

# Information Structure in Linguistics

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## Abstract

Information structure is a subfield of linguistic research dealing with the ways speakers encode instructions to the hearer on how to process the message relative to their temporary mental states. To this end, sentences are segmented into parts conveying known and yet-unknown information, usually labeled 'topic' and 'focus.' Many languages have developed specialized grammatical and lexical means of indicating this segmentation.

## Theoretical Background

The term *information structure* refers to the ways linguistically encoded information is presented relative to the speaker's estimate of the temporary mental state of the receiver of the message (cf Chafe, 1976). Utterances transmit both the information contained in the message and the implicit or explicit instructions on how this information is to be processed and integrated into the hearer's knowledge stock. In order to achieve this, the speaker has to decide which parts of the sentence are 'old' or 'given' and which are 'new' for the hearer. The hearer is led to identify those elements of her existing knowledge ('given elements') which shall be relevant for the processing of the message. The information comes about by relating the 'new' elements (i.e., what the hearer is assumed not to be aware of) to these 'given' elements. The speaker's choice of 'given' and 'new' segments within a sentence depends on her hypotheses about the current state of the hearer's attention and consciousness. Information structure thus relates two major functions of language, as a means to transmit knowledge and as a vehicle of social interaction. Linguistic research on information structure is based on the assumption that natural languages are equipped with formal means of signaling the basic distinction between known and unknown pieces of information, and a number of other distinctions. This research draws from a rich philosophical and psychological tradition and has been established as a separate field of linguistics in the past 50 years.

The way information structure is rendered overt in natural languages is illustrated in the sentence pairs (1)–(2) (small capitals mark the position of the sentence stress).

(1a) Jonathan opened the DOOR. (English)

(1b) JONATHAN opened the door.

(2a) Peter hat gestern das FAHRRAD  
P. has yesterday the bicycle  
genommen. (German)

taken

'Peter took the BICYCLE yesterday.'

(2b) Das Fahrrad hat gestern PETER genommen.  
the bicycle has yesterday P. taken

"As for the bicycle, PETER took it yesterday."

In (1a) and (1b), the sentence stress indicates what the hearer is to treat as new elements, the locus of information update. This is clearly apparent if one observes different

context compatibilities of (1a) and (1b): the former is a felicitous answer to the question "What did Jonathan open?", while the latter answers the question "Who opened the door?". The carrier of sentence stress in English thus seems to indicate what element(s) of the clause carry the desired information update, as it is this part of the sentence that is regularly used to fill the gap in the hearer's knowledge marked by the question word. This kind of element, which brings about information update, is usually called *focus*. Sentences (2a) and (2b) illustrate how 'given' elements work. In German, given elements are usually marked by the clause-initial position. The normal use of these sentences in context reveals the differences in their information structure: while (2a) is fine in a situation in which the interlocutors are talking about Peter and his mischiefs, (2b) would be used if the conversation is about the whereabouts of the bicycle. In the former case, 'Peter' is the segment of the message toward which the attention of the interlocutors is directed; in the latter, this segment is 'the bicycle.' Given elements to which the hearer is expected to relate the information update are called *topic*. Importantly, both examples (1) and (2) show that the information conveyed by the message is intended to increase the hearer's knowledge about the topic by ascribing the denotation of the focus to this topic. In (2b), for instance, the speaker intends to inform the hearer about the bicycle (topic), and does so by ascribing it the property of being taken away by Peter (focus).

This idea of information structure is rooted in a particular model of communication, the incremental model (Stalnaker, 1999). According to this model, communication consists of reducing the differences in the knowledge of the interlocutors by increasing the *common ground* between them, i.e., their stock of shared knowledge. In order to do this, constraints on the input to the common ground have to be taken into account: only such content can be added which relates to the previously existing knowledge. Since the particular portion of the existing knowledge relevant at the current point in communication is not necessarily manifest per se, it often needs to be indicated linguistically, via *presuppositions*. The content that is added, the proposed change in the output common ground, is related to presuppositions via *assertion*. Similarly, other speech acts have effects on common ground, so that, for instance, questions identify which type of content is expected to be added to which presupposed portion of knowledge. By structuring the transmitted information, speakers indicate how this

permanent change of common ground should develop, so that information structure itself has been occasionally defined as a *common ground management* system (Krifka, 2008). Information structure research assumes that this common ground management system operates via a number of linguistic categories. These minimally include topic and focus, but some approaches differentiate no less than half a dozen of categories (see the ‘Categories of Information Structure’ section).

