Semantics, Intonation and Information Structure

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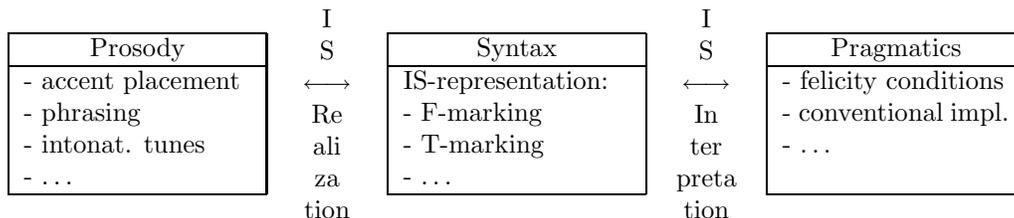
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1 Introduction

The term *information structure* (IS) goes back to Halliday (1967) and has been widely used in the subsequent literature to refer to the partitioning of sentences into categories such as focus, background, topic, comment etc. Related notions include Chafe (1974)'s *information packaging* as well as the *functional sentence perspective* of the Prague school (Firbas (1975); Sgall et al. (1986), see Sgall (1993) for a general introduction). There is no consensus on what and how many categories of information structure should be distinguished, or how these can be identified.

In this article I adopt the widely accepted view that information structure is an aspect of syntactic representation, which interfaces with the phonological form by rules of *IS realization*, and receives its meaning via rules of *IS interpretation*. While for some authors, IS is a level of representation in its own right, at which IS-categories are distinguished in terms of structural units (Vallduví, 1990; Erteschik-Shir, 1997), I will follow the lead of Jackendoff (1972) here and assume that IS-categories like focus and topic are part of the ordinary syntactic representation, represented as privative features F, T etc. on syntactic nodes.

This article will concentrate on the effects IS has on intonation, which in English is the primary mode of IS-realization. Some remarks on the effects of IS on constituent order will be made in subsection 4.3 below; other modes of realization, in particular through the use of morphemes, are widely attested across the languages of the world, but will not be discussed here.

As for IS interpretation, we will find that IS doesn't primarily affect the truth conditions of utterances, but more elusive aspects of their meaning, such as their implicatures and felicity conditions. We will model these, however, using the tools familiar from ordinary truth-conditional semantics (whence the title of this article). The general picture underlying this article is thus:

Prosody		Syntax		Pragmatics
- accent placement	I S ⟷ Re ali za tion	IS-representation:	I S ⟷ In ter preta tion	- felicity conditions
- phrasing		- F-marking		- conventional impl.
- intonat. tunes		- T-marking		- ...
- ...		- ...		

In transformational models of grammar, syntax is itself split into different levels of representation, say LF and PF, so that IS-interpretation and IS-realizations may connect up to different syntactic representations. Here, we will not make use of this architectural option, but assume that both interfaces 'see' the same representations, or at least ones with equivalent IS-properties. Speaking in transformationalist terms, we assume that all IS-relevant features are present at the branch-off point ('spell-out') and are not manipulated afterwards.

This article is organized as follows: In sections 2 and 3, I present the two aspects of IS that have received the most attention in recent formal work on IS: focus–background and topic–comment. For each, a sketch of their realization and, more extensively, their interpretation is given. Sections 4.1 and 4.2 discuss the particular assumptions about the interfaces these approaches require. In the latter section, I also make some remarks about the influence IS might have on constituent order.

2   Focus–Background

2.1   Preliminaries on Focus Realization

Speakers of English (and many other languages) have intuitions about *prosodic prominence* within words, phrases, and sentences. The main correlate of

perceived prominence in English is a *pitch accent* (PA), acoustically a local maximum or minimum of the fundamental frequency. Other correlates include loudness, duration, and certain changes in formant structure. Focus in declarative sentences is usually marked by a high pitch accent, though the details of the actual phonetic realization will differ, depending on other factors. Among the pitch accents within a certain domain, which for the purposes of this paper we can equate with the sentence, the final pitch accent is invariably perceived as the most prominent one (though it is not usually phonetically more elaborate than the others), and is referred to as the *nuclear pitch accent* (NPA). Speakers of Germanic languages easily identify the location of the NPA within a sentence, while the detection of *prenuclear* or *secondary* PAs might require some training. In what follows, we will mark the NPA by capitals, and prenuclear PAs, where relevant, by small caps; material in parentheses is given to provide context only, with no accents inidicated.

2.2 Introduction and Terminology

Authors differ as to whether they understand focus and background (or their counter-parts to these notions) as semantic or syntactic. We will take it to be a syntactic notion, and mark it by a syntactic feature F. Thus in (1), the word or NP *Kim*, not the denotation of that word, say, the person Kim, is focused in (1). Anything that does not bear an F-mark is *in the background*:

(1) KIM_F writes poetry in the garden.

It is common to talk about *the* focus and *the* background of a sentence (e.g. *Kim* and *writes poetry in the garden*, respectively, in (1)). But suppose we agree that *old* is the focus in (2), then what is the background?

(2)   (Which book did you buy?) I BOUGHT the OLD_F book.

Similarly, if we assume that *it* is the background in (3), we find that there isn't a single focus constituent in the answer:

(3)   (What happened to my harp?)
       a. $SOMEONE_F$ $STOLe_F$ it.
       b. $SOMEone_F$ $SENT_F$ it to $NORway_F$.

We conclude from this that while it makes perfect sense to speak of the F-marked vs. the non-F-marked constituents in a sentence, we do not generally have 'the focus' and 'the background'. As we will see below, we can devise a theory of focus interpretation which is perfectly happy with this situation. It thus seems unnecessary to create constituents that only contain F-marked (or F-less) elements at some level of (covert syntactic) representation.

2.3 Focus Interpretation

The two perhaps most persistent intuitions researchers have expressed about the background–focus distinction are the following:

- Given/New: New material is focused, Given material is not.

- Question–Answer: The material in the answer that corresponds to the *wh*-constituent in the (constituent) question is focused.

We will now provide formal implementations of both these ideas, and subsequently discuss the relation between them.

2.3.1 Given–New

Leaving a lexical expression unaccented, which means by assumption that it is not F-marked, signals that that constituent is, in a sense to be made precise, Given. For example, the unaccented object NP *the butcher* in (4A) is interpreted anaphorically, while accenting it blocks that interpretation, as in (4A'), rendering the reply somewhat incoherent:

(4) 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.

This effect generalizes: the N *Italian* may be unaccented in (5a), because it is Given, even if the NP it heads is not anaphoric, and so can verbs, like *jump* in (5b), for which the notion of anaphoricity isn't generally assumed to be relevant:

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

These examples show that Givenness cannot simply be equated with *familiar discourse referent*, as used in theories about the definite/indefinite distinction. A different, more general notion that would be helpful here is that of *information*; a focused expression would be an informative part of the sentence, a backgrounded one an uninformative one. Information, however, is a propositional notion: A sentence, or the proposition it expresses, can be informative (w.r.t. a given stock of knowledge), but parts of sentences cannot (unless, of course, they are themselves propositional in nature, e.g. embedded declarative clauses).

