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Background

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Grammars

Task:
Determine whether a given string of words is a grammatical (well-formed) sentence of language L_i or not.

Approach:
Throughout, a derivational, incremental approach to grammar will be adopted (following Chomsky (1995; 2000; 2001; 2008; 2014)).

(1) The syntactic component of a grammar:
   a. Lexicon: Set of lexical items (LIs)
   b. Operations: Merge (external and internal), Agree
   c. Constraints: derivational, representational, global, transderivational, translocal

Categories

LIs can be grouped together if they have a similar syntactic distribution and similar morphological properties: word classes, categories. There are lexical (typically open-class) and functional (typically closed-class) categories (both are lexical items).

(2) Lexical categories:

a. N (noun): Mary, man, book, idea, ...
b. V (verb): snore, meet, kiss, give, believe, ...
c. A (adjective): green, nice, fond, ...
d. P (preposition): of, under, for, after, ...

(3) Functional categories:

a. D (determiner): the, a, every, some, three, she, it, Ø ...
b. T (tense): did, can, will, Ø, ...
c. C (complementizer): that, whether, if, for, Ø

Words

(4) The make-up of LIs:

a. Phonological representation

b. Semantic denotation: This includes the argument structure or Θ-grid of a predicate (see Heim & Kratzer (1998))

c. Morpho-syntactic features (incl. categorial features, case features, ϕ-features (number, person, gender), tense features, and structure-building and probe features)

Derivations

Syntactic structures arise by iterative application of simple operations to LIs and categories formed by these operations – a building block system that makes syntactic structures grow. This procedure is called a derivation. Every intermediate structure thus formed is a representation. A sentence is a final representation that results when the derivation terminates. Chomsky (1995; 2000; 2001a) assumes that before a derivation starts, all the LIs that will be used in the derivation are assembled in a lexical array (LA) (sometimes, the notion of numeration is used – a numeration is a lexical array in which one and the same LI can be selected more than once).

(5) Lexical array (LA):
The lexical array is a set of LIs that are selected before the syntactic derivation starts.

(6) Inclusiveness Condition:
Material that is not part of the lexical array (other LIs, additional features) is inaccessible throughout a derivation.

Merge

The first basic operation that drives derivations is the operation Merge, which applies to two categories and yields a complex, structured object (a phrase marker or tree that is necessarily binary branching). If Merge uses a LI from the LA, the LI has irrevocably left that array.

(7) Merge:
Merge(α,β) yields [$_\gamma$ α β].

(8) Head:

a. If γ has been created by Merge of α and β, α is the head of γ (and γ is a projection of α) if α has a structure-building feature requiring β (i.e., if α subcategorizes for, or selects, β).

b. A head and its projection share morpho-syntactic features.

Structure-Building Features

A LI may require one or more other categories with certain properties in its projection in the syntax. Requirements of this type can be encoded in structure-building features on a LI: [•F•], where [F] is the feature that the LI is looking for. [F] is typically a categorial feature (in which case the selection requirement expressed by the structure-building feature can be called a subcategorization requirement); but it may also be some other morpho-syntactic feature (see below on movement). Structure-building features need to be discharged (and deleted, as a consequence) as soon as possible, given the the Merge Condition in (9) (possibly this is so because these features do not seem to be interpretable semantically (at the level of Logical Form)).

(9) Merge Condition (MC; Chomsky (1995; 2001),Heck & Müller (2013)):
For all structure-building features [•F•] on a head α and XPs β with a matching [F]: [•F•] triggers Merge(α,β), and [•F•] is thereby deleted.

Economy and Merge

Note:
Structure-building features thus trigger Merge. However, this does not yet suffice: It must be stated that Merge cannot apply untriggered.

(10) Economy Constraint on Merge:
Merge can only apply if it deletes a structure-building feature of a LI.

Crucial concepts of phrase structure

(11) Concepts of phrase structure

a. β is a complement of α iff β has been merged with a LI α that has a structure-building feature for it.

b. β is a specifier of α iff β has been merged with a non-LI α that has a structure-building feature for it.

c. α and β are sisters iff they have been merged.

d. γ immediately dominates α iff Merge has applied to α yield γ. (In that case, α is a daughter of γ.)

e. γ dominates α iff (a) or (b) holds:
   (i) γ immediately dominates α.
   (ii) γ immediately dominates δ, and δ dominates α.
   (α is a term or constituent of γ iff γ dominates α.)

f. α c-commands β iff (a) or (b) holds:
   (i) β is a sister of α.
   (ii) β is is dominated by a sister of α.

g. γ is an XP category iff it is the maximal projection of α.

h. γ is an X′ category iff it is a non-maximal, non-minimal projection of α.
   (Note: The status of a projection as an XP, X′, or X (= LI) may change during the derivation.)

