Derivation and representation in syntax
Foundations and Structure of Language

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September, 28th 2018

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Goals

- To show the tension between derivations and representations in linguistic theory.
- To show the main tenets of the Minimalist Program and nontransformational alternatives (HPSG).
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- To show the main tenets of the Minimalist Program and nontransformational alternatives (HPSG).
The situation in the eighties: several levels of representation (DS, SS, LF, PF) mediated by transformations and with specific principles.

Simplification of the system:

- **Monostratal models**: Generalized Phrase Structure Grammar and Head-driven Phrase Structure Grammar.
- **Minimalist Program**.
- **Lexical-Functional Grammar**.
- **Relational Grammar**.
Motivation

Basic idea
To reduce the computational system (syntax) to the bare minimum required to do the job and satisfy the needs of the Interfaces. This is a kind of intellectual exercise to build a more elegant and simpler system.

- To what extent is human language a ‘perfect’ system?
- To what extent is the computational system for human language optimal?
A minimalist T-model of the grammar

\[ N = \{ A_i, B_j, C_k \ldots \} \]

Select & Merge & Move

Spell-Out \[ \rightarrow \] PF

Select & Merge & Move

LF

From [HNG05]
The lexicon provides the computational system with the material for building sentences.

The computational system arranges lexical items to form pairs of sound and meaning.

Phonetic Form (PF) is the interface to the Articulatory-Perception System.

Logical Form (LF) is the interface to the Conceptual-Intentional System.

Linguistic expressions are optimal realizations of the legibility conditions imposed by PF and LF (Principle of Full Interpretation, that requires that all the features of the pair be legible at the relevant interfaces).
Figure 1 *Subset relationship among derivations*

From [HNG05]
The numeration

\{\langle \text{Girl}, 1 \rangle, \langle \text{Boy}, 1 \rangle, \langle \text{Love}, 1 \rangle, \langle \text{Many}, 1 \rangle, \langle \text{All}, 1 \rangle \\}
Select picks lexical items from the numeration to be combined by Merge.
Merge

The transformational system is reduced to a simple operation, \textsc{merge}, which combines two items and creates a new one with a label.

\begin{equation}
\gamma = \alpha \text{ or } \gamma = \beta
\end{equation}
Merge

When the operation is between pieces from the numeration, we call it external merge, and it replaces phrase structure rules:

(2) \[
\text{likes} \quad \text{likes linguistics}
\]

(3) \[
\text{Mary likes likes linguistics}
\]
When the operation involves merging something already in the structure, it is equivalent to movement (INTERNAL MERGE).

(4) kissed was was
    kissed Mary kissed Mary
          was remained

kissed Mary
Conditions on Merge

Extension condition

Applications of Merge can only target root syntactic objects.
Conditions on Merge

Extension condition

Applications of Merge can only target root syntactic objects.

(5)

\[
\begin{align*}
\gamma & \\
\alpha & \beta \\
\delta & \gamma & \star \gamma & \\
\alpha & \beta & \delta & \alpha
\end{align*}
\]
Conditions on Merge

Rather than imposing a condition on this illformed representation, we build the conditions on the operations themselves: Merge is defined to avoid multidominance.
Since the application of merge/move is free, we are required to restrict the power of the system by means of principles and conditions.

- economy principles over derivations
- reducing operational space
Local operations

Shortest move

Minimize the distance of your movement (→ superiority effect).

(6) Who bought what? / *What did who buy?

(7) \([\text{bought } \text{who } [\text{bought } \text{who } [\text{bought } \text{bought } \text{bought } \text{what } ] ] ] ]\]

(8) *[\text{bought } \text{what } [\text{bought } \text{who } [\text{bought } \text{bought } \text{bought } \text{what } ] ] ]]\]

(9) a. Whom did John persuade whom [to buy what]?
   b. *What did John persuade whom [to visit what]?
Local operations

Shortest move

Minimize the distance of your movement (→ superiority effect).

(6) Who bought what? / *What did who buy?

(7) \[[\text{bought who [bought who [bought bought what ] ] ]}\]

(8) \*[[\text{bought what [bought who [bought bought what ] ] } ]

(9) a. Whom did John persuade whom [to buy what]?
b. *What did John persuade whom [to visit what]?
It must be emphasized that economy principles cannot be stated a priori, but are open to empirical considerations. For example: which derivation is more economical, (a) or (b) [Was17, 130]?

