

18. LA-syntax for German

18.1 Standard procedure of syntactic analysis

18.1.1 Differences between natural languages

Natural languages are all based on the same time-linear derivation order. They differ only in their language specific handling of

- *agreement*
- *word order*
- *valency structure* (lexicalization)

18.1.2 Phase I of standard procedure

1. Formal treatment of declarative main clauses with elementary finite verbs and elementary nominal fillers determines the basic typological properties of the natural language,
2. Extension to complex nominal fillers requires treatment of the internal and the external agreement restrictions of derived noun phrases, and the time-linear derivation of complex fillers in pre- and postverbal position.
3. The extension to complex verb phrases treats complex tenses and modalities.

18.1.3 What has to be done before Phase II

A theoretically well-founded semantic and pragmatic interpretation for the syntactic analysis developed so far.

18.1.4 Phase II of the standard procedure

The syntactic analyses of the second phase should be developed directly out of the semantic and pragmatic interpretation, and be provided for both, the speaker and the hearer mode.

Topics: (i) addition of basic and derived modifiers ranging from adverbs over prepositional phrases to subordinate clauses, (ii) treatment of sentential subjects and objects including infinitive constructions, (iii) handling of different syntactic moods like interrogative and different verbal moods like passive, and (iv) treatment of conjunctions including gapping constructions.

18.1.5 Distinctive categorization of determiners

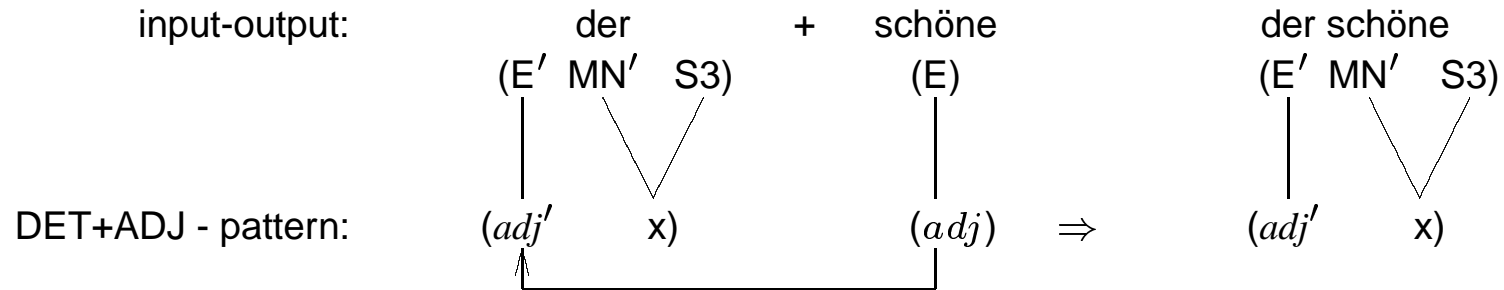
definite article

[der	(E' MN' S3)	
	(EN' F' G&D)	
	(EN' P-D' G)	DEF-ART]
[des	(EN' -FG' G)	DEF-ART]
[dem	(EN' -FD' D)	DEF-ART]
[den	(EN' M-N' A)	
	(EN' PD' D)	DEF-ART]
[das	(E' N-G' S3&A)	DEF-ART]
[die	(E' F' S3&A)	
	(EN' P-D' P3&A)	DEF-ART]

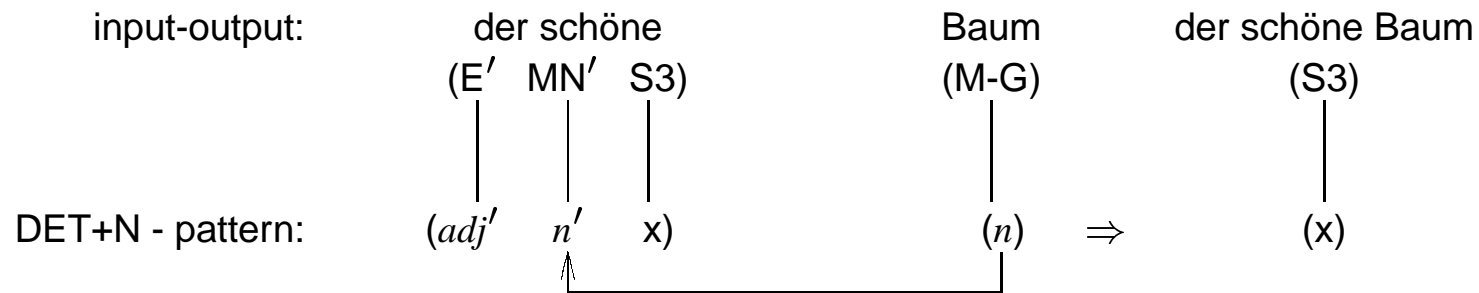
indefinite article

[ein	(ER' MN' S3)	
	(ES' N-G' S3&A)	INDEF-ART]
[eines	(EN' -FG' G)	INDEF-ART]
[einem	(EN' -FD' D)	INDEF-ART]
[einen	(EN' M-N' A)	INDEF-ART]
[eine	(E' F' S3&A)	INDEF-ART]
[einer	(EN' F' G&D)	INDEF-ART]