To generalize the notion to non-proposition-denoting expressions, we introduce the mechanism of *existential closure* ($\exists$C) as defined in Schwarzschild (1999). Roughly speaking, existential closure 'feeds' a non-propositional meaning variables until it becomes propositional, and then existentially quantifies all these variables. Thus the $\exists$C of *giraffe* is 'there is a giraffe', of *blue* 'there is something blue', and of *resemble* 'someone (or something) resembles someone (or something)'. Since the $\exists$C of any expression is a proposition, we can define Givenness of an expression E w.r.t. a set of sentences S as the case where S entails the $\exists$C of E.

Next we need to decide what the set of sentences S in the above sense should be. What comes to mind is of course the set of sentences that have been uttered before E. Or, put semantically, the set of propositions that are shared by speaker and hearer as part of the conversation, their *common ground* (Stalnaker, 1978). Closer inspection reveals, however, that no commitment to the $\exists$C of E on the part of any party in the conversation is required to make E Given:

(6)   A: Did you ever see an extraterrestrial?
          B: I don't think there ARE extraterrestrials.

Certainly neither A nor B are committed — even for the purpose of the conversation — to the truth of 'there are extraterrestrials', so no such proposition will be part of their common ground. Intuitively, the mere *mentioning* of *extraterrestrial* in A's utterance suffices to render it Given afterwards. This is an important and general point to note, since expressions in the background are often — but inaccurately — referred to as 'presuppositions', which they are not (see Rooth (1999) for convincing discussion).

Schwarzschild (1999)'s definition of Givenness captures this in that it merely requires that the $\exists$C of some previously uttered constituent — sen-

tential or smaller — must entail the ∃C of E to render E Given. Thus *extraterrestrials* in B is Given because its ∃C — 'there are extraterrestrials' — is entailed, not by the common ground, but by the ∃C of *extraterrestrial* in A. Similar remarks apply to *Italian* and *jump* in (5).

This notion of Givenness is obviously very close to one that equates Givenness with previous mentioning. The 'transposition' into the semantics however is necessary, because Givenness of E doesn't require literal mentioning of E, but merely mentioning of a hyperonym of E, as in (7):

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

These cases, too, are captured by Schwarzschild's definitions, since ∃C(*violin*) — 'there is a violin' — entails ∃C(*string instrument*) — 'there are string instruments'.

2.3.2   Question–Answer Congruence

Let us now turn to the second intuition mentioned above, that foci correspond to the *wh*-expression in a preceding constituent question:

(8)   (Who did Jones' father vote for?) He voted for JONES.

To formalize this, we introduce the notion of a *focus value* (sometimes called *alternative value* or *P-set*). The focus value for the answer in (8), written as $[\![\text{He voted for JONES}_\text{F}]\!]^f$ is the set of propositions in (9a), roughly those expressed by sentences of the form *He voted for x*, where x is an individual (W is the set of all possible worlds, E the set of all individuals); we will informally write such sets as in (9b):[1]

(9)   a. $\{\{w \in W \mid \text{Jones' father voted for } x \text{ in } w\} \mid x \in E\}$
        b. $\{$ Jones' father voted for $x \mid x$ an individual$\}$

A question–answer congruence condition makes use of the fact that question meanings, too, can be taken to be sets of propositions, roughly the set of all

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[1]Occasionally, focus values are taken to be functions, e.g. $\lambda x[\text{Jones's father voted for } x]$ or existentially closed propositions — $\exists x[$ Jones voted for $x]$ (they are also sometimes *represented* as open formulae like *Jones voted for x*, but these will end up denoting one of the other objects discussed here). The latter can be derived from the focus values introduced in the main text, which in turn can be derived from the functions, but not *vice versa*. The question how fine grained focus values need to be is widely discussed in the literature, e.g. Kratzer (1991); Krifka (1992); Rooth (1996); Stechow (1991); Wold (1996).

direct answers (Hamblin, 1973; Karttunen, 1977). Thus the question in (8) denotes the set of propositions indicated in (10a), while a question like *Which candidate did Jones' father vote for?*, which likewise can be answered by the declarative in (8), denotes the set in (10b) (superscript 'o' indicates that this is the *ordinary* meaning — as opposed to the focus value — of the expression in double brackets):

(10)   a. $[\![$Who did J.'s father vote for?$]\!]^o = \{$ J.'s father voted for $x \mid x$ is a person$\}$

   b. $[\![$Which candidate did J.'s father vote for?$]\!]^o = \{$ J.'s father voted for $x \mid x$ is a candidate$\}$

   c. $[\![$Who voted for Jones?$]\!]^o = \{x$ voted for Jones $\mid x$ is a person$\}$

The question *Who voted for Jones?* on the other hand, which (8) can*not* answer, gets the interpretation in (10c). To derive this pattern the question–answer condition needs to be stated as in (11):

(11)   Question–Answer Congruence (QAC):
   A is a felicitous answer to Q only if
   a. $[\![Q]\!]^o \subseteq [\![A]\!]^f$, and
   b.   there is no alternative focusing A' of A which has less F-markings and meets (11a).

The 'match' required by QAC can't be perfect (i.e. identity of $[\![Q]\!]^o$ and $[\![A]\!]^f$) since the questions can, to various degrees, be more specific than the answer, as shown by the fact that both (10a) and (10b) can be answered by (8). On the other hand, the match should be as 'tight' as possible, to block focusing of arbitrarily big constituents containing the 'correct' focus (e.g. VP or S in (8)) and trivially meet (11a). The minimization clause (11b) serves to guarantee that (the notions of 'alternative focusing' and 'less focus', of course, need to be spelled out, see e.g. Schwarzschild (1993)).

QAC straightforwardly generalizes to, and in fact immediately predicts, F-markings on complex constituents such as VP (*What did x do?*), or S (*What happened?*). A common misconception is that for these cases, grammar must provide a structural rule which determines the location of the NPA realizing this focus, often thought of as *focus projection* rules. A closer look at theories employing such rules, however, reveals that they assume the accent placement within bigger foci to be determined mostly pragmatically, e.g. by Givenness;

specific structural rules at most *restrict* the possible relations between such Givenness foci and higher F-markings, as we will see now.

