

Chapter I-6 Composing sentence meanings – first steps

Contrariwise, if it was so, it might be; and if it were so, it would be; but as it isn't, it ain't. That's logic.
(Lewis Carroll¹)

The chapter proposes a first rule of semantic composition: the combination of a referential NP with a predicate. In order to be able to state the rule, we decide what the meaning of a referential NP is and what the meaning of a predicate is.

1. Sentence meanings - some distinctions and a first composition rule

In the preceding chapter we have decided that the meaning of a sentence is the set of all possible situations that would make the sentence true. For a given sentence α , we write $[[\alpha]]$ for $\{s: s \text{ is a possible situation in which } \alpha \text{ would be true}\}$. Putting it slightly differently: If we know the meaning of a sentence and if we're then confronted with a particular situation, we know whether the sentence is true or false in that situation. Let's write $[[\alpha]]^s$ for the meaning of a sentence in a particular situation. According to what we have just stated, this must be either *true* or *false* – a truth value. For true and false, we will write 1 and 0, as is standard practice in semantic theory and logic.

Wait: it seems we have called both $[[\alpha]]$ and $[[\alpha]]^s$ meanings of α . Is this a problem? No, this is a distinction that linguists and logicians have been making for a long time – the first is called the **intension** and the second the **extension** of α . The intension of α is the 'real' meaning of α (the linguistic knowledge that native speakers have), the extension is α 's meaning relative to a given situation. If for every possible situation s we know $[[\alpha]]^s$, then we also know $[[\alpha]]$. And conversely, if we know $[[\alpha]]$, then we can determine $[[\alpha]]^s$ for any s . So intension and extension are two interdefinable notions of

¹ Read more at http://www.brainyquote.com/quotes/authors/l/lewis_carroll.html.

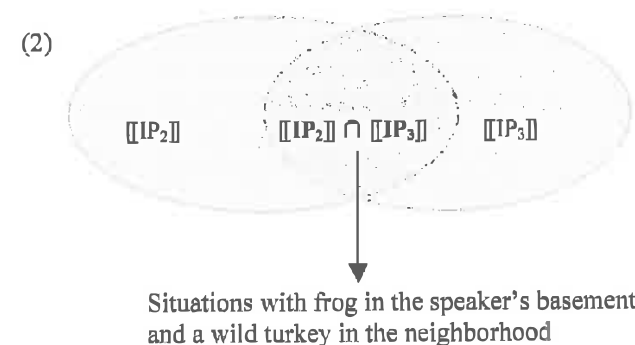
meaning. We will mostly look at extensions, i.e. the meanings that linguistic expressions have in particular situations.

As a first illustration of the idea behind compositionality, we take a look at coordination. Let us specify the intension of (1) (a conjunction) on the basis of the meanings of the simpler sentences it contains.

- (1) $[[IP_1 \quad [IP_2 \textit{ There is a frog in my basement}] \textit{ and} \quad IP_3 \textit{ there is a wild turkey in the neighborhood}]]$.

$[[[IP_2 \textit{ there is a frog in my basement}]]]$
= $\{s: s \text{ is a frog is in the speaker's basement in } s\}$
 $[[[IP_3 \textit{ there is a wild turkey in the neighborhood}]]]$
= $\{s: s \text{ a wild turkey is in the speaker's neighborhood in } s\}$

For the meaning of (1), we will want to consider situations which include both a frog in the speaker's basement and a wild turkey in the neighborhood. That is the set of situations which is the intersection of the meanings of the two conjuncts. This can be illustrated with the following Venn diagram:



We can formulate a first rule of composition for the case of conjoined sentences:

$$\text{If } Z = [X1 \textit{ and } X2] \text{ then } [[Z]] = [[X1]] \cap [[X2]]$$

This gives us a first idea regarding the composition of sentence meanings. The meanings of the sentence parts (the two smaller IPs) contribute to the meaning of the whole in a systematic way (namely via intersection).

Rules like the one for conjunction model native speakers' subconscious knowledge of how the combination of the meanings of the individual words and phrases proceeds. Recall the goal of compositional semantics: we want to be able to derive the meanings of all possible English sentences in this manner. This entails that we also need to know the meanings of the parts of the sentence (for example *a frog* and *in the basement*) and the ways in which they are combined (for example to derive the meaning of *there is a frog in my basement* compositionally). We turn to this enterprise in the next section.

