Phrase Formation

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1 Where we are

In the previous weeks, we have encountered the following concepts:

1. Signs, words, and phrases
2. Parts of speech: *v, n, a, p, d, adv, c*
3. The contents of words: n-place semantic relations with n arguments
4. The syntactic valence of words: SUBJ, SPR, and COMPS lists with one or more descriptions of syntactic arguments
5. The linking between semantic and syntactic arguments (typically a 1-to-1 mapping)

Together, the principles above license words which all have the following structure:

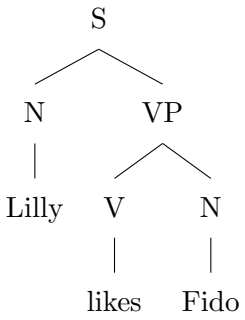
$$\begin{bmatrix} \textit{word} \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOC} \begin{bmatrix} \textit{loc} \\ \text{CAT} \begin{bmatrix} \textit{cat} \\ \text{HEAD} \quad \textit{pos} \\ \text{SUBJ} \quad \textit{list} \\ \text{SPR} \quad \textit{list} \\ \text{COMPS} \quad \textit{list} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Each such word has the following properties:

1. It belongs to one and only one of the 7 parts of speech.
2. The SUBJ list contains 0-1 elements.
3. The SPR list contains 0-1 elements.
4. The COMPS list contains 0-2 elements.

2 Phrases

Words combine with other signs to form phrases. Phrases typically have more than one part, or as we will call them, **constituents**. Phrases may differ from each other in what kinds and how many constituents they contain. The representation of the internal structure of a phrase is called its **phrase structure**. In order to visualize phrase structure, linguists typically use labeled tree diagrams. For instance, the sentence *Lilly likes Fido.* might be represented as the following phrase structure tree:



This tree visually encodes the following information:

1. The string of words *Lilly likes Fido* is an S (= sentence).
2. S has two immediate constituents:
   (a) *Lilly*, which is an N and
   (b) *likes Fido*, which is a VP (= verb phrase).
3. The VP also has two immediate constituents:
   (a) *likes*, which is a V and
   (b) *Fido*, which is an N.

On the basis of such tree diagrams, it is easy to define what it means for a string of words to be **grammatical**:

Definition

A string of words *String* is **a grammatical expression of category CAT** in language L if and only if the grammar of L licenses a phrase structure tree of the form:

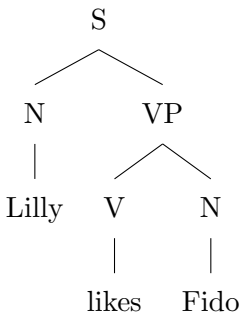
Based on this definition, the tree above encodes five grammaticality claims:

1. The string *Lilly* is a grammatical N.
2. The string *likes* is a grammatical V.
3. The string *Fido* is a grammatical N.
4. The string *likes Fido* is a grammatical VP.
5. The string *Lilly likes Fido* is a grammatical S.

3 Head-driven Phrase Licensing

The obvious question to ask at this point is: **how does a grammar license trees for some strings but not for others?**

Looking at our tree again, an answer suggests itself:



At the bottom of any tree, we find words, in this case, the three words *Lilly, likes,* and *Fido*. But we know already that all words are structures like the following:

$$\begin{bmatrix} \textit{word} \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOC} \begin{bmatrix} \textit{loc} \\ \text{CAT} \begin{bmatrix} \textit{cat} \\ \text{HEAD} \quad \textit{pos} \\ \text{SUBJ} \quad \textit{list} \\ \text{SPR} \quad \textit{list} \\ \text{COMPS} \quad \textit{list} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Recall that *pos* stands for the word's part of speech and that SUBJ, SPR, and COMPS stand for the lists of signs this word can or must combine with.

So, here is the question from above again and its answer:

Question: How does the grammar license trees for some strings but not for others?

Answer: Trees are licensed by the information in words, in particular, their part of speech and valence properties!

