

Bonsai Grammar for German

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I. Introduction¹

This paper presents a fragment of a Role and Reference Grammar-based analysis of German syntax. It is designed to handle the structures listed in IIA below, which include simple sentences with intransitive, transitive and ditransitive verbs, WH-questions, and finite complement clauses. It is termed a ‘bonsai grammar’, because it is a mini-version of what an account of German syntax would look like. Like a bonsai tree, it is the real thing, only smaller in size and in scope.

This is the first attempt, at least as far as we are aware, to work out the linking principles in detail for a set of sentences from a language. It includes a lexicon, a syntactic inventory, template selection principles, PSA selection principles, case and preposition assignment rules, and a finite verb/auxiliary agreement rule. It also contains a constructional schema for one construction, the *werden*-passive. The RRG semantics-to-syntax linking rules have been adapted to German and spelled out explicitly, so that they can account for the set of sentences below. One thing that is missing from the sketch is a representation of information structure in German and its role in the linking, especially in the linearization principles.

Further work will expand the grammar to cover more of the syntactic phenomena of German. Comments and suggestions are welcome and appreciated.

II. Fragment of a Role and Reference Grammar account of German syntax

A. Example sentences to be analyzed:

1. Simple intransitive sentences
 - a. Der Fernseher steht auf dem Tisch.
‘The TV is standing on the table.’
 - b. Sie hat im Büro geschlafen.
‘She has slept in the office.’
 - c. Er ist aufgestanden.
‘He has stood up.’

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- d. Er stand auf.
‘He stood up.’
- e. Jürgen ist Bäcker.
‘Jürgen is a baker.’
2. Simple transitive sentences
- a. David hat das Auto vor dem Haus gewaschen.
‘David has washed the car in front of the house.’ [*in front of the house* is a peripheral_{CORE} adjunct, not an NP modifier]
- b. David muss das Auto vor dem Haus waschen.
‘David must wash the car in front of the house.’
- c. David muss das Auto vor dem Haus gewaschen haben.
‘David must have washed the car in front of the house.’
- d. Der Bäcker schnitt das Brot mit dem Messer.
‘The baker cut the bread with the knife.’
3. Simple ditransitive sentences
- a. Die Frau hat dem Kind ein Buch geschenkt.
‘The woman has given a book to the child [as a gift].’
- b. Er hat den Fernseher auf den Tisch gestellt.
‘He has put the TV on the table.’
4. WH-questions
- a. Was steht auf dem Tisch?
‘What is standing on the table?’
- b. Was hat der Bäcker mit dem Messer geschnitten?
‘What has the baker cut with the knife?’
- c. Wem hat die Frau das Buch geschenkt?
‘To whom has the woman given the book [as a gift]?’
5. Passive
- a. Das Auto wurde von David vor dem Haus gewaschen.
‘The car was washed by David in front of the house.’
- b. Der Fernseher wurde auf den Tisch gestellt.
‘The TV was put on the table.’
6. Fronted Nucleus in the PrCS
- a. Gewaschen hat David das Auto noch nie.
Lit: ‘Washed has David the car not yet ever.’
- b. Das Auto gewaschen hat David noch nie.
Lit: ‘The car washed has David not yet ever.’
- c. Gewaschen haben muss David das Auto vor dem Haus.
Lit: ‘Have washed must David the car in front of the house’ (= ‘It must be the case that David has washed the car in front of the house.’)
7. Embedded clauses
- a. Ich glaube, dass die Frau dem Kind das Buch geschenkt hat.
‘I believe that the woman gave the book to the child [as a gift].’
- b. Ich glaube, dass sie es ihm gestern geschenkt hat.
‘I believe, that she gave it to him [as a gift] yesterday.’

B. Lexicon**Verbs:**

<i>aufstehen</i>	BECOME do' (x, [stand' (x)])
<i>schlafen</i>	do' (x, [sleep' (x)])
<i>schenken</i>	[do' (x, Ø)] CAUSE [BECOME have' (y, z)]
<i>schneiden</i>	do' (x, [use' (x, y)] CAUSE [(BECOME be-at' (z, y)] & BECOME cut' (z)]
<i>stehen</i>	do' (x, [stand' (x, ([be-LOC' (y, x)]))])
<i>stellen</i>	[do' (x, Ø)] CAUSE [BECOME be-LOC' (y, z)]
<i>waschen</i>	do' (x, [wash' (x, y)])

Operators:

<_{IF} <_{TNS} <_{STA} <_{NEG} <_{MOD} <_{DIR} <_{ASP} <**LS**>>>>>>>>

Auxiliary verbs:

—**Operator auxiliaries** (do not attach to the nucleus, only to the operator projection):

<i>haben</i> ['have']	'perfect'
<i>müssen</i> ['must']	'modal of necessity or obligation'
<i>sein</i> ['be']	'perfect'

—**Nuclear auxiliaries** (attach to the nucleus when they are nonfinite; they do not attach to the nucleus when they are finite):

<i>sein</i> ['be']	'predicate adjectives, predicate nominals, locative predications'
<i>werden</i> ['become']	'passive'

Adverbs:

<i>gestern</i>	yesterday' (x)	'yesterday'
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Prepositions:

<i>auf</i>	be-on' (x, y)	'on'
<i>in</i>	be-in' (x, y)	'in'
<i>mit</i>	be-with' (x, y)	'with'
<i>vor</i>	be-in-front-of' (x, y)	'in front of'

Nouns:

<i>Auto</i> n	'car'
<i>Bäcker</i> m	'baker'
<i>Brot</i> n	'bread'
<i>Buch</i> n	'book'
<i>Büro</i> n	'office'
<i>Fernseher</i> m	'TV'
<i>Frau</i> f	'woman'
<i>Haus</i> n	'house'
<i>Kind</i> n	'child'

Messer n 'knife'
Tisch m 'table'

Pronouns:

er 3sgM 'he'
sie 3sgF 'she'

Articles:

Definite:

der m

die f

das n

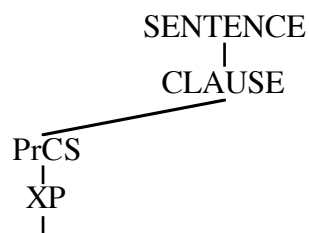
Indefinite:

ein m

Clause linkage marker:

dass 'that'

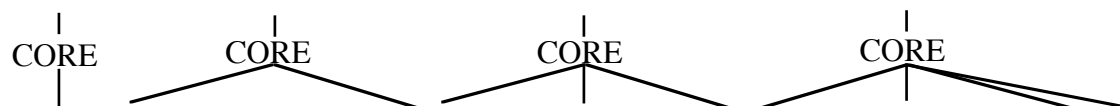
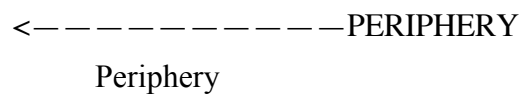
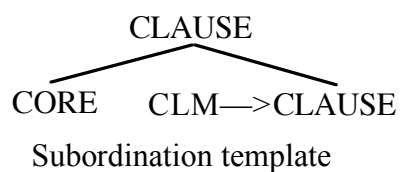
C. Syntactic Inventory



Clause/sentence with Precore Slot



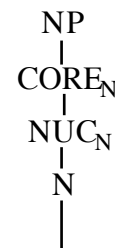
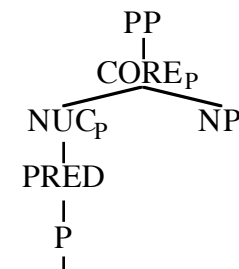
Clause template for subordinate clause



Core templates with one to four slots



Nucleus templates, \pm AUX (where AUX includes only the non-finite nuclear auxiliaries *sein* 'be' with predicate nominal, predicate adjective and locative predications, *werden* 'become' as the passive auxiliary, and *bekommen* 'receive' as a second passive auxiliary when they are nonfinite).



