaction with SF, they all follow as theorems of the analysis proposed in this study.

6. NESTED FOCI IN RIGHT-NODE RAISING. The analysis of nested foci also extends to right-node-raising cases like those examined in Féry & Hartmann 2005 for German. In 42 there are no nested foci, and stress consequently falls rightmost within the focused object. In 43, however, the adjectives are contrastively focused within a DP which is itself focused by the interrogative context. Crucially, in the final DP stress falls on the adjective rather than on *music*, even though *music* is rightmost in the DP and has discourse-novel status.

(42) Q: What do your friends like?

A: They like [Argentinian MUSIC]_f

(43) Q: What do your friends like?

A: Ramon likes [CUBAN_f]_f and Malte prefers [ARGENTINIAN_f music]_f.

The analysis follows once more from the interaction of SF and the constraints on prosodic prominence. As Hartmann (2000) explains, in right-node-raising structures like the one in 43, the final noun *music* has all the properties of an in-situ object of the second conjunct. The analysis of these sentences is thus fully analogous to the analysis of farmer sentences discussed earlier on. The prosodic peak of the P-phrase falls on the adjective in candidate (a) of 44 because this position satisfies SF for both foci at the expense of the lower-ranked HP, whereas placing it on the noun alone as in (b), or on both items as in (c), fails SF.

(44)	[Argentinian _f music] _f	SF	HP
a.	(x) P [Argentinian _f music] _f		*
b.	(x) P [Argentinian _f music] _f	*!	
c.	(x x) P [Argentinian _f music] _f	*!	*

Right-node-raising structures also permit us to examine the interaction between contrastive and new information focus. Consider 45, for example. The possessives *his* and *her* are contrastively focused. The sentential object *to clean the attic* is also focused by virtue of being the answer to the WH-question. As far as the prosodic prominence is concerned, *his* and *her* are more prominent than the infinitive construction, with main stress falling on *her*. This is expected if contrastive focus is more prominent than new information focus, whereas it is not expected if both types of foci are similarly prominent irrespective of their nature. In this latter case, *attic* should bear main stress as the rightmost phrasal head in the sentence.

(45) Q: What did John and Mary promise to their mothers?

A: John promised HIS_f and Mary promised HER_f mother [to clean the attic]_f

It follows that rather than a unique SF constraint, we must distinguish between SF_{contrast} and SF_{new}, with the former dominating the latter. The analysis is illustrated in 46. The constraint SF_{contrast} requires *her* to be most prominent in its focus domain, and it is satisfied by structure (a). The focus domain in this case coincides with the background shared by *his* and *her* and covers the entire VP *promises Y's mother to clean the attic*.

The constraint SF_{new} requires *to clean the attic* to be most prominent within its own focus domain, which coincides with the entire clause *Mary promises her mother to X*. The structure that satisfies SF_{new}, shown in (b), also satisfies HI because it places the intonational head rightmost. But the attested structure is (a), showing that SF_{contrast} dominates both SF_{new} and HI.

(46)	Mary promises her _f mother [to clean the attic] _f	SF _{contrast}	SF _{new}	HI	HP
a.	(x) I (x) (x) P ... her _f mother [to clean the attic] _f		*	*	*
b.	(x) I (x) (x) P ... her _f mother [to clean the attic] _f	*!			*

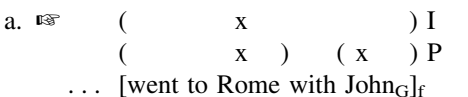
As the attentive reader will have noticed, the split of SF into two constraints does not undermine any of the previous analyses. In all cases the relevant focus was the contrastive one governed by SF_{contrast}. All analyses thus follow straightforwardly once SF is replaced with SF_{contrast}.

7. CONFLICTS INVOLVING DG. Before concluding, we turn to a few cases involving conflicts between the prosodic constraints and DG. They help us complete the ranking relations that hold between the constraints introduced in the preceding sections. Let us start with the Q/A-pair in 47 where focus affects the entire VP while *John* is discourse-given.

(47) Q: What did John's mother do?

A: She [went to ROME with John_G]_f

Stress falls on *Rome* rather than on rightmost *John* because the constraint DG overrides the lower-ranked constraint HI. This selects as optimal the structure without stress on *John* in (a) over the one stressing *John* in (b) in 48. Note how SF_{new} is neutral between the two structures since stress falls within the focused VP in both cases.