⊕ **Exercise. Disjunction** (*or*) and **negation** (*not, it is not the case that, no way, ...*) also systematically operate on sentence meanings. Write composition rules parallel to the one for conjunction in the text. Illustrate how they apply to (E1) and (E2). Explain this in your own words, and subsequently draw corresponding Venn diagrams. (As an aside: can you identify two different uses of *or* in English?)

(E1) *There is a frog in my basement or there is a wild turkey in the neighborhood.*

(E2) *It is not the case that there is a wild turkey in the neighborhood.* □

2. Meanings of parts of sentences: first steps

We have, with the previous sections, subscribed to what people call a referential theory of meaning: meanings are things. In the case of sentences, we can view sentence meanings either as truth values (the extension of a sentence) or as sets - sets of possible situations (the intension of a sentence). Meanings are out there in the world. Meaning relates language to the things talked about. Noun phrases give a simple example of what we mean by that, and we turn to their semantics next. This is followed by a semantics for predicates and a rule that compositionally combines NP meanings with predicates to yield sentence meanings.

2.1. Referential NPs

Many NPs (though not all; see Chapter I-8 for NPs with a different semantics) can be used to **refer**, i.e. stand for an individual in the world. Let us give some examples of referential NPs. Proper names constitute a prime example of referring expressions:

- (1)
- a. *Sir Edmund Hilary*
 - b. *Mount Everest*
 - c. *Barbara Partee*
 - d. *Edinburgh*
 - e. *Barack Obama*

“Individuals” is the standard term used in semantics for entities such as the ones above. Notice that the term is not restricted to persons, or even animate objects. *Mount Everest* and *Edinburgh* are names of places. The term “individual” simply stands for any kind of entity, including mountains, particular objects in the world, etc.

Definite descriptions are also referential NPs. Below are some examples:

- (2)
- a. *the highest mountain in the world*
 - b. *the tallest student in this course*
 - c. *the author of “North and South”*
 - d. *the president of the US*
 - e. *the printer in my office*

Definites have more internal structure – a topic to which we return in Chapter I-8. But as far as their overall semantic contribution goes, definite descriptions also denote individuals. So do demonstrative NPs and pronouns:

- (3)
- a. *this pen*
 - b. *those papers*
- (4)
- a. *she*
 - b. *we*

Demonstrative NPs are traditionally called deictics: you can point to the object they refer to. Pronouns can have deictic uses, too. If you imagine

such a use in (4a), for example, it is intuitively very clear that the meaning of the pronoun is an individual. We'll come back to the analysis of pronouns in Chapter II-7; but for current purposes, we note that reference to individuals can also be made with demonstrative NPs and pronouns.

Let us make our suggestion regarding the meaning of referential NPs precise: the meaning of the name *Sir Edmund Hilary* is the person Sir Edmund Hilary. This is stated in (5). Note that the expression from the language under investigation (English) is written in italics (as it has been throughout the book). We call this the **object language**. The English words show up inside the meaning brackets '[...]' because this is what we interpret. Note that the expression outside the meaning brackets to the right of the '=' sign is not an expression of the object language. It is an expression of the language that we (the authors) use to talk to you (the readers). This is called the **metalinguage** – the language we communicate in. This happens to be English as well. In order to keep the two apart, the object language is always in italics and the metalinguage never is.

- (5) $[[\textit{Sir Edmund Hilary}]]^s = \text{Sir Edmund Hilary}$ (for any situation s)

The referent of a proper name will always be the same individual – it does not depend on the situation. But this is not always the case with referential NPs. Clearly, the referent of *the president of the US* varies from one situation to another. If you pick a situation in 1998, for example, the referent of the same NP is Bill Clinton. Similarly in (7), and most of our other examples, the extension of an expression will vary from one situation to another.

- (6) $[[\textit{the president of the US}]]^s = \text{Barack Obama}$ (if s is our world in 2014)
- (7) $[[\textit{the highest mountain in the world}]]^s = \text{Mount Everest}$ (if s is here and now)

When nothing else is explicitly said, we will generally assume that the situation s relative to which we determine the extension of an expression (i.e. the superscript in the notation $[[...]]^s$) is the actual situation. That is, roughly speaking, the “here and now”.