2.4 A Hybrid Theory

We can combine our theories of Givenness and QAC into a general theory of focus marking by nesting F-marks that signal Newness into F-marks required by QAC, along the lines of e.g. Selkirk (1995):

(12)   Focus Interpretation

    a.   F-marks not dominated by any further F are the *FOC(s)* of S and define $[\![S]\!]^f$ for the QAC in (11)

    b.   all New constituents are F-marked

    c.   no Given constituent is F-marked, except perhaps FOCs

To see how this works, consider (13):

(13)   (Who did Jones's father vote for?)   He voted for [a FRIEND of Jones's]$_F$.
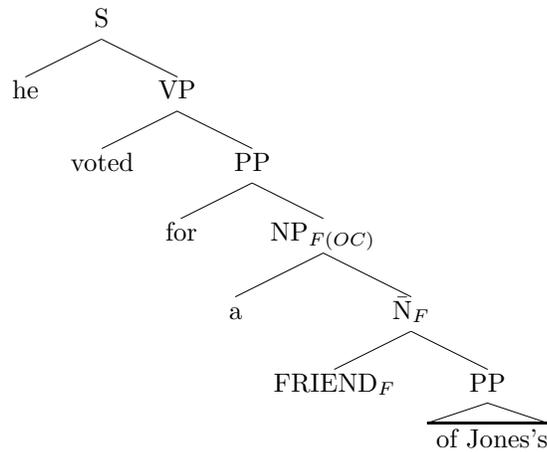
Semantically, the question is 'What person x did Jones's father vote for?' According to QAC then, the focus value of the answer must be { Jones's father voted for $x \mid x \in E$}, which is achieved by marking the object NP as the FOC of the sentence (the highest F-marker in the tree). All other Fs mark Givenness-foci: Since *(of) Jones* is Given, it is not F-marked (and since it isn't 'the answer to the question' it cannot be FOC-marked), which

means it will stay accent-less, whereas *friend* is New, hence F-marked, hence accented (why exactly the F on $\bar{\text{N}}$ is there need not concern us here).

Under this 'division of labor' view, focusing really consists of two phenomena: A rather involved QAC to guide 'the focus', and a rather low-level Givenness condition to determine actual F- and accent-placement. The effects of the latter are sometimes described as *deaccenting*, since they result e.g. in an accentless *Jones* in (13). It should be clear, though, that on the view pursued here, this term is not to be taken literally, since no accent is ever assigned to *Jones* in the first place.

A question not addressed so far is whether *any* F-marked (and accented) terminal can serve to signal FOC(us) on a node dominating it. It has been proposed, for example, that every F, including FOC, must immediately dominate another F on its head-daughter (the aforementioned *focus projection rules* of e.g. Rochemont (1986); Selkirk (1984, 1995)), i.e. accents on modifiers/adjuncts cannot 'license' F-marking on their mother. It should be noted, though, that the effects of such constraints are rather subtle, given the independent effects of Givenness on terminal nodes. For example, claiming that an F on the root node can be licensed by a sole terminal F on a transitive V is *not* tantamount to saying that a single PA on V can signal an all-new sentence, but at best that it can mark a sentence which has broad focus and in which moreover, all lexical XPs are Given (since otherwise they'd need F-marks for Givenness reasons) — as is arguably the case in (14):

(14)   (Why was Sue's father upset?) [Because she CRIticized$_\text{F}$ him]$_\text{FOC}$.

Whether restrictions on vertical focus projection exist is somewhat controversial (see Büring (to appear); Schwarzschild (1999):sec.6 and references there), and cannot be explored further here.

One might also ask if it could happen that a non-terminal FOC dominates Given constituents only. If it could, either additional F-marks on Given elements must be inserted, or purely structural principles of accent placement must apply to that constituent after all; unfortunately we cannot discuss this question here for reasons of space.

2.5 The Focus–Accent Relation

2.5.1 Integration

When discussing (13) — *He voted [for a FRIEND of Jones's]$_F$* — in the previous section, it was emphasized that the placement of accents within the FOC(us) — in this example, as in Germanic languages in general — is itself pragmatically, rather than structurally, determined (through embedded Givenness/F-markings), and does not require any structural accent rules. 'Standard' accent patterns such as in (15), too, simply follow from the fact that each N within the object NP is itself New and hence in need of F-marking, and that the last PA inevitably is the NPA:

(15)   (Who did Gus vote for? — Gus voted) [for a FRIEND of his NEIGHbors from LITtleville]$_F$.

We do not, however, subscribe to the view of Bolinger (1972a, 1985, 1987) that *all* accent placement is 'meaningful' in this sense, for reasons given in Gussenhoven (1984); Jacobs (1991/2b); Schmerling (1976); Stechow and Uhmann (1986) among many others. Cast in present terms, F-marks and PAs do not stand in a one-to-one relation. At a rather low level, structural factors do determine where an accent is assigned within a group of F-marked constituents.

For example, functional elements such as determiners, auxiliaries, or certain adverbials typically remain accentless even if, according to QAC or Givenness, they are in focus. We can think of this in terms of *horizontal focus projection* (Rochemont, 1986; Selkirk, 1984, 1995): an accent-induced F-feature on, say, an NP, can 'project' (really: jump) to a selecting head, the Det, without Det itself being accented. Alternatively, this can be viewed in terms of *focus/accent domain* formation or, as we will say, *integration* (Gussenhoven, 1983, 1992, 1999; Jacobs, 1991/2b, 1992, 1999; Uhmann, 1991): a stretch of F-marked elements, which doesn't necessarily form a syntactic constituent, forms a prosodic domain, which, as a unit, is marked by one accent.

One might be tempted to explain these cases away by assuming that all these 'light words' are inherently Given. While perhaps feasible in these cases, we note that even contentful lexical expressions such as verbs can be unaccented, despite F-marking, when adjacent to an accented argument. This effect has been noticed for English (Fuchs, 1976; Schmerling, 1976), and

more remarkably (since it affects NPA-placement), Dutch and German (see references above):

(16)   a.   (news headline) [JOHNson$_F$ died$_F$]$_F$
        b.   (all new) [I went$_F$ to IREland$_F$]$_F$
        c.   Ich bin nach IRland gefahren. (German)
             I   am to   Ireland driven

This integration effect is rather systematic in the Germanic languages, but not cross-linguistically (Ladd (1996):ch.5), which again makes it likely to be a phenomenon of IS-realization, rather than IS-interpretation (i.e. the verbs in (16) are unlikely to be simply not F-marked in the first place). Arguably, predicates integrated with their arguments are the only exception to the rule that F-marked elements must be accented.

2.5.2   Nuclear Stress and Prenuclear Accents

An inverse complication in the F-to-PA mapping regards pre-nuclear accents on F-less elements. Generally speaking, F-less material can be accented in accordance with general principles of rhythmic and prosodic organization (see 4.2 below), provided such an 'ornamental' pitch accent doesn't become the NPA (i.e. the last within the domain). For example, (15) above will most naturally be pronounced with additional PAs on the subject and — often — the verb, even though these are not F-marked; on the other hand, *Jones* in (13) can of course *not* receive an ornamental accent (which would, by definition, be the NPA) — that's what 'deaccenting' is all about.

2.6   Focus Function and Focus Semantics

The approach to focus outlined in this section maintains that its interpretation is non-truth conditional, and that it is uniform, in that it is exclusively related to discourse structure (see also the following subsection). Both claims are controversial. Regarding the latter, we often find the claims that there are different kinds of focus such as 'informational', 'corrective', 'contrastive', 'counterpresuppositional' etc. (Dik, 1980, 1997; Gussenhoven, to appear, among many others), suggesting — cast in present terms — that there are various features, say F_1, F_2..., which differ in their interpretation, and perhaps realization. While it is very well possible that some of these distinctions will be shown to be grammatical in nature, one should always

consider the alternative: to regard these as different *uses* of focusing, but not different foci. Note that the theory sketched so far is neutral about, and deliberately excludes, the *intentions* a speaker might have when using a particular F-pattern. It is not the *meaning* of focus to mark information, express contrast, or 'invoke alternatives'; focus simply reflects certain properties of the discourse context. The relation between such contexts and speaker's intentions is assumed to be a matter of conversational pragmatics, not IS-interpretation.

