Language form varies as a result of the information being communicated. Some of the ways in which it varies include word order, referential form, morphological marking, and prosody. The relevant categories of information include the way a word or its referent have been used in context, for example whether a particular referent has been previously mentioned or not, and whether it plays a topical role in the current utterance or discourse. We first provide a broad review of linguistic phenomena that are sensitive to information structure. We then discuss several theoretical approaches to explaining information structure: information status as a part of the grammar; information status as a representation of the speaker’s and listener’s knowledge of common ground and/or the knowledge state of other discourse participants; and the optimal systems approach. These disparate approaches reflect the fact that there is little consensus in the field about precisely which information status categories are relevant, or how they should be represented. We consider possibilities for future work to bring these lines of work together in explicit psycholinguistic models of how people encode information status and use it for language production and comprehension.

WHAT IS INFORMATION STRUCTURE?

People talk for a reason. They want to share news, connect with others, inform, amuse, or cause things to happen. Human languages are organized in ways that reflect the content and purpose of utterances – that is, the information that is contained in the words and structures that make up sentences. This organization is called **information structure**[[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R1),[2](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R2)] or **information packaging.**[[3](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R3)] This article reviews how information structure constrains linguistic form, that is, the way people say things.

Information structure helps explain why people say things in different ways. Speakers constantly make choices about how to phrase their utterances. For example, a speaker might say *The aardvark chased the squirrel*, *The squirrel was chased by the aardvark*, or *What was chased by the aardvark was the squirrel*. The squirrel may be referred to with a lengthy phrase (*The furry-tailed creature who stole my crackers)* or simply the pronoun *it*. While these variations could describe the same event, they are pragmatically felicitous (i.e. appropriate) in different contexts.

Language scholars agree that linguistic form varies as a function of informational considerations, including what the speaker is attending to, what the speaker wishes the addressee(s) to focus on, what is assumed to be already known, what is considered most important, or what is treated as background information. Yet the definition of information structure is notoriously variable across researchers and topics. Our review reflects this heterogeneity, and reports the definitions of information structure that are important for each phenomenon that we discuss. Nevertheless, two general approaches to information structure emerge. Many linguistic choices reflect a distinction between information that is **given** (i.e. previously known or discussed), and that which is **new**.[[4](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R4)] Other choices seem to reflect the distinction between the **topic** (i.e. information that is backgrounded or assumed) and the **focus** (i.e. that which is highlighted or focused). These distinctions establish the **information status** of a word or referent in the discourse.

In the first section of this paper, we provide an overview of what information structure is, and how it relates to four linguistic phenomena: 1) referential form, 2) morphology, 3) word order, and 4) prosody. In the second section, we consider how it relates to major theories about language structure, use, and processing. We then consider potential psychological mechanisms for representing information structure.

[Go to:](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \o "Go to other sections in this page)

HOW INFORMATION STRUCTURE SHAPES LANGUAGE

Reference

Information structure has a strong effect on how people refer to entities in the world, including both introducing new entities into a discourse and referring back to already-mentioned entities. This can affect multiple dimensions, including definiteness, pronoun use, and modification.

Many languages, including English, use different expressions for definite and indefinite information. For example, if the speaker has just been talking to someone about a particular dog, the speaker can refer to it with the definite expression *the dog* or perhaps even the pronoun *it*. However, if the dog is mentioned in the conversation for the first time, the speaker may use the indefinite expression *a dog*. In English, the definite article ‘the’ is traditionally regarded as indicating that the noun is specific and familiar to both the speaker and the hearer, by virtue of having already been mentioned in the discourse.[[5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R5),[6](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R6)]

