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Sentences and Systems

1 Introduction

A key topic in philosophy of language concerns the conditions of possibility of a natural language—that is, the features a natural language not only possesses but must possess if it is to be considered a natural language. Since Frege, scholars have agreed that the semantics of a natural language is necessarily compositional. The principle of compositionality states that the meaning of a sentence is a function of the meanings of the parts of that sentence. Here, the term “function” highlights the existence of an algorithm by means of which the meaning of the whole can be derived, based on the meanings of the parts and the rules of composition. It seems clear that the principle of compositionality is, at least to some extent, a valid principle. By way of example, consider the text you are now reading. In all probability, you have never previously encountered some of these combinations of words. Nevertheless, you understand these unfamiliar sentences perfectly. If every new sentence were a new meaning unit and not dependent on its parts—that is, if the principle of compositionality were not in force—it would be difficult to explain why such sentences present no problem of interpretation, as the meaning of each new sentence would require a specific learning as any new word does.

However, this is not the case, and the principle of compositionality explains why we can readily understand new sentences: given the meanings of the parts, we are able to construct the meaning of the whole. This is what you are doing while reading this text. Because you know the meanings of the constituent words, you can understand the meaning of these sentences, even though they are new to you. This explains why dictionaries contain lists of words rather than lists of sentences; if sentences were the smallest units of meaning and did not depend on the meanings of their parts, learning a language would involve learning the meanings of sentences rather than a lexicon and grammar. One might conclude, then, that the principle of compositionality implies an atomistic view of meaning—that in order to know the meaning of more complex linguistic units, it suffices to know the meanings of the simplest units. The aim of this essay is to show that this interpretation of the principle of compositionality is incorrect. Here, I contend that the atomistic view of meaning fails for at least two reasons.

- (1) Even if the principle of compositionality were valid without restriction, it would not follow that a sentence's meaning is the sum of the meanings that constitute it. Sentences have a syntactic structure that differs from their linear order, and that structure affects semantic interpretation. It follows that a sentence's meaning is not reducible to the sum of the meanings of its constituent words.
- (2) In any case, natural languages are not entirely compositional. The principle of compositionality is restricted by the fact that the correct understanding of sentences often depends on understanding the linguistic context.

2 Sentences Are Structured Entities

The first reason why sentences are not sums of words is that they are hierarchically structured entities.

2.1 Syntactic Structure

It has been demonstrated for a long time by very convincing arguments that the sentences used by speakers of a language have both a linear order, in which words follow each other,¹ and a further level of organization that may differ from this. This second level of organization is not linear but hierarchical, as the morphemes and words that form a sentence combine into increasingly larger, nested constituents. For instance, in the sentence “Two brothers of Paul will arrive soon”, we can first distinguish two large constituents: the noun phrase (NP) “two brothers of Paul” and the verb phrase (VP) “will arrive soon”. These phrases are formed in turn by smaller constituents—for instance, the NP “two brothers of Paul” can be segmented into a determiner (“two”) and another constituent (“brothers of Paul”). This latter constituent can be further segmented into a noun (“brothers”) and a prepositional phrase (“of Paul”), and so on. This structure is usually represented by means of a tree diagram, as in Fig. 1, where S stands for sentence, N for noun, V for verb, P for preposition, PP for prepositional phrase, and Adv for adverb. Such representations presuppose that languages are constituted by a finite number of discrete basic elements (phonemes, morphemes, words). This implies that their division into increasingly smaller constituents must end at a certain point—that is, there are elements that do not contain smaller elements. Additionally, representations of this kind presuppose that the rules that generate sentences are recursive—that is, that elements of a given kind can occur within elements of the same kind (For instance, the NP “Paul” occurs within the NP “two brothers of Paul”). Recursivity is a property of rules in which the rule can be applied to the result of applying the rule. This property explains

¹ For written texts, “follow” is intended in a spatial sense; for oral texts, it is intended in a temporal sense.

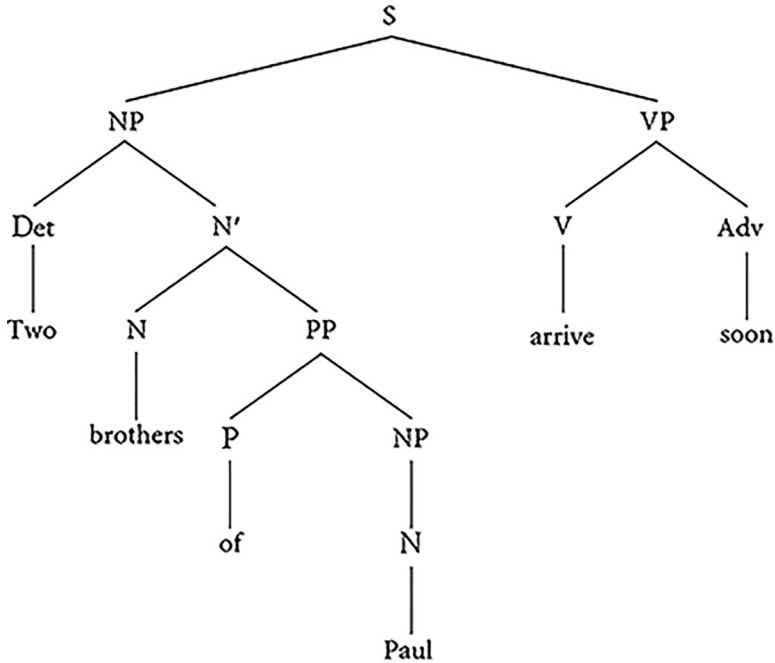


Fig. 1. Syntactic structure of the sentence “Two brothers of Paul will arrive soon”.