Linear Precedence

Note:
As such, the operation Merge does not say anything about linearization. Linear precedence is handled separately, by linear precedence statements (see Gazdar, Klein, Pullum & Sag (1985)).

(12) Linear precedence statements (English):

a. A head precedes its complement: X ≺ CompX.
b. A head follows its specifier(s): SpecX ≻ X.

(13) Linear precedence statements (German; simplified):

a. A [+V] head (V = [+V,–N], A = [+V,+N]) follows its complement: X ≻ CompX.
b. A [–V] head (N = [–V,+N], P = [–V,–N]) precedes its complement: X ≺ CompX.
c. A head follows its specifier(s): SpecX ≻ X.

(14) Linearization Theorem for Merge:
The output of Merge in language L_i must conform to the linear precedence statements of L_i.

Verb Phrases

(15) Verb types (preliminary):

a. intransitive verbs: schlafen, schnarchen, ankommen
argument structure: $[\Theta_1]$

b. transitive verbs: küssen, mögen, glauben
argument structure: $[\Theta_1 > \Theta_2]$

c. ditransitive verbs: geben, schicken, zeigen
argument structure: $[\Theta_1 > \Theta_2 > \Theta_3]$

Note:
Θ-roles are sometimes given names, such as "Agent", "Patient", "Goal", "Experiencer".

Arguments

Terminology:
Linguistic expressions that realize Θ-roles of the argument structures of verbs are called arguments. The argument that realizes the highest Θ-role of a (non-trivial) argument structure is sometimes called the external argument; other arguments can be referred to as internal arguments. Linguistic expressions that have argument structures (i.e., that need to combine with arguments in the syntax) are called predicates.

Intended state of affairs:
The highest Θ-role ends up on the highest argument in VP, the lowest Θ-role on the lowest VP-internal argument.

Question:
How can this be ensured by the Merge operation?

Linking

(16) Linking Principle:
The semantically-based argument structure corresponds to a reverse hierarchy of syntactically accessible selectional features.

Assumption:
The Economy Constraint on Merge is revised appropriately:

(17) Economy Constraint on Merge (revised):
Merge can only apply if it deletes the highest-ranked structure-building feature of a LI.

Hierarchies of subcategorization features

(18) Structure-building features and requirements and argument structures of verbs:

a.	ankommen: [•D•]	$\leftarrow [\Theta_1]$
b.	mögen: [•D•] $\succ$ [•D•]	$\leftarrow [\Theta_1 > \Theta_2]$
c.	glauben: [•C•] $\succ$ [•D•]	$\leftarrow [\Theta_1 > \Theta_2]$
d.	geben: [•D•] $\succ$ [•D•] $\succ$ [•D•]	$\leftarrow [\Theta_1 > \Theta_2 > \Theta_3]$

Note:
believe can also impose other selection requirements based on the same argument structure.

Assumption:
Words like the verbs in (18) enter LAs after having passed the morphological component, as fully inflected word forms.

Complication: The vP

Assumption:

- There are two classes of intransitive verbs: unergative verbs take a truly external (agent-type) DP argument; unaccusative verbs take an internal DP argument.
- Agent(-type) DP arguments of V are not merged within VP, but as specifiers of v.
- With ditransitive verbs, the first object asymmetrically c-commands the second object (*John sent every woman*$_1$ *her*$_1$ *paycheck.*). This implies that it is a specifier; however, V must then undergo movement to a higher position, where it precedes the first object but follows the subject (Larson (1988), Adger (2003)). This suggests that there is a VP-external position for external argument subjects.

Consequence:

- An external DP is merged via a structure-building feature [•D•] on v, not on V.
- This can be derived by, e.g., assuming that an agent(-like) Θ-role is singled out in the argument structure (e.g., by underlining), and is never realized by [•D•] on V; rather, iff there is an agent(-like) Θ-role on V in the numeration, there must be an accompanying v that bears [•D•].

