24 Solutions to the exercises

24.1 Introduction and basic terms

(1) a. [Karl]$_{VF}$ [isst]$_{LS}$.

b. [Der Mann]$_{VF}$ [liebt]$_{LS}$ [eine Frau]$_{MF}$, [den]$_{VF}$ [Peter]$_{MF}$ [kennt]$_{RS}$.
[[den Peter kennt]$_{NF}$]

c. [Der Mann]$_{VF}$ [liebt]$_{LS}$ [eine Frau, [die]$_{VF}$ [Peter]$_{MF}$ [kennt]$_{RS}$]$_{MF}$.

d. [Die Studenten]$_{VF}$ [haben]$_{LS}$ [behauptet]$_{RS}$, [[nur wegen der Hitze]$_{MF}$ [einzuschlafen]$_{RS}$]$_{NF}$.

e. [[Dass]$_{LS}$ [Peter]$_{MF}$ [nicht kommt]$_{RS}$]$_{VF}$, [ärgert]$_{LS}$ [Klaus]$_{MF}$.

f. [Einen Mann]$_{MF}$ [küssen]$_{RS}$, [[der]$_{VF}$ [ihr nicht]$_{MF}$ [gefällt]$_{RS}$]$_{NF}$, [würde]$_{LS}$ [sie]$_{MF}$ [nie]$_{MF}$.
[[Einen Mann küssen, der ihr nicht gefällt]$_{VF}$]

On (1c): theoretically, this could also be a case of extraposition of the relative clause to the postfield. Since *eine Frau, die Peter kennt* is a constituent, however, it is assumed that no reordering of the relative clause has taken place. Instead, we have a simpler structure with *eine Frau, die Peter kennt* as a complete NP in the middle field.

24.2 Phrase structure grammars

1. For any grammar, it is possible to assume additional symbols and rules that create unnecessary structure or are simply never used because there are no words or

phrases that could be used on the right-hand side of the rule. If we were to add the following rule to our grammar, for example, we would have a more complex grammar that can still analyze the same fragment of the language.

(2) Tralala → Trulla Trololo

2. In general, it is assumed that the grammar with the fewest rules is the best one. Therefore, we can reject grammars that contain unnecessary rules such as (2).

   One should bear in mind what the aim of a theory of grammar is. If our goal is to describe the human language capacity, then a grammar with more rules could be better than other grammars with less rules. This is because psycholinguistic research has shown that highly-frequent units are simply stored in our brains and not built up from their individual parts each time, although we would of course be able to do this.

3. The problem here is the fact that it is possible to derive a completely empty noun phrase (see Figure 24.1). This noun phrase could be inserted in all positions where

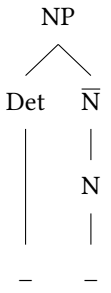


Figure 24.1: Noun phrases without a visible determiner and noun

an otherwise filled NP would have to stay. Then, we would be able to analyze sequences of words such as (3), where the subject of *schläft* 'sleeps' is realized by an empty NP:

(3) * Ich glaube, dass schläft.
I believe that sleeps

This problem can be solved using a feature that determines whether the left periphery of the N̄ is empty. Visible Ns and N̄ with at least an adjective would have the value '–' and all others '+'. Empty determiners could then only be combined with N̄s that have the value '–'. See Netter (1994).

4. If *Bücher* 'books' were an NP in the lexicon, then adjectives such as *interessant* 'interesting' would have to modify NPs in order for phrases such as (4) to be analyzed.

(4) interessante Bücher
interesting books

If adjectives are combined with NPs, however, it still has to be explained why (5) is ungrammatical.

(5) * interessante die Bücher
interesting the books

For a detailed discussions of this topic, see Müller (2007b: Section 6.6.2).

5. This kind of rule cannot analyze noun phrases such as those in (6):

(6) a. interessante [Aufsätze und Bücher]
interesting essays and books

b. interessante [Aufsätze und Bücher aus Stuttgart]
interesting essays and books from Stuttgart

Since adjectives can only be combined directly with nouns, these phrases cannot be analyzed. *Bücher* 'books' or *Bücher aus Stuttgart* 'books from Stuttgart' would be complete NPs. Since it is assumed that coordinated elements always have the same syntactic category, then *Aufsätze* 'essays' would have to be an NP. *Aufsätze und Bücher* and *Aufsätze und Bücher aus Stuttgart* would then also be NPs and it remains unexplained how an adjective can be combined with this NP. Because of (5), we must rule out analyses that assume that full NPs combine with adjectives.