### Categories of Information Structure

Topic (also called *theme*, *link*, *given information*, etc.) has been defined in a number of ways, depending on the general model of information structure. Two major competing definitions are those based on the notions of *givenness* and *aboutness*. Givenness-based definitions are hearer-centered: topic is that part of the utterance that is assumed to be already known to the hearer, present in the common ground of the interlocutors, and/or activated in the hearer’s short-term memory, by being mentioned previously, inferable, or given in the extralinguistic context. The alternative view is that topic is that part of the utterance about which this utterance is meant to give information. The focus is here more on the speaker’s intentions than on the hearer’s state of mind: the speaker determines what she intends to increase the hearer’s knowledge about and encodes this element as a topic. As shown by Reinhart (1981), the aboutness-based definition is empirically superior, even though the notion of givenness cannot be fully excluded from definitions of topicality. Speakers seem to be free to choose what segments of the hearer’s knowledge they intend to enrich with new content, so as to increase the common ground. However, they are constrained by the considerations of the hearer’s processing capabilities. What is chosen to be a topic of a given utterance is generally in one way or another given/old and thus easily accessible to the hearer; otherwise, the hearer is confronted with the double task of identifying inaccessible, inactive knowledge and adding new content to that segment of their knowledge. This usually leads to a breakdown of communication, or at least to infelicitous utterances, as seen in examples in (3).

Context: Why didn’t you come to work yesterday?

- (3a) I have some elephants I take care of. Yesterday, one little elephant was ill.  
 (3b) #Yesterday, one little elephant was ill.

The second clause in (3a) is felicitous, since its topic, ‘one little elephant,’ has been indirectly introduced previously and thus made accessible to the hearer. The answer in (3b) is communicatively bad, since it forces the hearer to accommodate a rather unusual piece of knowledge (the speaker takes care of elephants) and to ascribe it a property of being ill at the same time. Topics are thus elements of the proposition that the utterance is construed about, and that are usually restricted to given, accessible elements.

Focus has been defined in even more different ways, and has been labeled even more variably; other, partly or mostly synonymous labels include *comment*, *rheme*, *new information*, etc. Intuitively, focus is the locus of the common ground update,

the element that carries the proffered new content. The two most prominent theoretical approaches to focus are Alternative Semantics and the assertion-based theory of focus; other approaches include Givenness Theory, Structured Meanings Theory, etc. (see Krifka, 2008 for an overview). The assertion-based approach to focus (Lambrecht, 1994) defines focus as that part of the proposition by which assertion differs from presupposition. Importantly, focus is not equated with assertion, as assertion, i.e., update, comes about only by applying the new content to the presupposed content. Focus is rather defined negatively, as the segment that is not presupposed. This definition relies heavily on the incremental model of communication and treats focus as a propositional phenomenon. Alternative Semantics (Rooth, 1992) attempts to develop a denotational semantics for focus, treating it as an operator which generates alternatives to the expression that is focused. Informally, focus indicates alternatives relevant for the interpretation of the focused expression. In processing a focused element, the hearer must assume that this element can be interpreted only with respect to some set of alternative denotations. This is illustrated in (4) and (5).

- (4) Who broke the vase? [PETER]<sub>focus</sub> broke it.  
 (5) They were quarreling about buying a present. In the end, [MARY]<sub>focus</sub> bought it.

The question in (4) indicates that there are a number of possible culprits for the destruction of the vase; the focus of the answer, ‘Peter,’ picks out one of these referents and, by evoking alternative values (e.g., ‘John,’ ‘Mary,’ etc.), relates it to the set induced by the question. The same mechanism is at work in (5): the focus on ‘Mary’ indicates that there were other potential present-buyers.