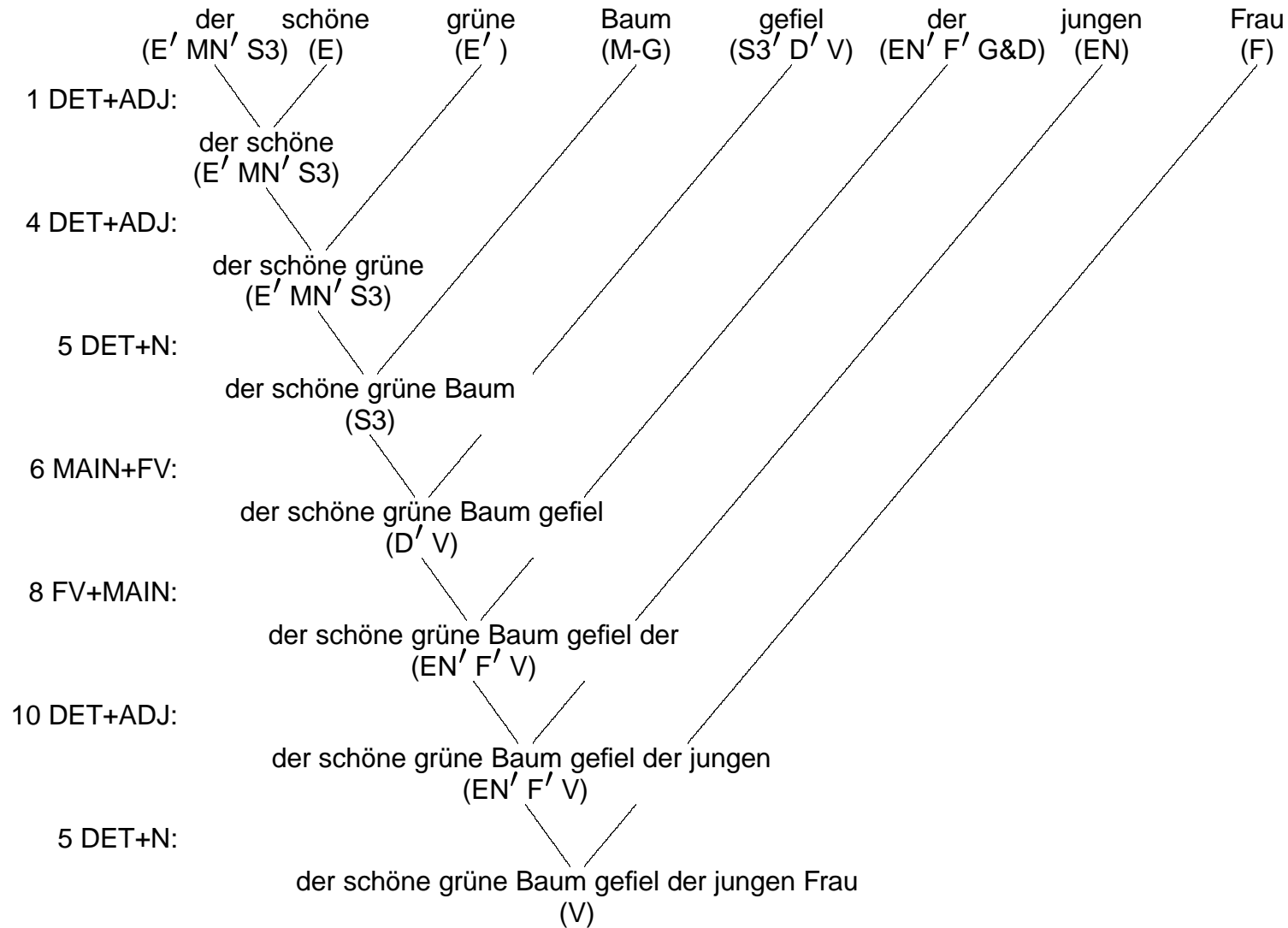
18.1.6 Categorical operation of DET+ADJ



18.1.7 Categorical operation of DET+N



18.1.8 Pre- and postverbal derivation of noun phrases



18.2 German field of referents (*LA-D2*)

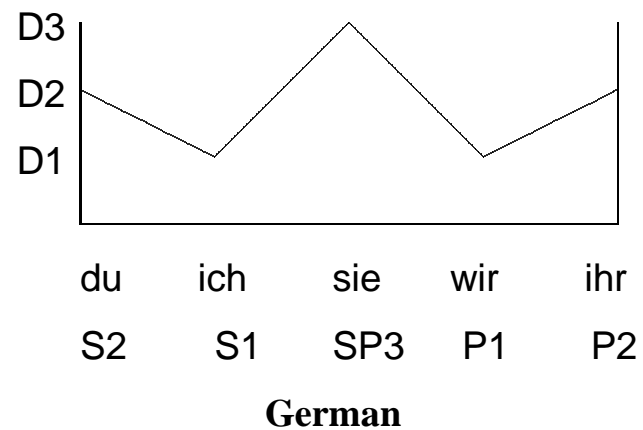
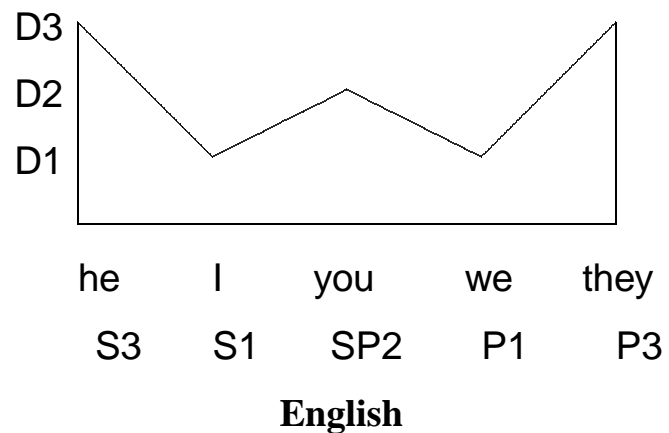
18.2.1 Traditional paradigms of German noun phrases

	<i>Masculinum</i>	<i>Femininum</i>	<i>Neutrum</i>	<i>Plural</i>
<i>Nominative</i>	der Mann	die Frau	das Kind	die Männer, etc.
<i>Genitive</i>	des Mannes	der Frau	des Kindes	der Männer, etc.
<i>Dative</i>	dem Mann	der Frau	dem Kind	den Männern, etc.
<i>Accusative</i>	den Mann	die Frau	das Kind	die Männer, etc.