Intransitive Verbs

(19) Partial LA for an unaccusative intransitive V

a. ankommt: { [V], Θ_1, [•D•] }
b. v: { [v], [•V•] }
c. sie: { [D] }

(20) Partial LA for an unergative intransitive V

a. schläft: { [V], $\underline{\Theta_1}$ }
b. v: { [v], [•V•] $\succ$ [•D•] }
c. sie: { [D] }

Transitive verbs

(21) Partial LA for a transitive verb:

a. mag: { [V], $\underline{\Theta_1} > \Theta_2$, [•D•] }
b. v: { [v], [•V•] $\succ$ [•D•] }
c. er: { [D] }
d. sie: { [D] }

(22) A derivation :

a. Merge ([$_{\mathrm{D}}$ sie], [$_{\mathrm{V}}$ mag]) $\rightarrow$ [$_{\mathrm{VP}}$ [$_{\mathrm{DP}}$ sie] [$_{\mathrm{V}}$ mag]]
b. Merge (v, [$_{\mathrm{VP}}$ [$_{\mathrm{DP}}$ sie] [$_{\mathrm{V}}$ mag]]) $\rightarrow$ [$_{\mathrm{vP}}$ v [$_{\mathrm{VP}}$ [$_{\mathrm{DP}}$ sie] [$_{\mathrm{V}}$ mag]]]
c. Merge ([$_{\mathrm{D}}$ er], [$_{\mathrm{vP}}$ v [$_{\mathrm{VP}}$ [$_{\mathrm{DP}}$ sie] [$_{\mathrm{V}}$ mag]]]) $\rightarrow$ [$_{\mathrm{vP}}$ [$_{\mathrm{D}}$ er] [$_{\mathrm{v'}}$ v [$_{\mathrm{VP}}$ [$_{\mathrm{DP}}$ sie] [$_{\mathrm{V}}$ mag]]]]

Problem:
Is there anything that would preclude the reverse application of Merge operations?

Transitive verbs, wrong derivation

(23) A wrong derivation :

a. Merge ($[_{\mathrm{D}}$ er], $[_{\mathrm{V}}$ mag]) $\rightarrow$ $[_{\mathrm{VP}}$ $[_{\mathrm{DP}}$ er] $[_{\mathrm{V}}$ mag]]

b. Merge (v, $[_{\mathrm{VP}}$ $[_{\mathrm{DP}}$ er] $[_{\mathrm{V}}$ mag]]) $\rightarrow$ $[_{\mathrm{vP}}$ v $[_{\mathrm{VP}}$ $[_{\mathrm{DP}}$ er] $[_{\mathrm{V}}$ mag]]]

c. Merge ($[_{\mathrm{D}}$ sie], $[_{\mathrm{vP}}$ v $[_{\mathrm{VP}}$ $[_{\mathrm{DP}}$ er] $[_{\mathrm{V}}$ mag]]]) $\rightarrow$ *$[_{\mathrm{vP}}$ $[_{\mathrm{D}}$ sie] $[_{\mathrm{v'}}$ v $[_{\mathrm{VP}}$ $[_{\mathrm{DP}}$ er] $[_{\mathrm{V}}$ mag]]]] (Intended meaning: 'She likes him'.)

Solution:

In addition to structure-building features, there are probe features that trigger Agree operations. Agree values features like ϕ-features (person, number, gender) and case features. After v has been merged with a VP containing a DP, v values the case feature of that DP via Agree. Thus, this DP can only have accusative case, not nominative.

Agree

(24) Agree Condition (Chomsky (2001)):
α Agrees with β with respect to a feature bundle Γ iff:

a. α c-commands β or β c-commands α.
b. α has a probe feature [$*$F$*$], which is checked by a matching goal feature [F] on β in Γ; unvalued features ($\square$) become valued.
c. There is no δ that could carry out Agree with with α, and that is closer to α than β.