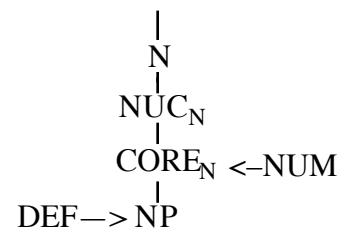
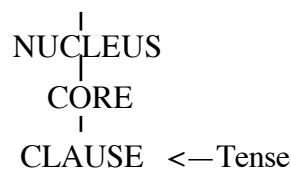
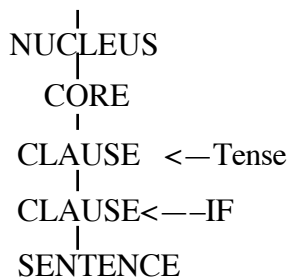
Predicative PP

Proper Noun NP

Pronominal NP

Common noun NP

The operator projection is determined by the operators in the semantic representation of the clause and NP. Templates representing the minimally required operators for clauses, main and subordinate, and NPs, are given below.



Main clause operator projection

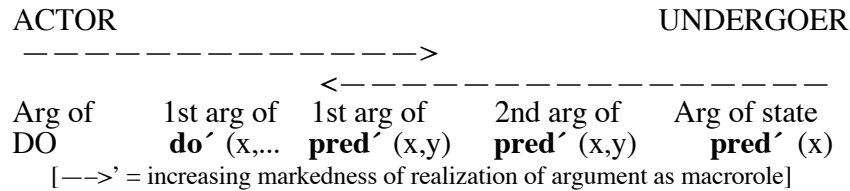
Subordinate clause op. proj.

NP operator projection

D. Rules and principles involved in the linking from semantics to syntax

Core template selection principles:

- (1) a. Core syntactic template selection principle:
The number of syntactic slots for arguments within the core is equal to the number of distinct specified argument positions in the semantic representation of the core.
- b. Language-specific qualifications of the principle in (a):
 1. All cores in the language have a minimum syntactic valence of 1.
 2. In the passive, the number of core slots is reduced by one.
 3. The occurrence of a syntactic argument in the pre/postcore slot reduces the number of core slots by 1 [may override (1) above]



Actor-Undergoer Hierarchy

Case assignment rules for German direct arguments:

- a. Assign nominative case to the highest ranking macrorole argument.
- b. Assign accusative case to the other macrorole argument.
- c. Assign dative case to non-macrorole arguments (default).

Case assignment rule for German prepositions which assign both dative and accusative case:

- a. Assign dative case to the first argument of **be-LOC'** (x, y)
- b. Assign accusative case to the first argument of BECOME/INGR **be-LOC'** (x, y).

Preposition assignment rule for *mit*:

Assign *mit* to non-MR *b* argument if, given two arguments, *a* and *b*, in a logical structure, (1) both are possible candidates for a particular macrorole and (2) *a* is equal or higher (to the left of *b*) on the AUH.

Finite verb/auxiliary agreement:

The controller of finite verb/auxiliary agreement is the highest ranking macrorole argument.

NP-internal agreement:

The article agrees with the head noun in number, gender and case.

Privileged syntactic argument ['subject'] selection principle:

Highest ranking macrorole argument (actor > undergoer)

CONSTRUCTION: German passive (plain)
SYNTAX: Template: default PSA ['subject']: Undergoer selected; Variable [\pm pragmatic influence] Linking: Non-default; Actor omitted or in peripheral <i>von</i> -PP
MORPHOLOGY: Verb: past participle Auxiliary (nuclear): <i>werden</i>
SEMANTICS: PSA is not instigator of state of affairs but is affected by it (default)
PRAGMATICS: Illocutionary force: Unspecified Focus structure: No restrictions; PSA = topic (default)

Constructional schema for German passive (plain)

Completeness Constraint:

All of the arguments explicitly specified in the semantic representation of a sentence must be realized syntactically in the sentence, and all of the referring expressions in the syntactic representation of a sentence must be linked to an argument position in a logical structure in the semantic representation of the sentence.

Linking rules for German: Semantics to Syntax

1. In the lexicon, construct the semantic representation of the sentence, based on the LS of the predicator.
2. Determine the actor and undergoer assignments, following the Actor-Undergoer Hierarchy.
3. Determine the morphosyntactic coding of the arguments
 - a. Select the PSA, based on the PSA selection hierarchy.
 - b. Assign the arguments the appropriate case markers and prepositions.
 - c. Assign the agreement marking:
 1. Verbal
 - a. In simple present or past tense, the agreement marking is on the nucleus.
 - b. In complex tense forms, passive and copular constructions, the agreement marking is on the auxiliary (nuclear or operator auxiliary).
 2. Nominal: case, number and gender agreement is determined.
4. Select the syntactic template(s) for the sentence
 - a. For main declarative clauses and W-questions, select the clause template with PrCS.²
 - b. For embedded clauses, select the subordinate clause template.
 - c. For the core template, follow the core template selection principles.
 - d. For the nucleus template,
 1. select the branching template if there is a non-finite nuclear auxiliary;
 2. otherwise, select the non-branching template.
 - e. For NPs, select the appropriate template depending upon whether the NP is pronominal, a common noun or a proper noun.
 - f. Select a periphery template for all adjunct modifiers.
5. Assign LS elements to positions in the syntactic representation.
 - a. Assign the predicate to the nucleus.
 - b. Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
 - c. Assign the Nucleus to a position in the clause.
 1. In main clauses,
 - a. if the nucleus is finite, assign the nucleus to the first position in the core; if the verb has a separable prefix, the prefix occurs after the core and periphery and before the PoCS, if there is one.
 - b. if the nucleus is non-finite, assign it to the last position in the core (default) or the precore slot (subject to focus structure restrictions);

² The idea that all main, declarative clauses in German have a PrCs was first suggested to us by Ina Bornkessel and Matthias Schlesewsky (personal communication).

- otherwise, place the finite auxiliary before the first slot in the core;
non-finite auxiliaries are placed after the nucleus.
- c. if the nucleus is in the PrCS,
 1. the non-finite auxiliaries (if they occur) can either be placed adjacent to it or after the last position in the core, but not need not be adjacent to each other.
 2. one or more arguments from the core may be placed before it, subject to focus structure restrictions (i. e. the fronted elements (taken together) must be in the actual focus domain). The word order in the PrCS has to reflect the word order possibilities in the core, see 5.e below.
 2. In subordinate clauses, assign the nucleus to the final position in the core.
 - a. if the nucleus is non-finite, place the finite auxiliary after the nucleus.
 - b. Where there are both nucleus auxiliaries and operator auxiliaries, the operator auxiliaries follow the nucleus in the order dictated by the Scope Iconicity Principle [see e.g. Van Valin 2005:11].
 - d. An element must be assigned to the precore slot, [+WH] > other.
 - e. Remaining elements are assigned to the core and periphery
 1. General constraints: pronoun > other, NP > PP
 2. Case-based argument ordering constraint: NOM > DAT > ACC (default)
 3. If ACC = pronoun, then ACC > DAT (default)³

III. Analysis of selected sentences

Analysis of *Der Fernseher steht auf dem Tisch.*

Step 1: Construct semantic representation in Lexicon.