See Chapter 19 for a general discussion of empty elements.

6. If a specific determiner or just any determiner would be combined with an adjective to form a complete NP, there would be no room for the integration of postnominal modifiers like modifying genitives, PPs and relative clauses. For PPs and relative clauses, analyses have been suggested in which these postnominal modifiers attach to complete NPs (Kiss 2005), but modifying genitives usually attach to smaller units. But even if one admits postnominal modifiers to attach to complete NPs, one cannot account for the iteration of adjectives and for arguments that depend on the elided noun.

So, the simplest way to cope with the German data is the assumption of an empty noun. Alternatively one could assume that an adjective is directly projected to an $\overline{\text{N}}$. This $\overline{\text{N}}$ then can be modified by further adjectives or postnominal modifiers. The $\overline{\text{N}}$ is combined with a determiner to form a full NP. For phrases that involve elided relational nouns, one would have to assume the projection of an argument like *vom Gleimtunnel* 'of the Gleimtunnel' to $\overline{\text{N}}$. The $\overline{\text{N}}$ could be further modified or combined with a determiner directly.

7. Adjective phrases such as those in (7) cannot be analyzed since the degree modifier occurs between the complement and the adjective:

(7) der auf seinen Sohn sehr stolze Vater
the on his son very proud father
'the father very proud of his son'

One would either have to allow for specifiers to be combined with their heads before complements or allow crossing lines in trees. Another assumption could be that German is like English, however then adjectival complements would have to be obligatorily reordered before their specifier. For a description of this kind of reordering, see Chapter 3. See Section 13.1.2 for a discussion of $\overline{\text{X}}$-Theory.

8. Write a phrase structure grammar that can analyze the sentences in (8), but does not allow the strings of words in (9).

(8) a. Der Mann hilft der Frau.
the.NOM man helps the.DAT woman

b. Er gibt ihr das Buch.
he.NOM gives her.DAT the.ACC book

c. Er wartet auf ein Wunder.
he.NOM waits on a miracle.ACC
'He is waiting for a miracle.'

(9) a. * Der Mann hilft er.
the.NOM man helps he.NOM

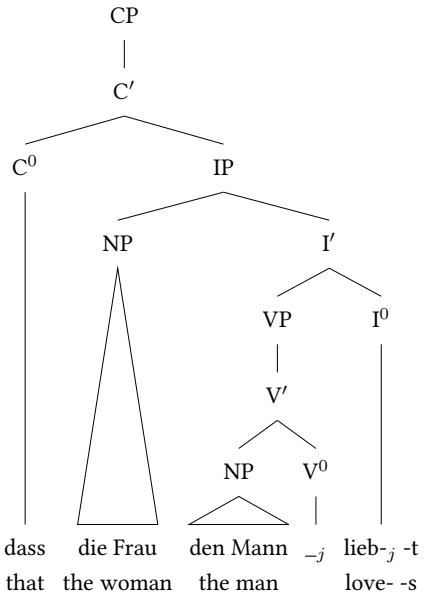
b. * Er gibt ihr den Buch.
he.NOM gives her.DAT the.ACC book

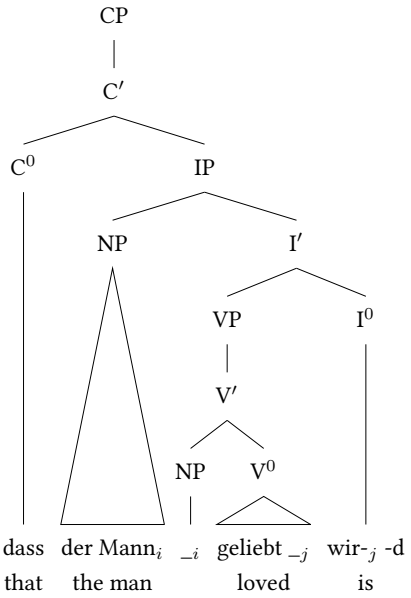
In order to rule out the last two sentences, the grammar has to contain information about case. The following grammar will do the job:

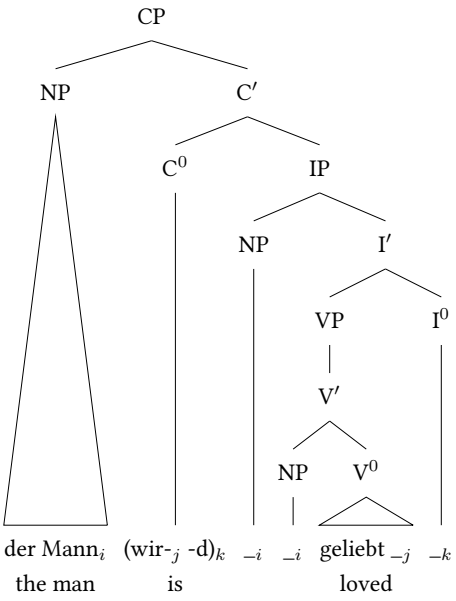
(10) a. s → np(nom) v(nom_dat), np(dat)
b. s → np(nom), v(nom_dat_acc), np(dat), np(acc)
c. s → np(nom), v(nom_pp_auf), pp(auf,acc)
d. pp(Pform,Case) → p(Pform,Case), np(Case)
e. np(Case) → d(Case), n(Case)
f. v(nom_dat) → hilft
g. v(nom_dat_acc) → gibt
h. v(nom_pp_auf) → wartet
i. np(nom) → er
j. np(dat) → ihr
k. d(nom) → der
l. d(dat) → der

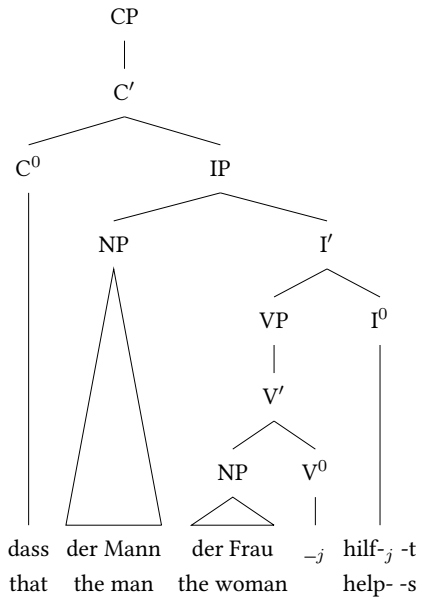
m. d(acc) → das
n. d(acc) → ein
o. n(nom) → Mann
p. n(dat) → Frau
q. n(acc) → Buch
r. n(acc) → Wunder
s. p(auf,acc) → auf

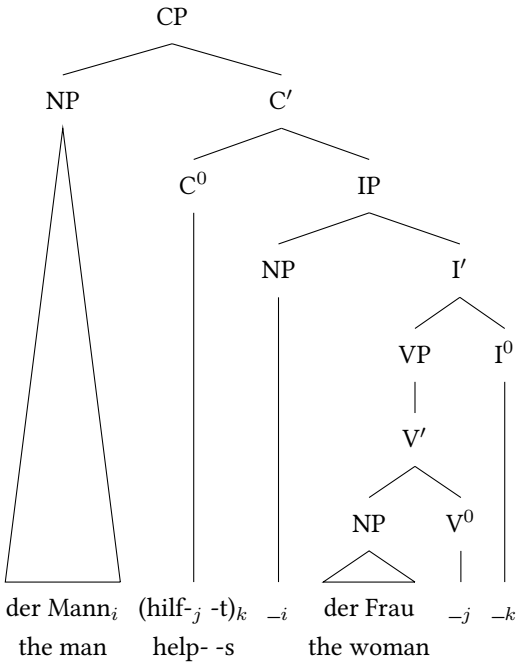
24.3 Transformational Grammar – Government & Binding











24.4 Generalized Phrase Structure Grammar

In order to analyze the sentences in (11), one requires a rule for transitive verbs and a metarule for the extraction of an element. Furthermore, rules for the combination of elements in the noun phrase are required.

(11) a. [dass] der Mann ihn liest
that the man it reads
'that the man reads it'

b. [dass] ihn der Mann liest
that it the man reads
'that the man reads it'

c. Der Mann liest ihn.
the man reads it
'The man reads it.'

It is possible to analyze the sentences in (11a,b) using the rules in (12) and the lexical entries in (13).

(12) a. V3 → H[6], N2[CASE nom], N2[CASE acc]
b. N2 → Det[CASE CAS], H1[CASE CAS]
c. N1 → H[27]

(13) a. Det[CASE nom] → der
b. N[27] → Mann
c. V[6, +FIN] → liest
d. N2[CASE acc] → ihn

The rules (12b,c) correspond to $\overline{\text{X}}$-rules that we encountered in Section 2.4.1. They only differ from these rules in that the part of speech of the head is not given on the right-hand side of the rule. The part of speech is determined by the Head Feature Convention. The part of speech of the head is identical to that on the left-hand side of the rule, that is, it must be N in (12b,c). It also follows from the Head Feature Convention that the whole NP has the same case as the head and therefore does not have to be mentioned additionally in the rule above. 27 is the SUBCAT value. This number is arbitrary.