In a similar vein, the present view will have to be combined with a pragmatic theory to explain certain *apparent* truth conditional effects of focus. Exhaustiveness for example, can presumably be derived as an *implicature*, if we assume that a speaker, when answering a question, will normally give as complete an answer as (s)he can, or thinks is relevant.

Perhaps the best candidates for a true semantic effect of focus are cases of so-called *association with focus*, as discussed e.g. in Jackendoff (1972); Dretske (1972); Stechow (1982); Jacobs (1983); Taglicht (1984); Rooth (1985), among many others:

(17)   a.   John only introduced BILL to Sue.
        b.   John only introduced Bill to SUE

Sentences (17a) and (17b) have different truth conditions, which can be paraphrased as in (18):

(18)   a.   John introduced Bill and nobody else to Sue (he may have introduced Bill to other people)
        b.   John introduced Bill to Sue and to nobody else (he may have introduced other people to Sue)

Similar effects can be seen with other particles (*even, also*), quantificational adverbials (*always, mostly*), negation, modal verbs, proportional determiners, and other categories.

In these cases, focus seems to enter the truth conditional meaning through the contribution of, say, *only*, which in turn seems to be *focus sensitive* (so no truth conditional interpretation resides with the F-feature itself) . Two strategies have been proposed in the literature: According to *semantic theories of focus*, focus sensitive elements like *only* have direct access to focus-induced information, for example the alternative values described

above, which restrict the domain of quantification (e.g. Stechow (1982); Rooth (1985), see Kratzer (1991); Stechow (1991) for surveys, and Krifka (1991/2, 1992); Wold (1996) for refinements). According to *pragmatic theories of focus*, elements like *only* are merely *context*-sensitive, i.e. their semantics depends on a contextually fixed variable which provides, for example, the domain of quantification. Focus only indirectly helps to fix the value of that variable, because it gives clues about the context via Givenness, or question–answer congruence (e.g. Taglicht (1984); Vallduví (1990); Fintel (1994)).

The latter view maintains a uniformly pragmatic analysis of focus, but has to shoulder the burden of systematically predicting the rather striking (apparent) focus effects in sentences like (18) through pragmatic reasoning (see e.g. Vallduví (1990); Schwarzschild (1997); Roberts (1996); Martí (2002)), which turns out to be a rather hard task. Recently, Beaver and Clark (2003) have argued on grounds of distributional evidence that indeed *some* association with focus phenomena are semantic, while others are pragmatic, a position not previously found in the literature.

2.7 Appendix: QAC Redux?

We have seen in example (13) that QAC alone cannot account for focusing, since it cannot determine where the accent within a complex focus will be assigned. Can we reduce the effects of QAC to Givenness in turn? On the face of it, the answer is no, since we note that the QAC-focus will be accented, even if it is Given:

(19)   (Who did Jones's father vote for?) He voted for JONES.

Every constituent in the answer in (19) is Given through the question. Accordingly, the QAC alone must determine focus assignment here (note that the conditions in (12) do not say anything about whether the FOC(us) must be Given or New). Examples like these have generally prompted researchers to give up on the idea of a unified interpretation for focus.

An alternative is explored in Schwarzschild (1999), which attempts to reduce QAC to a refined version of Givenness, thereby maintaining a uniform view of focus.

As a first step, the biconditional New↔F-marked is weakened to a mere material implication New→F-marked; this is consistent with experimental findings reported in Terken and Hirschberg (1994), that while there are many

accented Given elements, New elements (new NPs in their experiment) cannot remain accentless (for similar results see Nooteboom and Kruyt (1987)). We thus allow for Given foci, but, by the same token, risk to allow foci of arbitrary size (since nothing so far *blocks* F-marking). This, however, will be taken care of by a minimization condition like (11b) above, which in Schwarzschild (1999) is called AVOID F, which penalizes using more F-markers per sentence than absolutely necessary.

How does this work for a case like *He voted for JONES?* in which all parts of the sentences individually are Given? While both *Jones* and *voted for* are Given (by the question), *voted for Jones* is not. One possibility is to F-mark *Jones*. Does this make *voted for Jones* Given? It does, if we treat *Jones*, once F-marked, as a 'wild card' for the Givenness-properties of higher constituents. At the VP level, then, we don't have to ask whether 'vote for Jones' is Given, but whether, roughly, 'vote for someone' is (technically, 'vote for someone (or something)' is the *trivialization* of the focus value of VP, $\cup[\![\text{vote for JONES}_F]\!]^f$). The $\exists$C of 'vote for someone' is 'someone voted for someone', which is indeed entailed by the $\exists$C of *vote for* in the question.

So focusing *JONES*, even though not required by the Givenness-properties of the expression *Jones* itself, serves to make the VP Given (similarly for S). The same overall result could have been achieved by F-marking e.g. VP and V. But by AVOID F we are bound to use as few F-marks as possible, which will make F-marking on *Jones* alone the only possible focusing for this answer.

Schwarzschild's version of Givenness thus accounts for many of the cases that appeared lethal to a simpler Givenness theory of focus. It is not without problems, though. First and foremost, it needs to be supplemented by a more restrictive notion of focus alternatives. Suppose in our favorite example, we had simply F-marked the V, yielding the intuitively infelicitous accenting in (20):

(20) #(Who did Jones' father vote for?) He VOted$_F$ for Jones.

To see whether this meets Givenness, we have to ask whether the trivialization of VP and S are Given (we know that *Jones* and *he* are, and, trivially, *voted for*, since it is F-marked). By definition, the focus value of *vote for* is the set of all two-place relations. The trivialization of the focus value of *He VOTED$_F$ for Jones* is thus 'he stands in some relation to Jones'. Is this Given? Unfortunately yes, since he stands, for example, in the father-

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of relation to Jones. (20) is thus incorrectly predicted to be a felicitous question–answer sequence. The original formulation in Schwarzschild (1999) requires that for an expression to be Given, the expression whose ∃C entails it, must be 'salient'. Perhaps a restrictive notion of salience could yield the result that *Jones' father* is not salient in this example. A different intuitive answer to the problem is that the ∃C in (20) should not be 'he stands in some relation to Jones', but rather 'he did something to/for/with Jones', i.e. the alternatives to 'vote for' should be more akin to actual transitive verb meanings, rather than just any two-place relation. At present, the correct treatment of these cases under a pure Givenness theory à la Schwarzschild is unknown; a less parsimonious theory that assumes Givenness *and* QAC more solidly derives these cases.