- a. Access LS for *stehen* and select prepositional LS to fill **be-LOC'** slot in LS, *auf*:

$$\mathbf{do'} (x [\mathbf{stand'} (x, [\mathbf{be-LOC'} (y, x)]) + \mathbf{be-on'} (_, _)]) =>$$

$$\mathbf{do'} (x [\mathbf{stand'} (x, [\mathbf{be-on'} (y, x)])])$$
- b. Determine the value of the operators to be expressed:

$$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle \mathbf{do'} (x, [\mathbf{stand'} (x, [\mathbf{be-on'} (y, x)])]) \rangle \rangle \rangle$$
- c. Select the referring expressions to fill the variable positions in LS:

$$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle \mathbf{do'} (\text{Fernseher}, [\mathbf{stand'} (\text{Fernseher}, ([\mathbf{be-on'} (\text{Tisch}, \text{Fernseher})])]) \rangle \rangle \rangle$$

Step 2: Determine actor and undergoer assignments:

$$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle \mathbf{do'} (\text{ACT: Fernseher}, [\mathbf{stand'} (\text{Fernseher}, [\mathbf{be-on'} (\text{Tisch}, \text{Fernseher})])]) \rangle \rangle \rangle$$

Step 3: Determine the morphosyntactic coding of the arguments

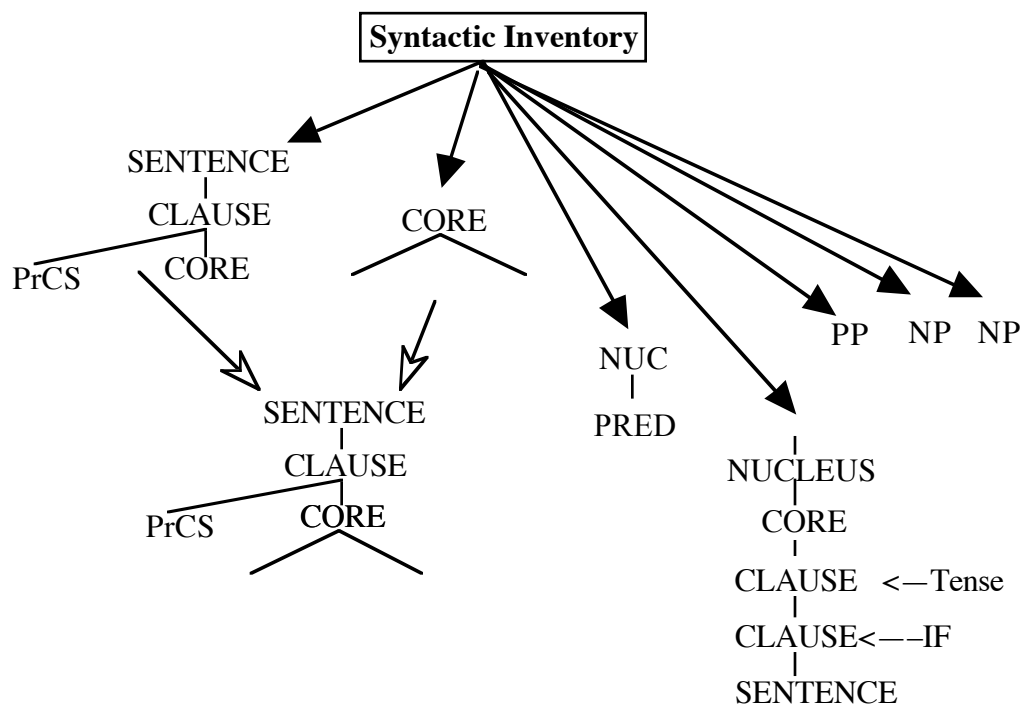
- a. PSA selection: Actor as sole macrorole is selected as PSA.

³ This formulation was suggested to us by Frank Liedtke (personal communication).

- b. Actor is assigned nominative case as highest ranking macrorole; preposition *auf* is assigned to *derTisch*, which receives dative case due to being the first argument of **be-on'**, a static location.
- c. As the tense is present, the agreement marking is on the nucleus. The nucleus will agree with the actor since it is the highest ranking macrorole.

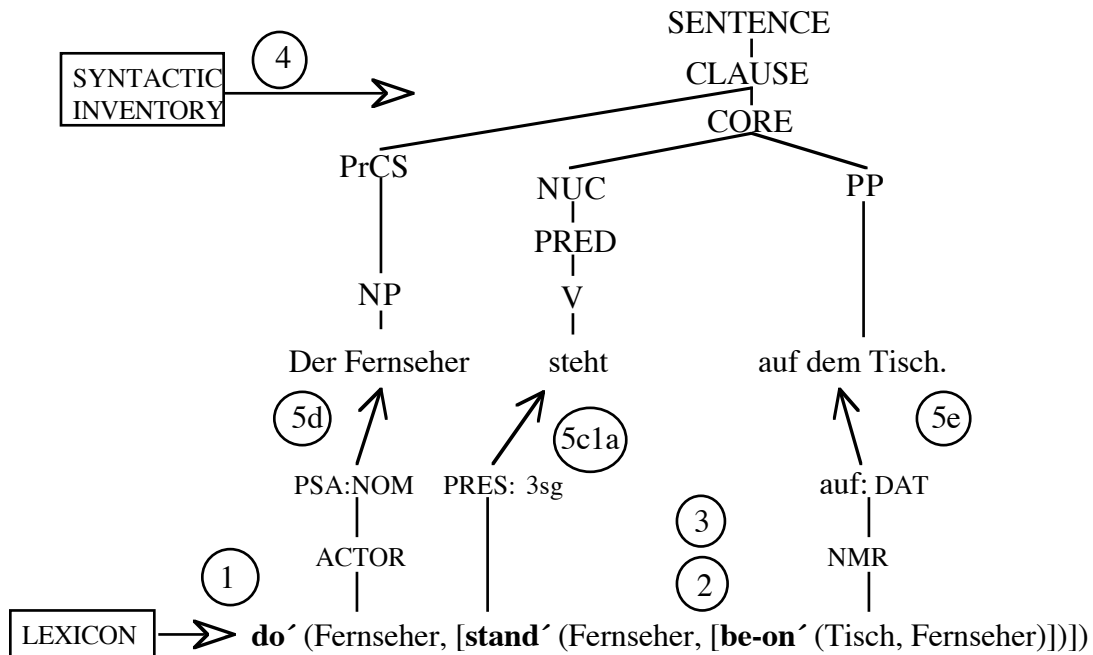
Step 4: Select syntactic templates:

- a. Select the PrCS template, which is obligatory in main declarative clauses.
- b. d. n. a.
- c. Select a two-place core, one place for the nucleus and one for the PP.
- d. Select the non-branching nucleus template.
- e. Select two common noun NP templates and a predicative PP template.

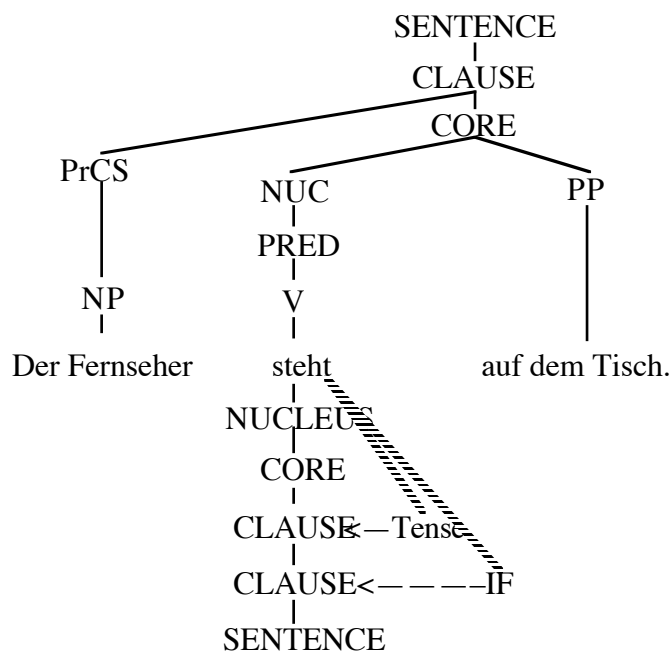


Step 5: Assign LS elements to positions in the syntactic representation:

- a. Assign the predicate to the nucleus.
- b. Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
- c. (1.a). Since the nucleus is finite, link it to the first position in the core.
- d. Link the nominative case-actor *Der Fernseher* to the PrCS.
- e. Link the PP to the remaining core position.
Completeness Constraint satisfied.



Simplified diagram of linking; the numbers refer to the steps in the linking.



Resulting tree structure, with constituent and operator projections

Analysis of *David hat das Auto vor dem Haus gewaschen.*

Step 1: Construct semantic representation in Lexicon.

- a. Access LS for *waschen* and select prepositional LS for adjunct PP and combine them.