Ditransitive Verbs

(25) Partial LA for a ditransitive verb:

a. gibt: { [V], $\underline{\Theta_1} > \Theta_2 > \Theta_3$, [•D•] $\succ$ [•D•] }
b. v: { [v], [•V•] $\succ$ [•D•] }
c. er: { [D] }
d. ihr: { [D] }
e. das: { [D] }

(26) A derivation :

a. Merge ([$_{\mathrm{V}}$ gibt], [$_{\mathrm{D}}$ das]) $\rightarrow$ [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]
b. Merge ([$_{\mathrm{D}}$ ihr] [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]]) $\rightarrow$ [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ ihr] [$_{\mathrm{V'}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]]])
c. Merge (v, [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ ihr] [$_{\mathrm{V'}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]]]) $\rightarrow$ [$_{\mathrm{vP}}$ v [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ ihr] [$_{\mathrm{V'}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]]]
d. Merge ([$_{\mathrm{D}}$ er], [$_{\mathrm{vP}}$ v [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ ihr] [$_{\mathrm{V'}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]]]]) $\rightarrow$ [$_{\mathrm{vP}}$ [$_{\mathrm{D}}$ er] [$_{\mathrm{v'}}$ v [$_{\mathrm{VP}}$ [$_{\mathrm{D}}$ ihr] [$_{\mathrm{V'}}$ [$_{\mathrm{D}}$ das] [$_{\mathrm{V}}$ gibt]]]]]

Determiner Phrases and Noun Phrases

(27) A LA of a simple DP :

a. eine: { [D], [•N•] }

b. Frau: { [N] }

(28) A derivation of a simple DP:

Merge ($[_{\mathrm{D}}$ eine], $[_{\mathrm{N}}$ Frau]) $\rightarrow$ $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ eine] $[_{\mathrm{NP}}$ Frau]]

More complex DPs: lexical array

(29) A LA of a more complex DP in German:

a. manchen:
{ [D], [•N•] } (some)

b. des:
{ [D], [•N•] } (the)

c. Interpretationen:
{ [N], [•D•] } (interpretations)

d. Vorschlags:
{ [N] } (proposal)

More complex DPs: derivation

(30) A derivation of a more complex DP in German:

a. Merge ($[_{\mathrm{D}}$ des] $[_{\mathrm{N}}$ Vorschlags]) $\rightarrow$ $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ des] $[_{\mathrm{NP}}$ Vorschlags]]

b. Merge ($[_{\mathrm{N}}$ Interpretationen], $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ des] $[_{\mathrm{NP}}$ Vorschlags]]) $\rightarrow$

$[_{\mathrm{NP}}$ $[_{\mathrm{N}}$ Interpretationen] $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ des] $[_{\mathrm{NP}}$ Vorschlags]]]

c. Merge ($[_{\mathrm{D}}$ manchen], $[_{\mathrm{NP}}$ $[_{\mathrm{N}}$ Interpretationen] $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ des] $[_{\mathrm{NP}}$ Vorschlags]]]) $\rightarrow$ $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ manchen] $[_{\mathrm{NP}}$ $[_{\mathrm{N}}$ Interpretationen] $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ des] $[_{\mathrm{NP}}$ Vorschlags]]]]

Phrases that Cannot be Generated 1

(31) a. *[$_{DP}$ [$_{D}$ manchen] [$_{NP}$ [$_{N}$ Interpretationen] [$_{DP}$ [$_{NP}$ Vorschlags] [$_{D}$ des]]]]

(*Linearization Constraint on Merge)

b. *[$_{DP}$ [$_{D}$ manchen] [$_{NP}$ [$_{DP}$ [$_{D}$ des] [$_{NP}$ Vorschlags]]] [$_{N}$ Interpretationen]]

(*Linearization Constraint on Merge)

c. *[$_{DP}$ [$_{NP}$ [$_{N}$ Interpretationen] [$_{DP}$ [$_{D}$ des] [$_{NP}$ Vorschlags]]] [$_{D}$ manchen]]

(*Linearization Constraint on Merge)

Phrases that Cannot be Generated 2

(32) a. *[$_{DP}$ [$_{NP}$ [$_{DP}$ [$_{NP}$ Vorschlags] [$_{D}$ des]] [$_{N}$ Interpretationen]] [$_{D}$ manchen]]

(*Linearization Constraint on Merge)

b. *[$_{DP}$ [$_{D}$ manchen] [$_{DP}$ [$_{D}$ des] [$_{NP}$ [$_{N}$ Interpretationen] [$_{NP}$ Vorschlags]]]]

(*Economy Constraint on Merge)

c. *[$_{NP}$ [$_{N}$ Vorschlags] [$_{NP}$ [$_{N}$ Interpretationen] [$_{DP}$ [$_{D}$ manchen] [$_{DP}$ des]]]]

(*Economy Constraint on Merge)

Problem

Is there anything that would preclude the application of Merge operations in (33)?