To sum up, we say that an NP refers to an entity if the extension of the NP is that entity. For example $[[\textit{New York}]]^s$ is the actual city on the East

coast of the US; $[[\textit{the highest mountain on Earth}]]^s$ refers to Mount Everest, and so on.

2.2. Predicates

Remember: we are trying to construct the meaning of an entire sentence from its syntactic parts. Suppose we have a sentence like (8):

- (8) *Mount Everest is covered in snow and ice.*

The meaning of (8) can be rendered as in (9):

- (9) a. $[[\text{(8)}]] = \{s: \text{Mount Everest is covered in snow and ice in } s\}$
 b. $[[\text{(8)}]]^s = 1$ (i.e. the sentence is true in the here and now; it could be false e.g. in a different situation with extreme global warming)

What do we have to assume about $[[\textit{is covered in snow and ice}]]^s$ to derive (9) from its components?

The sequence *is covered in snow and ice* denotes a **predicate** or a property. An individual either has or does not have that property. We identify properties (their extensions) with sets: *is covered in snow and ice* denotes the set of all those individuals that are covered in snow and ice. The meaning of the predicate will look as follows:

- (10) $[[\textit{is covered in snow and ice}]]^s = \{x: x \text{ is covered in snow and ice in } s\} = \{\text{Mount Everest, Mount Cook, Mont Blanc, Anapurna, Antarctica ...}\}$

Now, the sentence (8) is true if and only if the denotation of the subject NP is a member of the set denoted by the predicate. The predicate is rest of the clause, I' in our syntactic analysis. We can state the truth conditions as follows:

- (11) $[[\textit{Mount Everest is covered in snow and ice}]]^s = 1$ iff
 $[[\textit{Mount Everest}]]^s \in [[\textit{is covered in snow and ice}]]^s$ iff
 $\text{Mount Everest} \in \{x: x \text{ is covered in snow and ice in } s\}$

We will be more explicit about how the grammar derives (11) in a moment. First, here are a few other examples of predicates:

- (12) a. *is a student*
 $[[is\ a\ student]]^s = \{x: x\ \text{is a student in } s\}$
 b. *loves Mary*
 $[[loves\ Mary]]^s = \{x: x\ \text{loves Mary in } s\}$
 c. *is French*
 d. *is present*
 e. *paints watercolors*

Such properties can be used to form sentences together with individual-denoting NPs:

- (13) a. *Judith is a student.*
 b. *She loves Mary.*
 c. *The dark-haired male student in my class is French.*
 d. *The tallest student in this class is present.*
 e. *Lindsey paints watercolors.*

We observe that the pattern of combining the subject NP with the predicate is quite general. For the sentence to be true, the individual denoted by the subject must be a member of the set denoted by the predicate. We have thus arrived at our first composition rule. We call the rule the Subject-Predicate Rule and it is stated below. We first state the actual rule in formally correct terms. Underneath, we describe what it says informally.

Subject-Predicate Rule (SUBJPRED)

If $X = [{}_{IP}\ NP\ I']$, then for any s : $[[X]]^s = 1$ iff $[[NP]]^s \in [[I']]^s$

For a sentence X consisting of NP and I' , the meaning of X in any situation s is the truth value 'true' iff the meaning of the NP in s is a member of the meaning of the I' in s .

☞ **Exercise.** Calculate the truth conditions of (13d). Determine the extensions of NP and predicate as well as the sentence's truth value for the situation you are in. □

This is progress: we have made a specific proposal for how the truth conditions of a sentence IP depend on the meaning of the subject and the predicate. But it is only a first step. In our examples above, we have just assumed that we know the interpretations of NP and I' . However, those interpretations really have to be determined compositionally, too. We have to calculate them from the subparts they contain (ultimately from the lexicon upwards according to syntactic structure). So, more rules of composition will be required.

We have set our research agenda for the chapters to come. But we have also achieved something else: We know a bit more about meanings. Meanings can be individuals, as in the case of referential NPs, but also more abstract entities like sets. Let's keep that in mind, and proceed with our research program.