$\text{do}'(x, [\text{wash}'(x, y)]) + \text{be-in-front-of}'(w, z) \Rightarrow$
 $\text{be-in-front-of}'(w, [\text{do}'(x, [\text{wash}'(x, y)])])$

- b. Determine the value of the operators to be expressed:

$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(w, [\text{do}'(x, [\text{wash}'(x, y)])]) \rangle \rangle \rangle \rangle$

- c. Select the referring expressions to fill the variable positions in LS:

$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(\text{Haus}, [\text{do}'(\text{David}, [\text{wash}'(\text{David}, \text{Auto})])]) \rangle \rangle \rangle \rangle$

Step 2: Determine actor and undergoer assignments:

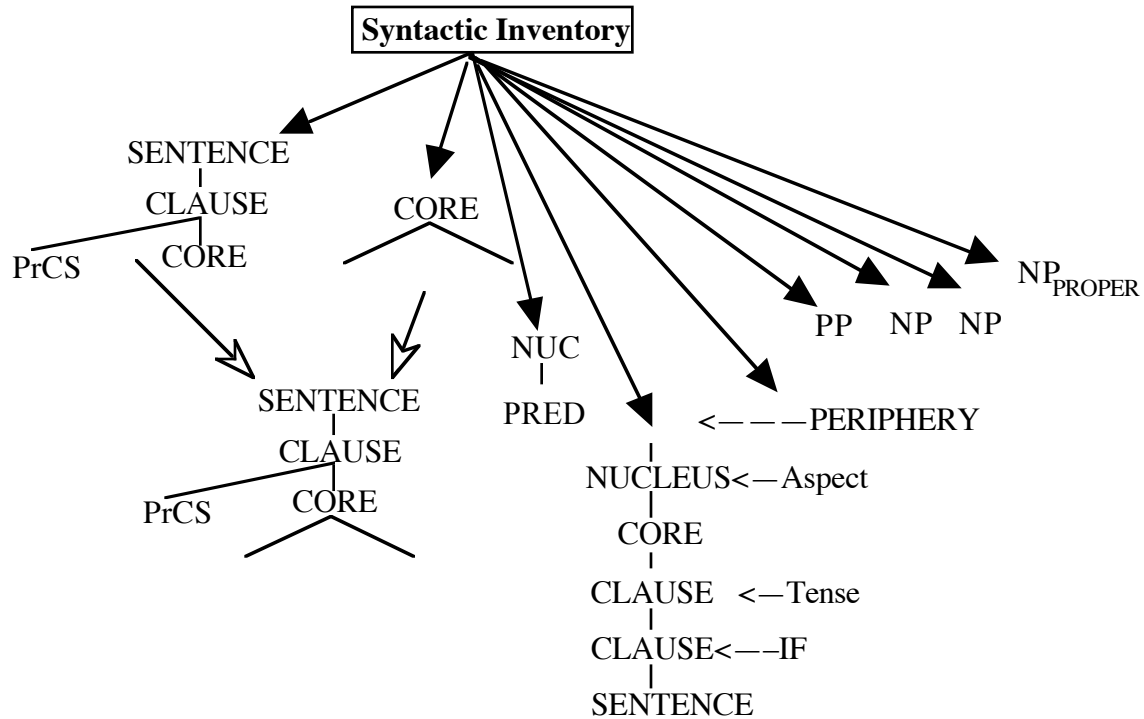
$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(\text{Haus}, [\text{do}'(\text{ACT:David}, [\text{wash}'(\text{David}, \text{UND:Auto})])]) \rangle \rangle \rangle \rangle$

Step 3: Determine the morphosyntactic coding of the arguments

- a. PSA selection: Actor as highest ranking macrorole is selected as PSA.
- b. Actor is assigned nominative case as highest ranking macrorole; Undergoer is assigned accusative case as the other macrorole; preposition *vor* is assigned to *das Haus*, which receives dative case due to being the first argument of **be-in-front-of'**, a static location.
- c. As the tense is complex (perfect), the agreement marking is on the operator auxiliary. The finite auxiliary will agree with the actor since it is the highest ranking macrorole.

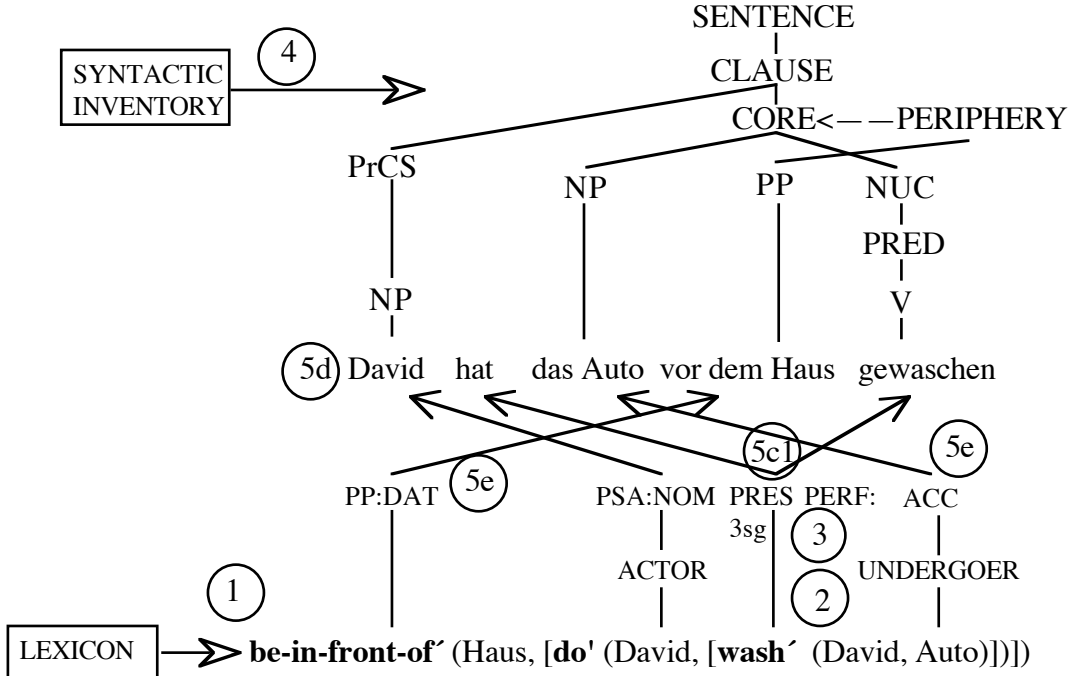
Step 4: Select syntactic templates:

- a. Select the PrCS template, which is obligatory in main declarative clauses.
- b. d. n. a.
- c. Select a two-place core, one place for the nucleus and one for the accusative NP.
- d. Select a non-branching nucleus template.
- e. Select one proper noun template, two common noun NP templates and a predicative PP template
- f. Select a Periphery template for the adjunct PP

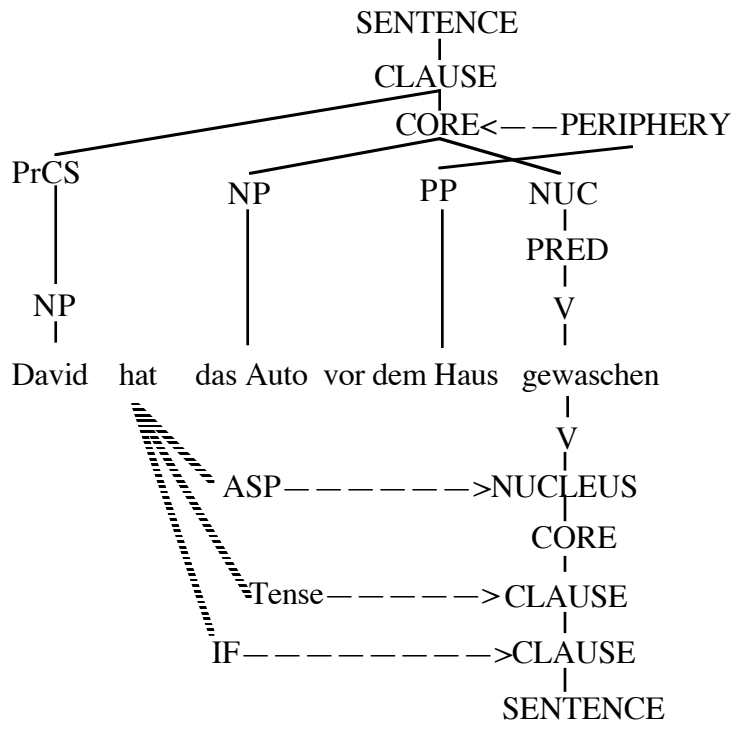


Step 5: Assign LS elements to positions in the syntactic representation:

- a. Assign the predicate to the nucleus.
 - b. Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
 - c. (1.b.) Since the nucleus is non-finite, link it to the last position in the core.
(1.c.) Place the finite auxiliary before the first position in the core.
 - d. Assign the nominative case-actor *David* to the PrCS.
 - e. Assign the accusative NP *das Auto* to the remaining core position and the predicative PP to the periphery modifying the core.
- Completeness Constraint satisfied.