(a)

FILLER
which dog  GAP

do you think we saw scratch you

(b)

FILLER
which dog  GAP

do you think we saw scratch you
A ‘perfect language’ should meet the condition of inclusiveness: any structure formed by the computation (in particular, PF and LF) is constituted of elements already present in the lexical items selected for [the numeration] N; no new objects are added in the course of computation apart from rearrangements of lexical properties (in particular, no indices, bar-levels in the sense of X-bar theory, etc.). Chomsky, Noam 1995. The Minimalist Program, p. 228.
Copy theory of movement

What about traces?

(10) 
\[
\begin{array}{c}
\text{TP} \\
\text{T'} \\
\text{T} \quad \text{VP} \\
\text{arrives Mary}
\end{array}
\quad \rightarrow 
\begin{array}{c}
\text{TP} \\
\text{Mary} \\
\text{T'} \\
\text{T} \quad \text{VP} \\
\text{arrives t}
\end{array}
\]
Copy theory of movement

(11) $TP \rightarrow TP$

$\text{T'}$

$T \quad \text{VP}$

arrives Mary

$\text{TP}$

Mary $\text{T'}$

$T \quad \text{VP}$

arrives Mary
Copy theory of movement

(12) \([_{VP} \text{ arrives Mary}]\)

a. \textit{Copy} Mary

b. \textit{Merge} arrives and Mary: \([_{TP} \text{ Mary} [_{VP} \text{ arrives Mary}]]\)

c. Delete the lower copy: \([_{TP} \text{ Mary} [_{VP} \text{ arrives Mary}]]\)
Copy theory of movement

Deletion of copies may vary

(13) Wen denken die Besucher, wen/*dass sie gesehen haben? Swiss/Bavarian German

‘Who do the visitors think that they saw?’

(14) Met wie het jy nou weer gesê met wie het Sarie gedog met wie gaan Jan trou? Afrikaans

‘Who(m) did you say again that Sarie thought Jan is going to marry?’
Copy theory of movement

Deletion of copies may vary

(13)  Wen *denken die Besucher, wen/*dass sie gesehen haben? Swiss/Bavarian German

‘Who do the visitors think that they saw?’

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Copy theory of movement

**Reconstruction phenomena**: the moved element acts as if it were in situ regarding binding theory.

(15) Which picture of himself did John destroy?

(16) LF: Which picture of himself did John destroy which picture of himself?

(17) Joe wondered which picture of him Jim bought.

(18) LF: Joe wondered \([CP [DP which picture of him_k] [IP Jim_k bought [DP which picture of him_k]]] \)
Copy theory of movement

**Ambiguous binding:** the moved element acts as if it were both in its moved position and in situ regarding binding theory.

(19) Joe$_i$ wondered which picture of himself$_{i/k}$ Jim$_k$ bought.

(20) LF: Joe$_i$ wondered \([_{\text{CP}} [_{\text{DP}} \text{which picture of himself}_k] [_{\text{IP}} \text{Jim}_k \text{bought} [_{\text{DP}} \text{which picture of himself}_k]]]]\)

(21) LF: Joe$_i$ wondered \([_{\text{CP}} [_{\text{DP}} \text{which picture of himself}_i] [_{\text{IP}} \text{Jim}_k \text{bought} [_{\text{DP}} \text{which picture of himself}_i]]]]\)
HPSG is surface-oriented, constraint-based, and strongly lexicalist, resorting to attribute-value matrices of features.

- Words and phrases are very rich matrices of features which are formed under lexical constrains.
- They are combined in syntax by PSG rules.
- Features must be saturated, and the way they project in the tree is constrained by general principles.
Feature structure
Feature structure

```
word
PHON
<put>
CATEGORY
SYNSEM|LOCAL

HEAD
AUX -
SUBJ
VALENCE
COMPS

put-relation
PUTTER 1
THING-PUT 2
DESTINATION 3

verb

[NP₁]
[NP₂, PP₃]
```
Tree combination

```
phrase
  SYN
  HEAD 2
  COMPS <>
  SPR  <NP>
SEM   [...]
```

```
word
  SYN
  HEAD 2
  COMPS 1
  SPR  <NP>
ARG ST  <NP, NP>
SEM   [...]
```

```
phrase
  SYN
  HEAD [...]
SEM   [...]
```
Tree combination

Alex denies the allegation.