☞ **Exercise.** Some of the predicates we have seen contain the copula, i.e. the verb *be*. You should have a clear idea from the previous chapters how *be* behaves syntactically in English. But we do not yet know what its semantic contribution is. Try to establish a preliminary answer by making use of a small, crosslinguistic investigation. If you have access to a language such as **Russian**, **Hungarian**, or **African-American English**, make a list of examples which correspond to simple Standard English sentences and contain the copula (e.g. 'That tree *is* very tall.'). What do you observe? Focus solely on the present tense (in order not to get involved with issues of tense). Taking your findings into account, suggest a simple hypothesis regarding the contribution of the copula in such examples. □

☞ **THE BASICS BOX: *Composing sentence meanings***

- ✓ Referential NPs denote individuals.
- ✓ Predicates denote sets of individuals.
- ✓ A sentence consisting of a referential NP subject and a predicate is true iff the individual denoted by the NP is a member of the set denoted by the predicate.

3. Selected references

The division between two types of semantic meaning (for which we have used ‘extension’ and ‘intension’) has a long tradition in logic with repercussions both in philosophy and linguistics. The classical reading is Frege’s (1892) *Über Sinn und Bedeutung* (‘sense’ and ‘reference’ in the English translation; cf. also Russell 1905, Carnap 1947, and Lewis 1970 for foundational literature as well as Szabó 2013 and Zimmermann and Sternefeld 2013 for interesting recent discussion, the latter in a more accessible format for the beginner level). The recent *Handbook of Semantics* (Maienborn, von Stechow and Portner 2011) contains an article specifically concerned with Frege’s notions of sense and reference. Discussion of proper names as rigid designators can be found in Montague (1970) and Lewis (1986).

We use situations in this book informally in the place of a proper intensional semantics with both times and worlds. (Von Stechow & Heim 2011 is a good introduction to intensional semantics, with references to the classical work in this area.) We stay with an intuitive understanding of situations. But our use of them should be compatible with Kratzer (1989). See also Kratzer (2011) for how situations may feed into standard intensional semantic theories.

The semantics for conjunction (and also disjunction and negation) is intended to be the classical one, which can be found in any standard introduction to logic. See, e.g., Partee et al. (1990).

There is a large body of literature on referential noun phrases. A good starting point might be the section on NP semantics in the recent *Handbook of Semantics* (2011, ed. Maienborn et al.). Heim’s (1991) “Artikel und Definitheit” is a great discussion of the semantics of definites, with many classical references (cf. also Heim 2011’s overview). Demonstratives are analyzed in particular in Elbourne (2005). His analysis is extended to pronouns.

If you are interested in the realization of non-verbal predicates without the copula, e.g. in African American English and Hungarian, Green (2002) and É. Kiss (2002) are theoretically informed grammatical descriptions. Interesting information on Sir Edmund Hillary’s life and mountaineering accomplishments is available at the DOC visitor center and the Hermitage hotel in Mount Cook village, NZ.

Chapter I-7 Extending the theory

Compositionally I do not exclude the building across the road; [...]
(From an interview with Frank Gehry¹)

This chapter adds rules of interpretation to the semantics component which allow us to handle simple sentence structures compositionally, in keeping with the goal laid out at the end of the preceding chapter. In addition, we discuss the semantic topic of modification, and we add transitive verbs and other relation denoting categories to the picture.

1. Step by step composition – some trivial steps

We saw in the previous chapter how the meanings of subjects and predicates can be combined to derive the truth conditions of a sentence: the individual denoted by the subject NP needs to be a member of the set denoted by predicate, in order for the sentence to be true. This is a rule of composition in keeping with the Fregean program: the meaning of a complex expression, IP, is defined in terms of set membership on the basis of the meanings of its component parts, NP and I'. But the NP and the I' are themselves complex expressions. Their meanings need to be derived from the meanings of their component parts as well.

This section adds further rules of composition to the semantics component of the grammar. Those rules enable us to compositionally interpret simple sentences like (1) below. (1) is ‘simple’ in that what needs to be added to the subject-predicate rule is not very interesting semantically. Let us be precise about what we have to do in order to spell out a compositional semantics. For each constituent in (1b) that is not a lexical item, we require a rule that states how its meaning is determined from the meaning(s) of its daughter(s). The meanings of the words come from the lexicon – they are

¹ Retrieved via http://www.interviewmagazine.com/art/new-again-frank-gehry/#_.