3.1 The Categories of the Tree Nodes

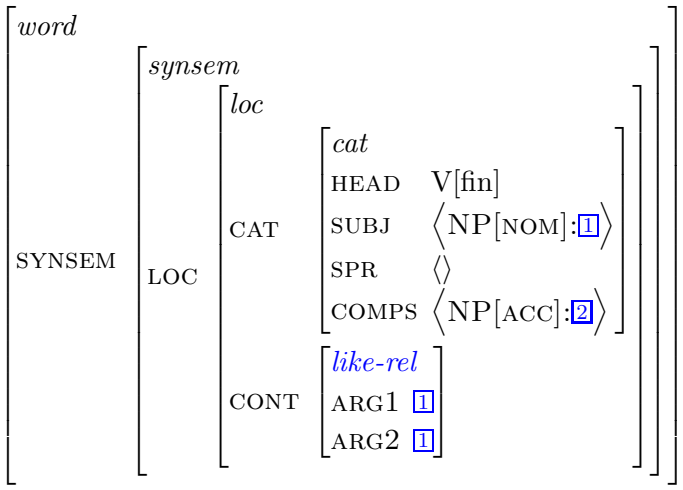
Each of the nodes of our tree is labeled with one and only one category (= part of speech). Where do these categories come from?

For the word nodes, the answer is simple: the label for the word nodes represents the part of speech of the word that makes up the node. And each word specifies its part of speech in its lexical entry under the feature path: SYNSEM:LOC:CAT:HEAD.

But how do phrasal nodes get their category label? Once we understand why phrases are formed in the first place, then the answer to this question will also be straightforward.

3.1.1 Why are Phrases Formed?

Let us look at a typical word, the word *likes* and what information it contains:



The word *likes* expresses a liking relationship (*like-rel*) between a liker (1) and a liked one (2). In order for such a relation to be expressed, all three pieces of the *like-rel* need to be realized syntactically. The lexical entry of the verb contains a "building plan" for the syntactic expression of the three pieces making up such a complete state of affairs of liking, as follows:

1. the liking-relation *like-rel* is expressed by the verb itself.
2. The liker 1 is expressed by the verb's SUBJ and the liked 2 by the verb's single COMP.

So here is the question again that we are currently considering and its answer:

Question: Why are Phrases Formed?

Answer: Phrases are formed from a word and its syntactic valents, in order for the semantic arguments of the word to be syntactically realized!

In the case of the verb *likes*, the verb itself expresses *like-rel*, but leaves the semantic arguments 1 and 2 to be expressed by its syntactic arguments NP[nom] and NP[acc], which are realized as the verb's subject and complement, respectively. By forming a VP with the NP[acc] and then an S with the NP[nom], all three pieces of the verb's content are expressed and as a result we get a sentence with the meaning that Lilly likes Fido.

3.1.2 The Head Feature Principle

So, words form phrases in order to combine with the syntactic valents which express the word's semantic arguments. When such a phrase is formed, we call the constituent that selects the valent(s) **the head daughter** of the phrase and the expressed valents **the non-head daughter(s)** of the phrase.
Clearly, the head daughter of a phrase is its most important daughter, since the non-head daughters are only present because the head selects them as its arguments. In order to represent the special status of the head daughter, it has the privilege to determine the category of the new phrase, according to the following important principle of modern syntactic theory:

The Head Feature Principle

The categories of a phrase and its head daughter (i.e. the value of the feature path SYNSEM:LOC:CAT:HEAD) are the same.

For example, the HEAD value of a phrase whose head daughter has HEAD value v is v as well, and the same relationship holds for phrases whose head daughters belong to one of the other 6 parts of speech!

4 What Kinds of Phrases are there?

The reason for phrases being formed is that syntactically incomplete expressions must combine with the valents they select. It is not surprising, therefore, that for each kind of valent, there is a kind of phrase that combines a head daughter and this kind of valent:

1. When a word combines with its COMP(S), then the result is a **Head-Complement Phrase** (*hd-comp-ph*).
2. When a sign combines with its SPR, then the result is a **Head-Specifier Phrase** (*hd-spr-ph*).
3. When a sign combines with its SUBJ, then the result is a **Head-Subject Phrase** (*hd-subj-ph*).

