

Syntax, Information Structure and Prosody

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1 Introduction

1.1 Syntax and Prosody

This article surveys the relation between syntactic structure, information structure, and prosodic structure. It will explicate what prosodic structures look like in general, and which prosodic structures go with which syntactic structures. As suggested by this formulation, the perspective here is that syntax and prosody are each generative systems, which independently define two sets of well-formed structures, one of syntactic phrases markers, one of prosodic structures; in addition, MAPPING CONSTRAINTS define the set of possible pairs $\langle s,p \rangle$ of syntactic and prosodic structures, which correspond to the well-formed sentences of the language. This is illustrated in figure 1.

An overall architecture like this has been proposed e.g. in Jackendoff (1997). It is worth noting that it imposes no specific conditions on the nature of syntactic rules and representations itself, i.e. whether a syntactic representation is build by rules or constraints, and whether it consists of one or more (PF, LF) sub-representations.

1.2 Narrow Syntactic Mapping v. Extraneous Feature Mapping

It seems useful to distinguish two aspects in which non-prosodic information is reflected in prosody, and hence two classes of mapping constraints. The first I will call NARROW SYNTACTIC MAPPING, NSM; by that I mean the way prosodic structure reflects aspect of syntactic structure proper, such

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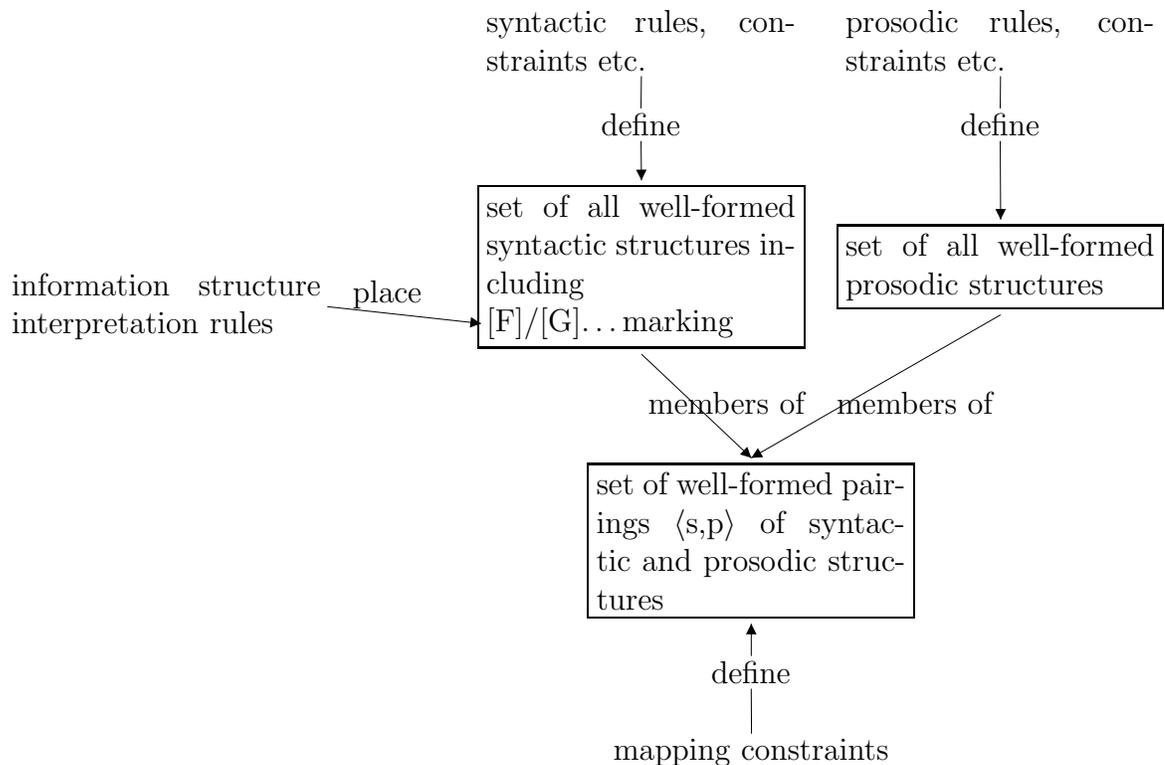


Figure 1: Architecture of Grammar

as constituency, embedding, perhaps syntactic category etc. The second I will call **EXTRANEOUS FEATURE MAPPING**, **EFM**, by which I mean the way things like focus, topic, givenness etc. are reflected in prosody. Unlike **NSM**, **EFM** relates to features and properties that probably wouldn't have a life in syntax, were it not for their prosodic effects. More concretely, these are commonly thought to be encoded in the form of privative features like **[F]**, **[G]** etc. which are present on syntactic nodes *in addition* to their narrow syntactic features (such as syntactic category, case etc.), see the leftmost column in figure 1.

2 Syntax–Prosody Interface

The two aspects of (English) prosody most easily detected by naive listeners are **(RELATIVE) PROMINENCE** and **PAUSES** or **BREAKS**. A third may be **TUNE** or **MELODY**, e.g. whether the voice at a certain point in a sentence goes ‘up’ or ‘down’. I will elaborate on these notions in turn.

2.1 Elements of Prosodic Structure

2.1.1 Prominence and Pitch Accents

The primary acoustic cue for perceived prominence is fundamental frequency, or pitch: very roughly, a syllable (and derivatively the word or phrase containing it) that is the location of a local maximum (‘peak’) or minimum (‘valley’) in the fundamental frequency curve is perceived as prominent, or more prominent than those that don’t. (Other factors like length, amplitude and formant structure of vowels correlate with perceived prominence as well, but in case of doubt, pitch overrides them all.) The direct theoretical correlates of these frequency peaks and valleys are PITCH ACCENTS (PAs): tonal targets like high (H*) or low (L*) tones that are associated with syllables perceived as prominent. Pitch accents are not the same as STRESS (though parts of the literature appear to use the terms interchangeably), but the two are closely related, see section 2.2.2 below.

Simple short sentences usually contain one syllable that is easily perceived as the most prominent one, which we’ll say bears the NUCLEAR PITCH ACCENT (NPA; again, often called ‘nuclear stress’). Contrary to intuitions, the NPA is not necessarily more elaborate (higher, louder, longer. . .) than other, pre-nuclear, PAs in the sentence, but simply the last. Put differently, even short sentences often contain several PAs, the last of which is perceived—but not necessarily realized—as the ‘strongest’.¹

2.1.2 Pauses, Prosodic Constituents, and Boundary Tones

What triggers the perception of a pause/break? Actual periods of silence within an utterance do occur, but the more common correlates are again tonal movements—the fundamental frequency falls or rises towards the end of the word before the ‘pause’—and lengthening of the final syllable before the ‘pause’. Correlates in the prosodic theory are BOUNDARIES of prosodic constituents (prosodic words, phonological phrases etc. —see next section); in particular, syllables before a right boundary are lengthened, and in case of larger constituents, associated with so called BOUNDARY TONES, written as H% (high) or L% (low).

A more subtle cue is the SCALING of PAs: within a prosodic constituent, subsequent high tones often follow a pattern of relative lowering from one to the next, so called DOWNSTEP. This pattern is reset after a prosodic constituent boundary, i.e. the absolute height of pitch accents after a boundary

¹In unpublished work, Katz and Selkirk (2009) have argued that there are instances in which a non-final pitch accent is in a grammatical sense stronger than the final one. If so, the picture is more complicated than outlined here.

may be ‘re-set’ to a higher frequency than the previous PAs.

Where a sentence contains a prosodic break, the last PA before it, i.e. the final one in the prosodic constituent ending at the break, is again usually perceived as more prominent than PAs preceding it within that constituent; it is nuclear within that constituent. As a consequence, among the non-final (pre-nuclear) pitch accents in a sentences with complex prosodic structure, some may be perceived as more prominent than others, namely those that are final/nuclear within smaller prosodic constituents. It is in fact conceivable that whenever one accent is perceived as more prominent than another, it is because it is final in some prosodic constituent.

2.2 Assumptions about Prosodic Structure

There are two kinds of prosodic representations regularly employed in the literature: METRICAL STRUCTURE, which represents prosodic units of various sizes (syllable, foot, prosodic word, phonological phrase etc.) and their stress patterns (more about which momentarily);² and INTONATIONAL STRUCTURE, which also represents certain prosodic units like the intonational and intermediate phrases, but focused on *tonal* events such as pitch accents and boundary tones mentioned above.³

2.2.1 Prosodic Constituents, Heads, and Stress

In this article, I will employ a single prosodic representation, which consists of hierarchically ordered prosodic constituents of various sizes (as in metrical structures). These are indicated by parentheses above the examples, as in (1a). I assume that the higher/bigger phrasal ones of these are the same as the phrases of intonational structure (called INTERMEDIATE and INTONATIONAL PHRASE in English); their boundaries are the anchoring points for boundary tones in intonational structure.

²Other representation formats proposed in the literature include metrical grids, bracketed metrical grids, and metrical trees (see e.g. Halle and Vergnaud, 1987; Hayes, 1995; Liberman and Prince, 1977; Prince, 1983). The prosodic structures employed here are special instances of bracketed metrical grids and as such represent the same information as those.

³Structures of the former kind are the primary object of investigation in PROSODIC PHONOLOGY, which often diagnoses prosodic units as the domains for segmental phenomena, and METRICAL PHONOLOGY, which is interested primarily in stress patterns. Structures of the latter kind (intonational structures) are the representation of choice in INTONATIONAL PHONOLOGY.