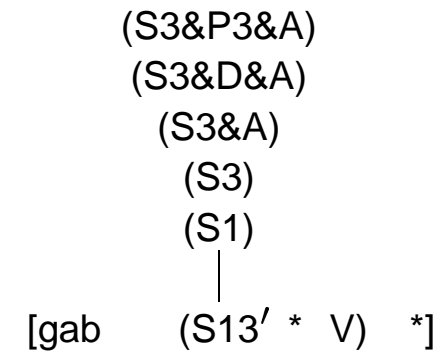
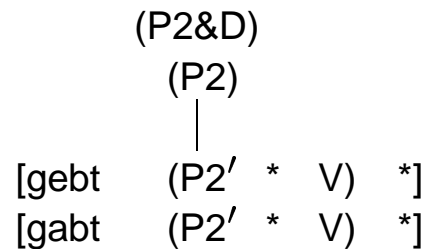
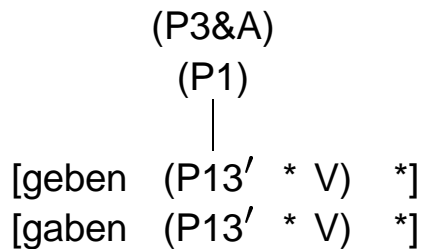
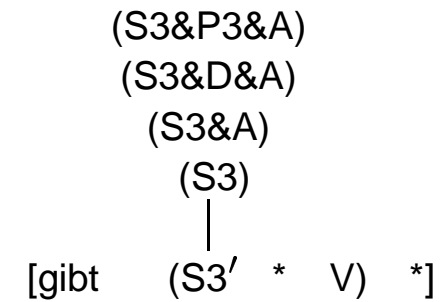
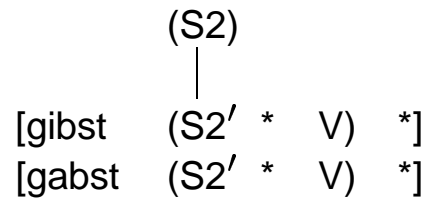
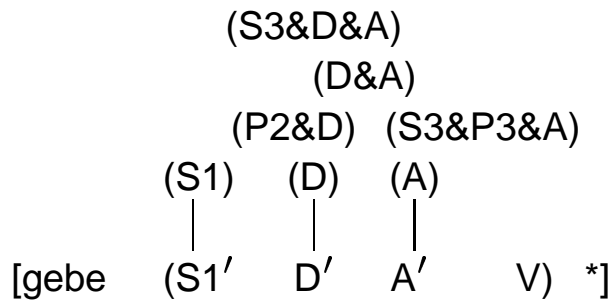
18.2.2 Distinctive categories of nominal fillers (German)

	Singular				Plural				
N	du (S2)	ich (S1)	er (S3)	Peter (S3&A&D)	das Kind es die Frau (S3&A)	sie (S3&P3 &A)	die Männer die Frauen die Kinder (P3&A)	wir (P1)	<i>ihr</i> (P2)
A	dich (A)	mich den Mann	ihn					uns (D&A)	euch
D	dir (D)	mir dem Mann	ihm dem Kind	der Frau (G&D)	<i>ihr</i>	ihnen	den Männern den Frauen den Kindern		
G	deiner	meiner	seiner	des Kindes des Mannes	ihrer (G)		der Männer der Frauen der Kinder	unserer	eurer

18.2.3 Centering and distance in fields of reference



18.2.4 Agreement of nominal fillers and verbal valencies



18.2.5 German LA-grammar handling complex fillers (LA-D2)

LX = LX of LA-D1 plus the determiners defined in 18.1.5, the nouns defined in 14.5.1, 14.5.2, and the following pronouns

[ich (S1) *], [du (S2) *], [er (S3) *], [es (S3&A) *], [wir (P1) *],
 [ihr (P2&D) *], [sie (S3&P3&A) *], [deiner (G) *], [uns (D&A) *],
 [euch (D&A) *], [mir (D) *], [dir (D) *], [ihm (D) *], [mich (A) *],
 [dich (A) *], [ihn (A) *]

plus adjectives with comparation

[schöne (E) *]	[schönere (E) *]	[schönste (E) *]
[schönen (EN) *]	[schöneren (EN) *]	[schönsten (EN) *]
[schöner (ER) *]	[schönerer (ER) *]	[schönster (ER) *]
[schönes (ES) *]	[schöneres (ES) *]	[schönstes (ES) *]

plus finite main verb forms of differing valency structures

[gebe (S1' D' A' V) *]	[lese (S1' A' V) *]	[schlafe (S1' V) *]
[gibst (S2' D' A' V) *]	[liest (S23' A' V) *]	[schläfst (S2' V) *]
[gibt (S3' D' A' V) *]	[lesen (P13' A' V) *]	[schläft (S3' V) *]
[geben (P13' D' A' V) *]	[lest (P2' A' V) *]	[schlafen (P13' V) *]
[gebt (P2' D' A' V) *]	[las (S13' A' V) *]	[schlaft (P2' V) *]
[gab (S13' D' A' V) *]	[last (S2P2' A' V) *]	[schlief (S13' V) *]
[gabst (S2' D' A' V) *]	[lasen (P13' A' V) *]	[schliefst (S2' V) *]

[gaben (P13' D' A' V) *]

[gabt (P2' D' A' V) *]

[schliefen (P13' V) *]

