Information structure

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Abstract. Information Structure, the packaging of information to satisfy the immediate communicative needs, exerts a powerful force on all structural levels of language. We show how this concept can be defined, we argue for focus, givenness, topic, frame setting and delimitation as important subconcepts, and we illustrate the wide variety in which these information structural functions are expressed in languages.

1. What is Information Structure?

The phenomena we subsume under the notion of *information structure* (IS, for short) have enjoyed the attention of linguists for a long time. What we now capture by terms like *topic* or *focus* has been identified since the medieval Arab grammatical tradition by different linguistic schools in a number of ways. To mention the perhaps most influential one, the Prague School initiated by Mathesius has argued that the identification of given material (the *theme*) and the highlighting of new material (the *rheme*) exerts a powerful force on language structure. Today, the effects of IS are recognized in every theoretic framework that strives for a comprehensive view of linguistic structure, and they are investigated in a wide variety of distinct languages – witness the contributions to the Parallel Session on Information Structure at CIL 18.

But what is "information structure"? Following Chafe (1976), we understand it to refer to the *packaging* of information that meets the immediate communicative needs of the interlocutors, i.e. the techniques whose *raison d'être* is to optimize the form of the message with the goal that the message be well understood by the addressee in his or her current attentional state. One such feature, for example, is the highlighting of constituents, which is called *focus*. In the following example, a question creates a particular attentional state, which is recognized by the focus in the answer, expressed by pitch accent on *tiger* (cf. 1a). Pitch accent on *road*, as in (1b), would lead to an infelicitous answer, even though the truth conditions of (1a) and (1b) are the same, as it does not fit to the context question. (Small caps indicate stress).

(1)   {What did you see on the road?}
        a. We saw a TIGER on the road.
        b. #We saw a tiger on the ROAD.

Chafe's talk of IS as a packaging phenomenon suggests that IS never affects truth conditions. However, one shold be aware of the fact that the markings of IS can have truth-conditional effects, for example with focus-sensitive particles like *only*. In (2a), the speaker may have seen other animals on the road, but the only place

where a tiger was spotted was on the road. In (2b), no other animal was seen there. Depending on the placement of the pitch accent, this English sentence is true in different contexts.

(2)   a. We only saw a tiger on the ROAD.
         b. We only saw a TIGER on the road.

In short, one and the same linguistic device, sentence accent, can be used for packaging as well as for constructing the truth-conditional content of a particular sentence. There are two possible ways of dealing with this multiple use of features such as accent: One is to assume that the two uses of the same feature are essentially unrelated, just as the uses of accent in English to express focus and to distinguish words such as *REcord* and *reCORD*. The other is to assume that the feature is to be interpreted in a particular way that makes sense for the purposes of information packaging and of building information content. The second alternative appears to be more attractive, following the principle that we should not assume multiple meanings if possible. We will see that focus indeed can be interpreted in this way.

Before we do this, we will first provide definitions of the notions of IS. In a second step, some of the linguistic means used for the realization of IS are examined in a cross-linguistic perspective, and it is shown that the grammatical devices for focusing, defocusing or topicalizing are always parts of a set of reflexes existing independently in the language under consideration. We wish to point the readers to Féry, Fanselow & Krifka (ed.) (2006) for a more comprehensive expositon of some of the points discussed here.

2. The notions of information structure

We want to talk about communication as transfer of information and its optimization relative to the temporary needs of interlocutors. To this end, it is useful to adopt a model of information exchange that makes use of the notion of *Common Ground*. The original notion of CG (cf. Stalnaker 1974) saw it as a way to model the information that is mutually known to be shared, which is continuously modified in communication. This allowed for modeling the distinction between *presuppositions*, as requirements for the input CG, and assertions or the *proffered content*, as the proposed change in the output CG. This distinction is relevant for information packaging, as the CG changes continuously, and information has to be packaged in correspondence with the CG at the point at which it is uttered.