However, the effects of information structure on reference are modulated by real-world knowledge and inferences. For example, definites are not restricted to cases where the referent is given. Consider a sentence such as *I went to a wedding and the bride wore white, but unfortunately a guest spilled wine on her.*[[7](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R7)] Here, *a wedding* is indefinite and being mentioned for the first time, *the bride* is definite although being mentioned for the first time (i.e. a novel definite), and *a guest* is indefinite and being mentioned for the first time. Novel definites occur with entities that are familiar to all and known to be **unique** (e.g. the moon, the sky), as well as with unique entities whose existence can be inferred from mentioned entities (e.g., we can infer *the bride* from *the wedding*; Prince[[4](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R4)] uses the term ‘inferrable’). Due to this inference process, some novel definites can result in slowed comprehension.[[8](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R8)]

Information structure also guides the speaker’s selection of nouns, pronouns and other referring expressions. After mentioning a great new book, the speaker will probably use the pronoun ‘it’ to refer to the book in the immediately subsequent utterances. Use of pronouns provides an efficient, shorthand way of referring to already-mentioned, prominent referents and allows speakers to avoid excessive repetition. In fact, using a name when a pronoun would be sufficient has been shown to result in processing difficulties, at least under certain circumstances.[[9](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R9)] By contrast, introduction of a new referent requires fuller expressions, like a description (*the donkey)*, possibly a modification (*the scared donkey)*, or a name *(Sylvester*).

Many researchers agree that the choice of expression is determined by the salience, or accessibility of a referent in context. The more-reduced referring expressions (e.g. pronouns) are used to refer to more prominent/salient entities – i.e. those that are more activated or accessible in people’s minds at that point in the discourse – and fuller referring expressions (e.g. nouns) are used for entities that are less salient.[[10](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R10),[11](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R11)] However, the definition of salience/accessibility is complex. Intuitively, referents become accessible when they are topical in the recent discourse – for example, when they have been recently mentioned, especially when they have been mentioned in syntactically prominent positions like the subject position.[[5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R5), [12](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R12), [13](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R13)] Yet this effect is modulated by the grammatical position of the referring expression: pronouns in subject and object position tend to be interpreted as referring to previously-mentioned entities in the parallel syntactic position (e.g. preceding subject or object).[[14](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R14)] The interpretation of pronouns is also guided by the plausibility of potential referents, which is often connected to their thematic roles. One such effect is the implicit causality of an event, e.g. in *The parrot blamed the tiger, because he*…., comprehenders expect the pronoun to refer to the tiger.[[15](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R15)] Implicit causality and other effects of verb semantics are modulated by the coherence relation between the two clauses, for example whether the second clause communicates the cause (“…because…”) or something else.[[52](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R52)] It also appears that accessibility is not a single dimension, in that different kinds of referring expressions seem to be sensitive to different kinds of information. For example, Finnish is a language with flexible word order where humans can be referred to with demonstrative pronouns (‘this’) or personal pronouns (‘s/he’). In Finnish, demonstrative pronouns tend to be coreferential with post-verbal arguments (subjects or objects), which tend to be discourse-new. By contrast, personal pronouns exhibit a strong preference to be coreferential with syntactic subjects, regardless of their given/new status or sentence position.[[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R16),[17](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R17)]

Morphological marking of information structure

Noun morphology

Many languages use morphological marking on nouns to indicate grammatical role. For example, in Japanese and Korean, subjects have the nominative marker –*ga* (Japanese) and –*i*/–*ka* (Korean), and direct objects are marked with accusative (–*o* in Japanese and *– (l)ul* in Korean). These languages also have an information-status marker that indicates the topic, namely – *wa* in Japanese and –*(n)un* in Korean,[[18](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R18),[19](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R19)] which can occur on either subjects or objects. Both Japanese and Korean topic markers can occur on the topical entity, i.e. what the sentence is about. When the whole sentence is new information (e.g. the answer to “What happened?”), only the nominative marker is felicitous on the subject in both languages (ex. 1a, # denotes infelicity). In contrast, in a context where one entity is topical, use of the topic marker on that entity is more natural (ex. 1b, ? indicates that the usage is awkward). Both *–wa* and –*(n)un* can also have more nuanced interpretations (e.g. can be used to mark contrastive topics),[[20](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R20)] depending on their position and the information-structural properties of the rest of the sentence.[[21](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R21)]