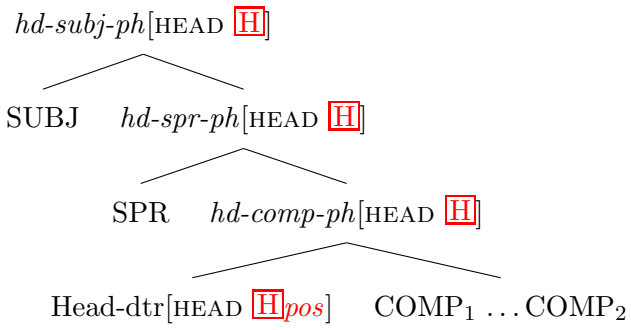
Let us compare the order of phrase formation in the list above with the top-to-bottom order of the three valence lists in a sign:

$$\begin{bmatrix} \textit{sign} \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOC} \begin{bmatrix} \textit{loc} \\ \text{CAT} \begin{bmatrix} \textit{cat} \\ \text{HEAD} \ \textit{pos} \\ \text{SUBJ} \ \textit{list} \\ \text{SPR} \ \textit{list} \\ \text{COMPS} \ \textit{list} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The order suggests the following procedure for phrase formation:

1. If the sign has one or more COMPS valents, then combine it with its COMPS to form a *hd-comp-ph*.
2. If the sign is COMPS ⟨⟩ but has a SPR valent, then combine it with its SPR to form a *hd-spr-ph*.
3. If the sign is COMPS ⟨⟩ and SPR ⟨⟩ but has a SUBJ valent, then combine it with its SUBJ to form a *hd-subj-ph*.

Based on this procedure, a word that has one COMP, one SPR, and one SUBJ will project a phrase structure like the following:



By the Head Feature Principle, the head daughter and the three phrases all have one and the same part of speech.

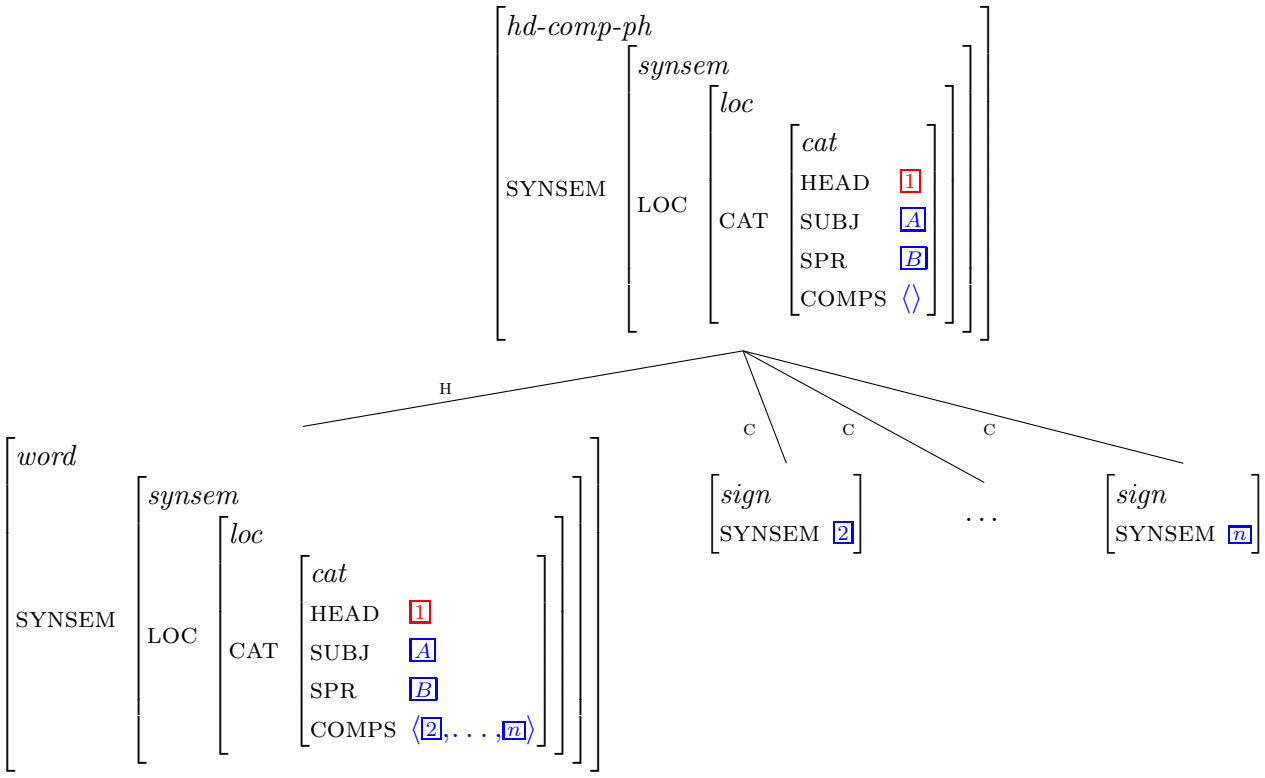
On the following three pages of the handout, each of the three phrase types is defined precisely and examples of strings are given that the grammar licenses as belonging to this phrase type.