CG does not only consist of a set of propositions that is presumed to be mutually accepted (or the conjunction of this set, one proposition), but also of a set of entities that have been introduced into the CG before. Such entities can be explicitly introduced, e.g. by an indefinite NP, or they can be accommodated. They can be taken up by pronouns or by definite NPs, which express requirements to the input CG. The choice of anaphoric expression depends on the recency of the antecedent, again a notion that falls squarely within Chafe's notion of packaging.

The properties of CG mentioned so far have to do with the truth-conditional information in the CG, so we can subsume them under the heading of *CG content*. But any useful notion of CG that can be applied to the analysis of real

communication must also contain information about the manifest communicative interests and goals of the participants. For example, questions typically do not add factual information to the common ground, but indicate informational needs on the side of one participant that should be satisfied by a conversational move of the other. We call this dimension of the common ground *CG management*, as it is concerned with the way the CG content is supposed to develop. Just as CG content, the tasks of CG management is shared by the interlocutors, with the understanding that the responsibility for it may be asymmetrically distributed among participants.

Turning now to definitions of the IS categories that we consider crucial, we propose first a three-way distinction between *focus*, *givenness* and *topic*.

A general definition of focus, making use of a central insight of Alternative Semantics (Rooth 1992), appears in (3).

(3)   Definition of focus
        Focus indicates the presence of alternatives that are relevant for the
        interpretation of linguistic expressions.

One prominent use of focus is the identification of context questions in answers, as in (1). The idea is that the meaning of a question identifies a set of alternative propositions, the answer picks out one of these, and the focus within the answer signals the alternative propositions inherent in the question.

The alternative denotations indicated by focus have to be comparable to the denotation of the expression in focus, i.e. they have to be of the same type, and often also of the same ontological sort (e.g., persons or times). They also can be more narrowly restricted by the context of utterance. The complement of focus is 'background,' that is the part of the sentence which is not in focus.

The second notion to be defined is givenness, its counterpart being 'newness.'

(4)   Definition of givenness:
        A feature X of an expression α is a Givenness feature iff X indicates
        whether the denotation of α is present in the CG or not,
        and/or indicates the degree to which it is present in the immediate CG.

Schwarzschild (1999) develops a refined theory of interaction between givenness and focusation, which checks givenness recursively and states that constituents not in focus must be given, and that focus has to be applied only when necessary, i.e. to prevent that a constituent is given. But while focus is restricted in Schwarzschild's theory, it cannot be eliminated totally. In fact focus/background and given/newness cannot be reduced to just one opposition, as these pairs of notions are only partially overlapping. For example, given expressions, like pronouns, can be focused.

We now turn to the definition of topic, a notion which comes with a complementary part called 'comment.' Reinhart (1982) has integrated the notion of topic into a theory of communication that makes use of the notion of CG. According to her, new information is not just added to the CG content in form of unstructured propositions, but is rather associated with entities, just like information in a file card system is associated with file cards that bear a particular heading. A definition based on this insight appears in (6).

(5)   Definition of topic:
        The topic constituent identifies the entity or set of entities under which

the information expressed in the comment constituent should be stored in the CG content.

For example, while (6a,b) express the same proposition, they structure it differently insofar as (a) should be stored as information about Aristotle Onassis, whereas (b) should be stored as information about Jacqueline Kennedy.

(6)　　a. [Aristotle Onassis] $_T$ [married Jacqueline Kennedy]$_C$
　　　　b. [Jacqueline Kennedy]$_T$ [married Aristotle Onassis]$_C$

Theories of IS often introduce additional notions beyond focus, givenness and topic. One such notion is *contrast*, which is distinguished from pure *information focus* that shows up, e.g., in the answer to constituent questions. With contrast, the alternatives have to be given explicitly, and usually it is also assumed that only one of the contrasted alternatives is acceptable. For example, answers to alternative questions would qualify as having contrastive focus:

(7)　　A: Do you want TEA or COFFEE?
　　　　B: I want TEA.