(33) An unwanted derivation for a more complex DP in German:

a. Merge ([$_{\text{D}}$ manchen], [$_{\text{N}}$ Vorschlags]) $\rightarrow$ [$_{\text{DP}}$ [$_{\text{D}}$ manchen] [$_{\text{NP}}$ Vorschlags]]

b. Merge ([$_{\text{N}}$ Interpretationen], [$_{\text{DP}}$ [$_{\text{D}}$ manchen] [$_{\text{NP}}$ Vorschlags]]) $\rightarrow$ [$_{\text{NP}}$ [$_{\text{N}}$ Interpretationen] [$_{\text{DP}}$ [$_{\text{D}}$ manchen] [$_{\text{NP}}$ Vorschlags]]]

c. Merge ([$_{\text{D}}$ des], [$_{\text{NP}}$ [$_{\text{N}}$ Interpretationen] [$_{\text{DP}}$ [$_{\text{D}}$ manchen] [$_{\text{NP}}$ Vorschlags]]]) $\rightarrow$ [$_{\text{DP}}$ [$_{\text{D}}$ des] [$_{\text{NP}}$ [$_{\text{N}}$ Interpretationen] [$_{\text{DP}}$ [$_{\text{D}}$ manchen] [$_{\text{NP}}$ Vorschlags]]]]

Answer: Yes, this derivation is incompatible with ϕ-feature and case feature valuation via Agree.

Missing D

Note:
So far, the assumption is that personal pronouns like he are D elements, hence, DPs when they occur as arguments of predicates. Expressions like a woman are also DPs. In line with this, structure-building features of verbs so far only included [•D•], not [•N•].

Problem:
What about proper names (like John, Madonna) or indefinite common nouns in the plural (so-called "bare plurals", like Bücher)?

(34) Proper names and bare plural common noun phrases:

a. sie John mag
b. sie Bücher über Madonna mag

Empty D

Assumption:
[•N•] cannot be a structure-building feature on a predicate; but [•D•] can be.
The NPs in (34) are selected by empty D elements. If there is no empty D selecting, e.g., John in the initial LA, (34-a) cannot be generated by a derivation.

(35) LA of (34-a):

a. mag: { [V], [•D•] }
b. sie: { [D] }
c. v: { [v], [•V•] ≻ [•D•] }
d. John: { [N] }
e. Ø: { [D], [•N•] }

She likes John

(36) Derivation of (34-a):

a. Merge ([$_{\text{D}}$ Ø], [$_{\text{N}}$ John]) → [$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]]

b. Merge ([$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]], [$_{\text{V}}$ mag]) → [$_{\text{VP}}$ [$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]] [$_{\text{V}}$ mag]]

c. Merge (v, [$_{\text{VP}}$ [$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]] [$_{\text{V}}$ mag]]) → [$_{\text{vP}}$ v [$_{\text{VP}}$ [$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]] [$_{\text{V}}$ mag]]]

d. Merge ([$_{\text{D}}$ sie], [$_{\text{vP}}$ v [$_{\text{VP}}$ [$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]] [$_{\text{V}}$ mag]]]) → [$_{\text{vP}}$ [$_{\text{D}}$ sie] [$_{\text{v'}}$ v [$_{\text{VP}}$ [$_{\text{DP}}$ [$_{\text{D}}$ Ø] [$_{\text{NP}}$ John]] [$_{\text{V}}$ mag]]]]

Workspace

Observation:
If a specifier is complex, it must have been formed earlier in the derivation, before it is merged. Trees that have been created and that then wait for further use in a derivation can be said to belong to the workspace of the derivation.

(37) A LA:

a. mag: { [V], [•D•] }
b. die: { [D], [•N•] }
c. Frau: { [N] }
d. v: { [v], [•V•] ≻ [•D•] }
e. ihn: { [D] }

(38) Derivation of (38), part 1:
Merge ($[_{\mathrm{D}}$ die], $[_{\mathrm{N}}$ Frau]) → $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ die] $[_{\mathrm{N}}$ Frau]]