* (1a)

What happened?

|  |  |  |
| --- | --- | --- |
| {Sumi-ka / #Sumi-nun} | apa | [Korean] |
| {Sumi-NOM / #Sumi-TOP} | sick |  |
| ‘Sumi is sick.’ (with NOM) or ‘As for Sumi, she’s sick.’ (with TOP) | | |

* (1b)

What happened to Sumi?/Why didn’t Sumi come?’

|  |  |  |
| --- | --- | --- |
| {Sumi-nun /?Sumi-ka} | apa | [Korean] |
| {Sumi-TOP/ Sumi-NOM} | sick |  |

Other languages, such as the Mayan language Tzotzil, also use morphological means to mark topics. Topic phrases in Tzotzil begin with the particle *a* and end with the enclitic –*e*.[[22](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R22)] There are also languages that use morphology to mark the focused, new-information elements rather than topical elements (e.g. in West African language groups such Gur, Kwa, and Chadic).[[23](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R23)] Even languages that are not commonly thought of as having morphological topic markers show indications of morphology being sensitive to information structure. For example, in Russian, the object of a negative sentence (e.g. ‘letter’) is marked with accusative case when the letter is known to exist (‘He did not receive letter-ACC’ means he did not receive the letter), and with genitive case when the existence of the letter is not known/not presupposed (‘He did not receive letter-GEN’ means he did not receive any letter).[[24](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R24)] Related patterns exist in Finnish.[[25](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R25)]

Verb morphology

Some languages mark the information status of arguments with verbal morphology, in what is called an **Inverse system**. On transitive verbs, verbal inflections indicate which argument is ‘proximate’ (i.e., topical and/or given), and which is ‘obviative’ (less topical). This is similar to the function of the passive in English, in that the inverse verbal morphology indicates that Actor argument is less topical than the other argument. For example, in the language of the Mapuche people of Chile, ‘I’ and ‘you’ are assumed to be more topical than 3rd person arguments, so the sentence meaning *She saw me* is required to take the Inverse morphology, resulting in a sentence more like *I was seen by her*.[[26](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R26)] Inverse systems have also been reported for Algonquian, Cherokee, and other languages.[[27](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R27)]

Other focus markers

The effects of information structure are also evident in the use of focus particles such as *only* and *even*.[[28](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R28)] While some focus particles are separate words (e.g. English *only*, *too*, German *nur* ‘only’, *auch* ‘too’), they can also be clitics that attach to other constituents (e.g. Finnish –*kin* ‘too’, Japanese *-mo* ‘too’). The effect that these expressions have on the meaning of a sentence crucially depends on the information-structural properties of the sentence: Consider a sentence with *only*, such as *John only saw the dog.* If *saw* is the new information, then the sentence means that John only SAW the dog, but didn’t pet it or walk it. But if the dog is the new information, the sentence means that John only saw the DOG, and not anything else (see also the section on prosody, below).

Word order variation

The effects of information structure extend to variation in word order or constituent order. For example, a single event might be described in numerous ways, as shown in (2). (See [[31](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R31)] for more discussion of different constructions in English.)

* (2)

* + a

Active: *The cat swiped the dog on the nose.*

* + b

Passive: *The dog was swiped on the nose by the cat.*

* + c

Heavy-NP-shifted: *The cat swiped on the nose the dog that had frightened it.*

* + d

Topicalization: *The DOG the cat swiped on the nose, while the ferret got away.*

* + d

Prepositional Dative: *The cat gave a warning to the dog.*

* + e

Double object Dative: *The cat gave the dog a warning.*

* + f

Clefting: *It was the dog that the cat swiped on the nose*

It is widely argued that a function of word order variation is to mark information structure, following the broad generalization that given or more accessible information precedes new or less accessible information.[[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R1),[6](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R6),[29](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R29)]. A related effect is the tendency to put long and complex phrases later in the utterance, and relatively shorter ones earlier (ex. 2c).[[30](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R30)] These two patterns are not independent, because short phrases tend to refer to given and topical information. Nevertheless, there is evidence that phrase complexity and information structure have independent effects on word order.[[47](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R47)]