There is a plausible argument that we do not need contrastive focus as a separate basic notion, as we already have introduced givenness; hence contrastive focus can be defined as that subtype of focus in which the alternatives are given. The uniqueness assumption may follow if we assume that apparent non-uniqueness arises because alternatives can be combined (e.g., *we saw a tiger and a baboon on the road*), but that the explicit enumeration of alternatives that does not include a combination (e.g., *or both* in (7.A)) suggests that such combinations should be disregarded.

Another important notion is *contrastive topic*, as in the following example:

(8)　　A: What are your sisters playing?
　　　　B: [My YOUNGER sister plays the VIOLIN,
　　　　　　and my OLDER sister, the FLUTE.]

The phrase *my YOUNGER sister* is a contrastive topic. Rising accent indicates that at the current position of discourse, other topics could have been chosen (e.g, *my OLDER sister*, which is here chosen by the second clause). Again, we do not need contrastive topic as a basic notion. If focus, in general, indicates the presence of alternatives, then focus within a topic would indicate the presence of alternative topics at the current point in discourse. In (8), the choice of *my YOUNGER sister* as topic indicates that there are other possible topics that can be described by *my X sister*; and indeed, the second clause, *my OLDER sister* identifies such an alternative topic. Contrastive topics are to be expected whenever a question is too complex to anser on the basis of one single topic; they indicate a particular answering strategy by introducing subtopics (cf. Büring 2003).

There is a phenomenon that is somewhat related to topichood but sufficiently distinct from it, which has been called *frame setting* (cf. Jacobs 2001).

(9)　　{How is John?}
　　　　{Healthwise / As for his health}, he is FINE.

This is a statement about John, but it is restricted to those aspects that concern John's health (in contrast, e.g., to his financial sitation). We call phrases like *healthwise* "frame setters". Clearly, focus plays a role with frame setters, just as

with contrastive topics, as they express a certain restriction of the ensuing predication to some perspective that is not clearly identified by the context already – if the health perspective were already established, there would be no need to express it explicitly. Frame setters can be seen as restricting context-sensitive expressions, like *be fine*, to the specified dimension, or they as delimiting the kind of predications that can be made. For example, *As for his health, he had a serious flu recently* is fine, but *As for his financial situation, he has a serious flu recently* is not.

There is an obvious similarity between contrastive topics and frame setters that is recognized by the way how these information-structural functions are marked (e.g., by a B accent in English, or by the postposition *nun* in Korean). Both express that the predication is restricted in some way – e.g., (8b) restricts the predication *plays the violin* to the younger sister (where the expected value is the sisters in general), and (9) restricts the predication to aspects concerning John's health. It is perhaps useful to introduce a new term for this function: *delimitation*. It is a genuin phenomenon of IS, as it responds to the current informational need of the addressee: It is indicated that the issue at hand is broader, and that the ensuing speech act concerns only a part of this more general issue. Hence, delimitation can be defined as follows:

(10)   Definition of Delimitation
        A delimiter α in within an expression $[\ldots\alpha\ldots]$ always comes with a focus within α indicating alternatives α', α'' etc. It indicates that the current informational need is not totally satisfied by $[\ldots\alpha\ldots]$ but would be satisfied by additional expressions $[\text{---}\alpha'\text{---}]$, $[\alpha''\text{---}]$ etc.

We do not claim that the notions of focus, givenness, topic, frame setting and delimitation exhaust what there is to say about IS, in the tradition of Chafe, which was refined here in the sense of Common Ground management. For example, in an argumentative discourse, the current informational need might dictate the selection and ordering of arguments to gain support for a particular conclusion. But such effects go beyond the limit of the sentence, and relate it to discourse structure. Here we will stay within the confines of the sentence (in a particular context), and we will try to illustrate some of the ways in which the IS notions specified above are expressed in languages.

2. The expression of information structure

The grammatical reflexes of IS always have a relationship to prosody: focus tends to be prosodically prominent, and givenness tends to be prosodically non-prominent, while topi tends to form a separate prosodic phrase, and is thus also prominent (the same holds for frame setters). This prosodic connection is achieved by different grammatical correlates in different languages, depending on the languages' general properties.