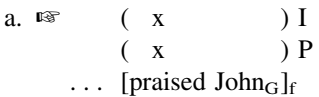
(48) She [went to Rome with John _G] _f	SF _{new}	DG	HI
a.  (x) I (x) (x) P ... [went to Rome with John _G] _f			*
b. (x) I (x) (x) P ... [went to Rome with John _G] _f		*!	

A similar conflict occurs between DG and HP. This is illustrated in 49, repeated from 17, where the entire VP is focused but the object is given. The verb and its object are in the same P-phrase, but the given status of the object forces accent on the verb.

(49) Q: What did John's mother do?

A: She [PRAISED John_G]_f.

The attested structure, candidate (a) of 50, satisfies DG at the expense of HP and STRESSXP because the head of the P-phrase fails to occur rightmost and the object is left without its phrasal stress. As (b) shows, however, it is not possible to satisfy these constraints without violating the higher-ranked DG, thus establishing the ranking DG >> {STRESSXP, HP}. Once again SF_{new} is neutral between the two candidates because stress falls within the focused VP in both of them.

(50) She [praised John _G] _f	SF _{new}	DG	STRESSXP	HP
a.  (x) I (x) (x) P ... [praised John _G] _f			*	*
b. (x) I (x) (x) P ... [praised John _G] _f		*!		

DG may also conflict with SF_{new} , in which case SF_{new} overrides DG. This occurs whenever focus applies to a discourse-given item. Consider again example 6, repeated as 51, from Schwarzschild 1999. *Him* is discourse-given and yet focused by the preceding question and for this reason it receives main stress.

(51) Q: Who did John_i's mother praise?

A: She praised $[HIM_i]_f$.

As 52 shows, main stress on *him* satisfies SF_{new} and violates DG, while the opposite is true when main stress falls on *praised*. The latter choice violates both HP and STRESSXP, but as we saw above, DG outranks these two constraints. The optimal status of (a) must thus follow from the ranking $SF_{new} \gg DG$.

(52)	She praised $[him_G]_f$	SF_{new}	DG	STRXP	HP
a.	(x) I (x) P ... praised $[him_G]_f$		*		
b.	(x) I (x) P ... praised $[him_G]_f$	*!		*	*

Finally, consider a sentence with only given constituents, such as the answer in dialogue 53 from Schwarzschild 1999.

(53) {Jack said the American president drinks. What did Gilles say?}

A: He said that the FRENCH president drinks.

This example is similar to 49 in forcing stress out of its unmarked rightmost position due to the givenness of *president* and *drink*. When the context is changed so as to also introduce *French*, as in 54, insertion of *too* seems to be the best option available.

(54) {Jack said the American president drinks. What did Gilles say about the French president?}

A: He said [the French president drinks *too*]_f.

Every single word of 54 but *too* is given and as such unaccentable due to DG, and yet an accent is necessary in order to satisfy SF_{new} . *French* is mentioned in the immediately preceding question and no longer contrasts with *American* (if it did, it would be stressed). The same is true for *president* and *drink*. At the constituent level *French president* is obviously given. What is new, thus, is the entire proposition *He said that the French president drinks* which is not entailed by anything in the context. The issue is how to convey this information prosodically while satisfying the ranked constraints in the best possible way.

We would like to suggest that *too* is present in 54A precisely in order to avoid placing stress on any of the discourse-given items, thus avoiding a violation of DG. Under this analysis, *too* is not in the input and therefore its insertion violates the constraints DEP in 55, which prevents the insertion of lexical items.

(55) DEP: All lexical elements in the output have a correspondent in the input.

As shown in tableau 56, the structure with *too* in (a) beats the one without it in (b) because DG outranks DEP.

(56)	[. . . the French _G president _G drinks _G] _f	SF _{new}	DG	DEP
a.	([the French president drinks too] _f) I			*
b.	([the French president drinks] _f) I		*!	