3 Topic–Comment

3.1 Topic Realization

Let us now turn to a second pair of IS categories, the *topic–comment* distinction (sometimes called *theme–rheme*). While for some authors, topic and background are identical, many assume that these two coexist, either as two independent bipartitions of the sentence, or with the one — focus–background — nested within the other. Enric Vallduví in a series of works (Vallduví, 1990, 1993; Vallduví and Zacharski, 1993; Vallduví and Engdahl, 1996) has convincingly argued that instead, only a tripartition is called for, which allows, optionally, for a non-focused part to be specially marked as *link*, or as we shall say, *contrastive topic*.

As the notion suggests, we don't understand contrastive topics in the sense of 'what the sentence is about', which might apply to constituents in the background that do not bear any special marking, but as an intonationally marked IS category. In English, contrastive topics are characteristically marked by a fall-rise contour, what Jackendoff (1972) calls the *B-accent*, and what has been described in its most elaborate realization as an H* or L+H* followed by a L-H% boundary sequence in Pierrehumbert (1980)'s autosegmental notation. An example from Jackendoff (1972), may serve as an illustration:

(21)   A: Well, what about FRED? What did HE eat?

$$\overset{\text{L+H* L- H\%}}{} \qquad \overset{\text{H* L- L\%}}{}$$

B: FRED$_{\text{CT}}$ ate the BEANS$_{\text{F}}$.

As indicated, we represent contrastive topic by a different marker, CT, in the syntax. Vallduví argues that all sentences must contain a focus, while not all need to have a background or a contrastive topic. Order aside, sentences thus come as F-only, B-F, CT-B-F, and CT-F. In many languages, CTs must precede a focus (German, Italian, Korean), while in others, including English, F-CT order seems possible, as in (22):

(22) A: Well, what about the BEANS? Who ate THEM?

$$\qquad\qquad \overset{\text{H*}}{} \qquad\qquad\quad \overset{\text{L+H* L- H\%}}{}$$

B: FRED ate the BEANS.

English also has sentences with only a B-accent; whether this means that, contrary to Vallduví's claim, there are focus-less CT-B sentences, is an open question.

3.2   Topic Interpretation

What is the meaning of CT? Virtually all analyses agree that a common *function* of the B-accent in English is to mark contrast, often introducing an adversative implicature, as exemplified in (23):

(23) (What did the pop stars wear?)   The FEmale$_{\text{CT}}$ pop stars wore CAFtans$_{\text{F}}$.

Clearly, female pop stars are contrasted with male pop stars, the implicature being that the latter wore something else. As for the *meaning* of CT, different analyses have been put forward: CT expresses that a new discourse referent (the female pop stars, rather than the pop stars) has become the one about which information is being provided (Vallduví, 1990); it marks non-monotonic anaphora, i.e. that the female pop stars are not identical to the antecedent 'pop stars' (Hendriks, 2002); it signals an additional question like 'What did the X pop stars wear?' (Steedman, 1991, 2000a,b; Roberts, 1996); it indicates that a question different from the actual question asked is being answered ('What did the female pop stars wear?'; Büring (1997)); it requires that a different, open question of the form 'What did the X pop stars wear?' be discussed next (ibd.).

As with focus, CT marking is not limited to referential expressions, which argues against an interpretation in terms of the discourse referent system. Rather, we will sketch a treatment in terms of discourse-appropriateness that relies on the notion of *strategies*, i.e. question–subquestion structures, as proposed in Roberts (1996) and elaborated on in Büring (2003). The latter analysis builds on an extension of alternative semantics as introduced in 2.3.2 above, which associates another semantic object with a declarative sentence S, its *CT-value*, $[\![S]\!]^{ct}$. The CT-value is a set of sets of propositions, i.e. a set of focus values, or a set of question meanings. The CT-value for the answer in (23) is the set of sets of propositions sketched in (24), or simply put, the set of questions asking 'what did the x pop stars wear?', where x is an adjective meaning:

(24) $\{\{\text{the } x \text{ pop stars wore } y \mid y \in E\} \mid x \in \{0,1\}^E\}\}$

The meaning of CT is discourse related: It expresses that there is a set of questions in the discourse structure, which together form a strategy to answer a common super-question. These questions must be elements of the CT-value, and the immediate question under discussion (IQUD) must be one of them.

Example (23) receives an indirect explanation under this analysis: The questions in the strategy are questions about the outfit of different pop star groups (male, female, ...). The common super-question is the one asked overtly in (23). The IQUD is a *covert* or *implicit* question: 'What did the female pop stars wear?'

The application to (21) and (22) (*Fred ate the beans.*) is more straightforward: Both relate to the super-question 'Who ate what?' but signal different strategies: 'What did x eat?' for (21) (since *Fred* is the CT and *beans* is F), 'Who ate x?' for (22) (since *Fred* is F and *beans* is CT). In the contexts given, in which the IQUD is overt, the account explains why the two realizations of the answer cannot be felicitously swapped between the two question contexts: they each signal a different strategy.

A sense of non-monotonic anaphora, topic shift, or deviance from the question (pop stars — female pop stars) will arise whenever the IQUD is implicit and the super-question itself is asked, which is of course different from, and usually more general than, the IQUD. A sense of implicature or 'new question' arises whenever the IQUD is explicit, but the presence of other questions within the strategy, and indirectly of the common super-question,

is signalled by the presence of CT:

(25) (Where was the gardener at the time of the murder? —) The GARdener$_{CT}$ was in the HOUSE$_F$. (implicates new question: Where was the chauffeur/maid/cook. . . ?)

It should be stressed that this treatment does not confine CT-phenomena to question–answer pairs, or implies that other configurations, which involve implicit questions, must be derived by repair strategies such as accommodation. What it does commit to is that the logical structure of any discourse is organized in terms of hierarchical question, sub-question, and answer structures, and that it is that abstract structure, rather than the overt utterances, that CT is sensitive to.

According to all of the above authors, CT doesn't influence truth conditions directly, but only relates to discourse information. This can yield effects on truth conditions indirectly. Adversative implicatures, e.g. that some other pop stars wore some other clothes, for example will arise from the fact that the relevance of questions about other pop stars' clothes in the present discourse is expressed by the strategy-indicating meaning of CT, and that general pragmatic principles lead us to expect that the super-question wouldn't have been split up into these sub-questions, had the speaker known that the others wore caftans too.

Other cases are more involved, but still within the limits of this theory. (26), with the CT-marking indicated, forces a wide-scope reading for the negation: 'It is not because I'm sad that I drank':

(26) Ich habe NICHT$_{CT}$ getrunken, weil   ich TRAUrig$_F$ bin.
      I   have not   drunk   because I   sad   am
      'I didn't drink because I'm sad.'

Strikingly, the same sentence without CT-marking on the negation allows for a second reading 'It is because I'm sad that I didn't drink'. This effect can be explained as follows: The CT-marking on *nicht* signals a strategy consisting of the questions 'Why did you drink?' and 'Why didn't you drink?'. If the answer is taken on its 'I didn't drink, and that's because. . . ' meaning, such a strategy would be contradictory (since it asks for a reason for something that didn't happen); taken on its 'It is not because I'm sad, that I drank' meaning, on the other hand, it is perfectly consistent with the other sub-

question: 'Why did you drink?'