4.1 Exercise

Type each of the examples for a given phrase type on the following pages into our online grammar and convince yourself that each phrase is licensed by the grammar as the phrase type under which it is listed. Study the phrase structure of each phrase carefully!

Important: click on the XP-label of a tree node in order to see the phrase type of the feature structure in the top-left corner!

HEAD-COMPLEMENT PHRASE



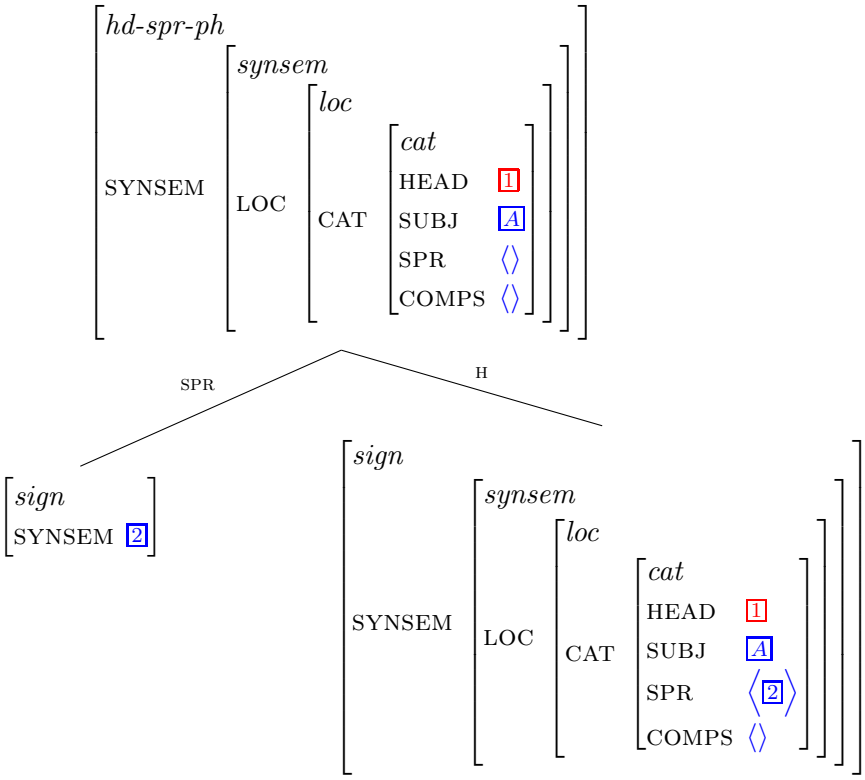
Conditions:

1. The head daughter must be a word which is looking for 1-2 complements.
2. The head daughter can be of any part of speech.
3. Each complement can be a word or a phrase.