The question may be raised as to why other sentences involving given material do not give rise to similar violations of DEP. The reason may lie in the difference in presupposition induced by the preceding contexts. For example, in 54 *too* could occur freely because the entailed presupposition that someone other than the French president drank is true. Contrast it with 7, repeated here as 57. As we saw in §2, all syntactic material within the focused phrase *the rising of the tides* is given. But adding *too* would entail the presupposition that something other than *the boat being empty* depends on *the rising of the tides*, which clearly does not hold in the given context.⁵

(57) {The rising of the TIDES depends upon the MOON being full and}
[the BOAT_F being empty_F]_F depends upon [the rising of the TIDES]_F

Once merged together, the ranking relations examined in all of the above sections yield the following overall ranking, with the discourse-structure constraints SF_{contrast}, SF_{new}, and DG dominating the prosodic constraints.

(58) Constraint ranking

SF _{contrast}
SF _{new}
DG
{STRESSXP, HI, HP, DEP}

8. CONCLUSIONS. The analysis of the relation between discourse structure and prosody that emerges from this study relies on the ranking of several constraints. Three of them relate accent or the absence thereof to discourse structure (SF in its two versions and DG), while the remaining ones, DEP aside, govern the position of prosodic prominence (STRESSXP, HP, HI). That accent assignment is parsimonious and normally rightmost follows from the prosodic constraints, while deviation from this default is imposed where necessary by the discourse constraints.

The analysis provides a principled account of the prosodic contour of farmer, Superman, and right-node-raising sentences, all of which share the property of allowing for nested foci of the kind schematized in 20. In all of these cases the rightmost most deeply embedded focus carries the strongest prominence even if this requires pushing the nuclear accent leftwards. This marked accent pattern follows from the constraint ranking in 58 which favors SF_{contrast} over all other constraints.

⁵ Thanks to Ede Zimmerman for discussing the semantic and pragmatic implications of *too* with us.

The analysis also accounts for the effects of Schwarzschild's givenness in well-known examples from Büring and Schwarzschild. Given constituents are not stressed except where necessary in order to express focus. It also extends to additional cases, showing how lexical particles like *too* can become necessary when no other new item is available to carry stress.

Finally, our analysis shows that there is no direct translation of pitch accents into focus marking mediated by F-marks. The marking of syntactic constituents as focused or given—the discourse marking—is entirely dependent on context and therefore fully independent of prosody. Prosody is affected only by discourse marking via the prosodic requirements imposed by the discourse constraints in interaction with the prosodic constraints. The same interaction also entails as theorems important descriptive generalizations on the prosodic expression of nested foci that must otherwise be redundantly posited as independent principles.

The analysis also raises some interesting issues. First, if discourse marking is context-dependent why do distinct pitch-accent distributions appear to determine different discourse markings? This is the familiar problem exemplified by Selkirk (1995) with 59 and 60. While the prosodic contour of 59 is compatible with the focusing of every constituent ending with *bats*, including the focusing of the entire sentence, 60 allows only for narrow focus on *Mary*. The asymmetry follows straightforwardly from the analysis presented in this discussion note once we assume that hearers use it to compute the discourse markings that make the observed sentences optimal.

(59) Mary bought a book about BATS.

(60) MARY bought a book about bats.

A second issue regards the fate of F-marks. Like Büring (2003), we dispute their role as direct mediators of the relation between prosody and discourse marking. They may, however, remain necessary for the computation of discourse marking from context. For example, in Schwarzschild's model, discourse marking follows from those F-mark distributions that are consistent with GIVENness while using the minimal number of F-marks (equivalent roughly speaking to the minimal possible foci consistent with GIVENness). Yet, as we discussed in §3.1, F-marks are unable to deal with nested foci, and Schwarzschild himself welcomes the possibility of eliminating F-marks altogether (Schwarzschild 1999). Their elimination would not adversely affect the analysis proposed here, provided a device deriving discourse marking from context is in place.

A final issue arises from the structure of the English constraint ranking given in the last section, which shows the discourse-related constraints SF_{contrast} , SF_{new} , and DG dominating all of the prosodic constraints. Is this a universal property of grammar, or should we expect to find languages where the same constraints are ranked lowest, leaving little if any scope for prosodic reflections of discourse marking? The answer to this question can emerge only from further empirical research. It is worth pointing out, however, that deriving crosslinguistic variation from constraint reranking does not necessarily imply that reranking is always possible, especially when constraints of a very different nature are involved, as is the case here. The discourse constraints could conceivably dominate the prosodic constraints in all languages, in which case variation would be limited to reranking within each group of constraints.

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