On this view, then, a structurally possible, and truth conditionally distinct, construal of a given ambiguous string may be incompatible with the implicatures of IS-marking, making that reading unavailable. Yet, IS-marking doesn't itself have truth conditional meaning.

4   The Nature of the Interfaces

4.1   IS-Interpretation

Now that we have a rough sense of what interpretations are connected to the IS-categories focus and contrastive topic, we may ask what the interface between IS and meaning has to look like. As mentioned at the outset, I assume that there is no level of *semantic representation*, hence *a fortiori* no semantic level at which F and CT are represented. On the other hand, IS-meanings were argued to be non-truth conditional in nature. How, then, can they be treated?

It is well-known that an update-function view on meaning — i.e. one where each sentence is interpreted as an *update-function* from contexts to contexts — can model non-truth conditional effects of meaning: For example, following a suggestion by Karttunen (1974), Heim (1988) models contexts as sets of worlds, the *context set* (cx), and declarative meanings as functions from a context to a context. If the presuppositions of a sentence S are not met in a context C, the update function denoted by S will simply not be defined for C.

As we have seen, focus meaning does not relate to discourse commitments. In order to model a QAC-theory of focus, we have to assume that a context consists of a context set plus a question meaning, the *question under discussion* (QUD). A declarative update will have in its domain only contexts in which question–answer congruence w.r.t. the QUD is met. For all other contexts, the update will be undefined.

Similarly for Givenness: We have to add to the context a set of *salient antecedents* (sa), either expressions, or the meanings thereof. An utterance will update a context by adding its parts (or at least some of them) to the set of salient antecedents, while possibly removing others from it. An update with S will be defined on a context C only if the set of salient antecedents in C provides Givenness antecedents for all F-less constituents in S, as sketched

in (27):

(27) Let ⟨cx, QUD, sa⟩ be a context, then
$\llbracket S \rrbracket (\langle cx, QUD, sa \rangle) = \langle cx \cap \llbracket S \rrbracket^o, QUD', sa' \rangle$, provided

a. S is minimally focused such that $QUD \subseteq \llbracket S \rrbracket^f$ (QAC), and
b. for each constituent C in S, there is an element A in sa such that
$\exists C(A) \subseteq \exists C(\cup \llbracket C \rrbracket^f)$ (Givenness)
Else, $\llbracket S \rrbracket (\langle cx, QUD, sa \rangle)$ is undefined.

Obviously, a full definition must include specification of QUD' and sa', i.e. the way S provides new salient antecedents, and changes (or removes) the QUD.

When topics enter the picture, the context representation will become even more complex. For example, if topics relate to more questions than just the immediate QUD, the QUD part of a context representation will have to be replaced by an ordered set of question meanings, such as Roberts (1996)'s *question-under-discussion stack*.

Things get yet more complex if we assume that contrastive topics have a 'forward looking' aspect to them, for example that they introduce a new, open question under discussion. On the face of it, declaratives simply do what questions do, i.e. set up a new QUD. Thus, *The FEMALE$_{CT}$ pop stars wore CAFTANS$_F$* would, among other things, map a context C onto a new context C', where the QUD in C' is 'What did the male pop stars wear?' But note that in the general case, it is not known *which* question in the CT-value is to become the new QUD. For example in (28), the CT-marking on *the gardener* signals that another question of the form 'Where was x at the time of the murder?' is part of the strategy, but not *which* question (the chauffeur? the maid?):

(28) (Where was the gardener at the time of the murder?) The GARdener$_{CT}$ was at HOME$_F$.

To model this, we could assume that a context doesn't just contain *one* QUD (or QUD-stack), but a set of them, which models potential insecurity about which of a number of questions is the actual QUD.

Finally we should mention that implicit moves, as well as non-directional meanings complicate the picture as well. The answer in (28) could be used
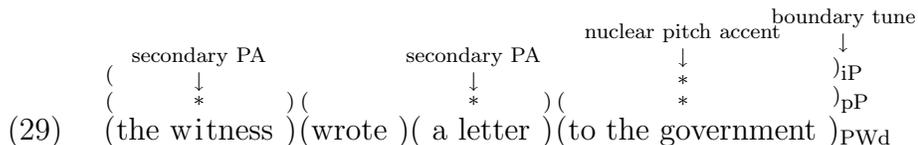
as an answer to the super-question 'Where was everybody at the time of the murder?', or to the actual sub-question asked; in the latter case, it could be the first, the last, or a middle one within a strategy consisting of 'Where was x?'-type questions. The update denoted by the answer must be defined for all these contexts, and must map them onto different resulting contexts.

What we see, then, is that — depending on our theory of IS-interpretation — the representation of contexts gets more and more complex, and so do, accordingly, the domain and range of the update functions denoted by sentences. But the general picture remains the same: IS-related meanings can be modelled in terms of update-semantics, even though they do not pertain to truth conditions. The felicity conditions associated with the different IS-categories can be formulated in terms of their update effects (e.g. new QUD), or restrictions on the domain of the update (QAC, Givenness etc.). Though the latter treatment is formally identical to that of presuppositions in satisfaction theories of presuppositions, it is somewhat misleading to call the IS-effects presuppositional, if, as we hypothesized, IS-effects regard discourse information only, not public commitments (as 'ordinary' presuppositions do).

4.2   IS-Realization

Let us now turn to the IS-realization interface. We assume that the representation on the prosodic side of the interface is a prosodic structure, which comprises at the supra-segmental level indications of hierarchical prosodic constituency (syllables, feet, prosodic words (PWd), phonological phrases (pP), intonational phrases (iP) etc.), various degrees of stress, and pitch events such as pitch accents and boundary tones.

It is standardly assumed that languages show a *default prosody*, which defines a regular mapping between prosodic structure and syntactic structure. Without going into the details at all, the default prosodic realization from the prosodic word level upward for an English sentence is illustrated in (29):

(29)

	secondary PA		secondary PA		nuclear pitch accent	boundary tune
	↓		↓		↓	↓
(		)(		)(	*	)iP
(	*	)(	*	)(	*	)pP
(the witness	)(wrote	)(a letter	)(to the government	)PWd	

The sentence is exhaustively parsed into PWds, pPs and an iP; each phrase has one *head*, which I marked by an asterisk at the pertinent level for pPs

and iP. PAs are aligned with pP-heads, with the iP-head hosting the NPA.

The default prosodic structure is related, but crucially not isomorphic, to syntactic structure, partly because the latter, but not the former, is recursive, partly because of systematic mismatches such as insertion of additional boundaries, or annexation of adjacent material, on the left or right of designated elements.
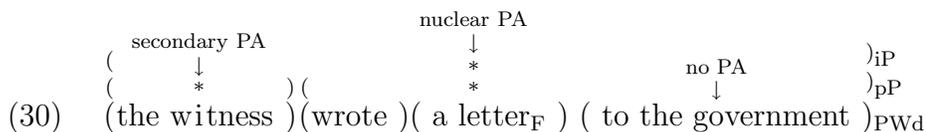
It is clear that IS-representation must influence the shape of this prosodic realization, in English at least through the location and choice of pitch accents, and the choice of boundary tones (in other languages, IS has clear effects on prosodic phrasing as well, cf. Frascarelli (2000); Nespor and Vogel (1986); Selkirk (2000); Truckenbrodt (1995, 1999) among many others).