Simplified diagram of linking; the numbers refer to the steps in the linking.



Final structure with constituent and operator projections

Analysis of *Das Auto wurde von David vor dem Haus gewaschen.*

Step 1: Construct semantic representation in Lexicon.

- a. Access LS for *waschen* and select prepositional LS for adjunct PP and combine them.

$\text{do}'(x, [\text{wash}'(x, y)]) + \text{be-in-front-of}'(w, z) \Rightarrow$
 $\text{be-in-front-of}'(w, [\text{do}'(x, [\text{wash}'(x, y)])])$

- b. Determine the value of the operators to be expressed:

$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(w, [\text{do}'(x, [\text{wash}'(x, y)])]) \rangle \rangle \rangle \rangle$

- c. Select the referring expressions to fill the variable positions in LS:

$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(\text{Haus}, [\text{do}'(\text{David}, [\text{wash}'(\text{David}, \text{Auto})])]) \rangle \rangle \rangle \rangle$

Step 2: Determine actor and undergoer assignments:

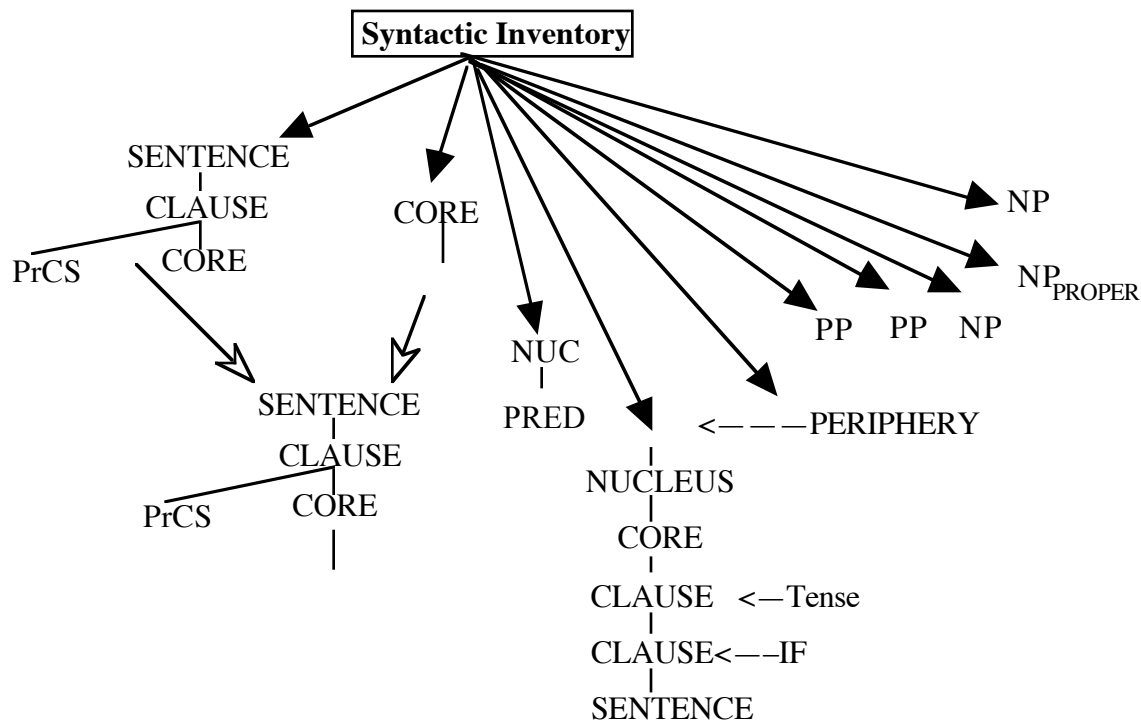
$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(\text{Haus}, [\text{do}'(\text{ACT:David}, [\text{wash}'(\text{David}, \text{UND:Auto})])]) \rangle \rangle \rangle \rangle$

Step 3: Determine the morphosyntactic coding of the arguments

- a. PSA selection: Plain passive construction, and following the constructional schema, the Undergoer is selected as PSA; the Actor will occur as an adjunct.
- b. The Undergoer is assigned nominative case as highest ranking core macrorole; the Actor is marked by the preposition *von*, following the constructional schema, and receives dative case from *von*; preposition *vor* is assigned to *das Haus*, which receives dative case due to being the first argument of **be-in-front-of'**, a static location.
- c. The agreement marking is on the nuclear auxiliary. The finite auxiliary will agree with the Undergoer since it is the highest ranking core macrorole.

Step 4: Select syntactic templates:

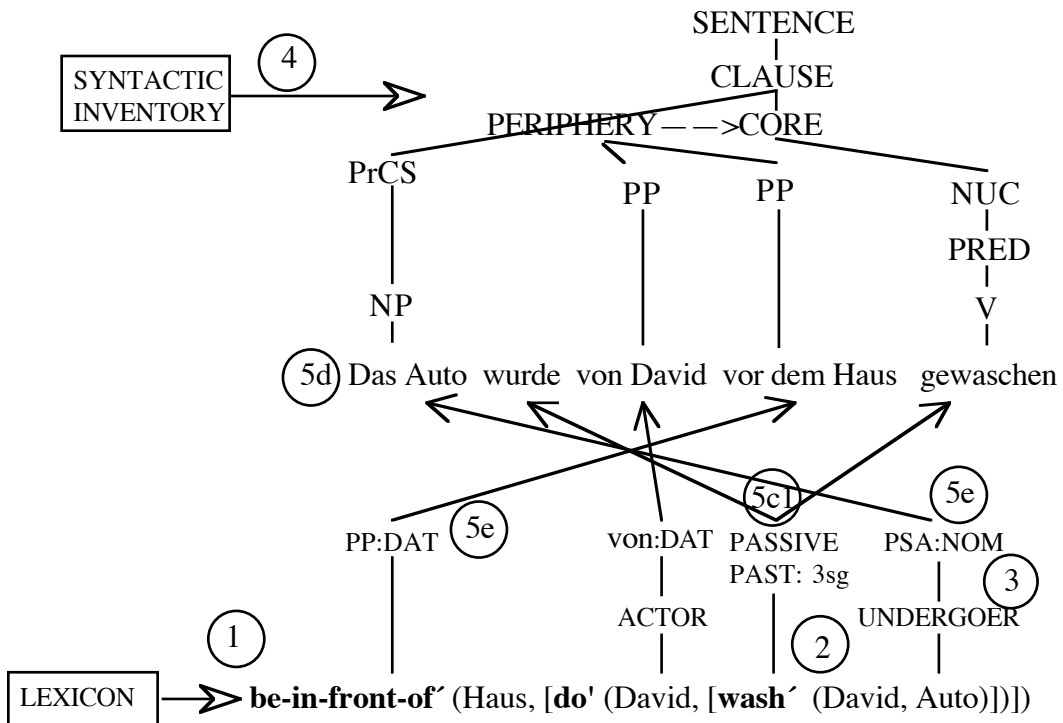
- a. Select the PrCS template, which is obligatory in main declarative clauses.
- b. d. n. a.
- c. Select a one-place core for the nucleus .
- d. Select a non-branching nucleus template.
- e. Select one proper noun template, two common noun NP templates and two predicative PP templates
- f. Select a Periphery template for the adjunct PPs