Examples:

1. [$_{\text{VP}}$ [$_{\text{H}}$ *likes*] [$_{\text{C}}$ *Fido*]] (verb with 1 complement)
2. [$_{\text{VP}}$ [$_{\text{H}}$ *gives*] [$_{\text{C}}$ *Fido* [$_{\text{C}}$ *a book*]]] (verb with 2 complements)
3. [$_{\text{AP}}$ [$_{\text{H}}$ *fond*] [$_{\text{C}}$ *of Fido*]] (adjective with 1 complement)
4. [$_{\text{PP}}$ [$_{\text{H}}$ *to*] [$_{\text{C}}$ *Fido*]] (preposition with 1 complement)

HEAD-SPECIFIER PHRASE



Our grammar only contains two kinds of specifier:

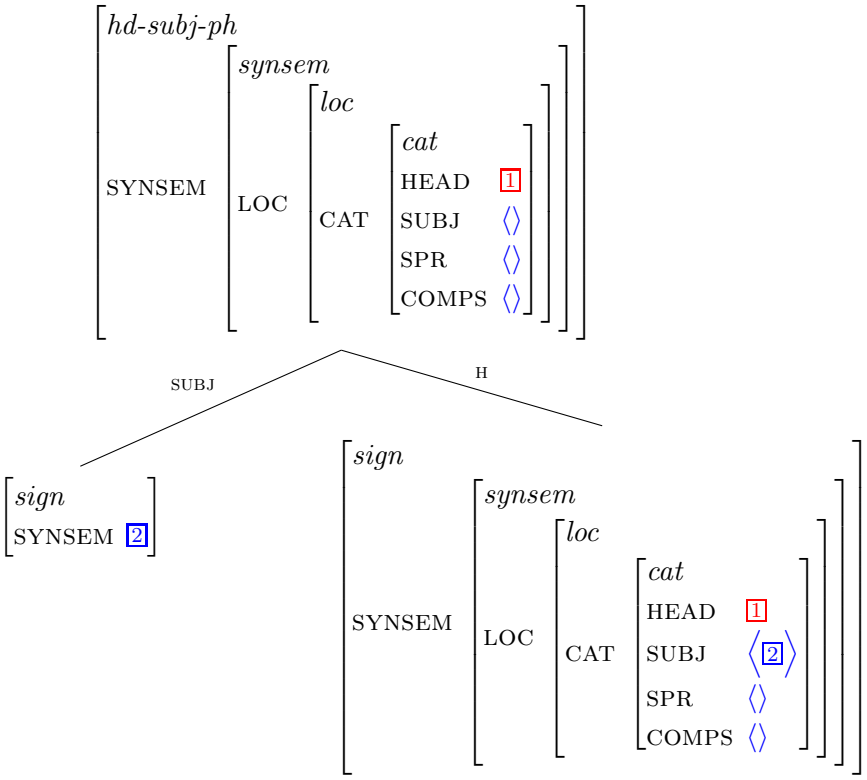
a. Determiners specify nominals (nouns or noun phrases) that need a specifier:

1. [NP [SPR *the*] [H *student*]]
2. [NP [SPR *the*] [H *cat*]]

b. Degree adverbs specify adjectives or adjective phrases that need a specifier:

1. [AP [SPR *very*] [H *big*]]
2. [AP [SPR *very*] [H *fond of Lilly*]]

HEAD-SUBJECT PHRASE



Conditions:

Both daughters may be words or phrases.

Examples:

1. [S [SUBJ *Lilly*] [H *danced*]].
2. [S [SUBJ *The cat*] [H *danced*]].
3. [S [SUBJ *Lilly*] [H *likes Fido*]].
4. [S [SUBJ *The cat*] [H *likes Fido*]].

5 Three Additional Constraints

Question: Why is there a difference in grammaticality between the following 3 sentences:

(1) a. Lilly dances.
b. She dances.
c. * Cat dances.

Exercise: Parse the words *Lilly, she,* and *cat* to see where they differ!

The answer is that *Lilly* and *she* are valence-complete, whereas *cat* is incomplete: it is still looking for a specifier.

This leads us to formulate the following constraint on valents:

The Valent Constraint

A valent must be valence-complete (or, as it is also called, *saturated*).

Formally:

$$\begin{bmatrix} \textit{sign} \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOC} \begin{bmatrix} \textit{loc} \\ \text{CAT} \begin{bmatrix} \textit{cat} \\ \text{SUBJ} \ \langle\rangle \\ \text{SPR} \ \langle\rangle \\ \text{COMPS} \ \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Given the concept *valence-complete*, we can also define what it means to be a *main clause*:

The Main Clause Constraint

A main clause must be a finite verb phrase which is valence-complete.