The examples in (2) come from English, which has relatively limited word order variation, and most of the variation comes from non-canonical word orders.[[31](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R31)] Many other languages – including Finnish, Japanese, Korean, German, Turkish, Mayan languages and West African languages – allow even freer variation of word order. Similar to English, word order reflects information packaging, generally following a given-new order. For example, in Finnish, subjects canonically precede objects, but objects can occur before subjects when they have already been mentioned in the preceding discourse (ex. 3)[[32](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R32)]. Word order can also be used to mark focus similar to clefts in English (e.g. Finnish OSV and SOV order, ex. 3(c)).

* (3)

* 1. What did Esa read?

|  |  |  |  |
| --- | --- | --- | --- |
| Esa | luki | kirjan | (Finnish: SVO) |
| Esa-NOM | read | book-ACC |  |
| ‘Esa read a book.’ | | | |

* 1. Who read the book?

|  |  |  |  |
| --- | --- | --- | --- |
| Kirjan | luki | Esa | (Finnish: OVS) |
| Book-ACC | luki | Esa-NOM |  |
| ‘Esa read the book.’ / ‘The book was read by Esa.’ | | | |



|  |  |  |  |
| --- | --- | --- | --- |
| Kirjan | Esa | luki | (Finnish: OSV) |
| Book-ACC | Esa-NOM | read |  |
| ‘It was the book that Esa read.’ | | | |

Prosody and Intonation

In languages like English, information structure is reflected in the prosody of speech. *Prosody* includes syllable stress and intonational phrasing, and the rhythmic structure of an utterance. A subpart of prosody, *intonation*, operates independently of rhythmic prosody, and marks the information or focus structure of a sentence. The intonational structure of an utterance determines which words receive *accents*, i.e. which words sound more acoustically prominent. Accents are commonly realized with pitch excursions, and greater duration and amplitude. Intonational accent makes the difference between the two otherwise identical sentences shown in (4), where capitals denote accented words.

* (4a)

She had a pet RAT.

* (4b)

She had a PET rat.

Accenting signifies information status categories such as focus, contrastiveness, and givenness/newness.[[33](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R33)] Focus refers to the marking of constituents in an utterance that constitute news, or contribute to the speaker’s conversational goals.[[34](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/#R34)] Example (4) shows how focus can differentially highlight information in an utterance. (4a) appropriately answers a question like “Did she have any pets?” while (4b) might occur after “Did she have any rats?” Focus need not refer to explicit questions.

Accents can also mark the contrastive element of a set of entities,[[35](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R35)] as in (5):

* (5a)

No, not the GREEN lizard, the BROWN one.

* (5b)

No, not the green LIZARD, the green SNAKE.

In 5a, the speaker refers to the brown lizard particularly as contrasted with the green, focusing on the color. In 5b, the accent instead marks the contrast between two comparable animals, focusing on the different reptiles. Focus and contrast often overlap, as in this example, where the accent reflects informational focus on one piece of contrastive information.

Finally, accent often marks the difference between given and new information, which tend to be deaccented and accented respectively, as in (6):

* (6)

We had a FERRET before we bought our CORGI. The ferret (GIVEN) was surprisingly friendly. Then we bought a CAT (NEW).

As with contrast, focus plays a core role in the relationship between accent and givenness/newness.[[36](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R36)]

There is substantial empirical evidence that speakers and listeners are sensitive to the functions of intonation. Speakers modulate prosody based on the information status of their words, using *acoustic reduction* (i.e. shorter, unaccented, and less intelligible pronunciations) for previously-mentioned words or entities,[[37](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R37)]. Similarly, listeners are faster to interpret references to given information if the word is unaccented.[[38](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4491328/" \l "R38)] However, the precise acoustics of accenting and deaccenting are not yet fully understood, and further research is needed to understand how speech reflects the linguistic categories of information status.