In order for the verb to appear in the correction position, we need linearization rules:

(14) V[+MC] < X
X < V[−MC]

The fact that the determiner precedes the noun is ensured by the following LP-rule:

(15) Det < X

The Extraction Metarule in (16) is required in order to analyze (11c):

(16) V3 → W, X ↦
V3/X → W

Among others, this metarule licenses the rule in (17) for (12a):

(17) V3/N2[CASE nom] → H[6], N2[CASE acc]

The rule in (18) is used to bind off long-distance dependencies.

(18) V3[+FIN] → X[+TOP], V3[+MC]/X

The following linearization rule ensures that the +TOP-constituent precedes the sentence in which it is missing:

(19) [+TOP] < X

Figure 24.2 shows the structure licensed by the grammar. In sum, one can say that the

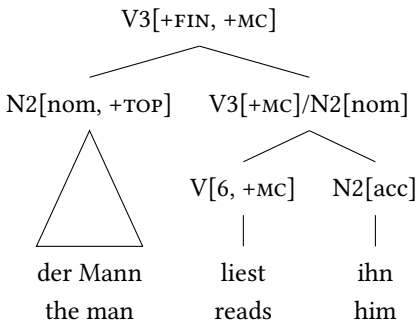


Figure 24.2: Analysis of *Der Mann liest ihn.* 'The man reads it.'

grammar that licenses the sentences in (11) should have (at least) the following parts:

1. ID rules:

   (20) a. V3 → H[6], N2[CASE nom], N2[CASE acc]
   b. N2 → Det[CASE CAS], H1[CASE CAS]
   c. N1 → H[27]

2. LP rules:

   (21) V[+MC] < X
   X < V[−MC]
   Det < X
   [+TOP] < X

3. Metarules:

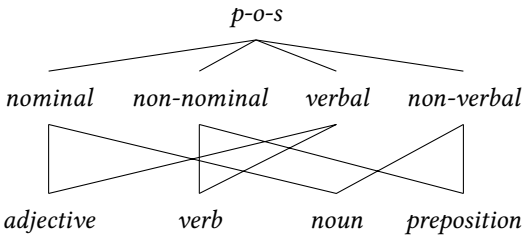
   (22) V3 → W, X ↦
   V3/X → W

4. Lexical entries

   (23) a. Det[CASE nom] → der
   b. N[27] → Mann
   c. V[6, +FIN] → liest
   d. N2[CASE acc] → ihn

24.5 Feature descriptions

1. For the class [+V], the type *verbal* is assumed with the subtypes *adjective* and *verb*. For the class [−V] there is the type *non-verbal* and its subtypes *noun* and *preposition*. This is analogous for the N values. The corresponding hierarchy is given in the following figure:



2. Lists can be described using recursive structures that consist of both a list beginning and a rest. The rest can either be a non-empty list (*ne_list*) or the empty list (*e_list*). The list ⟨ *a*, *b*, *c* ⟩ can be represented as follows:

(24)
$$\begin{bmatrix} \textsc{first} & a & & \\ \textsc{rest} & \begin{bmatrix} \textsc{first} & b & \\ \textsc{rest} & \begin{bmatrix} \textsc{first} & c \\ \textsc{rest} & e\_list \end{bmatrix} \\ & ne\_list \end{bmatrix} \\ & ne\_list \end{bmatrix}$$

3. If we extend the data structure in (24) by two additional features, it is possible to do without *append*. The keyword is *difference list*. A difference list consists of a list and a pointer to the end of the list.

(25)
$$\begin{bmatrix} \textsc{list} & \begin{bmatrix} \textsc{first} & a \\ \textsc{rest} & \begin{bmatrix} \textsc{first} & b \\ \textsc{rest} & \boxed{1}\ \textit{list} \\ \textit{ne\_list} \end{bmatrix} \\ \textit{ne\_list} \end{bmatrix} \\ \textsc{last} & \boxed{1} \\ \textit{diff-list} \end{bmatrix}$$

Unlike the list representation in (24), the REST value of the end of the list is not *e_list*, but rather simply *list*. It is then possible to extend a list by adding another list to the point where it ends. The concatenation of (25) and (26a) is (26b).