(39) Derivation of (39), part 2:

a. Merge ($[_{\mathrm{D}}$ ihn], $[_{\mathrm{V}}$ mag]) → $[_{\mathrm{VP}}$ $[_{\mathrm{D}}$ ihn] $[_{\mathrm{V}}$ mag]]
b. Merge (v, $[_{\mathrm{VP}}$ $[_{\mathrm{D}}$ ihn] $[_{\mathrm{V}}$ mag]]) → $[_{\mathrm{vP}}$ v $[_{\mathrm{VP}}$ $[_{\mathrm{D}}$ ihn] $[_{\mathrm{V}}$ mag]]]
c. Merge ($[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ die] $[_{\mathrm{N}}$ Frau]], $[_{\mathrm{vP}}$ v $[_{\mathrm{VP}}$ $[_{\mathrm{D}}$ ihn] $[_{\mathrm{V}}$ mag]]]) → $[_{\mathrm{vP}}$ $[_{\mathrm{DP}}$ $[_{\mathrm{D}}$ die] $[_{\mathrm{N}}$ Frau]] $[_{\mathrm{v'}}$ v $[_{\mathrm{VP}}$ $[_{\mathrm{D}}$ ihn] $[_{\mathrm{V}}$ mag]]]]

TPs

Observation:
German does not have obligatory filling of SpecT (it lacks the EPP property); subject DPs can stay in vP.

(40) T: { [T], [•v•] }

CPs

Observation:
If C does not want a specifier (via movement; see below), it has a simple specification.

(41) dass: { [C], [•T•] }

Adjective Phrases

Adjectives as Predicates

(42) a. dass John nett ist
b. dass sie auf ihn stolz ist

(43) LA of (42-a):

a. John: { [N], }
b. Ø: { [D], [•N•] }
c. ist: { [T] [•N•] }
d. nett: { [A], [•D•] }
e. dass: { [C], [•T•] }

Adjectives as Modifiers

Note:
As it stands, sentences like (44) cannot yet be accounted for.

(44) a. dass er einenette Frau getroffen hat
b. dass sie ihn wahrscheinlich mag

Problem:
The problem is that there does not seem to be a selectional relation between the adjective nette and the noun Frau, or between the adverb wahrscheinlich and the verb mag. Suppose there were such a relation. First, it seems clear that the structure-building feature would have to be on nett and wahrscheinlich, respectively (compare, e.g., the Linearization Constraint on Merge). We would expect that D and T, respectively, would be the head of the projection after Merge. Consequently, D would have to select either A or N depending on whether nette is present or not in (44-a); and T would have to select either A or V, depending on whether or not wahrscheinlich is present in (44-b). This does not seem plausible.

Modification

Assumption:
The system has to be revised so as to permit modification. In particular, the notion of head and the Economy Constraint on Merge must be revised.

(45) Head:

a. If γ has been created by Merge of α and β, α is the head of γ (and γ is a projection of α) if (i) or (ii) holds:
   (i) α selects β.
   (ii) α is semantically modified by β.

b. A head and its projection share morpho-syntactic features.

Economy Constraint on Merge again

Note:
In principle, there might be a situation in which a projection γ has two heads: α subcategorizes for β, and α semantically modifies β. In practice, this situation does not arise.

(46) Economy Constraint on Merge (revised):
Merge can only apply if (a) or (b) holds:

a. Merge deletes the structure-building feature of a LI.
b. Merge results in semantic modification.

Modifiers

Note:
In addition to the structural notions of complement and specifier, a third structural notion of (syntactic) modifier can now be introduced. It is worth noting that modifiers are not specifiers – the structural position may be the same, but selectional features are not involved in Merge.

(47) Complements, specifiers, and modifiers (see (11)):

a. β is a complement of α iff β has been merged with a LI α that has a structure-building feature for it.

b. β is a specifier of α iff β has been merged with a non-LI α that has a structure-building feature for it.

c. β is a modifier of α iff β has been merged with α, where α is the head and neither β nor α has a structure-building feature for the other.

The Displacement Property of Natural Language

1. Observation: Syntactic items do not necessarily show up in the canonical positions in which they are placed by the rules of the base component (e.g., phrase structure rules); they often are displaced, (or dislocated), to the left or right periphery.
2. Displacement can be viewed as one of the defining properties of natural languages (in addition to recursion, double articulation, and compositionality).
3. Analysis: Movement. There is a connection between the base position and the new, displaced position. This connection may be brought about by genuine movement, or by some other means. (In the latter case, "movement" is just a metaphor.)

Some Instances of Movement

(48) Wh-movement in English:
What do you think that Mary bought □ ?

Movement creates main clause structures on the basis of embedded clause structures (not: embedded clauses) in German (Bierwisch (1963)); see complementary distribution of conjunctions and verb-second.