Each prosodic constituent has one metrically strongest element, its HEAD, indicated by an asterisk. Thus being stressed is by assumption the same as being the head of some prosodic constituent. Prosodic element A has more/higher stress than prosodic element B if A is the head of some constituent containing B.⁴

As I said in the introduction, it is instructive to think of prosodic structure as a generative system in its own right. That is to say, there is a set of PROSODIC WELL-FORMEDNESS CONSTRAINTS (the top right corner in figure 1) which, in purely prosodic terms, define the set of well-formed prosodic structures: strings of segments and syllables, organized into higher prosodic units, their boundaries and heads marked by accents, boundary tones, particular timing etc. Take (1) as an illustration at the word level:

- (1) (*) prosodic word
 (*) (*) foot
 (*) (*) (*) (*) syllable
a. sub-or-ga-nic
b. shet-ur-go-lid
c. sub-lis-te-nic

suborganic is a well-formed word of English: its prosodic structure (1a) is well-formed, it has a well-formed morphological analysis, and the two can be mapped onto one another by the rules of morphology-to-prosody mapping. *sheturgolid* and *sublistenic*, with the same prosodic structure, too are prosodically well-formed. But (1b) can't be mapped onto English morphemes at all, and (1c) can't be mapped onto a well-formed morphological structure (because the suffix *-ic* can't attach to a verbal stem like *listen*); hence they are not words of English.

(1a) also illustrates a perhaps trivial point: that morphological structure—here [*sub*[[*organ*][*ic*]]—and prosodic structure are not isomorphic. The same is true, as we will see, for syntactic and prosodic structure.

2.2.2 Stress and Accent

The columns of asterisks in (1a) correspond to metrical strength or STRESS. We remarked above that stress is related to, but not the same as, accent. For

⁴Formally: A has more stress than B iff i) A is the head of some constituent containing B, or ii) A is the head of some constituent that has more stress than B. By this definition, the syllables *sub* and *ga* in (1a) are stronger than *or* and *nic*, and the foot *ganic* is stronger than the foot *subor* and the syllables *sub* and *or*, all according to clause i). Clause ii) furthermore makes *ga* stronger than the syllables *sub*, *or* and the foot *subor*, which accords with the intuitive use of the terms 'stronger' or 'more stressed'.

example, *suborganic* can be produced with one, two, even three, or no pitch accent (!H here marks a DOWNSTEPPED high tone, i.e. one that is high, but lower than the preceding one; this is a common realization for citation forms, though of course not the only one):

- (2) a. $\begin{array}{c} \text{H} \quad \text{!H} \\ | \quad | \\ \text{suborganic} \end{array}$ citation, careful speech
- b. $\begin{array}{c} \text{H} \\ | \\ \text{suborganic} \end{array}$ faster speech, within larger utterance
- c. $\begin{array}{c} \text{H} \text{ !H} \text{ !H} \\ | \quad | \quad | \\ \text{suborganic} \end{array}$ over-enunciated speech
- d. $\begin{array}{c} \text{H}^* \quad \quad \quad \text{H}^* \\ | \quad \quad \quad | \\ \text{Even his SUGAR is suborganic.} \end{array}$ deaccented

We assume that in all of these realizations, *suborganic* has the same metrical structure, (1a). While this means that the number of pitch accents is not determined by the stress pattern, there are strict rules on the association of the two. If a constituent contains a pitch accent, its head is pitch accented. Put differently, PA are assigned ‘from top to bottom’: the accent on *or* is only possible if *sub* is accented, which in turn is possible only if *ga* is. In addition, there can’t be pitch accents after the metrically strongest syllable, so no PA on *nic*, which follows the strongest syllable *ga*; this will be of importance later on. Both these properties are encoded in (3):

- (3) STRESS-TO-ACCENT PRINCIPLE (a prosodic well-formedness constraint)
The last pitch accent within a prosodic constituent (if there is one) is on the head of that constituent.

We noted above that the last pitch accent before a break is perceived as most prominent; by (3), this has now a theoretical counterpart: the last pitch accent within a metrical constituent C will always be on the metrically strongest syllable of C, i.e. the one with the strongest stress.

Experimental evidence suggests that stressed syllables can be phonetically distinguished from less stressed ones even without accenting, e.g. by length, intensity or more careful articulation; these effects are very subtle though and won’t play much of a role in what follows.

2.3 The Syntax–Prosody Mapping

In this section and the following I will use the terms ‘prosodic phrase/unit’, ϕ for short, to refer to any prosodic constituent above the prosodic word level.

a ϕ containing XP.

(8b) meets $XP \leftrightarrow \phi$: The first ϕ contains the subject DP/NP, the second the inner VP and the object, the third the PP/DP/NP. The head of each is located within the phrases it contains. As far as higher constituents like the outer VP or TP are concerned, these meet $XP \leftrightarrow \phi$ once we consider the ϕ that contains the entire sentence:

$$(11) \quad \left(\begin{array}{c} \left(\begin{array}{c} \left(\begin{array}{c} \text{DP} \end{array} \right) \text{the} \left(\begin{array}{c} \text{NP} \end{array} \right) \text{boy} \end{array} \right) \left(\begin{array}{c} \text{VP} \end{array} \right) \text{met} \left(\begin{array}{c} \text{DP} \end{array} \right) \text{the} \left(\begin{array}{c} \text{NP} \end{array} \right) \text{girl} \end{array} \right) \left(\begin{array}{c} \text{PP} \end{array} \right) \text{at} \left(\begin{array}{c} \text{DP} \end{array} \right) \text{the} \left(\begin{array}{c} \text{NP} \end{array} \right) \text{teacher's} \end{array} \right) \end{array} \right)$$

The highest ϕ meets $XP \leftrightarrow \phi$ for the higher VP and the entire sentence (and, incidentally, for the final PP/DP/NP). Note that, according to $XP \leftrightarrow \phi$, the head of that ϕ could also be on *girl*, since that, too, is contained in VP and all higher syntactic constituents. To derived the correct placement (as in (11)), we therefore add the following constraint:

- (12) HEADRIGHT (a prosodic well-formedness constraint)
Among sister ϕ s, the rightmost one is the head of its mother.

2.4 Phrasal Stress, Pitch Accents, Integration

One interesting and important consequence of $XP \leftrightarrow \phi$ (or STRESSXP) is that syntactic heads will not bear phrasal stress if they have a syntactic complement (syntactic XPs, on the other hand, will always bear phrasal stress). The default phrasing/stress for a V plus (prosodically simple) object will thus be as in (13):

$$(13) \quad \begin{array}{ll} \text{a. } \left(\begin{array}{c} \left(\begin{array}{c} \text{VP} \end{array} \right) \text{verb} \left(\begin{array}{c} \text{object} \end{array} \right) \end{array} \right) \text{PWd} & \text{b. } \left(\begin{array}{c} \left(\begin{array}{c} \text{VP} \end{array} \right) \left(\begin{array}{c} \text{object} \end{array} \right) \text{verb} \end{array} \right) \text{PWd} \end{array}$$

These phrasal stress patterns determine not just metrical prominence, but also possible pitch accent patterns, using the STRESS-TO-ACCENT Principle (3), repeated here:

- (14) STRESS-TO-ACCENT PRINCIPLE (a prosodic well-formedness constraint)
The last pitch accent within a prosodic constituent (if there is one) is on the head of that constituent.

Due to (14), the verb may (but need not) bear a PA in (13a), where its stress is pre-nuclear, but not in (13b), where its stress is post-nuclear. This effect is known as INTEGRATION in the literature: verbs, or generally heads, bear

less stress than their complements, and in head-final structures, cannot bear a PA.⁸ It is most striking in OV languages like German and Dutch, where it leads to an apparent shift of the NPA to the left:

- (15) Peter will ein BUCH lesen. (not: ein Buch LESeN) [German]
P. wants a book read
 ‘Peter wants to read a book.’

The integration effect follows from the syntax–prosody mapping rule $XP \leftrightarrow \phi$ (following the guide of Truckenbrodt, 2006). It is worth emphasizing that the integration effect does not follow from anything about the assignment of sentential stress. It follows from the assignment of phrasal stresses, the last of which becomes, by (12), HEADRIGHT, the sentential stress. It is thus a very local phenomenon.

To predict default accent patterns, we assume, besides (14), that pitch accents in complex prosodic structures don’t align with stresses below the word level, (i.e. that prosodic words usually bear at most one accent) and that phrase level stresses align with pitch accents where allowed by (15) (i.e. ϕ s contain at least one pitch accent).

Taken together, our rules then predict the following sentential DEFAULT ACCENTING:

- every lexical head bears a pitch accent, except...
- heads with a complement
 - need not when preceding the complement
 - must not when following the complement (integration)
- the rightmost accent within a complex ϕ will be strongest

This concludes our survey of the basic mapping from narrow syntax to prosody. We will refer to the prosodic structures defined jointly by mapping constraints like $XP \leftrightarrow \phi$ and prosodic well-formedness constraints like HEADRIGHT, STRESS-TO-ACCENT etc. as the DEFAULT PROSODY —as opposed to prosody co-determined by mapping extraneous features like focus, to be discussed in section 4 below.

⁸See Fuchs (1976, 1984); Gussenhoven (1983); Jacobs (1992, 1999); Schmerling (1976); Uhmman (1991) among many others.