(26) a.
$$\begin{bmatrix} \textsc{list} & \begin{bmatrix} \textsc{first} & c \\ \textsc{rest} & \boxed{2}\ \textit{list} \\ \textit{ne\_list} \end{bmatrix} \\ \textsc{last} & \boxed{2} \\ \textit{diff-list} \end{bmatrix}$$

b.
$$\begin{bmatrix} \textsc{list} & \begin{bmatrix} \textsc{first} & a \\ \textsc{rest} & \begin{bmatrix} \textsc{first} & b \\ \textsc{rest} & \begin{bmatrix} \textsc{first} & c \\ \textsc{rest} & \boxed{2}\ \textit{list} \\ \textit{ne\_list} \end{bmatrix} \\ \textit{ne\_list} \end{bmatrix} \\ \textit{ne\_list} \end{bmatrix} \\ \textsc{last} & \boxed{2} \\ \textit{diff-list} \end{bmatrix}$$

In order to combine the lists, the LIST value of the second list has to be identified with the LAST value of the first list. The LAST value of the resulting list then corresponds to the LAST value of the second list (2 in the example.)

Information about the encoding of difference lists can be found by searching for the keywords *list*, *append*, and *feature structure*. In the search results, one can find pages on developing grammars that explain difference lists.

24.6 Lexical Functional Grammar

1. *kannte* 'knew' is a transitive verb:

   (27) *kannte* V (↑ PRED) = 'KENNEN⟨SUBJ, OBJ ⟩'
   (↑ SUBJ AGR CAS = NOM)
   (↑ OBJ AGR CAS = ACC)
   (↑ TENSE) = PAST

2. In the sentence (28), the object of *verschlingen* 'devour' is in the prefield.

   (28) Den Apfel verschlingt David.
   the.ACC apple devours David.NOM
   'David is devouring the apple.'

   The analysis is a combination of the analysis in Figure 7.2 on page 233 and the analysis of long-distance dependencies that was presented in Section 7.5. The object is not realized inside the VP, but rather in the prefield.

   The necessary c-structure rules are given in (29):

   (29) a. VP → NP VP
   (↑SUBJ |OBJ) = ↓ ↑= ↓

   b. VP → (V)
   ↑= ↓

   c. C′ → C VP
   ↑= ↓ ↑= ↓

   d. CP → XP C′
   (↑DF) = ↓ ↑=↓
   (↑DF) = (↑COMP* GF)

   These rules allow two f-structures for the example in question: one in which the NP *den Apfel* 'the apple' is the topic and another in which this NP is the focus. Figure 24.3 shows the analysis with a topicalized constituent in the prefield.