(49) Verb-second movement in German:

a. dass Karl das schöne Auto kauft.
b. Kauft Karl das schöne Auto?
c. weil Maria den Plan ablehnt.
d. Lehnt Maria den Plan ab?

(50) Topicalization in German:

a. Kauft Karl das schöne Auto?
b. Das schöne Auto kauft Karl.
c. Karl kauft das schöne Auto.
d. Lehnt Maria den Plan ab?
e. Den Plan lehnt Maria ab.
f. Maria lehnt den Plan ab.

Unboundedness

Observation:
Movement must in principle be able to take place across aribtrarily large syntactic domains ('unbounded dependencies').

(51) Unbounded movement:

a. Ich weiß nicht, wann du denkst, dass er eintreffen wird.
b. Wen sagt Maria, dass wir einladen sollten?
c. Wen denkst du, dass Maria glaubt, dass der Fritz gesagt hat, dass man einladen sollte?
d. In Hannover glaube ich nicht, dass man so etwas sagt.
e. Den Fritz meinte sie, solle man einladen.

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

(53) Unbounded movement (e.g., Ross (1967)):
$[_{\mathrm{CP}}$ What$_1$ do you think $[_{\mathrm{CP}}$ that Mary bought t_1]] ? (anachronistic notation)

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

(54) Successive-cyclic Comp-to-Comp movement (e.g., Chomsky (1973; 1977; 1981)):
$[_{\mathrm{CP}}$ What$_1$ do you think $[_{\mathrm{CP}}$ t$'_1$ that Mary bought t$_1$]] ? (anachronistic notation)

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

(55) Successive-cyclic movement to CP and vP edges (e.g., Chomsky (2000; 2001), Fox (2000), Nissenbaum (2000), Bruening (2001), Barbiers (2002), many others):
$[_{\mathrm{CP}}$ What$_1$ do you $[_{\mathrm{vP}}$ t$_1'''$ think $[_{\mathrm{CP}}$ t$_1''$ that Mary $[_{\mathrm{vP}}$ t$_1'$ $[_{\mathrm{VP}}$ bought t$_1$]]]]] ?

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

(56) Successive-cyclic movement to phrase edges (e.g., Sportiche (1989), Takahashi (1994), Agbayani (1998), Bošković (2002), Boeckx (2003), Müller (2004), Chomsky (2004; 2005)):
[$_{\mathrm{CP}}$ What$_1$ do [$_{\mathrm{TP}}$ t$_1^{\prime\prime\prime\prime\prime}$ you [$_{\mathrm{vP}}$ t$_1^{\prime\prime\prime\prime}$ [$_{\mathrm{VP}}$ t$_1^{\prime\prime\prime}$ think [$_{\mathrm{CP}}$ t$_1^{\prime\prime}$ that [$_{\mathrm{TP}}$ t$_1^{\prime}$ Mary [$_{\mathrm{vP}}$ t$_1$ [$_{\mathrm{VP}}$ bought t$_1$]]]]]]]] ?

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

(57) SLASH feature percolation (e.g., Gazdar (1981; 1982); Gazdar et al. (1985), Pollard & Sag (1994), Levine & Sag (2003b;a), Müller (2007; 2016); also Koster (2000), Neeleman & van de Koot (2007)):
[$_{\mathrm{CP}}$ What$_1$ [$_{\mathrm{C'{:}S}}$ do [$_{\mathrm{TP{:}S}}$ you [$_{\mathrm{T'{:}S}}$ T [$_{\mathrm{vP{:}S}}$ t$_{you}$ [$_{\mathrm{v'{:}S}}$ v [$_{\mathrm{VP{:}S}}$ think [$_{\mathrm{CP{:}S}}$ that [$_{\mathrm{TP{:}S}}$ Mary [$_{\mathrm{T'{:}S}}$ T [$_{\mathrm{vP{:}S}}$ t$_{Mary}$ [$_{\mathrm{v'{:}S}}$ v [$_{\mathrm{VP{:}S}}$ bought t$_1$]]]]]]]]]]]] ? (anachronistic notation)

Genuine Long-Distance Movement vs. Smaller Steps

(52) What do you think that Mary bought ?