[schlieft (P2' V) *]

variable definition

$$np \in \{S1, S2, S3, P1, P2, P2\&D, G, G\&D, D, A, S3\&A, S3\&D\&A, D\&A, P3\&A, S3\&P3\&A\}$$

$$np' \in \{S1', S13', S2', S23', S2P2', S3', P13', P2', G', D', A'\}$$
and if $np \in \{G, D, A\}$, then np' is correspondingly G' , D' , or A' if $np = P1$, then $np' = P13'$ if $np = S1$, then $np' \in \{S1', S13'\}$ if $np = S2$, then $np' \in \{S2', S23'\}$ if $np = S3$, then $np' \in \{S3', S23'\}$ if $np = P3\&A$, then $np' \in \{P13', A'\}$ if $np = P2\&D$, then $np' \in \{P2', D'\}$ if $np = G\&D$, then $np' \in \{G', D'\}$ if $np = D\&A$, then $np' \in \{D', A'\}$ if $np = S3\&A$, then $np' \in \{S3', S23', A'\}$ if $np = S3\&D\&A$, then $np' \in \{S3', S23', D', A'\}$ if $np = S3\&P3\&A$, then $np' \in \{S3', S23', P13', A'\}$

$$n \in \{MN, M-G, M-NP, M-GP, MGP, M-GP-D, F, N-G, -FG, -FD, N-GP, N-GP-D,$$

NDP-D, P, P-D, PD},

$n' \in \{MN', M-N', F', N-G', -FG', -FD', P-D', PD'\}$, and

if $n \in \{MN, -FG, -FD, F, P-D, PD\}$, then n' is corresponding

if $n = M-G$, then $n' \in \{MN', M-N'\}$

if $n = M-NP$, then $n' \in \{-FG', -FD', P-D', PD'\}$

if $n = M-GP$, then $n' \in \{MN', -FD', M-N', P-D', PD'\}$

if $n = MGP$, then $n' \in \{-FG', P-D', PD'\}$

if $n = M-GP-D$, then $n' \in \{MN', -FD', M-N', P-D'\}$

if $n = N-G$, then $n' \in \{N-G', -FG', -FD'\}$

if $n = N-GP$, then $n' \in \{N-G', -FG', -FD', P-D', PD'\}$

if $n = N-GP-D$, then $n' \in \{N-G', -FG', -FD', P-D'\}$

if $n = NDP-D$, then $n' \in \{-FD', P-D'\}$

if $n = P$, then $n' \in \{P-D', PD'\}$

$adj \in \{e, en, es, er\}$ and adj' is corresponding

$ST_S =_{def} \{ [(x) \{1 \text{ DET+ADJ}, 2 \text{ DET+N}, 3 \text{ MAIN+FV}\}] \}$

DET+ADJ: $(adj' x) (adj) \Rightarrow (adj' x) \{4 \text{ DET+ADJ}, 5 \text{ DET+N}\}$

DET+N: $(adj' n' x) (n) \Rightarrow (x) \{6 \text{ MAIN+FV}, 7 \text{ FV+MAIN}\}$

MAIN+FV: $(np) (x np' y V) \Rightarrow (x y V) \{8 \text{ FV+MAIN}\}$

FV+MAIN: $(x np' y V) (z np) \Rightarrow (z x y V) \{9 \text{ FV+MAIN}, 10 \text{ DET+ADJ}, 11 \text{ DET+N}\}$

$ST_F =_{def} \{ [(V) rp_{MAIN+FV}], [(V) rp_{FV+MAIN}], [(V) rp_{DET+N}] \}$

18.3 Verbal positions in English and German

18.3.1 Finite verb position in declarative main clauses

English: post-nominative

1. Julia *read* a book
2. *a book *read* Julia
3. Yesterday Julia *read* a book
4. *Yesterday *read* Julia a book
5. Julia yesterday *read* a book
6. *While Mary slept, *read* Julia a book
7. While Mary slept, Julia *read* a book

German: verb-second

- Julia *las* ein Buch
Ein Buch *las* Julia
*Gestern Julia *las* ein Buch
Gestern *las* Julia ein Buch
*Julia gestern *las* ein Buch
Als Maria schlief, *las* Julia ein Buch
*Als Maria schlief, Julia *las* ein Buch

18.3.2 Nonfinite main verb position in declarative main clauses

English: contact position

1. Julia *has slept*
2. Julia *has read* a book
3. *Julia *has* a book *read*
4. Yesterday Julia *has read* a book
5. *Yesterday *has* Julia a book *read*
6. Julia *has given* M. a book yesterday
7. *Julia *has* M. yesterday a book *given*

German: distance position

- Julia *hat geschlafen*
- *Julia *hat gelesen* ein Buch
- Julia *hat* ein Buch *gelesen*
- *Gestern Julia *hat gelesen* ein Buch
- Gestern *hat* Julia ein Buch *gelesen*
- *Julia *hat gegeben* M. ein Buch gestern
- Julia *hat* M. gestern ein Buch *gegeben*

18.3.3 Satzklammer in German

Julia has the offer of the opposing party yesterday afternoon

Julia hat das Angebot der Gegenseite gestern nachmittag	<i>abgelehnt.</i>	declined
	<i>verworfen.</i>	refused
	<i>kritisiert.</i>	criticized
	<i>zurückgewiesen.</i>	rejected

18.3.4 Verb position in subordinate clauses

English: post-nominative

1. before Julia *slept*
2. before Julia *had slept*
3. *before Julia *slept had*
4. before Julia *bought* the book
5. *before Julia the book *bought*
6. before Julia *had bought* the book
7. *before the book a man *bought*

German: clause final

- bevor Julia *schlief*
*bevor Julia *hatte geschlafen*
bevor Julia *geschlafen hatte*
*bevor Julia *kaufte* das Buch
bevor Julia das Buch *kaufte*
*bevor Julia *hatte gekauft* das Buch
bevor das Buch ein Mann *kaufte*

18.4 Complex verbs and elementary adverbs (*LA-D3*)

18.4.1 LA-paradigms of German auxiliaries and modals

[bin (S1' S' V) *]	[habe (S1' H' V) *]	[kann (S13' M' V) *]
[bist (S2' S' V) *]	[hast (S2' H' V) *]	[kannst (S2' M' V) *]
[ist (S3' S' V) *]	[hat (S3' H' V) *]	[können (P13' M' V) *]
[sind (P13' S' V) *]	[haben (P13' H' V) *]	[könnt (P2' M' V) *]
[seid (P2' S' V) *]	[habt (P2' H' V) *]	[konnte (S13' M' V) *]
[war (S13' S' V) *]	[hatte (S13' H' V) *]	[konntest (S2' M' V) *]
[warst (S2' S' V) *]	[hattest (S2' H' V) *]	[konnten (P13' M' V) *]
[waren (P13' S' V) *]	[hatten (P13' H' V) *]	[konntet (P2' M' V) *]
[wart (P2' S' V) *]	[hattet (P2' H' V) *]	