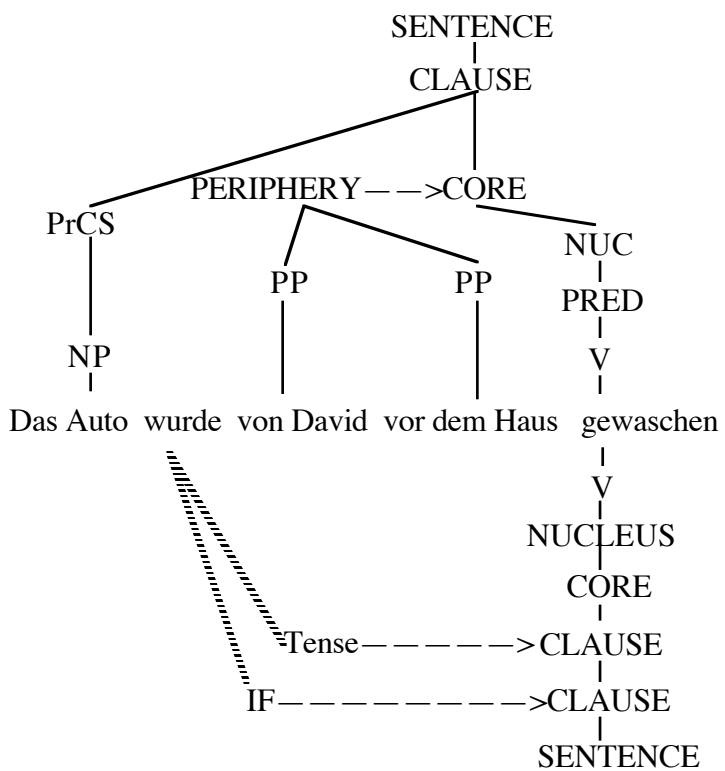
Step 5: Assign LS elements to positions in the syntactic representation:

- a. Assign the predicate to the nucleus.
- b. Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
- c. (1.b.) Since the nucleus is non-finite, link it to the last position in the core.
(1.c.) Place the finite auxiliary before the first position in the core.
- d. Assign the nominative case-undergoer *das Auto* to the PrCS, following the constructional schema.
- e. Assign the Actor PP *von David* and the predicative PP *vor dem Haus* to the periphery_{CORE}.

Completeness Constraint satisfied.



Simplified diagram of linking; the numbers refer to the steps in the linking.



Final structure with constituent and operator projections

Analysis of *Gewaschen haben muss David das Auto vor dem Haus*.

Step 1: Construct semantic representation in Lexicon.

- a. Access LS for *waschen* and select prepositional LS for adjunct PP and combine them.

$\text{do}'(x, [\text{wash}'(x, y)]) + \text{be-in-front-of}'(w, z) \Rightarrow$
 $\text{be-in-front-of}'(w, [\text{do}'(x, [\text{wash}'(x, y)])])$

- b. Determine the value of the operators to be expressed:

$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{STA}} \text{NEC} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(w, [\text{do}'(x, [\text{wash}'(x, y)])]) \rangle \rangle \rangle \rangle \rangle$

- c. Select the referring expressions to fill the variable positions in LS:

$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{STA}} \text{NEC} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(\text{Haus}, [\text{do}'(\text{David}, [\text{wash}'(\text{David}, \text{Auto})])]) \rangle \rangle \rangle \rangle \rangle$

Step 2: Determine actor and undergoer assignments:

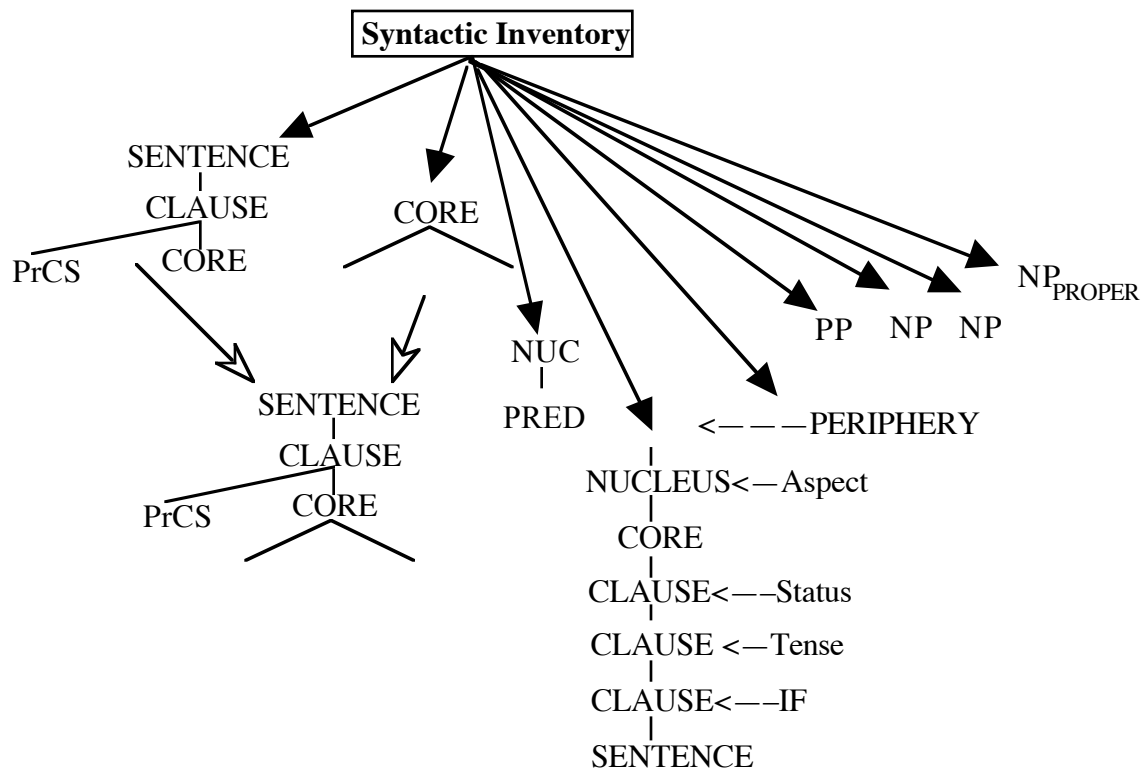
$\langle_{\text{IF}} \text{DEC} \langle_{\text{TNS}} \text{PRES} \langle_{\text{STA}} \text{NEC} \langle_{\text{ASP}} \text{PERF} \langle \text{be-in-front-of}'(\text{Haus}, [\text{do}'(\text{ACT:David}, [\text{wash}'(\text{David}, \text{UND:Auto})])]) \rangle \rangle \rangle \rangle \rangle$

Step 3: Determine the morphosyntactic coding of the arguments

- a. PSA selection: the Actor as highest ranking macrorole is selected as PSA
- b. The Actor is assigned nominative case as highest ranking macrorole; the Undergoer is assigned accusative case as the other macrorole; preposition *vor* is assigned to *das Haus*, which receives dative case due to being the first argument of **be-in-front-of'**, a static location.
- c. As the tense is complex (modal + perfect), the agreement marking is on the operator auxiliary. The finite auxiliary will agree with the actor since it is the highest ranking macrorole.