Reflexes of IS are quite diverse. In English as in most European languages, focus and topic correlate with pitch accents, and givenness is often expressed by deaccenting, see (1) and (2). But in a number of Asian and African languages, pitch accents only play a minor role, if at all, and morphological and syntactic means

seem to be prevalent. In tone languages, phrasing can replace the pitch accents of intonation languages, and particles can play the role of boundary tones. An extreme case of prosodic marking of IS is ellipsis. In many languages, only the focused part of a sentence is pronounced, and the given part is just deleted.

Following Rochemont (1986) and Selkirk (1995) among others, we assume that IS roles are grammaticalized at the surface syntactic structure with the help of features, in the way shown in (11) to (13). This may be a simplification but it is helpful to pin down visually the constituent we are talking about in the examples. F stands for focus, G for given and T for topic.

(11)   a. We only saw a tiger [on the ROAD]$_F$.
        b. We only saw [a TIGER]$_F$ on the road.

(12)   {What did you see on the road?}
        [We saw]$_G$ [a TIGER]$_F$ [on the road]$_G$.

(13)   [As for tigers,]$_T$ [we saw one on the road]$_F$.

We examine syntactic, phonological and morphological reflexes of IS in the next subsection, and show in each case how they relate to prosody.

2.1 Sentence Position

First, IS roles are often associated with sentence positions. Halliday (1967-8), for instance, claims that the initial position is a necessary condition for a 'theme' (a topic in our terminology). This preferred place for a topic is easily explained from a functional perspective: since it is the element about which the remainder of the sentence makes a comment, it makes sense to introduce it right at the beginning of the sentence. However, a topic is not necessarily located sentence-initially. In the following Korean sentence (41), the topic *dezaato-wa* 'dessert' is placed after a quantifier phrase and is thus not initial.[1] A subscript P shows a prosodic phrase (p-phrase), and a subscript I a larger intonation phrase (i-phrase).

(14)   ((Nwukwuna-ka)$_P$ ([dessert-nun]$_T$)$_P$ (ice cream-ul mek-ess-ta)$_P$)$_I$
        everyone-NOM   dessert-TOP   ice cream-acc eat-past-dec
        'As for dessert, everyone ate ice cream.'

Sentence-final topics, sometimes called 'anti-topics' are also possible, as illustrated in (15) for Cantonese and (16) for French.

(15)   ((Go loupo)$_P$ (nei   gin-gwo gaa)$_P$, ([ni go namjan ge]$_T$)$_P$)$_I$.
         CLF wife   2.SG   see-EXP DSP   this CLF man   DSP
        'The wife you have seen, of this man.'

(16)   ((Pierre l'   a   mangée)$_P$, ([la pomme]$_T$)$_P$)$_I$.   (French)
        Peter it-ACC has eaten,   the apple
        'Peter has eaten the apple.'

The common property of the topics in these sentences is their separation from the remainder of the sentence. They tend to form their own i-phrase (intonation phrase),

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[1]   Thanks to Shin-Sook Kim for providing this sentence.

and initiality allows a clear intonational separation. In all examples, topics and anti-topics require a clear prosodic separation from the rest of the sentence, rather than a position like sentence-initiality or finality. In languages like Japanese or Cantonese, particles not only signal the role of the constituent as a topic, but also add place for a boundary tone. This allows the topic in (16) to be inserted in a non-initial position.

Focus has also been associated with special focus positions in certain languages. Hungarian has been described as a language which obligatorily places an exhaustive focus preverbally (É. Kiss 1998), while Italian has been analyzed as a language with clause-initial (Rizzi 1997) or clause-final (Samek-Lodovici 2006) foci.

