Jana Vejvodová

Constraints in Phrase Structure Grammar

Phrase Structure Grammar – no movement, no transformations, context-free rules

X/Y = X is a category which dominates a **„missing“** category Y

Let G be the set of basic rules:

G:
- a. {[$_S$ NP VP],
- b. [$_{VP}$ V NP],
- c. [$_{PP}$ P NP],
  ...}

For any syntactic category β, there will be some subset of the set of the nonterminal symbols V_N, each of which can dominate β according to the rules in G. Let us call this set V_β. Now, for any category β ($\beta \in V_N$) we can define a set of derived rules D(β,G) as follows:

(1) $D(\beta,G) = \{[_{\alpha/\beta}\ \sigma_1 \ldots. \sigma_i/\beta \ \ldots\ \sigma_n] : [_\alpha\ \sigma_1 \ldots. \sigma_i \ \ldots\ \sigma_n] \in G\ \&\ 1 \leq i \leq n\ \&\ \alpha,\sigma_i \in V_\beta\}$

In other words: β is the „missing“ category; it is dominated by some nonterminal symbol σ_i, which is dominated by some category α. The information about the „missing“ category projects up to α.

(2) Example of sets of derived rules:

β=NP
D(NP,G)
- a. {[$_{S/NP}$ NP/NP VP], [$_{S/NP}$ NP VP/NP],
- b. [$_{VP/NP}$ V NP/NP],
- c. [$_{PP/NP}$ P NP/NP],
  ...}

β=PP
D(PP,G)
- d. {[$_{S/PP}$ NP/PP VP], [$_{S/PP}$ NP VP/PP],
- e. [$_{VP/PP}$ V NP/PP],
- f. [$_{PP/PP}$ P NP/PP],
  ...}

The derived categories are introduced by the so called *linking rules*, such as:

(3) $<[_{\alpha/\alpha}\ t], h_\alpha>$

In other words: Hereby a null element (for phonological reasons) and a distinguished semantic variable (for correct semantic interpretation) is introduced into the position of the „missing“ category.

Some important constraints expressed by means of derived rules:

A-over-A Principle^d (Chomsky (1964)):
In a structure ... $[_A$ ... $[_A$ ... $]$ ... $]$ ..., an operation can only affect the higher, more inclusive category A.

(4) $\alpha \neq \beta$
$*D(\alpha,G) = \{[_{\alpha/\alpha}\ \sigma_1 \ldots.\ \sigma_i/\alpha\ \ldots\ \sigma_n]$

Left Branch Condition^d (Ross (1967)):
The leftmost item of an NP cannot be moved out of that NP.

Left Branch Condition^r (representational version):
$*\ldots\ \alpha_1\ \ldots\ [_{NP}\ t_1\ \ldots\ N\ \ldots\ ]\ \ldots$

(5) $*[_{NP/NP}$ NP/NP...]

Generalized Left Branch Condition^d (Ross (1967), Gazdar (1981)):
The leftmost item of an XP cannot be moved out of that XP.

(6)$*[_{\alpha/\beta}\ \sigma/\beta...]$: β = NP

The analysis of unbounded dependencies

An *unbounded dependency construction* (UDC) is one in which
- (i) a syntactic relation of some kind holds between the substructures in the construction, and
- (ii) the structural distance between these two substructures is not restricted to some finite domain (e.g. by a requirement that both be structures of the same simple clause).

Topicalization, missing-object constructions, WH constructions, It clefts...

Restrictive relative clauses

Relative clauses consist of a pronominal NP or PP followed by an S with a hole of an appropriate sort in it.

(7) $[_{NP}$ NP R]
$[_R$ (NP) S/NP]
+-WH (wh-/that)
+PRO

$[_R$ PP S/PP]
+WH
+PRO

(8) The man that Fido chased (9) The kennel in which Fido tends to sleep.

Matrix subject relatives x other

Relatives and interrogatives with a dependency into the matrix subject argument have a rather different structure from all other relatives and interrogatives.

(10)

Subj – Aux Inversion

(11) $[_{VP}\ V\ \ X] \Rightarrow [_{Q}\ V\ NP\ X]$

Is Kim stupid?
For every VP rule which introduces a tensed auxiliary verb, there is also to be a corresponding rule expanding the sentential category Q as the auxiliary verb followed by NP followed by whatever the auxiliary verb subcategorizes for.
What about auxiliaryless questions?

root constituent quesions:

(12) $[_{Q}\ \alpha\ \ Q/\alpha]$: $\alpha \in \{NP, PP, AP, AdvP\}$
[+WH]

Who did you think Mary saw? ? Who saw the man?
How suspicious was Mary? ? Which man drove the car?

