LCTG—Notes 3: Generalized Phrase Structure Grammar

(GPSG, Gazdar 1981; Gazdar et al. 1985)

We might attempt to extend the notions of phrase structure to account for discontinuities. . . . Similarly, one might seek to remdy some of the other deficiencies of [Σ, F] grammars by a more complex account of phrase structure. I think that such an approach is ill-advised, and that it can only lead to the development of ad hoc *and fruitless elaborations.*

Chomsky, 1957:41, note 6

Unbounded Dependencies within CFG

- Information about a "moved" or "missing" constituent can be passed up and down the tree by introducing
  - Additional category symbols ("slashed" categories) that must dominate a "gap" at some arbitrary depth beneath them
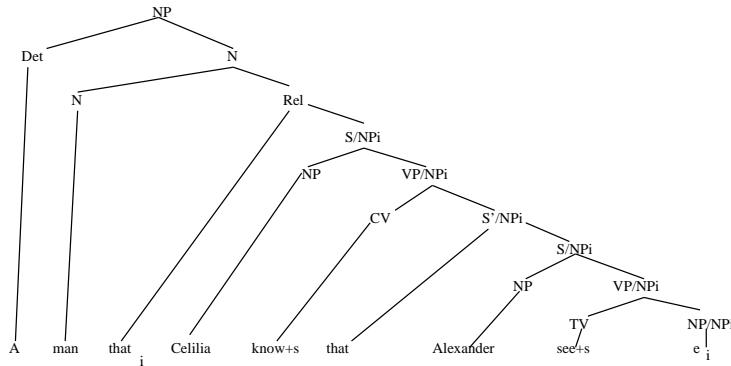 - A rule introducing a "gap" that must be licensed by a slashed category

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A Third View: GPSG CF base grammar

S	$\rightarrow$	$NP\ VP$
VP	$\rightarrow$	$TV\ NP$
VP	$\rightarrow$	$DTV\ NP\ PP$
VP	$\rightarrow$	$CV\ S'$
NP	$\rightarrow$	$Det\ N$
NP	$\rightarrow$	PN
N	$\rightarrow$	$N\ Rel$
S'	$\rightarrow$	$that\ S$
Rel	$\rightarrow$	$that\ VP$

A Third View of Relativisation: CFG Generalized

S	$\rightarrow$	$NP\ VP$
S/NP	$\rightarrow$	$NP\ VP/NP$
VP	$\rightarrow$	$TV\ NP$
VP/NP	$\rightarrow$	$TV\ NP/NP$
VP	$\rightarrow$	$DTV\ NP\ PP$
VP/NP	$\rightarrow$	$DTV\ NP/NP\ PP$
VP/NP	$\rightarrow$	$DTV\ NP\ PP/NP$
VP	$\rightarrow$	$CV\ S'$
VP/NP	$\rightarrow$	$CV\ S'/NP$
NP	$\rightarrow$	$Det\ N$
NP	$\rightarrow$	PN
NP/NP	$\rightarrow$	ε
N	$\rightarrow$	$N\ Rel$
S'	$\rightarrow$	$that\ S$
S'/NP	$\rightarrow$	$that\ S/NP$
Rel	$\rightarrow$	$that\ VP$
Rel	$\rightarrow$	$that\ S/NP$

A GPSG Derivation

A tree diagram with the following structure (labels top to bottom):

- NP
  - Det
  - N
    - N
    - Rel
      - S/NPi
        - NP
        - VP/NPi
          - CV
          - S'/NPi
            - S/NPi
              - NP
              - VP/NPi
                - TV
                - NP/NPi

Terminal words: A   man   that$_i$ Celilia   know+s   that   Alexander   see+s   e$_i$

The "Fixed Subject Constraint" revisited

- Include this next time

The "Coordinate Structure Constraint" revisited

- General assumption: only "like" categories can be coordinated...

  (1) $_{NP}$ NP and NP

    $_{VP}$ VP and VP

    a. *[$_{?P}$ NP and VP]

- ... but a "slashed" category is different from an unslashed one

  (2) *[$_{?P}$ VP/NP and VP]

- So the "Coordinate Structure Constraint" follows directly

  (3) *a man that$_i$ we [$_{?P}$ [$_{VP/NP}$ met t_i yesterday] and [$_{VP}$ saw him today]]

The Across-The-Board Exception to CSC Predicted

- Two unslashed categories can be identical:

  (4) I [$_{VP}$ [$_{VP}$ met him yesterday] and [$_{VP}$ saw him again today]].

- A slashed category cannot be identical to an unslashed one:

  (5) *a man that I [$_{?P}$ [$_{VP/NP}$ met t yesterday] and [$_{VP}$ saw him again today]].

- But two slashed categories can also be identical so ATB is allowed:

  (6) a man that I [$_{VP/NP}$ [$_{VP/NP}$ met t yesterday] and [$_{VP/NP}$ saw t again today]].

- The "same case" condition on the ATB exception to the Coordinate Structure Constraint follows for free:

  (7) *a man that [$_{?P}$ [$_{S/NP}$ I met t yesterday] and [$_{VP}$ saw me first today]].

Problems

- The Complex NP Constraint

  (8) a. ?a cake which I met a man who ate
      b. *a man who(m) I bought a cake which ate

- Violins and Sonatas The ATN HOLD register is a GPSG SLASH is a stack?

  (9) a. a violin which the Moonlight Sonata is easy to play on
      b. *a sonata which this Stradivarius violin is easy to play on

Towards an Answer to Chomsky's Implicit Question?

- The interest of the Dutch construction is that it is *not* capturable with a strongly adequate context free grammar.

- A related construction in Swiss German is not even weakly context free.

- It is interesting that such cases are rare: most phenomena seem to be context free.

- Later in the course we will see that there is a whole hierarchy of "mildly context sensitive" grammars between levels 1 and 2 of the Chomsky Hierarchy.

- These will be characterized by a generalization of the PDA which allows the items on the single stack to themselves be stacks.

Dutch Infinitival Complements

- Use Swiss German from ELL2 instead

- Dutch has the following basic word order in subordinate clauses, in which dependencies cross:

- Ik denk dat Subj-Obj(etc)-Adjunct-V[+fin]-(V[-fin](etc))-Sentential Complement

(10) Ik denk dat ik$_1$ Cecilia$_2$ de nijlpaarden$_2$ zag$_1$ voeren$_2$ *I think that I saw*

   I think that I   Cecilia   the hippos   saw   feed
   Cecilia feed the hippos

(11) Ik denk dat ik$_1$ Cecilia$_2$ Henk$_3$ de nijlpaarden$_3$ zag$_1$ helpen$_2$ voeren$_3$ *I*

   I think that I   Cecilia   Henk   the hippos   saw   help   feed
   think that I saw Cecilia help Henk feed the hippos