An alternative explanation, which accounts for the Hungarian facts without forcing an association between focus and preverbal position, can be stated in the following way: Hungarian is phonologically a left-headed language, both at the level of the prosodic word and at the level of the prosodic phrase. Focus wants to be prominent and the preferred stress position is at the beginning of the main i-phrase, directly after the topic, which forms an independent i-phrase, and thus does not count as the leftmost position for the remainder of the sentence. The initial position is occupied by the narrow focus, as often as possible, and happens to be the verb in all other cases (see Szendrői 2003, who gives a syntactico-phonological account of the IS facts of Hungarian). But focus may also be located postverbally. In (17), both the VP and *Mary* are focused and *Peter* is given, but the indirect object, which carries a narrow focus embedded in the VP, is postverbal. In such a case, only pitch accents indicate focus.

(17)   ((Tegnap   este)$_P$)$_I$ ((BEMUTATTAM   Pétert)$_P$ (MARINAK)$_P$)$_I$.
      yesterday evening PRT-introduced-I Peter-ACC Mary-DAT
      'Yesterday evening, I introduced Peter to Mary.'

In Italian, as in other Romance languages, given elements may be moved away from the matrix clause, and, in many cases, it is this movement which causes finality of focus; see (15), adapted from Samek-Lodovici (2006). In this example *Parigi* is the focus, and the following constituents are right-dislocated because given. Italian is a language with final stress, both at the level of the p-word, where it is trochaic, and at the level of the p-phrase, and syntactic reorganization helps prosody in moving narrow foci to the furthest possible rightward position. Thus, both in Hungarian and in Italian the peripheral position of focus is not a special feature of focus, but a general preference for prominence.

(18)   ((L'ho   incontrato [a   PARIGI]$_F$)$_P$, (Luigi)$_P$, (ieri)$_P$)$_I$.   (Italian)
      (I) him have-met   in Paris,   Luigi,   yesterday
      'I met Luigi in Paris yesterday.'

2.2 Accents

There have been numerous attempts in the literature to relate specific information roles to the form of pitch accents. Bolinger (1958) introduced a distinction between accent A, a falling accent, and accent B, a fall-rise accent, for English, and

Jackendoff (1972) and Liberman & Pierrehumbert (1984) related the former to focus and the latter to topic, as in (19). *Manny* has accent B, and *Anna* accent A.

(20)   {What about Manny? Who did he come with?}
        (([MANNY]$_T$)$_P$ (came with [ANNA]$_F$)$_P$)$_I$.

Büring (2003), for German, and Steedman (2000), for English, establish an obligatory relationship between contours and roles by having pitch accent contours participate in the definition of topics and foci. Attempts to relate forms of accents to specific IS roles are found for other languages as well. For instance, Frota (2000) claims that narrow foci in Portuguese are always associated with a certain kind of accent.

An alternative explanation is possible which only indirectly relates IS to the forms of accents.. The preference for associating some specific contours with IS roles can be explained by general properties of the language. As far as topics are concerned, the preference for sentence-initiality is paired with a preference for rising tones. The rising tone is just a reflex of the non-finality of this accent. And the falling contour often found on focus may be related to the late position of a focus in a sentence.

A crucial question is whether languages with pitch accents necessarily use them for topics and foci, or whether there are exceptions. The question bears on the necessity of accents (and of deaccenting) in general in relation to focus/topic/givenness. Jackendoff formulates a rule which directly relates a focus with an accent. 'If a phrase P is chosen as the focus of a sentence S, the highest stress in S will be on the syllable of P that is assigned highest stress by the regular stress rules' (1972:247). Nearly all models relating focus with phonology rely on a direct correspondence between semantics and phonetics and require an accent signaling the presence of a focused constituent (see for instance Cinque 1993, Reinhart 1981, Rooth 1985, 1992, Selkirk 1995, Schwarzschild 1999, and many others).

But in fact, there are a whole range of examples in which the association between focus and accent seems to be cancelled. One type of example is the so-called Second Occurrence Focus (SOF, see Partee 1999, Rooth 2004, Beaver et al. 2007, Féry & Ishihara 2005), which combines elements of association with focus and givenness. *Only vegetables* in (21b) is associated with the focus operator *only*, and is thus a focus, but it is also given, because it is repeated from (21a). The example comes from Partee (1999).