The assertion-based approach and Alternative Semantics are not mutually exclusive. As shown by Matic’ and Wedgwood (2013), alternatives necessarily arise whenever something is newsworthy enough to be asserted. Assertion is, as it were, plausible only when things could have been otherwise. However, some important differences remain: while assertion-based theories allow for focusing only at the level of propositions, nothing in Alternative Semantics prevents smaller linguistic entities, such as noun phrases, from having information structure of their own. The two major approaches to focus thus differ in the assumed scope of information structure. Some researchers, mostly those that assume some version of Alternative Semantics, take information structure to be recursive, so that not only the sentence is segmented into topic and focus, but also its component parts (e.g., Rooth, 1992). Others restrict information structure to propositional entities, since only propositions can have truth values and contribute to the update of the common ground (e.g., Lambrecht, 1994). The issue is not fully resolved, and it is sometimes conflated with yet another unresolved aspect of information structure research, that of the number of its dimensions. Researchers differ with respect to the number and kinds of subdivisions and categories involved in informational segmentation of the utterance. The minimal assumption is that all sentences fall into two parts, the topical and the focal one. In some approaches, it is assumed that in addition to topic and focus, there is a transitional informational element that indicates how new content (focus) is to be related to the topic (*transition*

in Firbas, 1992; *tail* in Vallduví and Engdahl, 1996). Other approaches take it that different dimensions of information structure are realized in different structural domains. It is thus often claimed, with different terminologies, that there are two different levels: the topic–comment and the focus–background articulation, which are orthogonal to one another (e.g., Halliday, 1967; Vallduví and Vilkkuna, 1998; Kruijff-Korbayová and Steedman, 2003). The topic–comment division corresponds roughly to what assertion-based theories of focus describe as information structure, bringing new content (comment) into relationship with a piece of the existing knowledge (topic), while the focus–background partition expresses the existence of alternatives for focus and the lack thereof for background. The former is a sentence-level phenomenon, whereas the latter is recursive. The way these various divisions function is illustrated by example (6), adapted from Kruijff-Korbayová and Steedman (2003).

6. Q: I know that this car is a Porsche. But what is the make of your other car?  
 A: (My OTHER car) (is ALSO a Porsche)  
 (Background Focus) (Background Focus Background)  
 Topic Comment

In other systems, what is labeled as topic and comment in (6) would be called topic and focus, and no other subdivisions would be acknowledged; or the comment in (6) would be subdivided into focus ('also') and transition, or tail ('is a Porsche').

Apart from these basic categories, subdivisions, and dimensions, a number of other categories are occasionally mentioned. The most persistently discussed one is *contrast* (Repp, 2010). It is occasionally equated with focus, especially in the form given to the latter in Alternative Semantics (Rooth, 1992); or it is assumed that it is a separate category of information structure, compatible with both topics and foci (Vallduví and Vilkkuna, 1998; Molnár, 2002). There are opposing views, too: ever since Bolinger (1961) it has often been argued that contrast is merely a matter of pragmatic inference, not a separate linguistic entity (Zimmermann, 2008).

## Research Traditions

The roots of information structure research reach deep into antiquity (good historical overviews are provided by Seuren, 1998; von Heusinger, 1999). The basic concept of the division of sentences into two parts, subject and predicate, goes back to Aristotle, who used it somewhat ambiguously to refer to the dichotomy of judgment at the logical, psychological, and grammatical levels. The rise of linguistics and modern logic in the nineteenth century brought the revival of the subject–predicate discussion. Linguists like Georg von der Gabelentz and Hermann Paul developed a theory of *psychological subject* and *psychological predicate*, applying the traditional Aristotelian dichotomy to the temporary psychological states of the interlocutors. They were also the first to notice the interconnectedness of information structure and discourse context, as shown by Paul's use of the question–answer test (see the analysis of example (1)) to show different configurations of subject