One approach towards this originates with Selkirk (1984), where it is assumed that IS-representation in the syntax directly triggers the assignment of pitch accents (i.e. F-marking on heads must correspond to pitch accents, though not in a one-to-one fashion). Prosodic structure must then be 'built around' the pitch accents in a way that respects certain constraints on PAs in prosodic structure, for example that pitch accents must be metrically prominent, i.e. have a high degree of stress, or that the last PA in a given domain is the nuclear, strongest one.[2]

This treatment can be generalized in an obvious way to IS-models with more categories, e.g. CT-markings in the syntax, which are mapped onto prosodically different kinds of PAs (e.g. L+H* vs. H*).

A slightly different idea is explored in Truckenbrodt (1995, 1999), where IS-representation — in particular F-marking — only influences prosody by way of prominence requirements. An F-marked constituent requires prosodic prominence, which means that it wants to become the head within its prosodic domain. To meet this requirement, which Truckenbrodt calls *Focus Prominence* (FoP), severe deviances from the default prosodic structure may be necessary, such as realignment of a head, and/or insertion or deletion of prosodic boundaries. (30) shows an example of a shifted main stress, in response to a particular focusing, which is achieved through omitting post-focal phonological phrases:

---

[2]*Nuclear stress algorithms* such as Cinque (1993)'s nuclear stress rule (NSR) constitute deprived versions of this, which only delivers the placement of one — the nuclear — PA in response to IS-representation.

```
                                        nuclear PA
                                            ↓
              secondary PA                  *                              )iP
          (       ↓          )    (         *           no PA             )pP
          (       *          ) (           *             ↓                )
(30)      (the witness  )(wrote  )( a letter_F )  ( to the government )PWd
```

As can be seen, the default prosody is retained prefocally, but not post-focally. The reason is that any post-focal pP, say around *government*, would thereby become the rightmost pP within the iP, which, by definition, must be the head of iP (= the NPA). But then *government* would, as the head of iP, be more prominent than *letter* — which is only the head of a pP — in violation of focus prominence. (30) sacrifices just enough of default prosody to avoid this mismatch.

This view then offers an explanation for the fact — discussed in subsection 2.5 above — that deaccenting is obligatory within and after the focus, but that 'ornamental accents' may occur on F-less prefocal elements: The accent on *witness* doesn't stop *a letter* from being the head of iP, meeting FoP.

Default prosody may also account for *integration*, discussed in 2.5 above, i.e. cases where one pitch accent appears to signal focus on more than one terminal. The logic goes like this: If there are two F-marked items A and B within an utterance, only one can become the head of the iP, the other one will 'surrender' at some point. This point could be sooner — lexical heads and their functional entourage form a prosodic word together, as in *to the government* —, or later — adjuncts and their modifyees always form separate pPs, but must be joint within one iP, or in the middle, as is the case for predicates and their arguments, which form separate pWds, but joint pPs (*wrote a letter*). At which level A and B 'merge', and which element becomes the head then, is decided by default prosody, e.g. by what is the 'normal size' for a PWd, pP, or iP (see Truckenbrodt (1995, 1999); Büring (2001a,b); Büring and Gutiérrez-Bravo (2001); Szendrői (2000, 2001); Samek-Lodovici (2002) for optimality theoretic accounts along these lines).

Treatments of this kind have so far only been pursued for F-realization. While the *placement* of CT-accents can presumably be handled in a similar fashion, the actual *choice* of PA requires extensions of the system. Either CT-marked terminal elements must directly be mapped onto specific pitch accent types (but crucially not just metrical prominence), or metrically prominent positions will be assigned different types of pitch accents according to the marking of some larger domain they are contained in.

In many languages, e.g. Greek (Baltazani, 2002b,a), CTs are typically realized as iPs of their own. In English, this option may exist (cf. the description of the B-accent as L+H L- H%, which is an iP tune), but doesn't seem to be the rule. It is tempting, though, to think of topic marking as a property of higher prosodic constituents, which influences phrase tones or boundary tones, as well as the actual shape of pitch accents within them.

A particularly straightforward implementation of this idea can be found in Steedman (1991, 2000a,b), which assumes that the prosodic structure, syntactic structure, and topic-comment structure are in fact isomorphic. Formally this is achieved in combinatorial categorial grammar, which allows for all sorts of non-standard constituencies. On this view, F-marking determines accent positions (compatible with the prominence-based view presented above), while topic (*theme* in Steedman's terms) marking on a higher constituent is realized by forming an iP with a certain boundary sequence, as well as determining the shape of the pitch accents within it (in Steedman's actual system, the pitch accents and boundary categories are matched through categorial features, but this seems equivalent to a view on which the actual pitch accents shapes are locally underspecified).

In sum, we have seen that IS-realization can be thought of as a set of mapping requirements, in addition to those of default prosody, between syntactic structure and prosodic structure, which make reference to the IS-representations (e.g. F and CT marking) in the syntax. It should be noted that the distinction default-prosody vs. IS-realization is a somewhat artificial one. Since there are, by assumption, no sentences without IS, there is no default or 'neutral' prosody in any actual utterance (a point argued forcefully in e.g. Bolinger (1972b) and Schmerling (1976)). As has been argued in the literature (Höhle, 1982; Jacobs, 1991/2b, a.o.), what is perceived as 'neutral intonation' is perhaps best described as an all-new or out-of-the-blue utterance, i.e. one where everything is F-marked. Such structures will, to an extent, reveal the properties of default prosody rather directly because in terms of IS, all other things are equal.

4.3 Constituent Order

Although the present article is dedicated to the interface of information structure with intonation, I want to add a few words on IS-related constituent order variation. As is well known, both topic and focus may influence con-

stituent order, or, put differently, be realized in terms of constituent structure (see the overview in Ward et al. (2002)). For example, English left-dislocated constituents often serve as topics (McCawley, 1988; Ward, 1988), though clearly, not all topics in the sense discussed here, are dislocated. Similarly, object–particle order is preferred with unaccented objects, while particle–object order is preferred with accented objects (Bolinger, 1971; Chen, 1986; Dehé, 1999, 2000, 2002; Svenonius, 1996):

(31) a. (What did Peter turn down?) He TURNED down the RAdio$_F$.
      b. (What did Peter do with the radio?) He TURned$_F$ the radio DOWN$_F$.

In other languages, constituent order effects of focusing are more noticeable. In Italian and Spanish, narrowly focused subjects and direct objects must occur in clause final position, which for the subject, in particular yields VS-order. In Hungarian, as in Turkish, narrowly focused elements have to occur in an immediately preverbal position. In German, focused direct objects cannot precede unfocused indirect objects, though unfocused direct objects can precede focused indirect ones.