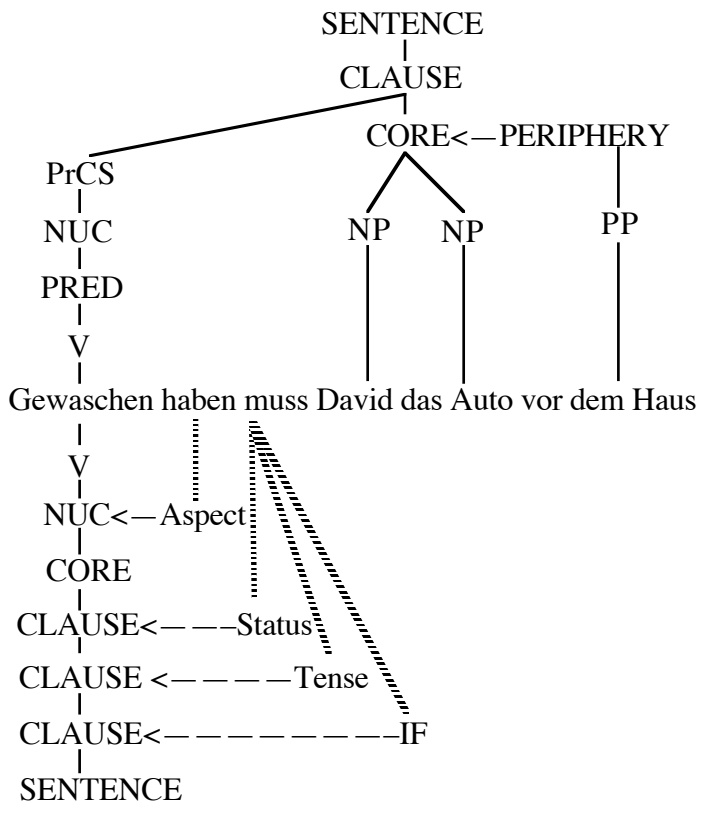
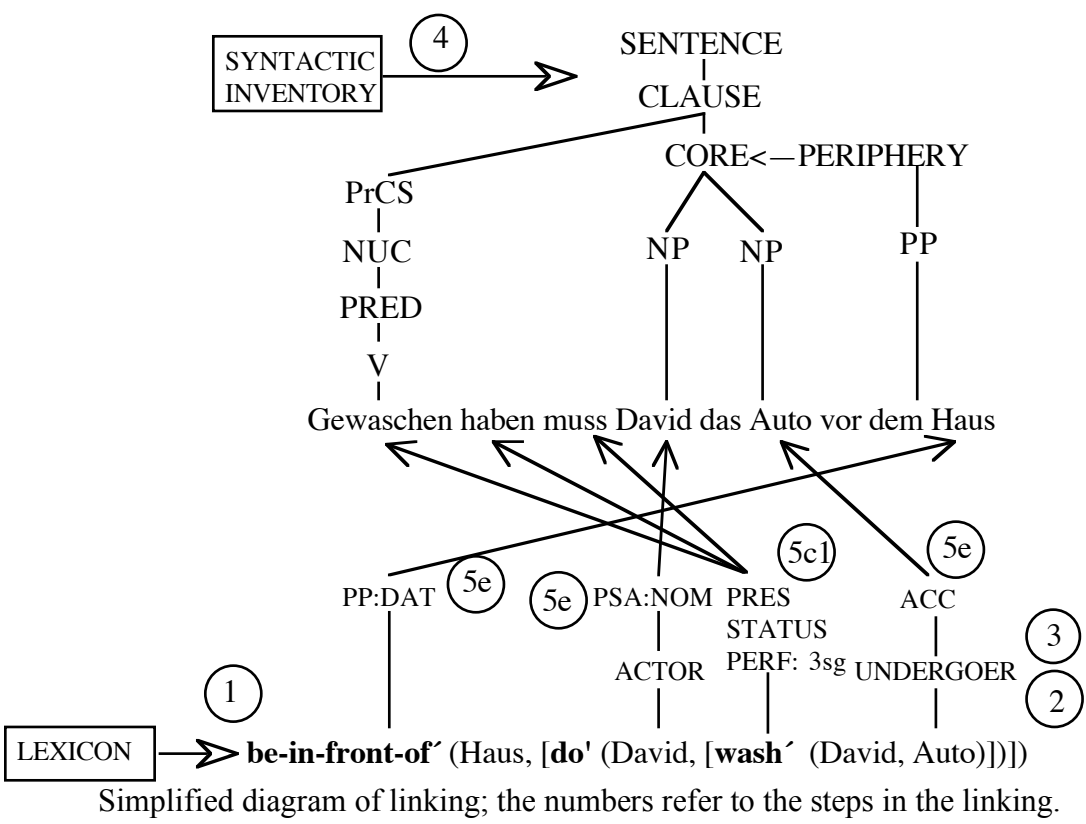
Step 4: Select syntactic templates:

- a. Select the PrCS template, which is obligatory in main declarative clauses.
- b. d. n. a.
- c. Select a two-place core for the two core arguments.
- d. Select a non-branching nucleus template.
- e. Select one proper noun template, two common noun NP templates and one predicative PP template
- f. Select a Periphery template for the adjunct PP



Step 5: Assign LS elements to positions in the syntactic representation:

- a. Assign the predicate to the nucleus.
- b. Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
- c. (1.b.) The nucleus is non-finite, and link it to the PrCS.
(1.c.) Place the finite auxiliary before the first position in the core; non-finite auxiliaries are placed after the nucleus.
(1.d.) Place the non-finite auxiliary adjacent to the nucleus.
- d. d.n.a. (because of c (1.b) above)
- e. Assign the nominative-Actor and accusative-Undergoer NPs to the core and the predicative PP to the periphery modifying the core, following word order principles.
Completeness Constraint satisfied.



Final structure with constituent and operator projections

Analysis of *Ich glaube, dass sie es ihm gestern geschenkt hat.*

Step 1: Construct semantic representation in Lexicon.

a. Access LSs for *glauben* and *schenken*, and select adverb LS and combine them.

believe'(w, v) + [**yesterday'**(u) + ([**do'**(x, Ø)] CAUSE [BECOME **have'**(y, z)] =>
believe'(w, [**yesterday'**([**do'**(x, Ø)] CAUSE [BECOME **have'**(y, z)])))]

b. Determine the value of the operators to be expressed:

<_{IF} DEC <_{TNS} PRES < believe' (x, [<_{TNS} PRES <_{ASP} PERF < **yesterday'**([**do'**(x, Ø)]
CAUSE [BECOME **have'**(y, z)]>>>)]>>>

c. Select the referring expressions to fill the variable positions in LS:

<_{IF} DEC <_{TNS} PRES < believe' (1sg, [<_{TNS} PRES <_{ASP} PERF < **yesterday'**([**do'**(3sgF,
Ø)] CAUSE [BECOME **have'**(3sgM, 3sgN)]>>>)]>>>

Step 2: Determine actor and undergoer assignments:

<_{IF} DEC <_{TNS} PRES < believe' (ACT: 1sg, [<_{TNS} PRES <_{ASP} PERF < **yesterday'**([**do'**
(ACT: 3sgF, Ø)] CAUSE [BECOME **have'**(NMR: 3sgM, UND: 3sgN)]>>>)]>>>

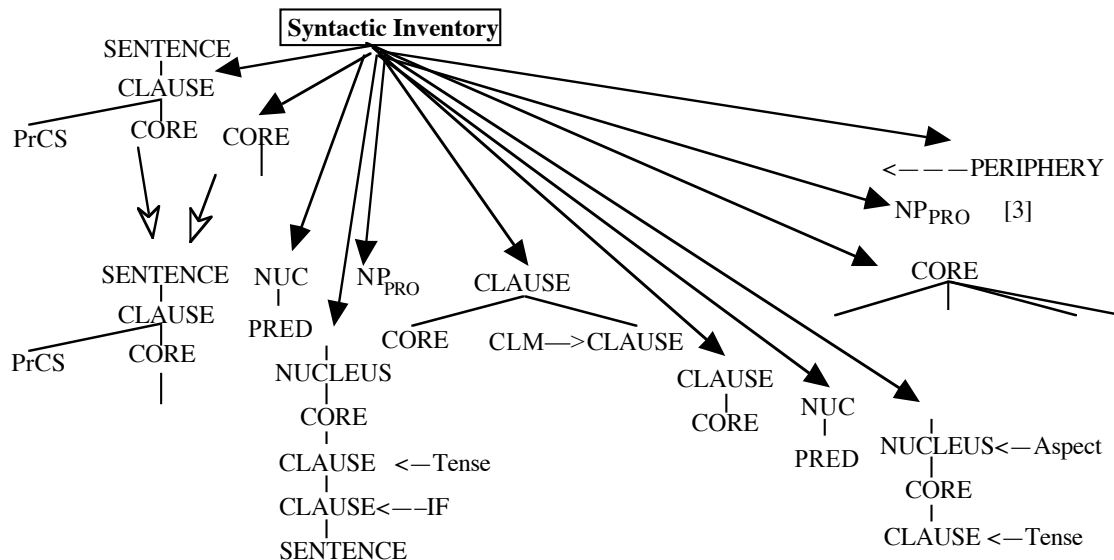
Step 3: Determine the morphosyntactic coding of the arguments