3 How Prosody Influences Syntax

An empirically plausible, and theoretically interesting hypothesis is that syntax should be ‘phonology free’ (Pullum and Zwicky, 1986; Zwicky, 1985); for example, syntactic rules/constraints don’t appear to make reference to the segmental features of the elements they manipulate, nor could they, according to many current theoretical frameworks. But there appear to be many cases of prosodically motivated variations in word and constituent order. I will review some of these in this section and then ask what they imply for the architecture of grammar.

A terminological note first: I will use transformationalist terminology such as ‘base position’, ‘movement’ etc. in the following discussion; all that is really necessary to assume, though, is that two (or more) syntactic structures can be identified as alternative realizations of ‘the same sentence’, and—crucially, as we will see in section 5.4 below— one of them as the ‘unmarked’ or ‘basic’ one. Generally, prosodically driven movement (and below: focus driven movement) should more neutrally be understood as ‘prosodically/focus driven deviation from canonical constituent order’.

3.1 Heavy NP Shift

Can prosody influence syntax? A case in question may be various so-called stylistic rules such as heavy-NP-shift (HNPS Ross, 1967). While the exact line between merely marked and categorically impossible may be hard to draw, it seems clear that structural and/or prosodic complexity facilitate rightward positioning of complement DPs:

- (18) a. I explained to Bill the reasons why he shouldn’t attend.
b. I explained to Bill the reinforcement resistance test.
c. ??I explained to Bill the test/the reasons.
d. *I explained to Bill them.

There are two issues that it is advantageous to keep apart: First, the less than categorical nature of the judgements themselves. Second, the dependency between syntax and prosody that they seem to reveal. My sole point of interest here is the second. That is, I do not believe that prosody-syntax interactions like this one are generally limited to weak ‘stylistic’, rather than stronger categorical acceptability judgements, nor that these kind of graded judgements are essentially different from many found in arguably core morphosyntactic domains such as agreement, extraction or binding theory. Whatever rule or constraint format one finds adequate to deal with the one can plausibly be

expected in the other.

Returning to HNPS, then, it appears that syntax needs to look at the internal, perhaps prosodic, complexity of a constituent before deciding whether it must, may, or cannot occur in shifted position (Hawkins, 1994; Kimball, 1973; Wasow, 1997; Zec and Inkelas, 1990). If a constituent is ‘too light’, HNPS is impossible.

Zec and Inkelas (1990:377) assume that, as a matter of syntax-to-prosody mapping, rightward shifted constituents need to be mapped onto prosodic constituents of a certain size. Such phrases in turn, as a matter of prosodic wellformedness requirements, need to contain a certain number of phonological phrases. (Zec and Inkelas, 1990, speculate that the pertinent phrase is the intonational phrase, which in turn needs to contain at least two ϕ s). According to such a view, prosodic well-formedness constraints restrict syntactic (re)ordering possibilities.¹⁰

3.2 Prosodic Extraposition

Relative clauses (RCs), and embedded clauses in general, often occur in extraposed positions, like the subject relatives in (19):

- (19) Suddenly some people started laughing who had been silent before.

Extraposition is ubiquitous in German (and Dutch), where embedded clauses overwhelmingly, in many constructions obligatorily, appear *after* the sentence-final verb, even though they originate to the left of it:

- (20) a. Wir haben niemanden gesehen, den du kennst
we have no one seen who you know
‘We saw no one you know.’
b. Er hat gesagt, dass er hungrig ist.
he has said that he hungry is
‘He said that he was hungry.’

Arguably, extraposition structures elegantly resolve a problem in the syntax-prosody mapping. Suppose that subordinate clause and matrix clause, both being clausal, should be mapped onto intonational phrases. As long as one

¹⁰Since it is much less clear that HNPS is ever obligatory, I will not speculate about factors that may disfavor non-shifted structures. As is well known, however, there are parsing advantages to reaching the beginning of complements earlier rather than later, which generally favors ordering shorter complements before longer ones, see e.g. Hawkins (1988, 1994).

clause is contained in the other, this is impossible, since one IP can't contain another:¹¹

- (21) a. * $\left(\text{some people } \left(\text{who had been silent before} \right)_{\text{IP}} \text{ started laughing} \right)_{\text{IP}}$
 b. $\left(\text{some people } t_{\text{CP}} \text{ started laughing} \right)_{\text{IP}} \left(\text{who had been silent before} \right)_{\text{IP}}$

In the extraposed structure, the RC, but crucially also the matrix clause to the exclusion of the RC, corresponds to contiguous strings and can thus each be mapped onto an intonational phrase. A prosodically based analysis would thus claim that extraposition is *triggered* by a conflict between the mapping constraints and prosodic wellformedness constraints.

Perhaps even more clearly than in the case of HNPS above, such an analysis would argue that the *in situ* structures in many of these cases are prosodically less than perfectly well-formed. (22), for example, shows an attested phrasing, where the center-embedded relative clause *is* mapped onto its own IP, at the price of breaking up the matrix clause into three phrases, the last of which is also prosodically very light, consisting of the prosodic word *gesehen* only:

- (22) $\left(\text{Wir haben niemanden, den du kennst, gesehen} \right)_{\text{IP}} \left(\text{we have no one who you know seen} \right)_{\text{IP}}$
 'We saw no one you know.'

This rendering, though possible, sounds much less natural than the extraposed version, which has one intermediate or intonational phrase for each clause:¹²

- (23) $\left(\text{Wir haben niemanden gesehen, den du kennst} \right)_{\text{IP}}$

So as in HNPS and the English cases discussed above, extraposition would serve to create a structure in which both clauses are mapped to IPs, and undersized IPs are avoided (prosody internal constraint). In addition, as first pointed out in Truckenbrodt (1995a:sec.2.2), the class of landing sites for extraposition in German is most easily defined in prosodic terms: descriptively, the extraposed clause has to follow the last verb in the sentence final verb cluster (i.e. the edge of the matrix clause), (24a), and can't occur between

¹¹To be sure, there are other ways of phrasing the non-extraposed (21a), most notably (D N)(RC)(VP) and (D N RC)(VP). But none of them succeeds in mapping both the matrix clause and the RC onto a single ϕ .

¹²Very arguably, (22) is not just stylistically marked, but also restricted to certain information structural configurations, in particular one in which VP is not a broad focus.

a selecting verb and its VP complement, (24b). On the other hand, when a lower VP is topicalized as in (23c), a relative clause can extrapose to the embedded VP’s edge (relative clause and head noun in bold):

- (24) a. er wird nicht [VP₁[VP₂ **alles tun**] können] **was du willst**
he will not all do can what you want
 ‘He won’t be able to do everything you want.’ [German]
- b. *er wird nicht [VP₁[VP₂ **alles tun**] **was du willst** können]
- c. [VP₂**alles tun**] **was du willst** wird er nicht [VP₁*t*_{VP₂} können]

This otherwise puzzling distribution —the extraposed clause would seem to attach to VP₂ in (24b) as well as (24c)— makes sense from a prosodic point of view, since topicalized VPs are generally set off into their own prosodic phrase (whereas clause-medial ones never are). It appears, then, that extraposition generally targets a prosodic phrase boundary (maybe IP) to the right (see Truckenbrodt, 1995a; Göbbel, 2007; Bobaljik and Wurmbrand, 2005; Inaba, 2007, for more and similar analysis for English).

3.3 Prosodic Movement?

What are we to make of cases of prosodically triggered movement, henceforth P-MOVEMENT as those in the last two sections? Do we have to assume that prosodic factors can trigger syntactic movement (license non-canonical syntactic structures) the same way that e.g. a *wh*-feature can? How can syntax even know what is of the proper size to shift or extraposed, if prosodic structure is to be construed only on its output?

A palatable account may have the following general format: Both canonical and shifted structures are *syntactically* well-formed. In order for them to correspond to acceptable sentences, however, there must also be *prosodically* well-formed structures that correspond to them. In certain cases, the canonical structures may not correspond to a well-formed prosodic structure, in others the shifted structures may not. Whenever the shifted structure’s prosodic correspondents are well-formed, but the canonical one’s aren’t (or less so), we get the effect of p-movement.

What this perspective requires, though, is that several syntactic variants, e.g. canonical and shifted, can exist side-by-side, i.e. be equally syntactically well-formed. Narrow syntax, in short, must allow for a certain amount of optionality (even more than it must anyway, because now some syntactically well-formed options may still not occur in well-formed sentences since they fail on prosodic grounds). In a framework in which all syntactic variation must be triggered by corresponding syntactic features (‘movement must be

feature driven’), the features in question will not be [+heavy] or [+intonational phrase worthy] (even if those may be what ultimately characterize the class of moveable elements), but narrow syntactic features (‘word order features’, EPP-type features etc.) which have no particular prosodic (or otherwise) interpretation, but which can be, randomly as it were, added to the input of syntactic computation for the sake of modelling optionality. The movements are not strictly speaking triggered by prosody (they are triggered by random features), but exploited (to use Fanselow’s, 2007, apt term) by prosody. In an evolutionary metaphor, syntactic constituent order variation is a random mutation, and prosodic wellformedness conditions are the natural selection that will let some mutations thrive, and others die. More prosaically, I will refer to this as the TRY AND FILTER APPROACH.