18.4.5 +FV alternatives of adding the auxiliary

1. input-output: Die Frau (S3&A) + (S3' hat H' V) ⇒ Die Frau hat (H' V)
- rule pattern +FV: (nom) (nom' aux' V) ⇒ (aux' V)
2. input-output: Dem Kind (D) + (S3' hat H' V) ⇒ Dem Kind hat (D S3' H' V)
- rule pattern +FV: (obq) (x aux' V) ⇒ (obq' x aux' V)
3. input-output: Gegeben (D' A' H) + (S3' hat H' V) ⇒ Gegeben hat (S3' D' A' V)
- rule pattern +FV: (x aux) (nom' aux' V) ⇒ (nom' x V)
5. input-output: Gestern (ADV) + (S3' hat H' V) ⇒ Gestern hat (S3' H' V)
- rule pattern +FV: (y ADV) (x V) ⇒ (y x V)

18.4.6 Extending MAIN+FV into +FV using clauses

- +FV:**
1. $(nom)(nom' aux' V) \Rightarrow (aux' V)$
 2. $(obq)(x aux' V) \Rightarrow (obq x aux' V)$
 3. $(x aux)(nom' aux' V) \Rightarrow (nom' x V)$
 4. $(np)(x np' y V) \Rightarrow (x y V)$
 5. $(y ADV)(x V) \Rightarrow (y x V) \{+MAIN, +NFV, +FV, +IP\}$

18.4.7 +MAIN Alternatives after the auxiliary

1. input-output: Dem Kind hat + die
 (D S3' H' V) (E' F' S3&A) (E' F' D H' V)
- rule pattern +MAIN: (x np' y aux' V) (z np) ⇒ (z x y aux' V)
2. input-output: Die Frau hat + dem
 (H' V) (EN' -FD' D) (EN' -FD' D H' V)
- rule pattern +MAIN: (aux' V) (y obq) ⇒ (y obq aux' V)
4. input-output: Dem Kind hat + gestern
 (D S3' H' V) (ADV) (D S3' H' V)
- rule pattern +MAIN: (x V) (y ADV) ⇒ (y x V)

18.4.10 German grammar handling complex verb forms (*LA-D3*)

LX = LX of *LA-D2* plus auxiliaries defined in 18.4.1, plus

nonfinite main verb form of 18.4.2, plus adverbials

[*gestern* (ADV) *], [*hier* (ADV) *], [*jetzt* (ADV) *], plus punctuation signs

[. (V' DECL) *], [? (VI' INTERROG) *], [? (V' INTERROG) *]