the productivity of natural languages. Although they have a finite number of basic elements and a finite number of combinatorial rules, a potentially infinite number of sentences can be generated. The production of this infinite set from a finite initial set can be explained only if the rules that generate larger constituents from smaller ones are recursive. Rules that enable the generation of sentences presuppose that words are assigned to different categories (noun, verb, preposition, adverb etc.), and that only some combinations of words from certain categories are allowed. For instance, one may combine an article with a noun but not with a verb (unless the verb is substantivized); while “the dog” is a grammatical phrase, “*the goes” is not. Permitted combinations of words from basic categories create larger constituents, which can be combined into still larger constituents, and so on—always on the basis of rules that permit only certain combinations. For instance, the rule governing how a noun phrase and a verb phrase form a sentence can be written as follows:

$$S \rightarrow NP + VP$$

The existence of such structures and rules shows that a sentence cannot be conceived simply as the sum of its constituent words. Beyond their superficial order, sentences have a syntactic structure that links the words into a whole. That structure is governed by rules that specify which relations among the parts

are permitted and which are not. This shows that sentences are systems. To account for how language works, it is not sufficient to list its constituent elements (phonemes, morphemes, words) and their meanings; as well as knowing the elements, we must also know how those elements can be structured into wholes.

2.2 Isomorphism Between Syntax and Semantics

Chomsky (1957) characterizes the syntactic structure of sentences as independent of the semantics associated with this structure. However, it is possible to interpret Chomskyan theory in a different way, in which there is instead a more or less perfect correspondence between syntactic and semantic structure. On this view, two words are syntactically connected because of their semantic connection—that is, the connection between their meanings. Syntactic structure would then describe the order in which these meanings must be composed. This isomorphism between syntactic and semantic structure implies at least two prerequisites. First, semantic categories must correspond to syntactic categories—that is, the same *kind* of meaning must correspond to every string belonging to a particular syntactic category. On the other hand, certain semantic operations must correspond to syntactic operations. For example, a given composition of the meanings of V and NP must correspond to the syntactic operation V+NP. Taking account of this semantic-syntactic structure of natural languages, Partee et al. (1990) rephrased the principle of compositionality as follows: the meaning of a complex expression is a function of its constituents and the grammatical rules used to combine them.

3 Limits of the Principle of Compositionality

While formal and logical languages are usually entirely compositional, natural languages are not. In this section, I address some limitations of the principle of compositionality in natural languages, analyzing some phenomena in which the whole conversely determines the meanings of the parts.

3.1 Idioms

Certain natural language expressions, which grammarians refer to as *idioms*, do not abide by the principle of compositionality, and their meaning must be specifically learned. Such expressions may be groups of words or entire sentences—for example, “It’s raining cats and dogs”, “kicked the bucket” or “red herring”. Their meaning is not compositional—that is, the meanings of the parts (and the rules of composition) do not suffice to explain the meaning of the whole.

3.2 Ambiguity and Polysemy

While idioms are of some relevance, languages are not for the most part idiomatic. However, there are other more pervasive phenomena that limit the principle of

compositionality. These phenomena include ambiguity and polysemy. Many words have more than one meaning, and the precise sense in which such words are used is determined by the context, as in the following examples.

- a. You parked across the street? That's *fine*.
- b. If you park there, you'll get a *fine*.

The English word “fine” has more than one meaning, and when used in a particular occasion, it expresses only one of these meanings. In most cases, someone who hears or reads a sentence containing an ambiguous word can readily discern the intended meaning from the linguistic context. In this case, it is the context (the whole) that determines the meaning of the word (the part) rather than *vice versa*. Given that ambiguity and polysemy are widespread phenomena, this represents one important limitation to the principle of compositionality.

3.3 Anaphoric Pronouns

Another pervasive phenomenon concerns the referents of anaphoric pronouns, which are again determined by the immediate context, as in “Ann said to Paul that *he* had to join *her* immediately”. Anaphoric pronouns such as “he” or “her” have no reference outside the context in which they are used. They acquire a referent only from the linguistic context (the words that precede and follow). The proper names “Ann” and “Paul” appear in the linguistic context, serving as referents for the personal pronouns. Thus, the anaphoric pronoun is an example of the whole determining the meaning of a part. Indeed, it is the anaphoric pronoun's presence in one sentence rather than another that provides a certain referent for the pronoun itself. If we change the context, the referent is also changed. In this case, the assignment of the meaning proceeds *top-down* (rather than *bottom-up*).