24.7 Categorial Grammar

1. The analysis of *The children in the room laugh loudly.* is given in Figure 24.4.

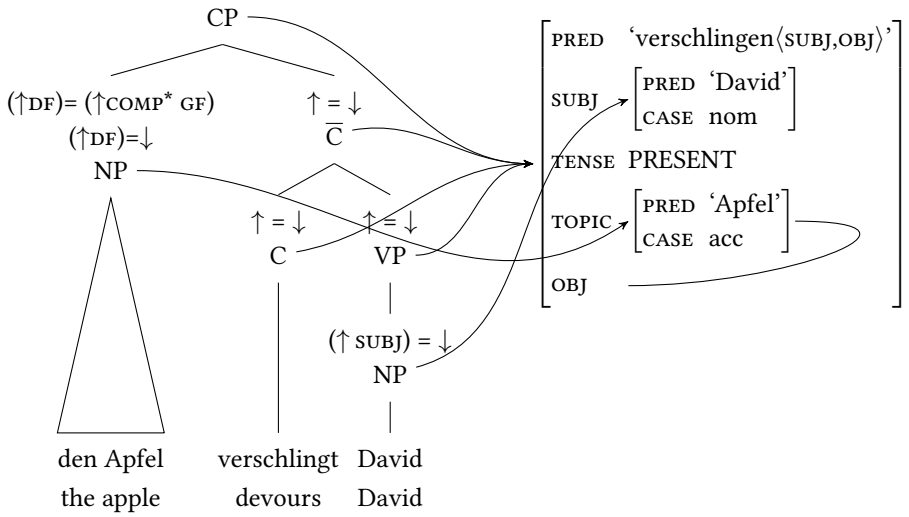


Figure 24.3: Analysis of verb second

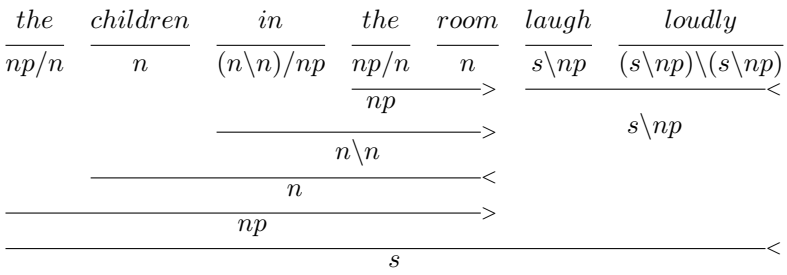


Figure 24.4: Categorial Grammar analysis of *The children in the room laugh loudly.*

2. The analysis of *the picture of Mary* is given in Figure 24.5. n/pp corresponds to N^0, n corresponds to $\overline{N}$ and np corresponds to NP.

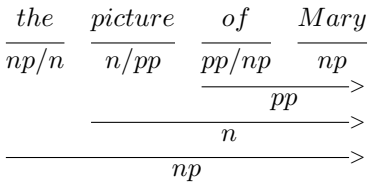
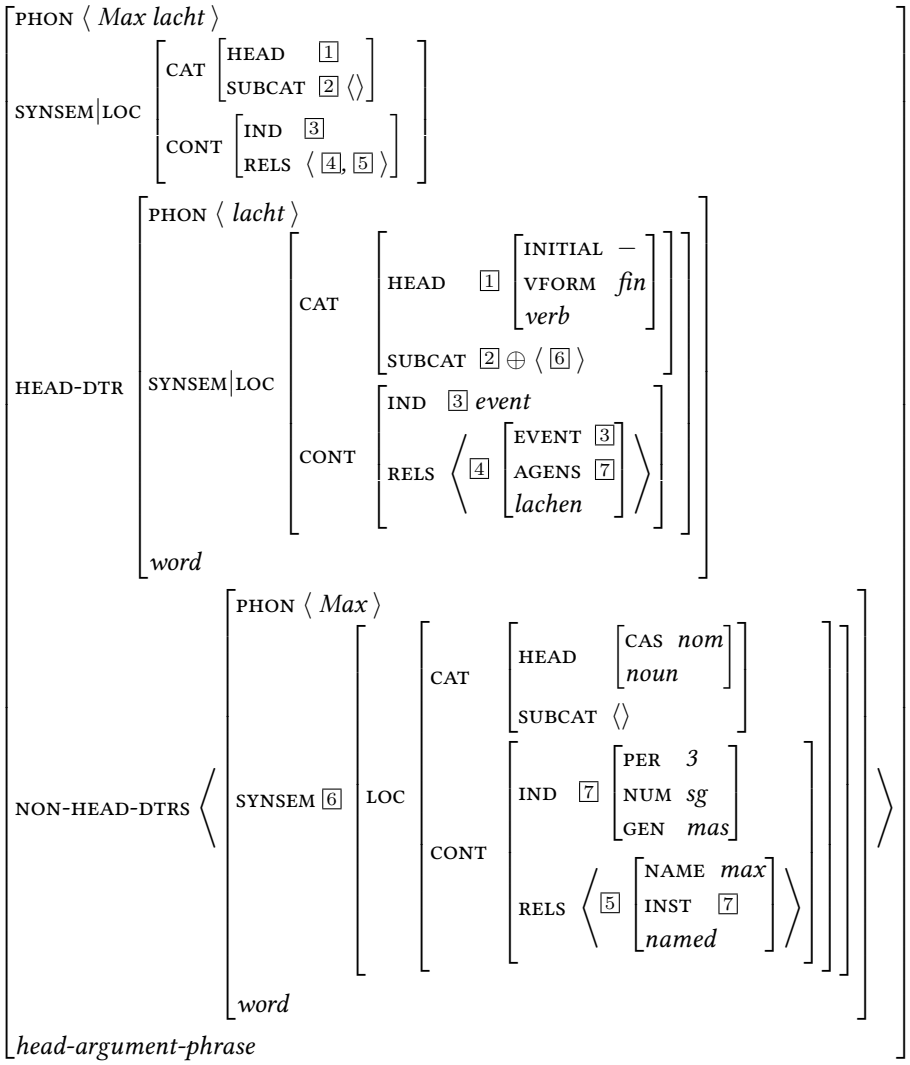


Figure 24.5: Categorial Grammar analysis of *the picture of Mary*

24.8 Head-Driven Phrase Structure Grammar

1. The solution is .



2. An analysis of the difference in (30) has to capture the fact that the case of the adjective has to agree with that of the noun. In (30a), the genitive form of *interessant* 'interesting' is used, whereas (30b) contains a form that is incompatible with the genitive singular.