variable definition = variable definition of *LA-D2* plus

$nom \in np \setminus \{D, A, D\&A\}$ nominative filler¹

$nom' \in np \setminus \{D, A\}$ nominative valency positions

$obq \in \{D, A, D\&A\}$ oblique filler

$aux \in \{H, B, M\}$, auxiliaries and modals

$vt \in \{V, VI\}$, mood marker

$sm \in \{DECL, INTERROG\}$, sentence mood

$ST_S =_{def} \{ [(x) \{1 +ADJ, 2 +N, 3 +FV, 4 +NFV\}] \}$

+ADJ: $(adj' x) (adj) \Rightarrow (adj x) \quad \{5 +ADJ, 6 +N\}$

+N: $(adj' n' x) (n) \Rightarrow (x) \quad \{7 +FV, 8 +MAIN, 9 +NFV, 10 +IP\}$

+FV: $(nom)(nom' aux' V) \Rightarrow (aux' V)$

$(obq)(x aux' V) \Rightarrow (obq x aux' V)$

$(x aux)(nom' aux' V) \Rightarrow (nom' x V)$

$(np)(x np' y V) \Rightarrow (x y V)$

$(ADV)(x V) \Rightarrow (x V) \quad \{11 +MAIN, 12 +NFV, 13 +IP\}$

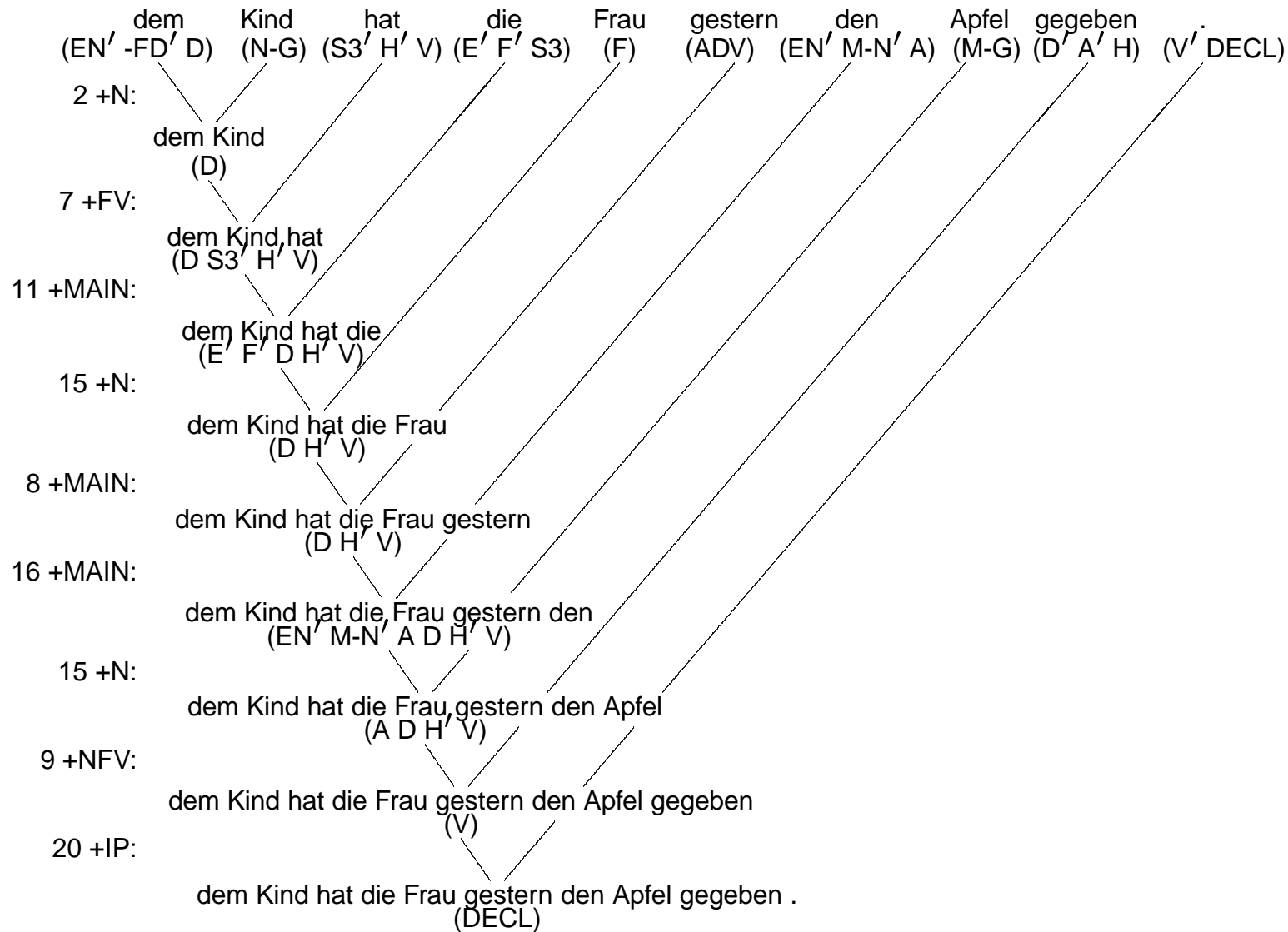
+MAIN: $(x \text{ nom}' y \text{ aux}' V)(z \text{ nom}) \Rightarrow (z x y \text{ aux}' V)$
 $(x \text{ aux}' V)(y \text{ obq}) \Rightarrow (y \text{ obq } x \text{ aux}' V)$
 $(x \text{ np}' y V)(z \text{ np}) \Rightarrow (z x y V)$
 $(x V)(y \text{ ADV}) \Rightarrow (y x V) \quad \{14 +\text{ADJ}, 15 +\text{N}, 16 +\text{MAIN}, 17 +\text{NFV},$
 $18 +\text{FV}, 19 +\text{IP}\}$

+NFV: $(x \text{ aux}' V)(x^{\sim} \text{ aux})$
 $(x = x^{\sim}) \Rightarrow (V) \quad \{20 +\text{IP}\}$

+IP: $(vt) (vt' sm) \Rightarrow (sm) \quad \{\}$

$\text{ST}_F =_{def} \{ [(sm) \text{ rp}_{+ipt}] \}$

18.4.11 Declarative with dative preceding auxiliary



18.5 Interrogatives and subordinate clauses (*LA-D4*)

18.5.1 Interrogative with and without auxiliary

1. *Hat* die Frau dem Kind gestern den Apfel *gegeben* ?
(*Has the woman the child yesterday the apple given* ?)
2. *Hat* dem Kind gestern die Frau den Apfel *gegeben*?
3. *Hat* gestern die Frau dem Kind den Apfel *gegeben*?
4. *Gab* die Frau dem Kind gestern den Apfel ?
(*Gave the woman the child yesterday the apple* ?)
5. *Gab* gestern die Frau dem Kind den Apfel?

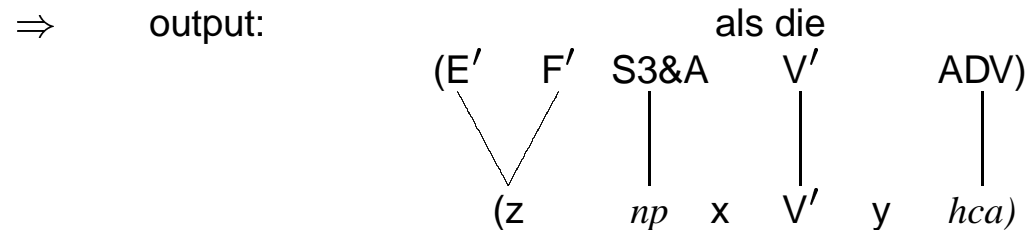
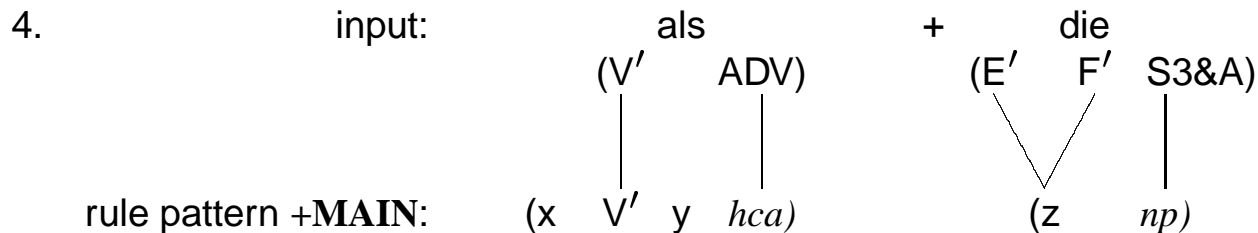
18.5.2 ?+MAIN starting an interrogative main clause

1. input-output:
- | | | | | | | | | | | |
|-------|------|----|---|-----|------|----------|--|-----|---------|-----------|
| (S3' | hat | V) | + | (E' | die | F' S3&A) | | (E' | hat die | F' H' VI) |
| | | | | \ | / | | | \ | / | |
| (nom' | aux' | V) | | (z | nom) | ⇒ | | (z | aux' | VI) |
- rule pattern ?+MAIN:

18.5.3 Subordinate clauses with and without auxiliary

1. *Als die Frau dem Kind gestern den Apfel gegeben hat*
(When the woman the child yesterday the apple given has)
2. *Als dem Kind gestern die Frau den Apfel gegeben hat*
3. *Als gestern die Frau dem Kind den Apfel gegeben hat*
4. *Als die Frau dem Kind gestern den Apfel gab*
(When the woman the child yesterday the apple gave)
5. *Als gestern die Frau dem Kind den Apfel gab*

18.5.4 +MAIN starting an adverbial subclause



18.5.6 Beginning of an adverbial subclause in postverbal position

Julia las, + als Julia las, als + Maria Julia las, als Maria
 (A' V) (V' ADV) \Rightarrow (V' A' V) (S3&D&A) \Rightarrow (S3&D&A V' A' V)

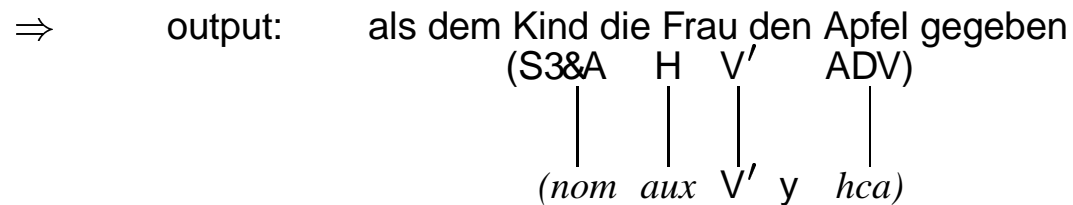
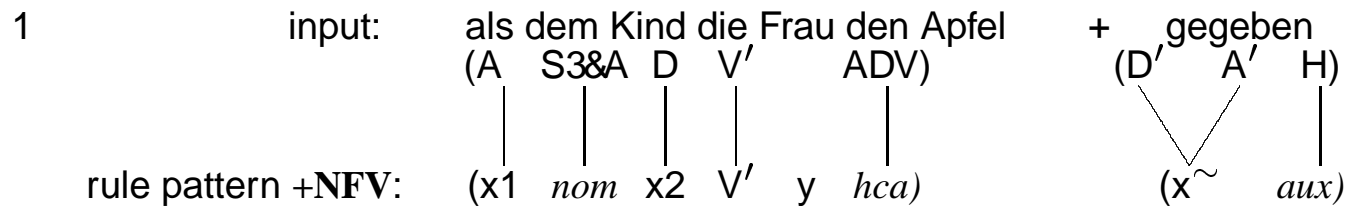
18.5.7 Completion of an adverbial subclause in postverbal position

Julia las, als Maria + schlief Julia las, als Maria schlief,
 (S3&D&A V' A' V) (S3' V) \Rightarrow (A' V)

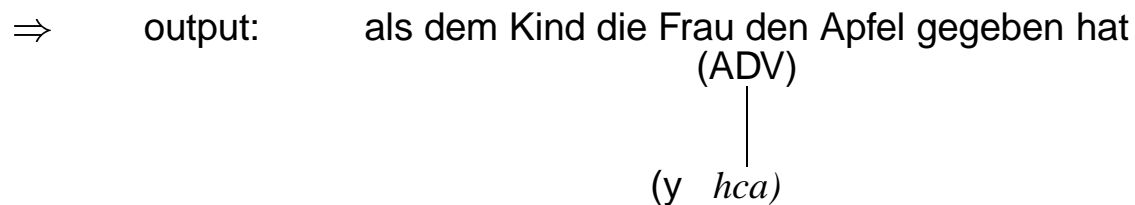
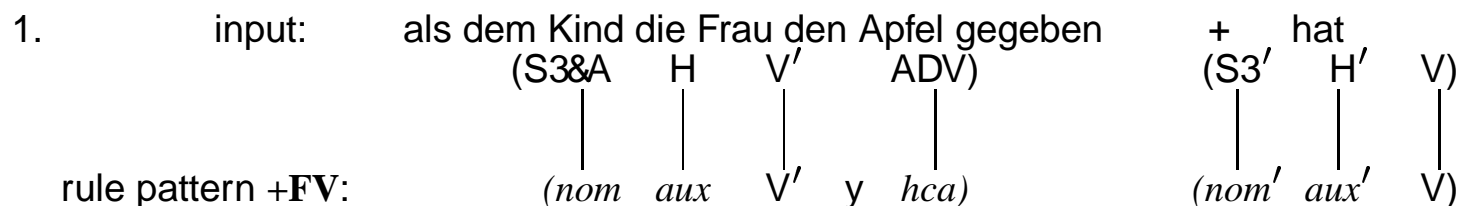
18.5.8 Nesting of adverbial subclauses in preverbal position

Als Maria, obwohl Julia die Zeitung + las Als Maria, obwohl Julia die Zeitung las,
 (A S3&D&A V' S3&D&A V' ADV) (S3' A' V) \Rightarrow (S3&D&A V' ADV)

18.5.9 +NFV adds nonfinite main verb to subclause



18.5.10 +FV concludes subclause with finite auxiliary



18.5.11 LAG handling interrogative and adverbial clauses (*LA-D4*)

LX = LX of *LA-D3* plus subordinating conjunctions

[als (V' ADV) *], [nachdem (V' ADV) *], [obwohl (V' ADV) *]

variable definition = variable definition of *LA-D3* plus $hca \in \{V, VI, ADV\}$

$ST_S =_{def} \{ [(x) \{1 +ADJ, 2 +N, 3 +FV, 4 +MAIN, 5 ?+MAIN\}] \}$

+N: $(adj' n' x) (n) \Rightarrow (x) \quad \{6 +FV, 7 +MAIN, 8 +NFV, 9 +IP\}$

+ADJ: $(adj' x) (adj) \Rightarrow (adj' x) \quad \{10 +ADJ, 11 +N\}$

?+MAIN: $(nom' aux' V)(z nom) \Rightarrow (z aux' VI)$

$(nom' aux' V)(y obq) \Rightarrow (y obq nom' aux' VI)$

$(x np' y V)(z np) \Rightarrow (z x y VI)$

$(x V)(y ADV) \Rightarrow (y x VI) \quad \{12 +ADJ, 13 +N, 14 +MAIN, 15 +NFV, 16 +IP\}$