- the allegation
- denies the allegation
- Alex denies the allegation.
Tree combination

```
phrase
  HEAD noun
  val-cat
  COMPS itr
  SPR +

word
  HEAD det
  val-cat
  COMPS itr
  SPR +

the

word
  HEAD noun
  val-cat
  COMPS itr
  SPR -

allegation
```
Tree combination
Tree combination
Tree combination
Head Feature Principle (HFP)

In any headed phrase, the HEAD value of the mother and the HEAD value of the head daughter must be identical.
Principles
Principles

The Valence Principle

Unless the rule says otherwise, the mother’s values for the VAL features (SPR and COMPS) are identical to those of the head daughter.
Specifier-Head Agreement Constraint (SHAC)

Verbs and common nouns must be specified as:

\[
\begin{bmatrix}
    HEAD \\
    VAL
\end{bmatrix}
\begin{bmatrix}
    AGR \\
    SPR
\end{bmatrix}
\left\langle \left[ \begin{bmatrix}
    AGR \\
    1
\end{bmatrix} \right] \right\rangle
\]
Derivation & representation
Constraints

\[ cn-lxm : \]
\[
\begin{align*}
\text{SYN} & \quad \text{HEAD} \quad \text{noun} \\
\text{SEM} & \quad \text{INDEX} \quad i \\
\text{ARG-ST} & \quad \langle DP_i \rangle \oplus \langle \rangle
\end{align*}
\]

\[ pn-lxm : \]
\[
\begin{align*}
\text{SYN} & \quad \text{HEAD} \quad \text{noun} \\
\text{SEM} & \quad \text{MODE} \quad \text{ref} \\
\text{ARG-ST} & \quad \langle \rangle
\end{align*}
\]
Semantic principles

Semantic Compositionality Principle
In any well-formed phrase structure, the mother’s RESTR value is the sum of the RESTR values of the daughters.

Semantic Inheritance Principle
In any headed phrase, the mother’s MODE and INDEX values are identical to those of the head daughter.
Basic PS rules

Head-Specifier Rule

\[
\begin{align*}
\text{phrase} & \quad \rightarrow \quad 1 \quad H \quad \text{VAL} \quad \left[ \text{SPR} \quad \langle \quad \rangle \right] \\
\text{VAL} \quad \left[ \text{SPR} \quad \langle \quad \rangle \right] & \rightarrow \quad \text{VAL} \quad \left[ \text{SPR} \quad \langle \quad \rangle \right]
\end{align*}
\]

Head-Complement Rule

\[
\begin{align*}
\text{phrase} & \quad \rightarrow \quad H \quad \text{word} \quad \text{VAL} \quad \left[ \text{COMPS} \quad \langle \quad \rangle \right] \\
\text{VAL} \quad \left[ \text{COMPS} \quad \langle \quad \rangle \right] & \rightarrow \quad \text{VAL} \quad \left[ \text{COMPS} \quad \langle 1 , \ldots , n \rangle \right] \quad 1 \ldots n
\end{align*}
\]

Head-Modifier Rule

\[
\begin{align*}
\text{phrase} & \quad \rightarrow \quad H \quad \text{VAL} \quad \left[ \text{COMPS} \quad \langle \quad \rangle \right] \quad \text{PP}
\end{align*}
\]

Coordination Rule

\[
\begin{align*}
\text{VAL} \quad 1 & \quad \rightarrow \quad \text{VAL} \quad 1 + \quad \left[ \text{word} \quad \text{conj} \quad \text{HEAD} \quad \text{conj} \right] \quad \text{VAL} \quad 1
\end{align*}
\]
Head-Specifier rule

\[
\begin{align*}
&\text{phrase} \\
&\begin{array}{c}
\text{HEAD} \\
\text{VAL}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{noun} \\
\text{COMPS} \\
\text{SPR}
\end{array}
\quad \text{itr} \\
\begin{array}{c}
+ 
\end{array}
\end{array}
\rightarrow
\begin{array}{c}
\text{word} \\
\text{HEAD} \\
\text{VAL}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{det} \\
\text{COMPS} \\
\text{SPR}
\end{array}
\quad \text{itr} \\
\begin{array}{c}
+ 
\end{array}
\end{array}
\begin{array}{c}
\text{phrase} \\
\text{HEAD} \\
\text{VAL}
\end{array}
\begin{array}{c}
\begin{array}{c}
\text{SPR}
\end{array}
\end{array}
\end{align*}
\]