(21) a.   {Everyone already knew that Mary only eats [vegetables]$_F$}.

     b.   If even [Paul]$_F$ knew that Mary only eats [vegetables]$_{SOF}$, then he
           should have suggested a different restaurant.

There are only weak correlates of accent, and no pitch excursions on postnuclear SOF, although according to Féry & Ishihara (2005), a pitch accent is indeed present in the prenuclear position.

Other cases of absence of accent on a focus are a consequence of avoidance of stress-clash and the consequent deaccenting. In (18a), *herself* is a so-called intensifier which is claimed to be obligatorily accented in the literature. But in the

presence of an adjacent narrow focus (association with focus), the accent on *herself* disappears. The same is true of the association with focus adjacent to a parallel focus in (18b), a sentence from Rooth (1992). In (18c), the answer to the question is completely deaccented. Instead the additive particle *also* carries the stress. (18d), a sentence from Reis & Rosengren (1997), shows that a contrastive topic (*Peter* in Krifka's 1999 analysis) can also be realized without excursion if another, more prominent topic (*Gauguin*) is adjacent.

(22) a.   Marie-Luise even grows RICE herself.

      b.   People who GROW rice only EAT rice.

      c.   {John said that Mark is coming, but what did Sue say?}
            She ALSO said that Mark is coming.

      d.   {Boy, Paul possesses a Gauguin.}
            Einen GAUGUIN besitzt Peter AUCH
            'Peter also owns a Gauguin'

In view of these examples, a strict and necessary association between focus and accent or topic and accent must be given up. Accent is a preferred option but it is not obligatory. It is only present if the phonological structure of the sentence allows it. To sum up, the preference for associating some specific contours with IS roles, or just pitch accents can be explained by general properties of the language.[2]

2.3 Morphological markers

Morphological markers are compatible with the general claim of this section that the marking of focus and topic is always prosodically prominent if can be shown that the presence of a particle change the prosody of the sentence it appears in. Examples confirming this claim appeared in (11) for Japanese and in (15) for Cantonese topic markers. In the last years, a number of tone languages have been studied as for their focus realizations which do not seem to have other correlates of IS than optional presence of morphological markers. Examples involving morphological markers for focus appear in the Gur languages Buli in (23) and Ditammari in (24), both from Fiedler et al. (to appear). In Buli, the focus marker *kà* precedes the focused constituent. But when the focused *túé* is sentence-initial, the marker *kà* is not obligatory. As for Ditammari, the focus marker *nyā* follows the focused constituent.

(23) Buli (Gur, Oti-Volta, Buli-Konni)

      Q: What did the woman eat?

      A: ò   ŋòb kà   túé.
         3.SG eat FM beans
         'She ate BEANS.'

(24) Ditammari (Gur, Oti-Volta, Eastern)

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[2] Many languages do not use pitch accents to highlight a focused element, but rather raise the pitch register of a focused phrase as a whole. This happens for instance in Mandarin Chinese (Xu 1999), in Korean, in Georgian and in Hindi.

Q: What did the woman eat?

A: ò   dī   yātũrà   nyā.
   3.SG eat beans   FM
   'She ate BEANS.'

These markers have a delimiting function in creating a prosodic boundary. We thus propose that the prosodic connection of the focus and topic markers is to be found in the phrasing properties of a constituent delimited by such a marker. Even if not enough is known about the exact behavior of particles, it seems to be a valid generalization that they always appear at the periphery of the constituent they mark.

In languages without special markers for IS, that is in languages which do not have pitch accent and which have only optional morphological markers, the answer to wh-question typically involves ellipsis of the given material. Only the constituent in focus is realized, a strategy which we propose to analyze in prosodic terms.

To conclude, this short paper has proposed definitions of IS concepts in a model of information exchange that makes use of the notion of Common Ground, as well as a unified prosodic theory of the realization of these concepts.

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