Formally:

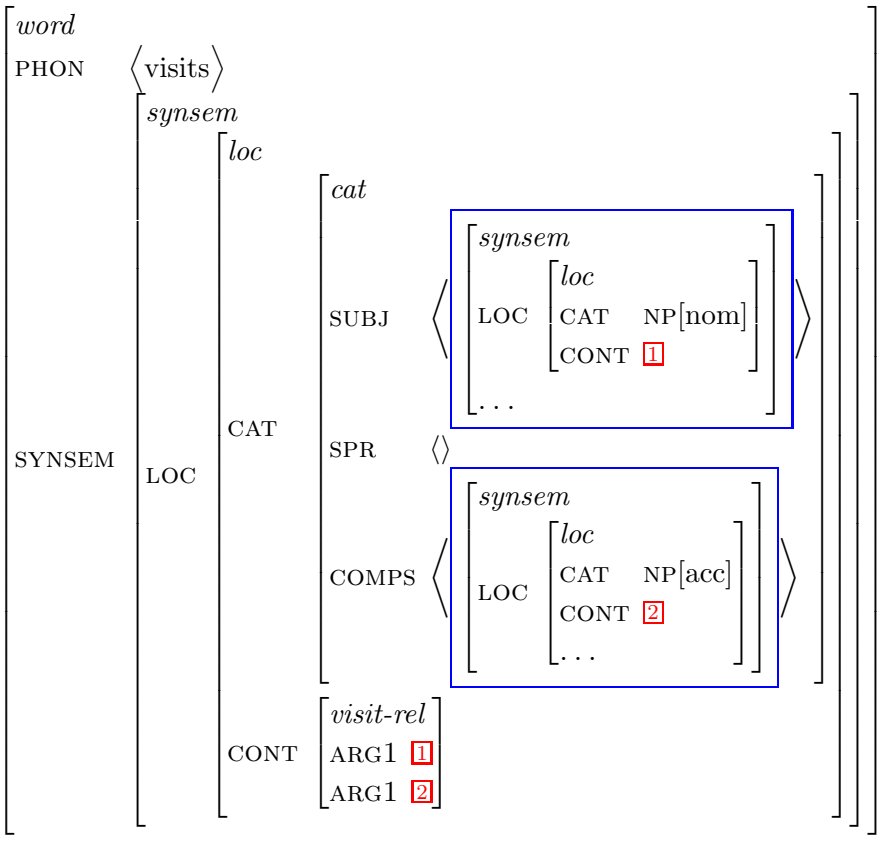
$$\begin{bmatrix} \textit{phrase} \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOC} \begin{bmatrix} \textit{loc} \\ \text{CAT} \begin{bmatrix} \textit{cat} \\ \text{HEAD} \begin{bmatrix} \textit{v} \\ \text{VFORM} \ \textit{fin} \end{bmatrix} \\ \text{SUBJ} \ \langle\rangle \\ \text{SPR} \ \langle\rangle \\ \text{COMPS} \ \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Third, given that a sign is a complex data structure, we must decide whether a head can select all the information in a dependent or just some of it.