and predicate. The growth of Gestalt psychology at the turn of the centuries, with its insistence on the perceptual dichotomy between *figure* and *ground*, triggered further interest in information structure. The idea that human subjects are capable of understanding foregrounded objects only by relating them to their background naturally relates to the theory of psychological subjects and predicates. The decisive move from psychology to linguistics was undertaken by the linguists of the Prague School, especially Vilém Mathesius, who used the categories derived from psychology and philosophy to account for phenomena of word order variation and prosody. The subject–predicate division was replaced by that of theme and rheme (later topic and comment, or topic and focus). The Praguean ideas of information structure were disseminated in the wider linguistic community through the work of Halliday (1967–68), who modified and refined the notion of theme–rheme partition. On his view, information structure (the term was coined by Halliday) is a component of grammar separate from syntax and semantics, but it interacts with both in a number of complex ways.

From the early 1970s, information structure has become an integral part of many grammatical theories and a frequent research topic in descriptive linguistics. Chafe (1976) has developed a framework in which many of the notions discussed above have been systematized for the first time. His work has spawned a number of approaches which share the view that information structure needs to be linked to the communicative and psychological reality of language users, no matter whether it is considered a proper part of grammar or a communicative, pragmatic phenomenon influencing grammar (e.g., Vallduví, 1992; Lambrecht, 1994; Van Valin, 2005). Important developments in this line of research are Vallduví's (1992) application of file change semantics to information-structural phenomena, where knowledge is conceived of as a set of file cards which get activated and deactivated, and Lambrecht's (1994) explicit embedding of information structure in the Stalnakerian model of communication. Another line of research was conceived in the generative framework, most notably by Jackendoff (1972). The principal purpose is to find a way how categories like topic and focus can be represented in grammatical description so as to account for the range of grammatical structures influenced or triggered by information structure in a maximally economical way. A device that has been used almost universally to achieve this aim is the representation of information-structural categories as grammatical features (F-feature for focus was introduced by Jackendoff himself) which trigger word order permutations and determine sentence stress assignment and similar phenomena. Further developments include the postulation of dedicated hierarchical positions for topic and focus (Rizzi, 1997) and optimality-theoretical accounts of the interaction of the focus feature with sentence structure (Büring, 2006). In recent years, important attempts have been made to formalize the relationship between discourse structure and information structure (Roberts, 2012). The basic idea is that the discourse develops through a series of implicit questions under discussion. The information structure relates the utterances to these underlying questions and thus renders the discourse structure transparent.

## Information Structure in Grammar

The linguistic interest in the phenomena of information structure stems from the fact that many formal features of language, such as prosody or word order, are intimately connected with information-structural variation. It is thus generally agreed that the assignment of sentence stress in many languages is determined by the position of focus (Ladd, 2006), as illustrated in examples (1a, b). Word order is also affected by information structure in many languages, either via optional rearrangement of constituents, as in German examples (2a, b), or via obligatory movement of information-structurally marked constituents to certain positions in the clause, as in Hungarian, where focus has to be immediately preverbal (compare the neutral sentence (7a) with the focus sentences in (7b) and (7c)). Other expressive means are also attested. Syntactic transformations of different kinds are found in most languages of the world; the best known example is cleft sentences, which in some languages, such as French, play a major role in signaling information structure (8). Many languages of the world have specialized morphology to indicate topic, focus, or some kind of contrast; the Japanese particle *wa* is a well-known example of a topic morpheme (9), while the case marker *-ləŋ* and the agreement suffix *-mələ* in Yukaghir (isolated language spoken in northern Siberia) is an instance of focus-indicating morphology (10).