(30) a. eines interessanten Mannes
one.GEN interesting.GEN man.GEN

b. * eines interessanter Mannes
one.GEN interesting.NOM man.GEN

(31) shows the CAT value of *interessanten*.

(31) CAT value of *interessanten* 'interesting' with case information:

$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \overline{\text{N}}\,[\text{CASE}\ \boxed{1}] \\ \text{CASE} & \boxed{1}\ \textit{gen} \\ & \textit{adj} \end{bmatrix} \\ \text{SUBCAT} & \langle\rangle \end{bmatrix}$$

The structure sharing of the case value of the adjective with the case value of the $\overline{\text{N}}$ under MOD identifies the case values of the noun and the adjective. *interessanten* can therefore be combined with *Mannes*, but not with *Mann*. Similarly, *interessanter* can only be combined with the nominative *Mann*, but not with the genitive *Mannes*.

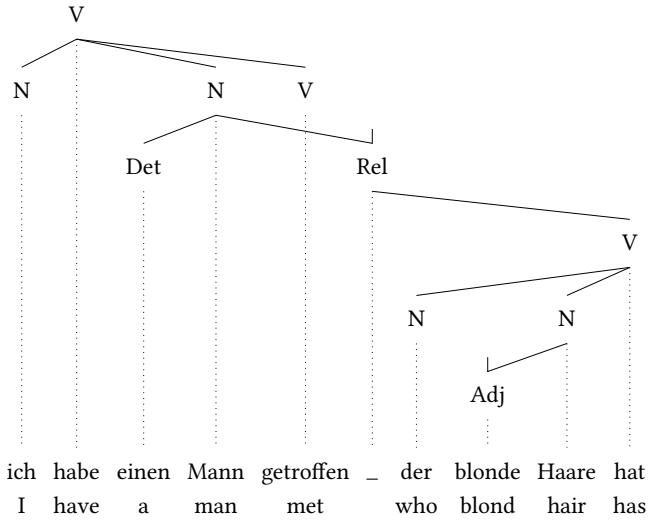
For a refinement of the analysis of agreement inside the noun phrase, see Müller (2007b: Abschnitt 13.2).

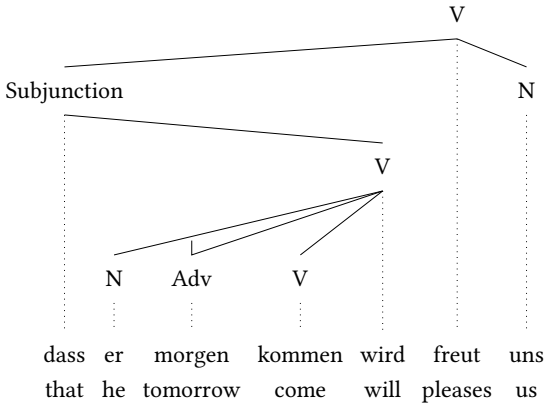
24.9 Construction Grammar

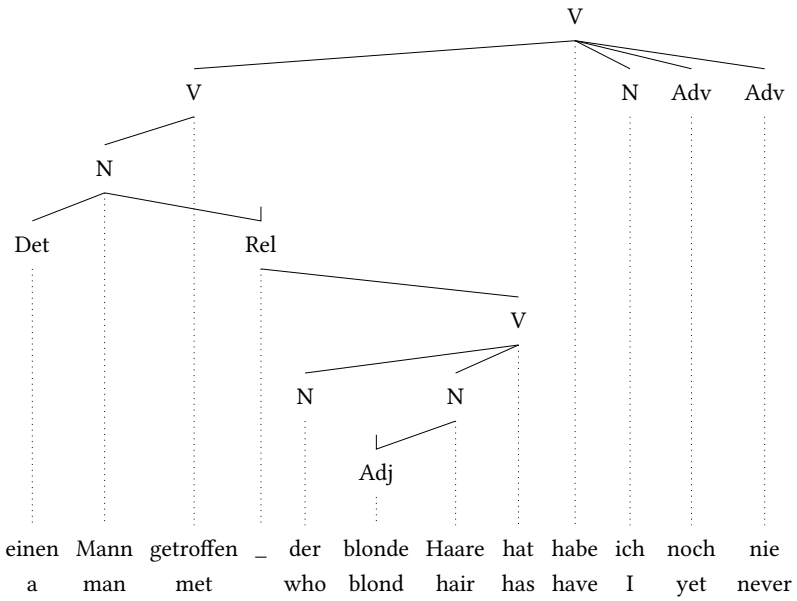
Idioms can be found by reading the newspaper carefully. The less exciting method is to look them up a dictionary of idioms such as the Free Dictionary of Idioms and Phrases[1].