The Try-and-Filter approach analyzes p-movement as run-of-the-mill syntactic movement. It has been suggested in some transformational analyses, though, that p-movement (or at any rate certain cases of it) constitutes a genuinely different kind of movement operation, sometimes labelled PF-movement, from those driven by core syntactic features such as *wh*- or argument movement. PF-movement would still move syntactic constituents and merge them with other constituents, but it would do so in a different ‘branch’ of the syntactic derivation, namely after spell-out (‘on the PF-branch’), presumably because it serves no syntax-internal purpose and hence needn’t be visible at Logical Form, the syntactic level at which syntactic feature checking needs to be completed.¹³

Consequently, PF-movement may be set apart from, say, *wh*-movement not only by its ‘motivation’, but also by syntax-internal properties such as its locality restrictions, the choice of possible target positions (or even the directionality of movement); most crucially, PF-movement would, by definition, not have any interpretive effect, since it takes place after spell-out, i.e. after LF relevant information has been sent off.¹⁴ This hypothesis goes farther than the one we have contemplated so far, namely that the out-

¹³There is of course the possibility that the movement itself is not syntactic at all, but done ‘in the phonology’, as it were. This would lead us to expect, among other things, movements that affect non-constituents. This doesn’t seem to be the case of the instances of p-movement discussed here; it has been argued for in cases of clitic movement in Serbo-Croatian, where clausal clitics sometimes seems to appear *inside* a clause mates (i.e. between non-constituents). It is, however, controversial whether these really involve non-constituents, so we will not discuss them further here. See e.g. Bošković (2001), Wilder and Čavar (1994), Zec and Inkelas (1990); Zec (2005); Yu (2008) for a recent survey.

¹⁴Büring and Hartmann (1997), for example, claim that all extraposition is obligatorily reconstructed for the purposes of binding theory. This would of course follow if extraposition, being PF movement, were ‘invisible’ to interpretation in the first place.

put of syntactic movement (or the lack thereof) may be filtered by prosodic well-formedness constraints, giving the appearance of prosodically motivated movement. Since we cannot review the empirical arguments in favor of the PF-movement hypothesis in the space of this article, we will merely conclude at this point that various movements, among them HNPS and extraposition, appear to satisfy prosodic requirements or, put differently, that the question of whether or not a particular syntactic structure yields an acceptable sentence (or how acceptable a sentence) may depend on the prosodic properties of the resulting structure.

4 Extraneous Feature Mapping

In this section we will turn to those aspects of prosody that are clearly related to meaning. These include the marking of focus, givenness, contrastive topic and possibly other categories, subsumed under the label INFORMATION STRUCTURE, but also features like [comma] in Potts (2003). For reasons of space, though, we will limit our discussion to focus and its complements, background or given. Likewise we restrict attention to stress/accent as their prosodic correlate (though phrasing and tune-choice are presumably relevant, too).

4.1 Basics of IS-Realization: Marked and Unmarked Intonation

The default prosody for (25)—intuitively and as defined by the rules in section 2 above— has the NPA on *friends*; *John* bears a secondary accent, another accent on *brought* is possible, too; this is indicated in (25a):

- (25) John brought two friends along.
- a. JOHN brought/BROUGHT two FRIENDS along.
 - b. JOHN brought two friends along.
 - c. John brought two friends ALONG.
 - d. John brought TWO friends along.

(25b–d), as opposed to that, are marked realizations. In each of them, the NPA is on a different element, *John*, *along* and *two*, respectively (secondary accents are not indicated in (25b)–(25d), but will likely be on the same elements that are accented in (25a)). In relation to (25a), we can think of these marked patterns as omission of PAs on *friends* (and *brought*) in (25b), addition of a PA on *along* in (25c), and omission of the accent on *friends* plus

addition of a PA on *two* in (25d).

Each of these marked patterns seems to signal a different emphasis relating to interpretation. How can we cash out this intuition? There are two prevalent intuitions found in the literature, which I will illustrate using (25b): On the first, the marked accent pattern doesn't really emphasize *John*, but deemphasizes the rest: *brought two friends along*. This could happen because 'bringing two friends along' is already salient at the time of utterance, or given in a previous conversational move. This jibes well with the intuition that the pronunciation in (25b) seems very odd out of the blue; we immediately interpret it as part of an ongoing conversation (e.g. one that started by someone saying *Bill brought two friends along*, or asking *who brought two friends along?*).

The second kind of intuition is that in (25b), *John* is emphasized, possibly to contrast John with other people who might have brought two friends along (but didn't). Omission of other accents is a side-effect of emphasizing *John*. We will now flesh out these intuitions some more.

4.2 Background: Interpreting Information Structure

4.2.1 Givenness

In its simplest form, a givenness theory would hold that there is a one-to-one correspondence between being discourse-new and being accented. Often, for example, leaving a lexical expression unaccented signals that that constituent is, in a sense to be elaborated, given; the unaccented object NP in (26A) is interpreted anaphorically, while accenting it blocks that interpretation, as in A', rendering the reply somewhat incoherent:

- (26) Q: (Did you see Dr Cremer to get your root canal?)
A: (Don't remind me.) I'd like to STRANGLE the butcher.
A':#(Don't remind me.) I'd like to STRANGLE the BUTCHER.

In (26), the given constituents are anaphoric, but anaphoricity does not suffice as a general characterization of givenness: The N *Italian* may be unaccented in (27a), because it is given; but the DP it heads is not anaphoric. Even verbs, like *jump* in (27b), for which the notion of anaphoricity isn't generally assumed to be relevant, can be given and hence deaccented:

- (27) a. (Why do you study Italian?) I'm MARRIED to an Italian.
b. (Don't jump! —) But I WANT to jump.

We may characterize givenness as in (28):

- (28) An expression E is given in a context C if there is a synonym or hyponym A to E s.t. the meaning of A is salient in C.

On its anaphoric reading, *the butcher* is synonymous with *Dr. Cremer* in (26), as is of course *jump* to *jump* in (27b). By assumption, using an expression makes its meaning salient, so (28) is met. While *Italian*, the language, is not synonymous to *Italian*, the nationality, we may assume that mentioning of the one can make salient the meaning of the other. Finally, the reference to hyponymy allows us to subsume cases like (29) (adapted from van Deemter, 1999) in which mentioning of *violin* makes *string instruments* given:

- (29) (I want to learn the violin,) because I LIKE string instruments.

It is inappropriate to speak of given constituents (or their meanings) as ‘presupposed’, for at least two reasons: First, one can only presuppose entire propositions or statements, but not properties, individuals, relations etc. (the same caveat applies to the notion ‘old information’ to characterize givenness). Second, even if a given constituent is propositional, its content need not be accepted by the conversationalists:

- (30) A: Do you think we’ll see Kim at the party?
B: I DOUBT she’ll be there.

The underlined part in B’s reply is unaccented because it is given. But neither A nor B actually hold the belief that Kim will be at the party; the proposition that she will is salient (and hence makes the embedded clause given), but not presupposed.

Is it empirically correct that given elements are never accented? No. First, given element, especially content words, frequently bear secondary accents. Second, if a given element appears in narrow focus, it will bear the main accent. We will return to these case below. Nevertheless, the relevance of givenness (or something like it) for deriving prosody is hard to deny (see Ladd, 1983, and sec. 4.2.4 below).

4.2.2 Focus

The intuition behind the notion focus is virtually the opposite of givenness: a constituent is highlighted by accent in order to emphasize its novelty or importance to what is expressed. Two representative examples are ANSWER FOCUS and CONTRASTIVE FOCUS:

- (31) Answer focus: Focus marks the constituent in the answer that cor-

responds to the *wh*-phrase in the question

Q: Who did Jones' father vote for?

A: He voted for JONES.

- (32) Contrastive Focus: Focus marks the constituent that distinguishes a larger constituent from a previously uttered one
- a. Last year Jones' father voted for Smith.
 - b. This year he voted for JONES.

It bears mentioning that the example in (32) is contrastive, but not corrective (as it would be if you replaced *This year* by *No!*); I assume that corrections are a sub-case of contrastive foci.

Since von Stechow (1981, 1989) and especially Rooth (1985), the notion of ALTERNATIVES has been successfully applied in analyzing foci. For example, in (32b), we can pick a FOCUS DOMAIN, here the clause *he voted for Jones*, replace the focus in it with a cleverly chosen alternative, here 'Smith', and thus get to the (meaning) of the TARGET, the clause *he/Jones' father voted for Smith*. Roughly, any sentence for which this procedure is successful qualifies as a contrastive focus sentence.

In the same vein, we can analyze answer-focus. Either assume that a *wh*-expression like *who* can be an alternative to *Jones* in A in (31). Or stipulate that the sum total of alternative instantiations (that he voted for Jones, that he voted for Smith, that he voted for . . .) equals the set of answers to the question under discussion, Q in (31); such a stipulation usually goes by the name QUESTION-ANSWER CONGRUENCE.

In either case we can say that focus marks the (minimal) element in a focus domain which makes that domain different from a previous utterance. As in the case of givenness, we can't say that the non-focus part is presupposed, nor that the focus part is '(new) information', since neither of them is propositional.

4.2.3 Others

Apart from focus/givenness, other information structural categories have been proposed, sometimes in addition, sometimes as alternatives. Most notably among them are probably various notions of topic, both contrastive and plain (i.e. non-contrastive). There seems to be a consensus that the treatment of topics, in particular contrastive ones, requires additional categories, such as T(opic) or C(ontrastive)T(opic). These are either paradigmatic with categories like F(ocus) (i.e. a constituent is either F- or T-marked (or neither)), or cross-classify with them (e.g. F can be within a topic constituent

or a non-topic constituent). For reasons of space these can not be discussed here, but see a.m.o. Büring (2003); Kadmon (2001); Steedman (2000b).