- (7a) János meg-ette az almát. (Hungarian)  
 J. PERFECTIVE-ate the apple.  
 "János ate the apple."
- (7b) János ette meg az almát.  
 J. ate PERFECTIVE the apple  
 "JÁNOS ate the apple."
- (7c) János az almát ette meg.  
 J. the apple ate PERFECTIVE  
 "János ate the APPLE."
- (8) C'est maman qui décide. vs. Maman décide. (French)  
 it's mother who decides mother decides  
 "It's MOTHER that decides." vs. 'Mother DECIDES.'
- (9) Inu wa hasitte iru.  
 dog TOP running is  
 "The dog is RUNNING." (Japanese)
- (10) Taŋ köde metin čoyojə-ləŋ tadi-mələ  
 that man to.me knife-FOC give-OBJECT.FOC.3SG  
 "that man gave me a KNIFE." (Yukaghir)

It is unclear whether it is possible to establish cross-linguistic regularities which would subsume all these different types of structures. Attempts to establish one universal information-structure-based sentence template out of which variable systems could be derived have not been successful (see Matic and Wedgwood, 2013 for a critique). Recently, there have been noteworthy attempts to reduce the number of possible information-structure types to a limited number (Van Valin, 1999) and to derive the cross-linguistic variability from some more fundamental processing strategies (Büring, 2010), but all these attempts need further elaboration. Irrespective of this, it has been shown that, in one way or another,

information structure does play an important role not only in such patent cases as word order variation or prosody, but also in reference resolution, long-distance dependencies, extraction, etc. (Van Valin, 2005, Erteschik-Shir, 2007).

The question of regularities that govern the form of information-structure-related structures in the languages of the world is not the only debated issue. The position of information structure in grammar is also a matter of dispute. The dispute revolves around two interconnected topics. First, is the proper domain of information structure semantics or pragmatics? Second, how is it connected to grammar? The answer to both questions depends on the definition of the semantics/pragmatics distinction one adopts. On one view, semantics is only what is truth-conditionally relevant. In most cases, topic and focus have no truth-conditional relevance whatsoever, so that they can be considered a proper subdomain of pragmatics. However, in some cases, they do seem to trigger truth-conditional effects, as in some kinds of generics and in certain types of conditionals. The best known examples include focus-sensitive expressions, whose interpretation seems to fully depend on focus assignment, so that they are considered *associated with focus* (Beaver and Clark, 2008). Such expressions are, among others, many particles, such as *only*, *also*, *even*, etc. The truth-conditional impact of their association with different foci is illustrated in (11).

- (11a) John only likes BANANAS (and nothing else).  
 (11b) John only LIKES bananas (and has no other relationship to them).  
 (11c) Only JOHN likes bananas (and nobody else).

This property of information-structural categories has often been adduced as a proof of their semantic nature (e.g., Rooth, 1992). However, one might argue that the differences observed in (11) are a mere product of pragmatic inference arising out of the meaning of the particles in particular contexts. The issue needs further research.

A different idea of the semantics/pragmatics distinction is based on what is linguistically encoded vs what needs to be derived inferentially. From this point of view, the question is whether the structures identified as connected with topic, focus, etc., are indeed dedicated to expressing the meanings of topic, focus, etc., or whether these meanings are rather pragmatic effects derived from quite different denotations. The answer to this question is an empirical one: each information-structurally marked construction in a language needs to be tested for its primary denotation, and, if it turns out that this structure is not primarily an information-structural category, a pragmatic mechanism needs to be defined through which information-structural effects come about. Some first results largely diverge: Beaver and Clark (2008) convincingly argue for focus as the encoded meaning of the sentence stress in English, while Matic and Wedgwood (2013) show that many apparent focus-denoting structures, such as English clefts or Somali focus morphology, can be better analyzed as having distinct (identificational, modal, aspectual, etc.) denotations with interestingly similar information-structural effects. It thus seems that information structure can but need not be an element of grammar, depending on whether the given language has grammaticalized the categories of topic, focus,

etc., or not. Information structure is thus a universal phenomenon of human communication, but it is not necessarily a universal phenomenon in natural language.

**See also:** Communicative Competence: Linguistic Aspects; Intentionality in Language and Communication, Emergence of; Linguistic Presupposition; Linguistic Typology; Pragmatics, Linguistic; Semantics; Suprasegmentals; Word Order.

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