NP \rightarrow D \rightarrow NOUN
Head-Specifier rule

\[
\begin{align*}
\text{phrase} & \rightarrow \text{HEAD} \quad \overbrace{\text{verb}}^1 \quad \text{COMPS} \quad \text{itr} \\
\text{VAL} & \quad \text{SPR} \quad + \\

\text{phrase} & \rightarrow \text{HEAD} \quad \overbrace{\text{noun}}^1 \quad \text{COMPS} \quad \text{itr} \\
\text{VAL} & \quad \text{SPR} \quad + \\

\text{phrase} & \rightarrow \text{HEAD} \quad \overbrace{}^1 \\
\text{VAL} & \quad \text{SPR} \quad -
\end{align*}
\]

S \quad \rightarrow \quad NP \quad \rightarrow \quad VP
Head-Complement rule
Lexical rules: extraposition

(22)  
  a. That James came late is a well-known fact.  
  b. It is a well-known fact that James came late.
Lexical rules: extraposition

Extraposition Lexical Rule

\[
\begin{align*}
\text{INPUT} & \quad \langle X, [\text{SYN} \quad [\text{VAL} \quad [\text{SPR} \quad \text{COMPS} \quad \langle \text{CP} \rangle \]\]\]\]\rangle \\
\text{OUTPUT} & \quad \langle Y, [\text{SYN} \quad [\text{VAL} \quad [\text{SPR} \quad \text{COMPS} \quad \langle \text{NP}[\text{FORM} \quad \text{it}] \rangle \]\]\]\]\rangle
\end{align*}
\]
Lexical rules: the passive

Passive Lexical Rule

\[ d-rule \]

INPUT \[ \left\{ 1, \left[ tv-lxm \right] ARG-ST \left( \left[ INDEX \ i \right] \right) \oplus \left[ A \right] \right\} \]

OUTPUT \[ \left\{ F_{PSP}(1), \left[ part-lxm \right. \right. \left. \left[ SYN \ HEAD \left[ FORM \ \mathit{pass} \right] \right) \oplus \left[ A \right) \left[ ARG-ST \left( \left[ INDEX \ i \right) \left[ PP \left[ FORM \ \mathit{by} \right) \right) \right) \right) \right) \right) \right) \]

subject
Lexical rules: the passive

\[
\begin{array}{l}
\text{SYN} \quad \text{HEAD} \quad [\text{verb} \\ \text{AGR} \quad 1] \\
\text{VAL} \quad \text{SPR} \quad \langle [\text{AGR} \quad 1] \rangle \\
\text{ARG-ST} \quad \langle \text{NP}_i, \text{NP}_j \rangle \\
\text{INDEX} \quad s \\
\text{SEM} \quad \text{RESTR} \quad \langle \text{RELN} \quad \text{love} \\
\quad \text{SIT} \quad s \\
\quad \text{LOVER} \quad i \\
\quad \text{LOVED} \quad j \rangle
\end{array}
\]
Lexical rules: the passive

\[
\begin{align*}
\text{SYN} & \quad [\text{part-lxm}] \\
\text{HEAD} & \quad [\text{verb} \quad \text{AGR} \quad \text{I} \quad \text{FORM} \quad \text{pass}] \\
\text{VAL} & \quad [\text{SPR} \quad \langle [\text{AGR} \quad \text{I}] \rangle] \\
\text{ARG-ST} & \quad \langle [\text{loved}, \text{NP}_j \left( \right), \text{PP} \left( \right), \text{INDEX} \quad i \rangle \rangle \\
\text{SEM} & \quad [\text{INDEX} \quad s] \\
\text{RESTR} & \quad \langle [\text{RELN} \quad \text{love} \quad s \quad \text{SIT} \quad i \quad \text{LOVER} \quad \text{LOVED} \quad j] \rangle
\end{align*}
\]
Non-local relations: wh-movement

```
S
  NP [s|LOC 1] what
  | V
  | do you
  VP [s|NONLOC|INHER|SLASH {1}]
    | V
    | think
    NP Terry
    VP [s|NONLOC|INHER|SLASH {1}]
      | V
      | said
      NP [s|NONLOC|INHER|SLASH {1}]
```
The MP is an attempt to simplify syntax to its minimum, as an optimal derivational system to connect the lexical material with the two interfaces (LF and PF).

HPSG is a surface-based, constraint-based, strongly lexicalist model that heavily resources to the manipulation of features.
Norbert Hornstein, Jairo Nunes, and Kleantes K. Grohmann.  
*Understanding Minimalism.*  

Thomas Wasow.  