4.2.4 The Relation Between Givenness and Focus

Comparing givenness and focus, it seems tempting to reduce one to the (inverse of the) other: Couldn't focus simply be the non-given part? Or, inversely, givenness be the same as background of a focus within a focus domain? The arguments are complex and impossible to do justice within the scope of this article, so a few cliff notes must suffice, starting with three arguments suggesting the need for givenness.

First, the majority of sentences are neither answers nor explicitly contrastive, yet many of these show marked accent patterns. These are open to explanations in terms of givenness, but require invocation of implicit questions or contrast targets to be subsumed under focus.

Second, if a sentence contains, in addition to an answer focus or a corrective focus, new material, that material is accented just like a focus.¹⁵

- (33) Q: What did you buy?
A: I bought [a BOOK]_F at the FLEA market.

Third, within larger foci, the actual accent placement may depend on givenness:

- (34) Q: Who did Jones's father vote for?
A1: He voted for [a friend of his WIFE]_F.
A2: He voted for [a FRIEND of Jones]_F.

On the other hand, given elements may end up accented, in case they are narrowly focused, as in our original examples in (31)A and (32b); so plausibly, focus is needed in addition to givenness.

All these distributional arguments suggest that a unification is impossible. Nevertheless, Schwarzschild (1999) develops an intriguing proposal to subsume the two under what he calls GIVENNESS (with a capital G). In a nutshell, a constituent counts as Given if, after replacing the focus, it finds a salient antecedent; this is virtually identical to the concept of focus discussed in 4.2.2 above and in particular allows for given elements to be accented if

¹⁵Recent experimental results by Katz and Selkirk (2009) suggest, however, that there are subtle differences between the realization of new material vis-à-vis the accenting of (associated) foci. If these are systematic, they'd constitute another, strong argument in favor of separating the given/new dimension from the focus/background dimension.

they happen to be the smallest locus of novelty within a focus domain, addressing point four. On the other hand, if a constituent doesn't contain focus, it is Given if it is given (since there is nothing to be replaced in it, it has to find a literal antecedent). So even though Schwarzschild's Givenness theory is often contrasted with 'focus theories' such as Rooth (1992), it is actually simply a generalization thereof (indeed Rooth, 2010, subsumes both under 'anaphoric theories of focus').

An entirely different argument for distinguishing givenness and focusing invokes interpretation. Indeed, early discussions of givenness emphasize the absence of what we may call 'semantic contrast' in typical givenness examples such as (35) ((7b) from Ladd, 1980, p.55):

- (35) A: Why don't you have some French Toast.
B: I've forgotten how to MAKE French Toast.

Here, the argument goes, *make* is not understood as contrasting with any other relation ('...but not how to sell French toast'...). Similarly for our examples in section 4.2.1 above. Granting this point (though see Buring, 2008; Wagner, 2006, for a different view), it is interesting to note though that formal theories of focus such as Rooth (1992) do not incorporate any notion of contrast other than the very weak one of finding an alternative that will match the focus domain to the target (which of course you can do in (35) by using 'have' as an alternative to *make* in VP). In other words, there is no 'true contrast' requirement on a focus domain and its target in discourse in such theories —this is of course the reason why Schwarzschild (1999) succeeds in subsuming focus under Givenness. Indeed, meaningful definitions of 'contrast' in a stronger sense prove difficult to formalize and often remain imprecise or circular (see e.g. É. Kiss, 1998; López, 2009; Vallduví and Vilkuna, 1998). It remains an open challenge to distinguish (non-)Givenness and focus on a semantic/pragmatic basis (see Krifka, 2008; Repp, 2010, for useful overviews, and Repp and Cook 2010 for a recent monograph)

Summarizing, the question whether givenness and focusing can be unified in their interpretation, and hence reduced to a single marking in the syntax is controversial. I will err on the side of caution here and assume that they are distinct.

4.3 The Influence of Focus/Givenness on Prosody

Building on our earlier assumptions about NSM, we will assume that extraneous features like focus and givenness will (sometimes) yield *amendments* to the prosodic structure(s) based on narrow syntactic information and prosody internal factors alone (an idea that goes back at least to Selkirk, 1984, where NSM builds a metrical structure, which is then amended to accommodate focus-driven PAs). Assume that focus and givenness are marked in the syntax by privative features [F] and [G]; then (36) provides a minimal version of a constraint set that achieves this:

- (36) a. FOCUS PROMINENCE (a mapping constraint)
An [F]-marked constituent contains the nuclear stress (in its focus domain)^{16,17}
- b. GIVEN NON-NUCLEAR (a mapping constraint)
A [G]-marked element doesn't contain the nuclear stress (unless it is [F]-marked)¹⁸

In addition, the constraints of narrow syntactic mapping, as well as prosody-internal wellformedness constraints as discussed in section 2, remain active, giving rise to what we may call...

- (37) Prosodic Inertia: Default Prosody is retained as much as possible while respecting FOCUS PROMINENCE and GIVEN NON-NUCLEAR.

The two most important ingredient of Default Prosody regarding stress/accent are that regular phrasal stresses are assigned to the heads of lexical XPs, *modulo* integration (STRESSXP/XP $\leftrightarrow\phi$, (10)), and no accents can follow the nuclear stress (STRESS-TO-ACCENT, (3)). Crucially, the latter principle, but not the former, is inviolable, so that both FOCUS PROMINENCE in (37a) and

¹⁶See the FOCUS constraint in Truckenbrodt (1995b *et seq.*), from which we also adopt the assumption that FOCUS PROMINENCE is the *only* way in which focusing influences prosody (see also sec. 4.4 below). An alternative formulation would be ‘...contains a phrasal stress’. Assuming that material outside of the focus is always given, it follows from (b) that the main stress falls on a focus; assuming, on the other hand, that there can be new material outside of the focus, it would allow for non-nuclear foci, which may or may not be empirically correct, cf. (33) above —see again Katz and Selkirk (2009).

¹⁷In relating [F]/[G] to stress, rather than directly to accents, we follow a.o. Ladd (1996) and Truckenbrodt (1995b). This is advantageous in particular to account for SECOND OCCURRENCE FOCUS phenomena (see the proposal in Büring, 2008/in press), but also focus realization in other types of language (Truckenbrodt, 1995b, also Büring 2009).

¹⁸Cf. DEACCENTGIVEN in Féry and Samek-Lodovici (2006) a.o. The principle given here is weaker in that it allows for ‘ornamental accents’ (Büring, 2001a), i.e. pre-nuclear accents on given elements, which are widely attested.

GIVEN NON-NUCLEAR in (37b) will result in the avoidance of pitch accents (‘deaccenting’) on given or non-focal elements if these would otherwise bear the last pitch accent (in the domain). The effects of (36) can be summarized as follows:

- The nuclear (strongest) stress/pitch accent of the sentence will be within a focus, if there is one (due to FOCUS PROMINENCE).
- Within a focus or in a sentence without focus (if there are such), the NPA will fall on a non-given element if there is one (due to GIVEN NON-NUCLEAR).
- Given a choice between several F-marked, G-less constituents, the nuclear pitch accent goes to the rightmost one (by Prosodic Inertia, particularly HEADRIGHT), *modulo* integration (see sec. 2.4 above); same if nothing is F/G-marked.
- There will be regular phrasal stresses, and thus (non-nuclear) pitch accents on eligible elements before the nuclear PA, regardless of their F/G-marking (Prosodic Inertia, in particular STRESSXP/XP $\leftrightarrow\phi$).
- There will be no pitch accents after the final focus or non-given element, because there can’t be PAs after the nuclear stress (Prosodic Inertia, particularly STRESS-TO-ACCENT), which by FOCUS PROMINENCE must be on an F-marked (and otherwise by GIVEN NON-NUCLEAR, on a non-given) element.
- All the above generalizations will apply to sub-constituents of sentences if these contain F/G-markings.

4.4 Prosodic Inertia and Focus Projection

By coining the term Prosodic Inertia, I have emphasized that principles of default prosody are integral, too, to understanding the realization of focus and givenness. Apart from the bullet points above, this is particularly evident in examples with multi-element foci: If the focus doesn’t contain the rightmost phrase accent and hence the NPA by default, prosodic structure will be changed so as to achieve this. *Within* the focus, accents will fall as usual (i.e. on all lexical elements *modulo* integration), and the last of those will become nuclear. This has essentially been noted in Jackendoff (1972), p.237: ‘the highest stress in S will be on the syllable of P [the focus of S, DB] that is assigned the highest stress by the regular stress rules’. The same follows from the transderivational system in Reinhart (1995, ch.3): The NS

on word *W* can realize focus on a higher constituent *P* only if nuclear stress on *W* presents the *minimal change* to the default prosody that results in *P* containing the NS.

Prosodic Inertia derives the very same effect. There are thus no specific rules to determine possible foci from accent positions, or accent positions within foci, so-called FOCUS PROJECTION RULES, other than the general rule *not* to change anything unless required by FOCUS PROMINENCE/GIVEN NON-NUCLEAR.

5 How IS Influences Syntax

So far we have concentrated on the effect of focus on prosody (and somewhat: interpretation). Indeed, I have characterized [F]-features as ‘extraneous’, suggesting that they don’t have syntax-internal relevance at all. But is this correct? Are there really no narrow syntactic effects of focus —and more generally, information structure features— at all?