+FV: $(nom aux V' y hca) (nom' aux' V) \Rightarrow (y hca)$

$(x V' y hca)(x \sim V)$

$[x = x \sim] \Rightarrow (y hca)$

$(nom)(nom' aux' V) \Rightarrow (aux' V)$

$(obq)(x aux' V) \Rightarrow (obq x aux' V)$

$(x aux)(np' aux' V) \Rightarrow (x np' V)$

$(np)(x np' y V) \Rightarrow (x y V)$

$(ADV)(x V) \Rightarrow (x V) \quad \{17 +MAIN, 18 +NFV, 19 +FV, 20 +IP\}$

+MAIN: $(x nom' y aux' V)(z nom) \Rightarrow (z x y aux' V)$

$$(x \text{ aux}' V)(y \text{ obq}) \Rightarrow (y \text{ obq } x \text{ aux}' V)$$

$$(x \text{ np}' y V)(z \text{ np}) \Rightarrow (z x y V)$$

$$(x V' y \text{ hca})(z \text{ np}) \Rightarrow (z \text{ np } x V' y \text{ hca})$$

$$(x V)(y \text{ ADV}) \Rightarrow (y x V) \quad \{21 +\text{ADJ}, 22 +\text{N}, 23 +\text{MAIN}, 24 +\text{NFV}, 25 +\text{FV}, 26 +\text{IP}\}$$

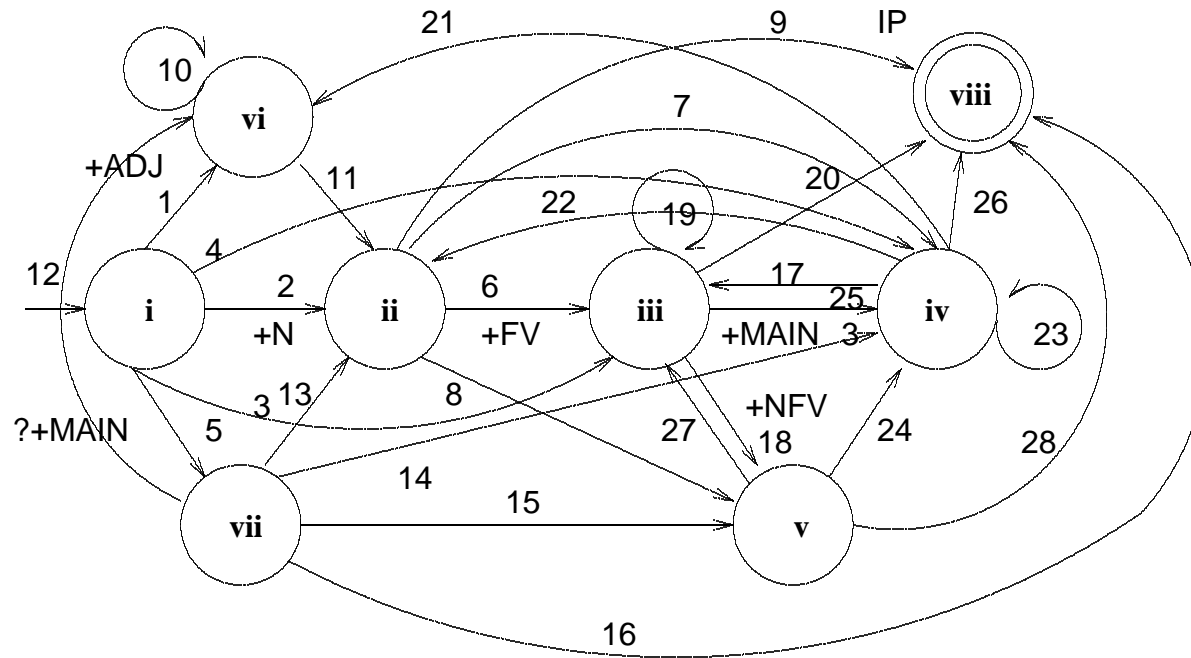
+NFV: $(x1 \text{ nom } x2 V' y \text{ hca})(x \sim \text{aux})$

$$[(x1 \circ x2) = x \sim] \Rightarrow (\text{nom aux } V' y \text{ hca})$$

$$(x \text{ aux}' V)(x \sim \text{aux}) \Rightarrow (V) \quad \{27 +\text{FV}, 28 +\text{IP}\}$$

+IP: $(vt) (vt' sm) \Rightarrow (sm) \quad \{\}$

$ST_F =_{def} \{ [(V) \text{rp}_{+ipt}], [(VI) \text{rp}_{+ipt}] \}$

18.5.12 The finite state backbone of *LA-D4*

ii	2, 11, 13, 19, 22,	+N	vi.	1, 10, 12, 21,	+ADJ
iii	3, 6, 8, 17, 19, 27	+FV	vii:	5,	+MAIN
iv	4, 14, 7, 23, 24, 25	+MAIN	viii:	9, 16, 20, 26,	+IP
v.	8, 15, 18,	+NFV			

18.5.13 Verification of grammars

1. *Syntactic verification*

The formal grammars for English and German developed so far should be implemented as parsers and tested automatically on increasing sets of positive and negative test sentences.

2. *Morphological and lexical verification*

The word form recognition of these grammars should be changed from the preliminary full form lexica LX to suitable applications of LA-Morph and be tested on corpus-based word lists in order to provide extensions with sufficient data coverage of the lexicon and the morphology.

3. *Functional verification in communication*

The formal grammars and parsers for natural languages should be supplemented with an automatic semantic and pragmatic interpretation that is (i) in line with the basis assumptions of the SLIM theory of language and (ii) demonstrated to be functional in automatic applications.