[1] http://idioms.thefreedictionary.com/, 04.03.2015.

24.10 Dependency Grammar







24.11 Tree Adjoining Grammar

The elementary trees in Figure 24.6 are needed for the analysis of (32).

(32) der dem König treue Diener
the.NOM the.DAT king loyal servant
'the servant loyal to the king'

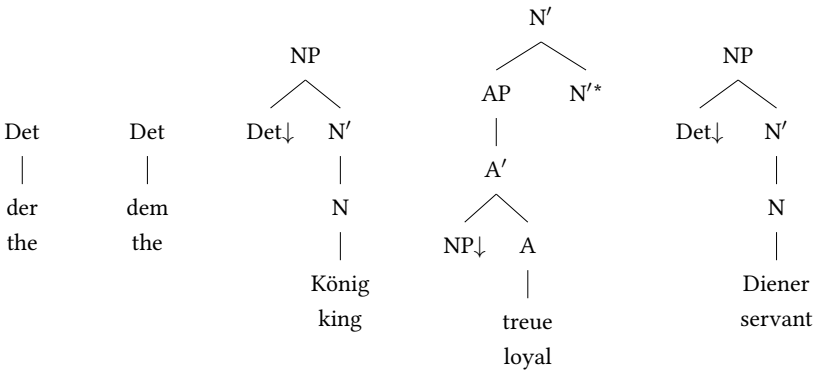


Figure 24.6: Elementary trees for *der dem König treue Diener*

By substituting the tree for *dem* 'the' in the substitution node of *König* 'king', one then arrives at a full NP. This can then be inserted into the substitution node of *treue* 'loyal'. Similarly, the tree for *der* 'the' can be combined with the one for *Diener*. One then has both of the trees in Figure 24.7.

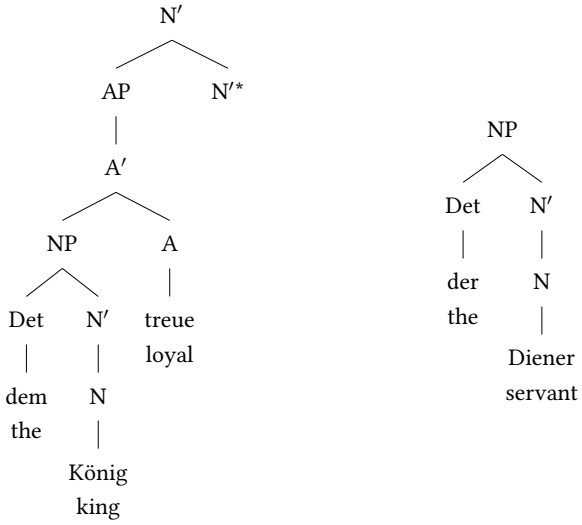


Figure 24.7: Trees for *der dem König treue* and *der Diener* after substitution

The adjective tree can then be adjoined to the N′-node of *der Diener*, which yields the structure in Figure 24.8 on the next page.

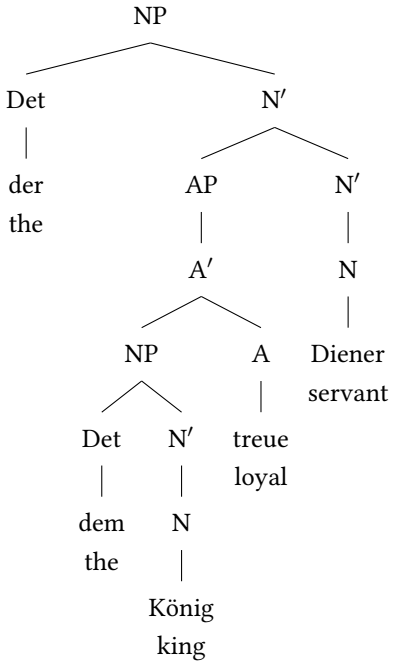


Figure 24.8: Result of adjunction of the AP to the N′-node