(53) Unbounded movement (e.g., Ross (1967)):
$[_{\mathrm{CP}}$ What$_1$ do you think $[_{\mathrm{CP}}$ that Mary bought t_1]] ? (anachronistic notation)

(54) Successive-cyclic Comp-to-Comp movement (e.g., Chomsky (1973; 1977; 1981)):
$[_{\mathrm{CP}}$ What$_1$ do you think $[_{\mathrm{CP}}$ t'_1 that Mary bought t_1]] ? (anachronistic notation)

(55) Successive-cyclic movement to CP and vP edges (e.g., Chomsky (2000; 2001), Fox (2000), Nissenbaum (2000), Bruening (2001), Barbiers (2002), many others):
$[_{\mathrm{CP}}$ What$_1$ do you $[_{\mathrm{vP}}$ t'''_1 think $[_{\mathrm{CP}}$ t''_1 that Mary $[_{\mathrm{vP}}$ t'_1 $[_{\mathrm{VP}}$ bought t_1]]]]] ?

(56) Successive-cyclic movement to phrase edges (e.g., Sportiche (1989), Takahashi (1994), Agbayani (1998), Bošković (2002), Boeckx (2003), Müller (2004), Chomsky (2004; 2005)):
$[_{\mathrm{CP}}$ What$_1$ do $[_{\mathrm{TP}}$ t'''''_1 you $[_{\mathrm{vP}}$ t'''''_1 $[_{\mathrm{VP}}$ t''''_1 think $[_{\mathrm{CP}}$ t'''_1 that $[_{\mathrm{TP}}$ t''_1 Mary $[_{\mathrm{vP}}$ t'_1 $[_{\mathrm{VP}}$ bought t_1]]]]]]] ?

(57) SLASH feature percolation (e.g., Gazdar (1981; 1982); Gazdar et al. (1985), Pollard & Sag (1994), Levine & Sag (2003b;a), Müller (2007; 2016); also Koster (2000), Neeleman & van de Koot (2007)):
$[_{\mathrm{CP}}$ What$_1$ $[_{\mathrm{C'{:}S}}$ do $[_{\mathrm{TP{:}S}}$ you $[_{\mathrm{T'{:}S}}$ T $[_{\mathrm{vP{:}S}}$ t_{you} $[_{\mathrm{v'{:}S}}$ v $[_{\mathrm{VP{:}S}}$ think $[_{\mathrm{CP{:}S}}$ that $[_{\mathrm{TP{:}S}}$ Mary $[_{\mathrm{T'{:}S}}$ T $[_{\mathrm{vP{:}S}}$ t_{Mary} $[_{\mathrm{v'{:}S}}$ v $[_{\mathrm{VP{:}S}}$ bought t_1]]]]]]]]]]]] ? (anachronistic notation)

Modelling Movement in the Grammar

Classical approaches

- movement transformations
- SLASH feature percolation

Chomsky's (2001) suggestion

- Merge operations can be external (as in all the examples so far) or internal. Internal Merge is movement.

(58) Merge:
Merge(α,β) yields [$_\gamma$ α β].

With internal Merge, β is a subtree of α before Merge takes place.

Features that Trigger Internal Merge

Observation:
If movement is brought about by the same mechanism that is responsible for basic structure-building (viz., Merge), it should be triggered in the same way, via structure-building features.

(59) Wh-movement:

a. $(\emptyset/\text{dass})_{\text{wh}}$: { [C], [•T•] ≻ [•wh•] }
b. wen: { [D], [wh] }
c. $[_{\text{CP}}\ [_{\text{D}}\ \text{wen}\ ]_1\ [_{\text{C}}\ (\emptyset/\text{dass})\ ]\ [_{\text{TP}}\ \text{sie}\ t_1\ \text{mag}\ ]]$

Note:
Internal Merge can be assumed to

- leave a trace (classical assumption)
- leave a copy: <wen$_1$> (standard assumption)
- leave nothing (possible assumption)

Intermediate Steps: The Phase Impenetrability Condition

Observation:
If nothing more is said, this approach gives rise to genuine long-distance movement in a single step, as in (53). The Phase Impenetrability Condition (Chomsky (2000, 108), Chomsky (2001, 13)) is a constraint that requires intermediate steps.

(60) Phase Impenetrability Condition (PIC):
The c-command domain of a head X of a phase XP is not accessible to operations outside XP; only X and its specifier(s) are accessible to such operations.

Two fundamental questions:

1. Which XPs count as phases?
2. Given the PIC, intermediate movement steps are required in the course of long-distance movement. But how can they ever take place, given the Economy Constraint on Merge?

(61) Economy Constraint on Merge (original version):
Merge can only apply if it deletes a structure-building feature of a LI.

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