5.1 Focus Effects on Constituent Order: Three Types of Approaches

That focus/givenness structure (in one of its nominal incarnations) can influence constituent order has been noted a long time, in at least two ways: First, as a general ordering principle, usually ‘old-before-new’, e.g. in Czech and other Slavic languages (see a.o. the work of the so-called Prague school, revisited e.g. in Hajičová et al., 1998), or earlier studies of German scrambling (Lenerz, 1977; Lötscher, 1972). Second in the form of reference to, usually peripheral, focus positions, especially in non-European languages.

Independent of that, Chomsky (1976) contained an argument that focus in English had to undergo quantifier raising at Logical Form (Chomsky’s argument has since been convincingly criticized and will not be repeated here).¹⁹ For simplicity I will use the term IS-movement to refer to all of

¹⁹See Krifka (2006) for a recent overview of arguments for and against LF focus movement, Wagner (2005) for a rather compelling, if complex, novel argument, and Wold (1996) for more critical remarks.

Historically, the need to isolate focus and background for the purposes of interpretation may have added to the attractiveness of focus movement, since its output would provide a sentence neatly separated into focus and background. However both Structured Meaning approaches (e.g. Jacobs, 1988, 1991/2b; Krifka, 1991/2, 1992; von Stechow, 1981, 1982, 1989) and Alternative Semantics (Rooth, 1985) have since provided frameworks for interpreting focus *in situ*. Indeed, all current theories that assume focus movement still assume one of these (usually Alternative Semantics) as part of focus interpretation, since in many

these; a more apt, but discouragingly cumbersome term would be ‘information structure related constituent order variation’.

Horvath (1986) presents an early formal analysis of Hungarian focus in which a feature [F] is assigned in a particular syntactic position (preverbally); this is refined in Bródy (1990), according to which focus needs to move to the specifier of a functional projection whose head itself bears the feature [F]. Subsequently, Rizzi (1997) proposed that that head is a designated Focus head, located in the left, CP region of the clause, and that hence, focus is moved to SpecFocusP. Movement of the focus to SpecFocusP is triggered by the necessity to check the focus’ [F] feature against that of the Focus⁰ head.

What is common to such approaches is that they assume the focus position to be located in absolute syntactic terms, i.e. in a particular position relative to other clausal heads and the elements occupying them. Because of that property approaches of this ilk are often called CARTOGRAPHIC APPROACHES. Cartographic approaches also typically assume that focus movement is triggered syntax internally by the feature [F].²⁰

As opposed to that, the analysis of Catalan in Vallduví (1990) is an early example of what I will call a MAPPING APPROACH to IS-movement. According to Vallduví (1990), all and only material within the core IP at s-structure is interpreted as focus (by an operator called Φ); non-focal material is left- or right-adjoined to IP, where it gets interpreted as background (‘ground’ in Vallduví’s terms, split into ‘links’ to the left, and ‘tail’ to the right). It appears from Vallduví’s discussion that movements to dislocated positions are in principle optional, but will result in a particular interpretation in the pragmatic component (his ‘informatics’), due to the nature of the syntax-to-pragmatics mapping.²¹

A recent version of a mapping approach is the analysis of Czech in Kučerová (2007), which, like Vallduví’s, assumes that all non-given (focal) material has to form a core sentential constituent, c-commanded (and in the case of Czech:

cases the moved constituent must be bigger than the semantically interpreted focus (see Drubig, 1994; Krifka, 2006, for arguments). From a semantic point of view then, focus movement does not simplify the theory.

²⁰The latter is not a logical necessity, though. In López’s (2009) analysis of Catalan and other Romance languages, information structural interpretations are assigned in specific syntactic positions to whatever elements happen to move into or through those positions for whatever reasons. Thus, López’ analysis is cartographic in that it assumes fixed syntactic positions for particular IS features (which in his case are not [F] but [anaphoric] and [contrast]), but it doesn’t assume that information structure features themselves trigger movement.

²¹Since Vallduví (1990) builds upon the Government & Binding model of syntax, movements are generally assumed to be optional, with apparent ‘purposes’ achieved solely *ex post*.

preceded) by all given material (within a certain syntactic domain).

Mapping approaches like Vallduví's and Kučerová's don't assume that there are designated, labelled focus positions in the syntax, nor do they rely on the existence of features like [F] in the syntax. In the case of Kučerová (2007), there isn't even a designated syntactic boundary between background and focus (what the innermost IP is in Vallduví, 1990), since *any* constituent can mark the boundary between given and focal material (marked by an operator *G* in Kučerová, 2007).

Finally, Zubizarreta's (1998) analysis of Spanish initiates the line of PROSODY-DRIVEN APPROACHES to IS-movement. Like mapping approaches, these don't assume syntactically defined focus positions or heads (nor necessarily focus features), but unlike mapping approaches, they assume that the domains in which elements are interpreted as focus and background, respectively, are defined by the syntax-to-prosody interface, not the interface to interpretation. The core principle of all these approaches is the requirement that focus needs to bear the main stress of the sentence (FOCUS PROMINENCE). IS-movement emerges in cases where this is achieved by bringing the focus constituent into the default main stress position, rather than shifting the main stress onto the focus constituent(s).

Prosody-based approaches provide an intriguing link between IS-movement and focus realization by prosody *in situ*: In both cases, the same underlying principle is operative: to align pragmatic focus and prosodic prominence. The difference is whether this is done by changing constituent order, or prosodic patterns.

Because of this interesting property, the number of thorough prosodically based analyses available, and because these are most pertinent to the topic of the present article, we will focus on prosody-based approaches to IS-movement in what follows.

5.2 Prosodically Driven Movement

In a number of unpublished manuscripts, and eventually her 1998 book, Maria-Luisa Zubizarreta has pioneered a prosody-based approach to focus placement in Spanish (and other languages). Spanish answer focus has to occur in the rightmost position of the core clause, followed at most by right-dislocated, prosodically separated material. Hence, narrow subject focus can only be realized in V(O)S order, and likewise, focus on an initial object requires dislocation of any following objects (based on exx.(57/8) in Zubizarreta, 1998, p.22):

- (38) (Context: Who ate an apple?)
- a. Comió una manzana JUAN.
ate an apple Juan
 ‘JUAN ate an apple.’
 - b. #Juan comió una manzana.
- (38) (Context: What did María put on the table?)
- a. María puso sobre la mesa el LIBRO.
M. put on the table the book
 ‘María put the BOOK on the table.’
 - b. #María puso el libro sobre la mesa.

Zubizarreta (1998) connects this to the fact that main sentential stress in Spanish is likewise strictly right-peripheral, and —unlike in English— cannot shift leftward in cases of narrow answer focus. Assuming that sentence stress is invariably assigned to the rightmost phrase in a Spanish clause, Zubizarreta then proposes that any non-canonical orderings such as VS, VOS, ... etc. result from a last resort operation called P-MOVEMENT, which moves non-focal material leftward across focused material, until the latter is ultimately in a right-peripheral, main stress position —in accordance with a principle like FOCUS PROMINENCE in (36) above, which requires focus to bear the main stress (called the ‘Focus Prosody Correspondence Principle’ in Zubizarreta, 1998, p.38).²²

As emphasized in Zubizarreta (1998), this analysis connects focus realization by peripheral placement in Romance languages like Spanish to focus marking by intonation in English and German, and even allows for incorporating optional focus movement (in French) and non-focus related prosodic movements such as HNPS in English, discussed in section 3.1 above (cf. esp. Zubizarreta, 1998, chap.3.6).

As also discussed at length in that book (see esp. pp.30–33), p-movement poses a bit of a conundrum in terms of standard transformational assumptions: the need for p-movement can only be assessed *after* main stress has been assigned, and hence after the syntactic derivation is complete (i.e. all ‘normal’ merges and moves have been completed); after all, it is not the [F] feature that triggers p-movement, but a configuration in which the ‘normal’ position of the [F]-marked element does not include the structurally assigned main stress. The resulting picture picture can thus be depicted as in figure 2.

²²Technically, the Focus Prosody Correspondence Principle assigns metrical strength to the [F]-marked constituent, while the Nuclear Stress Rule assigns metrical strength to the rightmost one. Where this results in two metrically strong sisters —something which is not allowed by grammar— p-movement of the right sister across the left sister results; see sec.3.5 in Zubizarreta (1998).

1. main syntactic derivation (all merges and movements driven by feature checking)
2. Main Stress Assignment by Nuclear Stress Rule & Focus Prosody Correspondence Principle
3. If stress assignment is contradictory:
 - (a) p-movement of right sister across left sister
 - (b) back to step 2

else on to next step
4. proceed to LF and PF

Figure 2: Grammar of p-movement in Zubizarreta (1998)

Note that on this picture, stress assignment must happen in the syntax proper (albeit at the very end), because it triggers syntactic movement (p-movement) and because the output of that movement can, at least in principle, influence interpretation, hence ‘feed LF’ (Zubizarreta, 1998, p.146). Consequently, Zubizarreta (1998) assumes that stress is assigned to syntactic, not prosodic, constituents.