- a. 1. PSA selection for the main clause: The Actor as highest ranking macrorole is selected as PSA
2. PSA selection for the embedded clause: The Actor as highest ranking macrorole is selected as PSA
- b. 1. In the main clause, the Actor is assigned nominative case as highest ranking macrorole.
2. In the embedded clause, the Actor is assigned nominative case as highest ranking macrorole; the Undergoer is assigned accusative case as the lowest ranking macrorole. The non-macrorole argument is assigned dative case by default.
- c. 1. In the main clause, the tense is non-complex (present). So, the agreement marker is on the nucleus. The finite nucleus will agree with the actor since it is the highest ranking macrorole.
2. In the embedded clause, the tense is complex (perfect). So, the agreement marker is on the operator auxiliary. The finite auxiliary will agree with the actor since it is the highest ranking macrorole.

Step 4: Select syntactic templates:

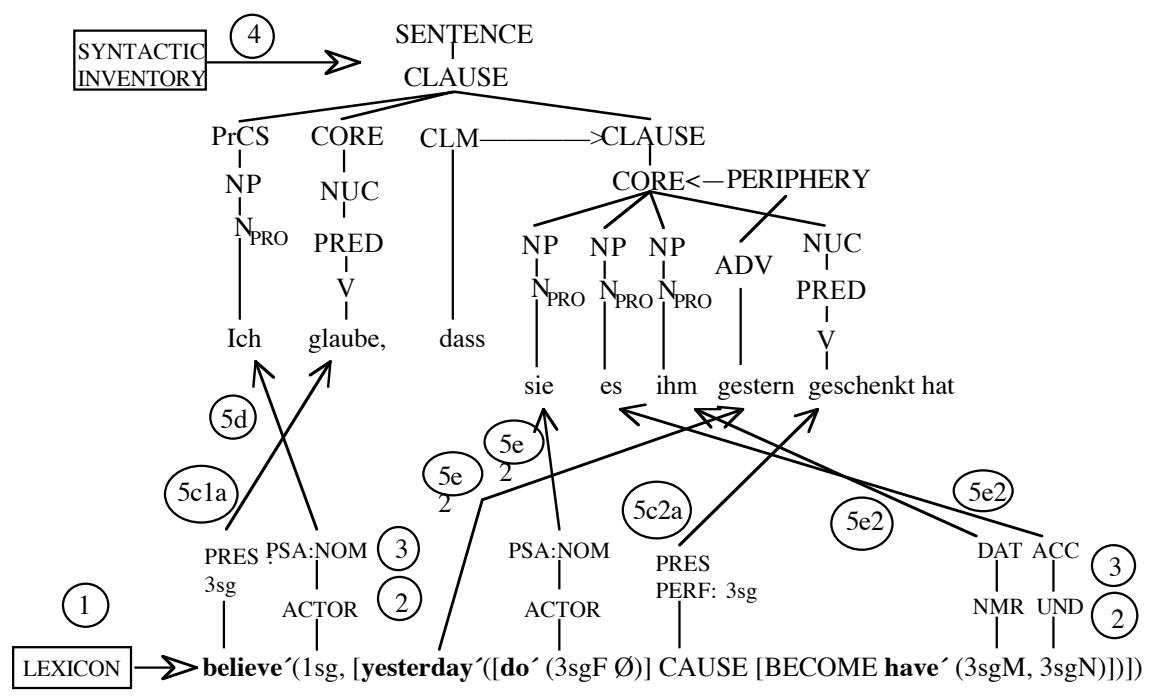
- a. Select the PrCS template, which is obligatory in main declarative clauses.
- b. For the embedded clause, select the subordinate clause template.
- c. For the core templates, follow the core template selection principles for both main and embedded clause.
 1. For the main clause, select a one-place core template for the nucleus.
 2. For the embedded clause, select a four-place core template for the three core arguments and the nucleus.
- d. 1. For the nucleus template of the main clause: Select the non-branching template.

2. For the nucleus template of the embedded clause: Select the non-branching template.
- e. 1. For the main clause, select a pronominal NP template.
2. For the embedded clause, select three pronominal NP templates.
- f. Select a periphery template for the adjunct modifier in the embedded clause.

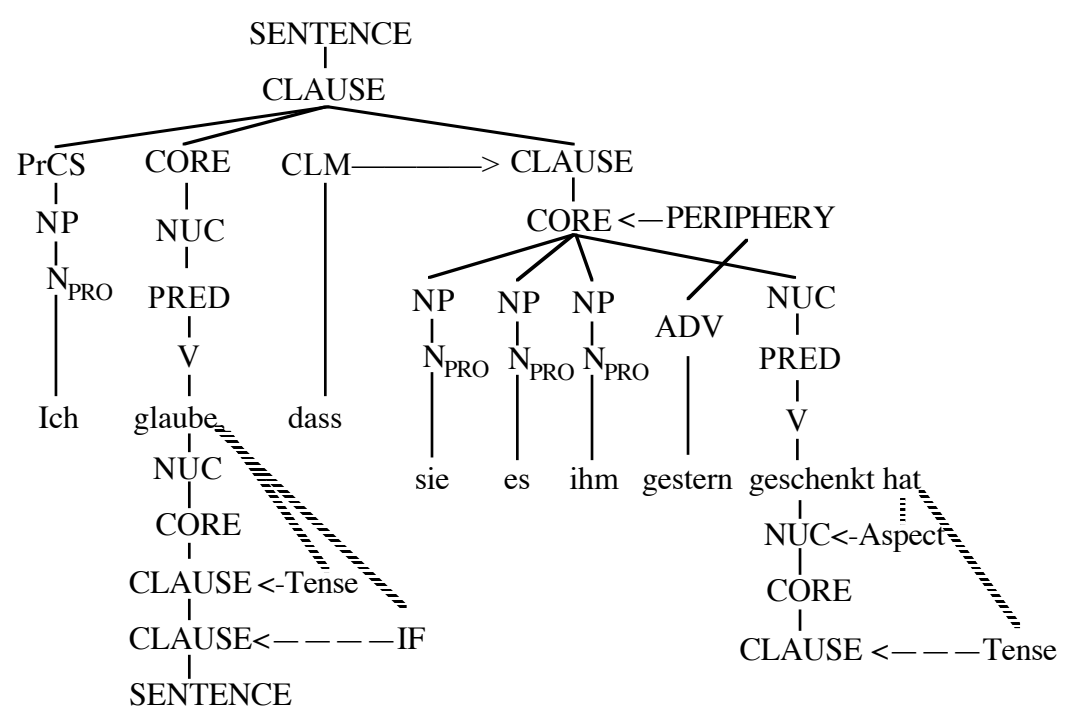


Step 5: Assign LS elements to positions in the syntactic representation.

- a. 1. Main clause: Assign the predicate to the nucleus.
2. Embedded clause: Assign the predicate to the nucleus.
- b. 1. Main clause: Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
2. Embedded clause: Join the operator projection template to the nucleus and attach the morphemes expressing operators to it.
- c. 1. a. Main clause: Assign the nucleus to the first position in the core.
2. a. Assign the nucleus to the last position in the core and place the finite auxiliary after it.
- d. Main clause: Assign the nominative pronoun to the precore slot.
- e. 1. Main clause: d. n. a.
2. Embedded clause: Pronouns are assigned to the core in the order following the principles in 2. and 3. The adverb follows the pronouns according to principle 1.



Simplified diagram of linking; the numbers refer to the steps in the linking.



Final structure with constituent and operator projections

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