3.4 Semantic Indeterminacy

Although the phenomenon of semantic indeterminacy bears some resemblance to ambiguity and polysemy, these concepts must be carefully distinguished. As described above, an ambiguous or polysemous word has more than one meaning, and context determines the intended meaning on a given occasion. In the case of semantic indeterminacy, however, there is only one indeterminate meaning, which is determined by the context of use. The following examples (cf. Searle 1980) serve to illustrate this point. Ann *cuts* the lawn. John *cuts* the cake. We know that the operation of cutting a lawn is very different from cutting a cake; while the blades of grass are severed using a sickle or a lawnmower, a cake is cut into slices by a knife. It would be surprising if, to cut the lawn, Ann took a knife and performed very long incisions or took a scissors and cut the blades of grass one by one vertically. Similarly, it would be surprising if, to cut the cake, John

used a lawnmower. Clearly, the meaning of the verb “to cut” is specified by the context. In general, it means “to divide something by means of a sharp tool”. However, the ways in which the object is divided, the kind of tool used and how it is used are determined by the context and specifically by the object that is cut. For every object, our encyclopedic knowledge suggests the tool to be used to cut it and the ways in which it must be cut, lending the sentence a more determinate meaning. In such cases, the context specifies a meaning that the word would not have in another context. Semantic indeterminacy is a widespread phenomenon, as for instance in these predications of color noted by Recanati (2004):

red car

red grapefruit

red book.

A car can be judged to be red when most parts of its body are red, even though other parts such as wheels, mechanical parts, underside and interior may not be red. For a grapefruit to be described as red, it must be red internally, although its peel may be another color. A book with a red cover may be described as red, although its pages may be another color. In short, the parts of an object that must be red to predicate its redness depend on the object itself and on our encyclopedic knowledge.

3.5 Exophoric Pronouns

As a final example, consider the nature of exophoric pronouns, which refer to objects in the extra-linguistic context. Suppose that Ann and John are dining at a nice restaurant on the sea. The night is beautiful, and the temperature is perfect. They have just been served and have begun to eat. John says:

It's tasty, isn't it?

Clearly, John is referring to the food that has just been served. Suppose, however, that, he had uttered a different sentence:

It's beautiful, isn't it?

It seems likely that John is referring to the restaurant where they are eating or, more generally, to the experience they are sharing. As the situation in which the two sentences are uttered is the same, the difference in the referent of the pronoun “it” must be determined by the predicate of the two sentences. As the predicate “tasty” is usually applied to food, it is plausible to believe that John wishes to refer to the more salient food in that moment: the dish they are tasting. On the other hand, the predicate “beautiful” is usually applied to things that are delightful to look at or, more generally, to pleasant experiences, but not to the flavor of food. The beauty of the restaurant and the setting make reference to the place or the

circumstance more probable. Therefore, the predicate can help in determining the referent of the exophoric pronouns.

While it is apparent that an *anaphoric* pronoun acquires its referent from the context, this is far less obvious in the case of *exophoric* pronouns, which usually refer to salient objects in the utterance context. In some cases, however, there are several candidate referents, and the extra-linguistic context will not suffice. In these cases, the predicate of the sentence can assist identification. Because many predicates are applicable only to certain categories of objects, the predicate is likely to provide information about the category to which the referent belongs while excluding other possible candidates. Moreover, as participants in conversation are led to presuppose that their interlocutors speak truly, they are also assumed to predicate true things of the objects to which they refer.² If something predicated of a candidate referent of an exophoric pronoun is clearly false (although of the right category), it will probably be discarded, and an alternative candidate will be considered. In John's sentence "It's beautiful, isn't it?", the fact that the restaurant and the panorama are pleasing renders these plausible referents of the pronoun "it". I conclude that the predicate can play an important role in selecting the referent of an exophoric pronoun because candidates that are from the wrong category or falsely predicated are commonly ruled out. This is another case in which the linguistic context is crucial for the determination of the meaning of a word. Again, the whole determines the meaning of the part rather than the other way around.

4 Conclusion

This paper defends two opposite theses. First, the centrality of the principle of compositionality has been asserted, as without the bottom-up processes of compositionality, we could not utter new sentences and hope to be understood.

On the other hand, radical versions of the principle of compositionality cannot be accepted, and some aspects of natural language can be understood only if the context determines the meanings of the elements in a typically top-down process. At this juncture, a question naturally arises: are these two theses contradictory? While in-depth analysis of this problem is beyond the scope of this essay, we can suggest that there is at least one way of interpreting these theses as non-contradictory. To do so, we must understand the relation between words and context as a virtuous circle. It is because a word, literally and conventionally, has a certain meaning that a certain context is selected—that is, that a certain encyclopedic knowledge is mobilized and the recipient's attention is directed to a certain portion of the world. On the other hand, it is the context so activated that permits

² Grice (1989) emphasizes that participants presuppose that their interlocutors say true and pertinent things.

the meaning of a word to be determined. The mobilized encyclopedic knowledge and the fact that the meaning of a word must be composed with the meaning of another word triggers the process of determination of the two words' meanings. If it is true that, in a sentence, the whole depends on its parts and the parts on the whole, then the sentence is a system that we cannot dissect into its separate parts without losing something essential.

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