Büring and Gutiérrez-Bravo (2001) transpose Zubizarreta’s analysis into a prosody-based framework like the one discussed in section 2, i.e. in particular one that assumes that stress is a property of prosodic structure, as built off of syntax, but not present in the syntax itself (that paper also extends the analysis to focus-related scrambling in German, as do Büring, 2001a,b). In that setting, the question of the role of p-movement in grammar presents itself with new urgency: If stress is only present in prosodic structure, i.e. after the PF-interface, what triggers p-movement in the syntax? Büring and Gutiérrez-Bravo’s (2001) answer is the same we adopted in section 3: ‘Try-and-Filter’. P-movement is a run-of-the-mill syntactic movement; whether it is legitimate or not can only be assessed by looking at the resulting syntactic *and* prosodic structure. A sentence is well-formed if it is prosodically well-formed—which in the case of Spanish means it has right-peripheral main stress—and meets FOCUS PROMINENCE, i.e. has the [F]-marked element cor-

respond to a prosodic constituent that bears main sentential stress. In a standard object focus case, the basic constituent order meets these constraints, while a subject-final order doesn't, in the case of narrow subject focus, the subject-final order (ostensibly derived by movement) does, whereas the basic SVO or VSO orders don't.

Analyses in exactly the same spirit, but much more detail, are presented for Italian and a number of other languages in Samek-Lodovici (2005), and for Hungarian in Szendrői (2001). Abstracting away from the details of particular analyses, the blueprint for these kinds of analyses based on prosodic structure²³ is thus as follows: Movement of focus, as well as backgrounded, constituents is not technically triggered by any focus (background) feature (in agreement with Zubizarreta, 1998), in fact it is syntactical optional (*pace* Zubizarreta, 1998); however, a derivation that fails to move and thereby ultimately violates FP, as well as a derivation that does involve movement but ultimately violates FP (e.g. 'wrongly' creates VSO order in a object focus sentence), will 'crash' (in minimalist terminology), or be blocked by a competitor that doesn't involve these violations (in the terminology of ranked violable constraints as used in most of the works cited), thus yielding the effect of focus/prosody-driven movement.

As the reader may have noted, it is indeed irrelevant for this kind of analysis by which means competing word orders are generated, since all relevant structures must be syntactically freely available, only to be filtered out once syntactic, prosodic and F-structure are, simultaneously, assessed by grammatical constraints. (There is, however, an additional complication having to do with the least effort nature of IS-movement, which we will discuss in section 5.4).

5.3 Features and Predictions of Prosody-Based Approaches

5.3.1 Multiplicity of 'Focus Positions'

If focus configurations are defined prosodically, there is no expectation that focused elements will occupy syntactically identical positions across sentences. For example, a clause final element in Spanish may be an object (hence VP internal) or an adjunct (hence VP external), or an intransitive verb:²⁴

²³And not just prosody, or rather: stress, as an aspect of syntax, as is the case in Zubizarreta's seminal work.

²⁴Example (39b) is (105) in Zubizarreta (1998:134), (a) and (c) courtesy of Kay Gonzalez, p.c.

- (39) a. (Context: What did Juan buy?) [Spanish]
 Juan compró el peRIÓdico.
J. bought the newspaper
- b. (Context: Where did Juan plant a rose bush?)
 Juan plantó un rosal en el jarDÍN.
J. planted a rose bush in the garden
- c. (Context: What did María do?)
 María BAlla
M. danced

Syntactic evidence shows that indeed all of these elements occupy the same position they do in ‘normal’ (broad focus) sentences. They uniformly end up receiving sentential stress because they happen to end up the last content word in the clause.

Similarly, according to Szendrői (2001, 2003) Hungarian assigns main stress clause initially, making that position, following topicalized (ostensibly TP adjoined) elements, the focus position. This position is often filled by movement (of the element to be focused) to a functional specifier, accompanied by raising of the verb (but not the verbal particle; accordingly, the order *mutattam be*—rather than the unmarked *be mutattam*—diagnoses focus movement):

- (40) (Context: Who did you introduce Peter to last night?) [Hungarian]
- a. Tegnap este MARinak mutattam be Pétert.
last night Mary.DAT introduced.I PERF Peter.ACC
 ‘It was to Mary that I introduced Peter last night.’

If that position remains empty, however, the finite verb itself—now leftmost in the core clause—receives main stress. This is the pattern found in narrow V focus, as well as verum focus sentences:²⁵

- (41) De, én ODA VITTEM a levelet. [Hungarian]
but I PRT took the letter.acc
 ‘But I TOOK the letter there/DID take the letter there.’

Like in Spanish, one can show that the verb here remains *in situ* and does not occupy a higher functional position (e.g. a hypothetical syntactic focus head): The verb *vittem* in (41) follows the preverbal particle *oda*.

In sum, prosody-based accounts define focus configurations in terms of alignment with a prosodically defined position, not structurally. Accord-

²⁵Examples (22) from Szendrői (2001:54).

ingly, focused elements can occupy different syntactic positions. Likewise, IS-movement will occur where an element to be focused doesn't occupy that position in the unmarked order, but there will not be string-vacuous movements of foci for the sake of checking a focus feature; being in the focus configuration is obligatory, moving focus is not.²⁶

5.3.2 Multiplicity of 'Focus Movements'

As discussed in the previous section, prosodic approaches predict that the focus configuration can be obtained by moving the to-be focus into the main stress position, or, where applicable, leaving it in its base position. In addition, an element to be focused can get into the main stress position through 'evacuation' of other elements (which would otherwise receive main stress). Common strategies of evacuation include pronominalization, right (or, especially in case the element to be evacuated is a contrastive topic, left) dislocation, and VP internal swapping of positions (Romance p-movement, Dutch/German scrambling), as well as possibly object shift in Scandinavian.²⁷

- (42) Right dislocation [Italian]
 (Context: What has John given to Mary?)
 Ha regalato un LIBro, Gianni, a Maria.
has donated a book, John, to Mary
 'John has given a BOOK to Mary.'
 (from unmarked *Gianni ha regalato un libro a Maria*)
- (43) Scrambling [Dutch]
 (Context: When did Jan kiss Marie?)
 Jan heeft Marie GISTERen gekust.
J. has M. yesterday kissed
 'Jan kissed Marie yesterday.'
 (from unmarked *Jan heft gisteren Marie gekust*)
- (44) VP internal p-movement [Spanish]
 (Context: What did Juan plant in the garden?)

²⁶Mapping approaches share these general features with prosody based approaches. In particular, since prosodic structure is aligned with syntactic structure as discussed in section 2, it is often difficult to tease apart alignment with, say, a main stress position at the right edge of the intonational phrase (as in prosody based approaches), and alignment with a syntactic domain, say the right edge of TP (as in a mapping approach).

²⁷Italian from Samek-Lodovici (2005:720, ex.(50)), Dutch from Costa (1998:161, ex.(110a)), Spanish from Zubizarreta (1998:134, exx.(104),(105b)).

Juan plantó en el jardín un ROSAL
J. planted in the garden a rose bush
 ‘Juan planted a rose bush in the garden.’

(from unmarked *Juan plantó un rosál en el jardín*, (= (39b)))

- (45) DP internal p-movement [Spanish]

(Context: Which place did the people denounce the invasion of by the Americans?)

El pueblo denunció la invasión por los americanos del
the people denounced the invasion by the Americans of
 Canal de PANAMÁ.
canal of Panama

(from unmarked [_{DP} *la invasión del Canal de Panamá por los americanos*])

In other words, such approaches are compatible with focus movement as well as ‘givenness movement’.²⁸

5.3.3 Mixing of Strategies

As pointed out above, prosody-based accounts draw a direct connection between focus realization by position and focus realization by accent. They are thus also well suited to the analysis of languages in which both of these focus realization strategies occur. Thus in German, focus on an initial (indirect) object can be realized by shifting the main stress leftward, or by evacuating (via scrambling) the final (direct) object to the left, making the focus right-peripheral. The analogous situation is found in French, though there the direct object is initial in the unmarked order (French from Zubizarreta, 1998, p.147, exx.(139a/140a)):

- (46) (Context: Who does she bequeath her poodle to?) [German]

a. Sie vermacht ihrer SCHWESter ihren Pudél.
she bequeaths her.DAT sister her.ACC poodle

b. Sie vermacht ihren Pudél ihrer SCHWESter.
she bequeaths her.ACC poodle her.DAT sister
 ‘She bequeaths her poodle to her sister.’

- (47) (Context: What did you return to Marie?) [French]

a. Nous avons rendu son LIVRE à Marie.
we have returned his book to Marie

²⁸Note incidentally that (45) shows that G-movement, too, is not ‘position bound’ in Spanish; here, it moves one DP-internal argument across another.

- b. Nous avons rendu á Marie son LIVRE.
 ‘We returned his book to Marie.’

As proposed e.g. in Zubizarreta (1998:146) and Büring (2001a), such a pattern can be analyzed as the coexistence of two grammars (formalizable e.g. as a constraint tie), one of which favors preserving unmarked constituent order (as in (47a)), the other standard prosody (as in (47b)). A similar analysis could be devised for ‘stylistic’ movements such as particle shift in English:

- (48) Context: What did she do when her neighbors complained about the loud music?
 a. She turned DOWN the music.
 b. She turned the music DOWN.

Crucially, under the prosodic account, these two strategies are closely related: Both serve to satisfy FOCUS PROMINENCE, differing only in whether principles preserving standard prosody (i.e. principles of NSM) or preserving standard constituent order (e.g. principles penalizing movement) are ranked below it.