One line of analysis is to assume that focused elements have to occur in a phrase-structurally determined position, say SpecFocusP, the specifier of a focus phrase. What argues against such a treatment, however, is the fact that in many cases of focusing in canonical order, say O, VP or S-focus in Italian, string-vacuous movements have to be postulated, where no indication of such movements is to be found. Furthermore, focusing in these languages often involves movement not of the focus, but of background material 'out of the way'. Thus in Italian, a focused DO can be realized either through non-canonical IO-DO ordering, or alternatively through right-dislocation of the IO (double commas mark a major pause/prosodic phrase break):

(32) Q: Who did you introduce to Maria?
      A: Ho   presentato a Maria GIANni.
          have-I introduced to M.   G.
      A': Ho   presentato GIANni,, a Maria.
          have-I introduced G.   to M.

A radically different analysis, first explored in work by Maria Luisa Zubizarreta (cf. Zubizarreta (1998)) is that focus positions are *prosodically* defined, e.g. as the position that receives the nuclear pitch accent. If the

focused constituent is 'normally' in that position, no re-ordering is necessary, else non-canonical order will surface.

What, then, defines the prosodic focus position? The assumption in Zubizarreta (1998) was that that position is determined through a rule that, based on the syntactic structure, assigns the nuclear accent to a syntactic constituent. The general insight, however, is easily, and perhaps advantageously, recaptured under the assumption adopted here, that pitch accents are citizens of prosodic structure. On this view, focus positions are typically peripheral elements within a given prosodic domain, here the right-peripheral pP within an iP. The boundaries of iPs, in turn, are (co-)determined by syntactic structure, e.g. as coinciding with the core clause (say S, IP, or AgrP).

Thus in Italian it is crucial that the (pP containing the) focus be right-peripheral within the iP, which will be the case if either it is normally the VP- (and hence clause-)final constituent, or after right-adjunction of the focus to VP around an intervening constituent, or after left- or right-dislocation of all intervening non-focused elements, which yields structures with more than one iP within an *utterance phrase*, uP (Samek-Lodovici, 2002; Szendrői, no year):

(33) a.
$$
\begin{array}{ll}
(& \quad\quad\quad\quad\quad\quad * \quad\quad\quad)_{\mathrm{iP}}\\
(\quad\quad\quad * \quad)(\quad * \quad)(\quad * \quad)_{\mathrm{pP}}\\
(\text{ho presentato})(\text{a Maria})(\text{Gianni}_{\mathrm{F}}\ )_{\mathrm{PWd}}
\end{array}
$$

b.
$$
\begin{array}{ll}
(& \quad\quad\quad\quad\quad\quad\quad)_{\mathrm{uP}}\\
(\quad\quad\quad\quad\quad * \quad)(\quad\quad * \quad)_{\mathrm{iP}}\\
(\quad\quad\quad * \quad)(\quad * \quad)(\quad\quad * \quad)_{\mathrm{pP}}\\
(\text{ ho presentato})(\text{Gianni }\ )(\text{a Maria }\ )_{\mathrm{PWd}}
\end{array}
$$

Similarly, focus movement in Hungarian can be thought of as bringing the focus to a peripheral position within the main clause, except that here, main prominence is assigned *left*-peripherally (pre-focal material such as topics, on this view, are clause-adjoined and hence not part of the main iP, cf. Szendrői (2001)).

Crucially, in these cases, the peripheral position of focus — where it isn't an instance of canonical order — is achieved through amending the syntax. The alternative, discussed in 4.2 above, is to amend the prosody. This can happen by creating additional boundaries (e.g. inserting a boundary right after the focus, which makes it right-peripheral within the prosodic constituent thus delineated), or as in (30) above, by omitting boundaries that separate the

focus from the edge of the iP. The latter strategy is more obviously found in Korean and Japanese, where focus is signalled by the systematic absence of post-focal prosodic structure; the prosodic phrase containing the focus is thus right-peripheral within the iP, though at the price of an 'over-sized' pP (Beckman and Pierrehumbert, 1986; Jun, 1993; Uechi, 1998).

What makes this last strategy relevant to the topic of this subsection is that the two strategies — non-canonical constituent order and non-canonical prosodic structure — may coexist, as they appear to do in German. Here, a focused IO can become right-peripheral within the iP by either forming an over-size pP with everything to its right, or by inverting canonical IO-DO order to DO-IO and forming a pP with the final verb only:

(34) a.
$$(\qquad\qquad * \qquad\qquad\qquad\qquad)_{iP}$$
$$(\qquad\qquad * \qquad\qquad\qquad\qquad)_{pP}$$
(Er hat)(dem   Piloten$_F$)(die Passagiere)(vorgestellt)$_{PWd}$
   he has   to-the pilot   the passengers   introduced

b.
$$(\qquad\qquad\qquad\qquad * \qquad\qquad)_{iP}$$
$$(\qquad * \qquad)(\qquad * \qquad)_{pP}$$
(Er hat)(die Passagiere)(dem Piloten$_F$)(vorgestellt)$_{PWd}$
'He introduced the passengers to the pilot.' (IO$_F$-DO/ DO-IO$_F$)

A focused DO, on the other hand, forms a right-peripheral pP in its canonical, verb-adjacent position, and non-canonical order would actually yield a more marked prosodic structure (one where DO, IO, and V would have to form one pP):

(35) a.
$$(\qquad\qquad\qquad\qquad * \qquad\qquad)_{iP}$$
$$(\qquad * \qquad)(\qquad * \qquad)_{pP}$$
(Er hat)(dem Piloten)(die Passagiere$_F$)(vorgestellt)$_{PWd}$

b.
$$(\qquad\qquad * \qquad\qquad\qquad)_{iP}$$
$$(\qquad\qquad * \qquad\qquad\qquad)_{pP}$$
*(Er hat)(die Passagiere$_F$)(dem Piloten)(vorgestellt)$_{PWd}$
'He introduced the passengers to the pilot.' (IO-DO$_F$/ *DO$_F$-IO)

The net effect, then, is that focus on IO yields either canonical order with marked prosody, or marked order with canonical prosody, while focus on DO 'freezes' the canonical word order, which is unmarked in all respects (Lenerz, 1977; Büring, 2001a).

Readers accustomed to a derivational way of thinking will ask how the perspective taken in this subsection can be implemented within the theory of the

syntax–prosody interface. Clearly, if the focus position is only determined in the prosodic structure, syntactic re-ordering processes shouldn't be able to 'see' focus positions as their targets. And indeed, this treatment seems hardly compatible with the idea that IS-related features would actually trigger syntactic movement. A derivationalist view will either have to assume that at least some syntactic movements can react to, or anticipate, (aspects of) the prosodic structure (this is essentially Zubizarreta (1998)'s view), or that reorderings take place optionally (perhaps triggered by optional formal features), and the match between prosody and IS-interpretation is checked, or even created, at the syntax–prosody interface (where mismatching representations are filtered out).

This last perspective is arguably equivalent to, though perhaps not as natural as, one on which prosodic and syntactic structure (the latter including IS-marking) are related by mapping rules, without one in any sense feeding into the other. On this view, a mapping on which focus is not prominent, or prominence is not peripheral, or boundaries are inserted in syntactically 'wrong' places, is simply not licensed by the grammar, while only those respecting these constraints are.

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