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Generalization:

(13) $[_{\alpha}\ X\ \sum /NP...] \Rightarrow [_{\alpha}\ X\ VP...]$
$[-C]$ $[+FIN]$

where X contains at least one major category symbol, where α is anything, and where ∑ ranges over sentential categories

In other words: For every rule in the grammar which introduces some [-C]omplement sentential category with an NP hole in it, there is to be a corresponding rule which is identical except that ∑ /NP is replaced by a tensed VP.

Ex.: (14)
a. $[_{Q}\ NP\ Q/NP]$ $[+WH]$ — root constituent questions → $[_{Q}\ NP\ VP]$ $[+WH]\ [+FIN]$
b. $[_{R}\ NP\ S/NP]$ $[+-WH]$ $[+PRO]$ — relative clauses → $[_{R}\ NP\ VP]$ $[+-WH]\ [+FIN]$ $[+PRO]$
c. $[_{S}\ NP\ S/NP]$ — NP topicalization → $[_{S}\ NP\ VP]$ $[+FIN]$

...

Matrix subject questions x constituent questions

(15)

⇒ constituent questions: Who saw the man?
⇒* relative clauses with an empty complement position: *The man chased Fido returned.
⇒ relative clauses with a nonempty complement position: The man that chased Fido returned.
⇒ better results than GLBC – we can generate structures like: The man that chased Fido returned.

Analysis of Coordination

Coordinate Structure Constraint[d] (Ross (1967)):
In a coordinate structure, no conjunct may be moved, nor may any element contained in a conjunct be moved out of that conjunct.

Conjunction/(Coordination) Reduction (CR) (Ross, 1967)
Deletes material under identity, and regroups the remainder.

Coordination in transformational grammar:
(16)

1. generates underlying sentential structures.
2. applies transformations
3. applies coordination reduction

1. The Dodgers beat the Red Sox and the Giants beat the Dodgers
2. The Dodgers beat the Red Sox and the Dodgers were beaten by the Giants
3. The Dodgers beat the Red Sox and were beaten by the Giants.

Across The Board (ATB)
A deleted material must be present on every daughter.

Problems:
Different teams beat the Red Sox and were beaten by the Giants.
The analysis can handle the syntax, but makes nonsense of the semantics.

Surface structure – the coordinating word forms a constituent with the immediately following node and is not simply a sister of all the conjuncts.

(17)

Coordination in PSG:
Coordinate constructions are simply multidaughter constructions in which every daughter is a head.
The traditional requirement of categorial identity of mother and daughters is incorrect.

Subtrees that contain an externally controlled hole are of a different syntactic category from those that do not. Only items of the same syntactic category can be conjoined.

⇒ no further need for CSC + CR

(18) *John is easy to please and to love Mary. (VP/NP & VP)
(19) * The man who Mary loves and Sally hates George computed my tax (S/NP & S)

ATB phenomena explained

(20) John is easy to please and to love. (VP/NP & VP/NP)

Still, the holes must be of same categories:

(21) *The kennel (in) which Mary made and Fido sleeps has been stolen (S/NP & S/PP)

In a coordination of relative clauses a relative with a matrix subject NP dependency cannot be conjoined with any other kind of relative, whereas a relative with an embedded subject NP dependency behaves quite normally with respect to ATB:

(22) *I know a man who Bill saw and liked Mary. { S/NP & VP / VP/NP & VP }

(23) I know a man who Mary likes and hopes will win. (VP/NP & VP/NP)

Complementizer conjoined wh phrases

(24) * John asked who and what bought.

Problem: *John, who and whose friends you saw, is a fool. (NP & NP)

Rightward dependencies

Right Roof Constraint (RRC) (first by Ross (1967)):
An element cannot move rightward out of the clause in which it originates.

RRC is neither universal, nor absolute.
(25) I have wanted to know for many years exactly what happened to Rosa Luxemburg.

All the starred sentences are excluded also by the Sentential Subject Constraint:

Sentential Subject Constraint[d] (Ross (1967)):
No element dominated by a CP may be moved out of that CP if that CP is a subject.

⇒ RRC is not part of the grammar at all.
⇒ natural language parser model: Material is attached to the tree as low as possible.

(26) A woman hit a girl who was pregnant.

Extraposed relative clauses must be generated in situ, cannot be the result of movement and deletion rule.

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