5.4 Syntactic Inertia

I have described prosody-based approaches above as ones that ‘blindly’ generate different constituent orders, then pair these with appropriate prosodic structures, and finally evaluate these pairs with regard to mapping constraints. This, however, cannot be the entire story. Characteristically, variations in constituent order for focus reasons is subject to SYNTACTIC INERTIA: unmarked constituent order is preserved as much as possible while achieving the focus configuration. I briefly illustrate with two sets of phenomena. First, marked constituent orders are generally narrow focus. For example, in subject final structures in Romance, only the subject (or a part thereof) can be interpreted as focus; in an object final structure, on the other hand, (parts of) the object, the VP, or the entire sentence can be interpreted as focus (note that in all of these cases, the (would-be) focus contains the final constituent and hence the main stress):

- (49) a. (Context: # What happened? [Spanish]
 Who at an apple?)
 Comió una manzana Juan. VOS
 ate an apple Juan
 ‘Juan ate an apple.’
 b. (Context: What happened?
 What did John do?)

What did John eat?)
 Juan comió una manzana. SVO

One may suspect that this is because subjects in general cannot project focus. (50) shows, that that cannot be the reason:

- (50) (Context: What happened?/What did Juan do?) [Spanish]
- a. Juan plantó un rosal.
J. planted a rose bush
 - b. Juan plantó un rosal en el jardín.
J. planted a rose bush in the garden
 - c. #Juan plantó en el jardín un rosal.

In the marked order *V PP O* in (50c), only the final object *un rosal* can be interpreted as focus. The sentence is thus odd in the contexts given; instead, the unmarked order *V O PP* as in (50b) must be used. But, as (50a) shows, the object can in principle project VP and sentence-wide focus, when in unmarked sentence final position. Thus the impossibility of wide focus in (50c) must be blamed on the marked constituent order, not a general inability of objects to project focus.

The second set of data comes from languages that allow both order variation and accent shift (cf. section 5.3.3 above): While each is possible in isolation, a constituent in non-canonical position cannot bear non-canonical main stress; this is illustrated for German in (51):

- (51) (Context: What does she bequeath to her sister?) [German]
- a. Sie vermacht ihrer Schwester ihren Pudel.
she bequeaths her.DAT sister her.ACC poodle
 - b. #?Sie vermacht ihren Pudel ihrer Schwester.
she bequeaths her.ACC poodle her.DAT sister
 ‘She bequeaths her poodle to her sister.’

Although accusative-before-dative order is in principle possible —see (46b) above— it is not if the accusative is to be narrowly focused. Generally, moving a narrow focus to the left is highly marked in Dutch and German, even though both languages allow non-final sentential stress and foci.

Both these patterns can be conceptualized in terms of Syntactic Inertia: Do not change constituent order unless the resulting structure allows you to realize the focus pattern with a less marked intonation. In wide focus case like those in (49) and (50), constituent order changes within the focus

don't improve prosodic structure, and in the narrow focus cases like (51b), scrambling make the prosody even worse.

In the account of Zubizarreta (1998), this is implemented straightforwardly: p-movement is *triggered* by a mismatch between focus realization and structural stress, and accordingly wouldn't take place if the pre-movement structure didn't have a mismatch to begin with.

On a Try-and-Filter approach, Syntactic Inertia has to be implemented by a constraint that penalizes non-canonical order relative to $\langle s,p \rangle$ pairs. In particular, even where both s and p are independently well-formed—as they are in (50c) and (51b)—and meet FOCUS PROMINENCE on the intended focusing—as they do for wide focus in (50c), and focus on the accusative object in (51b)— $\langle s,p \rangle$ will only be admitted by the grammar if there is no competitor $\langle s',p' \rangle$ that meets these criteria and involves less deviance from the canonical constituent order.

In other words, deciding whether a given syntax-prosody pair of representations is well-formed, involves comparing it to a set of other syntax-prosody pairs, its comparison class, in terms of some metric of 'canonicity', e.g. the number (and possibly distance) of movements, or more generally, a measure of deviance from the canonical order for the same sentence (where again 'same sentence' is in need of a formal definition).²⁹ The comparison class itself should comprise different prosodic structures paired with the same syntactic structure (as already seen in section 4.4 above), but also, and crucially, different syntactic permutations of the same sentence (with the same caveats as above).

5.5 Problems

Though prosody-based approaches have been applied successfully across a wide range of languages, there are also known problems, some of which will be mentioned in this section. First, an obvious prediction of these approaches is that the position of main stress and the position of focus should coincide. While this is the case in most languages studied, there is at least one glaring exception, Ntɛʔkepmxcin (Thompson River Salish), as analyzed in Koch (2008). In Ntɛʔkepmxcin focus has to align on the left of the clause, but

²⁹Examples of the former are the anti-movement constraints Stay in Samek-Lodovici (1996:698) and Buring (2001a:73) and *Structure in Szendrői (2001:154), as well as the canonical order constraints SO (for 'subject structurally above object') in Buring and Gutiérrez-Bravo (2001:44), Dative (precedes accusative) in Buring (2001a:93), and Animacy (animate precedes inanimates), Dative and Definiteness (definites precede indefinites) in Buring (2001b:78) (based on Grimshaw, 1997; Müller, 1999; Prince and Smolensky, 1993, respectively).

prosodic prominence is clearly on the right.

Second, as per the discussion in section 5.3.1, the prosody-based account predicts that there will be no string vacuous IS-movement, or generally no IS-movement which doesn't bring the focus closer to a prosodically defined edge. However, in Hausa, which otherwise has optional movement to a left-peripheral focus position, subjects obligatorily have to move to that position, even though their base position is sentence-initial (exx. from Hartmann and Zimmermann, 2007, and p.c.):

- (52) Q: Wàa ya-kèè kirà-ntà? [Hausa]
who 3sg-rel.cont call-her
 'Who is calling her?'
 A1: Daudàa (nee) ya-kèè kirà-ntà.
D. PRT 3sg-rel.cont call-her
 'Dauda_F is calling her.'
 A2#Daudàa ya-nàa kirà-ntà.
D.F 3sg-cont call-her

That movement has taken place is indicated by the so-called relative form of the verb (*ya-kèè* instead of *ya-nàa*) and the possibility of the particle *nee*. A regular SV structure with a non-relativized verb as in A2 is impossible with subject focus.

Finally, it appears there are cases in which given elements are moved leftward even if they are not, prior to movement, in nuclear stress position. According to López (2009:181), *dos pimientos* moves across *a mi hermana* in (53b) because it is part of the background —unlike in (53a). In both cases, the nuclear accent is on *madre*, which is part of the focus: *para mi madre* in (53a), and *di... a mi hermana para mi madre* in (53b). It is thus unclear what motivates the movement in (53b) (example (5.25) in López, 2009):

- (53) a. (Context: For whom did you give your sister two peppers?)
 Le di a mi hermana dos pimientos para mi
Cl.dat gave.1st.sg DAT my sister two peppers for my
 madre.
mother
 I gave my sister two peppers for my mother.
 b. (Context: What did you do with two peppers?)
 Le di **dos pimientos** a mi hermana *t* para mi madre.

At the very least, then, something other than nuclear stress must motivate the movement of *dos pimientos* in (53b).

5.6 The Three Types of Approaches Compared

As should have become clear from the foregoing discussion, there are many phenomena that jibe well with prosody based approaches as well as mapping approaches, but not cartographic approaches: the multiplicity of focus positions, the coexistence of movement into focus positions (of constituents to be focused) and away from focus positions (for constituents not to be focused), and the coexistence of positional and prosodic marking strategies in the same language. Generally, cartographic approaches do well with defined narrow focus positions, but have problems dealing with broader foci, including all-new sentences. Perhaps because of that, virtually no in-depth analyses of focus marking within the cartographic approach exist; its popularity, it seems, is owed more to its simplicity and compatibility with syntactic ideas of a certain period (in particular that all movement needs to be feature driven) than its empirical success.

As pointed out before, too, prosodic and mapping approaches are much harder to tease apart in their predictions. I have listed some problems for prosodic approaches in section 5.5 above, some of which may be amenable to solutions within mapping approaches. The reason for that is of course that mapping approaches are not committed to the existence of any independent correlates of their focus configurations; that affords them more analytical liberties. That, however, may also be considered their biggest shortfall: They fail to make a connection to prosody, and thereby to languages in which accent shift or other prosodic manoeuvres are the primary means of focus realization.

6 Summary

Prosodic structure is a structure in its own right, not just syntactic structure garnished with segments, stresses and accents. While narrow syntactic mapping constraints (like $XP \leftrightarrow \phi$) co-determine what prosodic structures occur, many aspects of prosodic structure follow from prosody-internal restrictions on prosodic wellformedness, including, we argued, main stress placement and accent assignment (`HEADRIGHT`, `STRESS-TO-ACCENT`). Extraneous features like `[F]`, too, influence the shape of prosodic structure, but the ultimate realization of focus and other information structural features is best understood as an interplay between narrow syntactic mapping constraints, prosody-internal wellformedness constraints (jointly defining default prosody) and constraints of extraneous feature mapping like `FOCUS PROMINENCE`. Finally, prosodically motivated movements (heavy NP shift, extraposition), including

arguably information structure related movements (focus/givenness movement), can be reconciled with a ‘prosody-free’ syntax, at the price of adopting a Try-and-Filter approach, i.e. syntactic optionality which in some cases leads to structures that can’t be paired with well-formed prosodic structures.

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