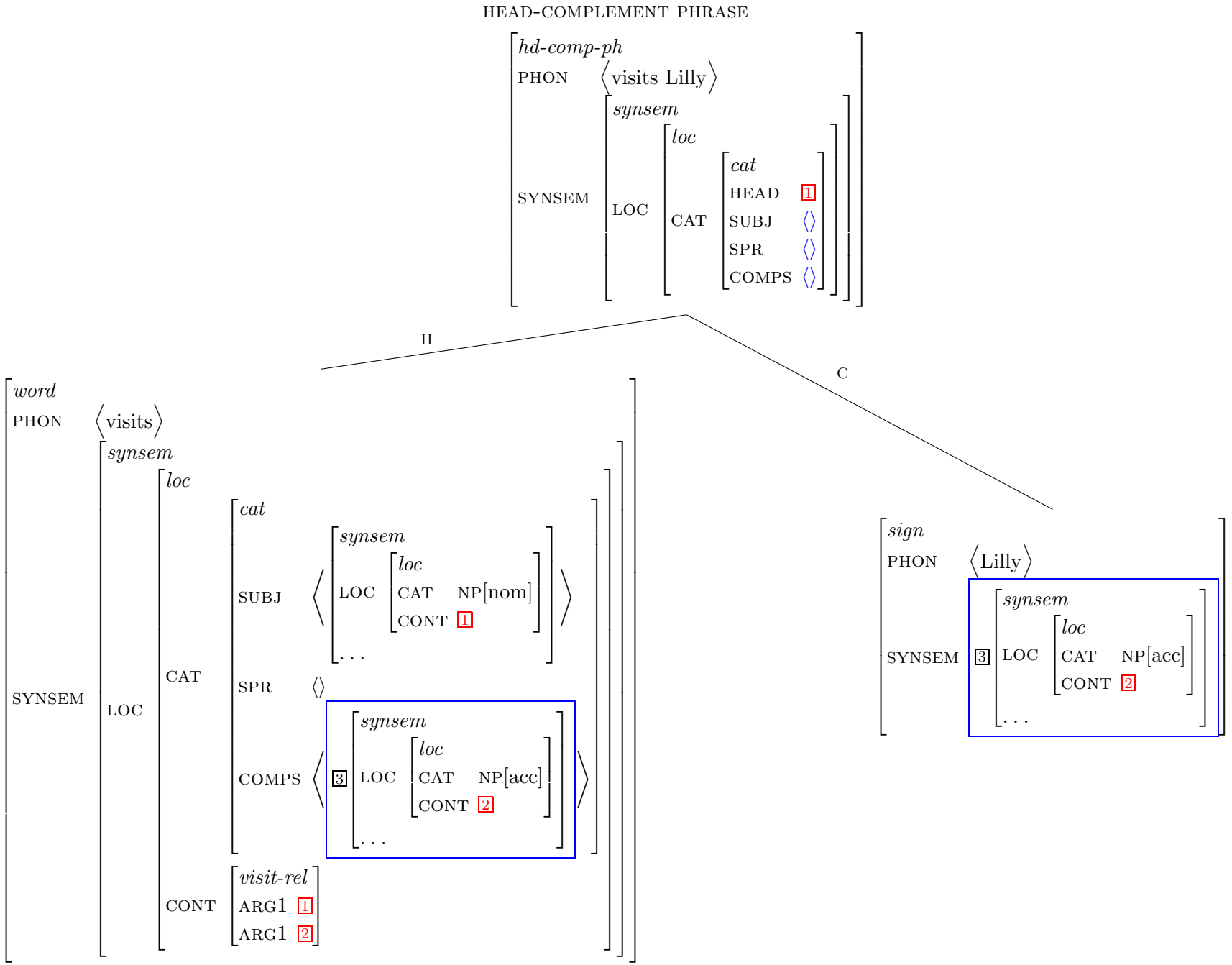
Here are some considerations that are relevant to the decision:

1. Clearly, the head must be able to select at least the CONT value of each valent, since (in the normal case) it selects the valent in order to express one of the head's semantic arguments.
2. At the other end of the scale: the head should not be able to select all of the information in the sign, since then it would also be able to select the valent's PHON value. But, verbs typically do not select their subject or complements on the basis of their phonological properties.

A reasonable compromise that satisfies both of the considerations above is for the head to select the *synsem* portion of its valents! This is illustrated in the following schematic word:



The word above can form a HEAD-COMPLEMENT PHRASE which looks as follows:


HEAD-COMPLEMENT PHRASE
hd-comp-ph
PHON ⟨visits Lilly⟩
SYNSEM synsem loc cat HEAD 1 SUBJ ⟨⟩ SPR ⟨⟩ COMPS ⟨⟩
H
C
word
PHON ⟨visits⟩
SYNSEM synsem loc cat SUBJ ⟨ synsem loc CAT NP[nom] CONT 1 ... ⟩ SPR ⟨⟩ COMPS ⟨ 3 synsem loc CAT NP[acc] CONT 2 ... ⟩ CONT visit-rel ARG1 1 ARG1 2
sign
PHON ⟨Lilly⟩
SYNSEM 3 synsem loc CAT NP[acc] CONT 2 ...