Generating French with the LKB

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Outline

I. grammar overview

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III. grammar modifications

IV. demo

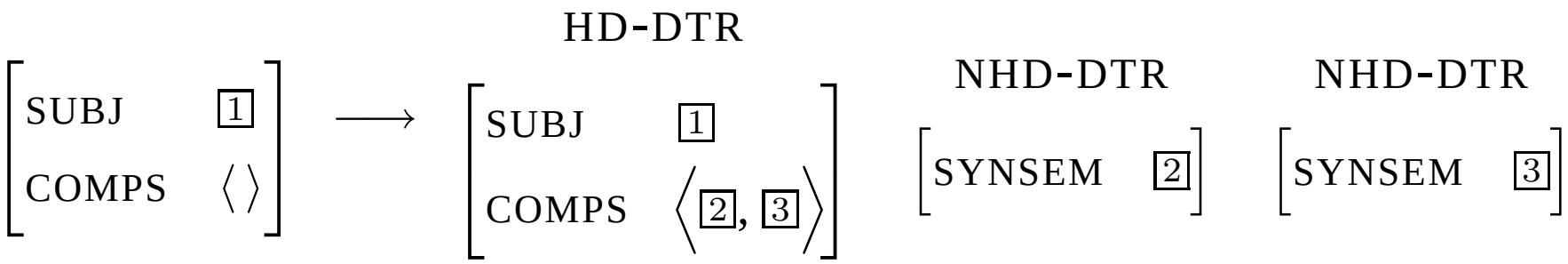
Standard HPSG: ARG-ST and VALENCE

$$\begin{bmatrix} \text{ARG-ST} & \textit{list(synsem)} \text{ (“initial subcategorization”)} \\ \text{VALENCE} & \begin{bmatrix} \text{(“surface subcategorization”)} & \\ \text{SUBJECT} & \textit{list(synsem)} \\ \text{SPECIFIER} & \textit{list(synsem)} \\ \text{COMPLEMENTS} & \textit{list(synsem)} \end{bmatrix} \end{bmatrix}$$

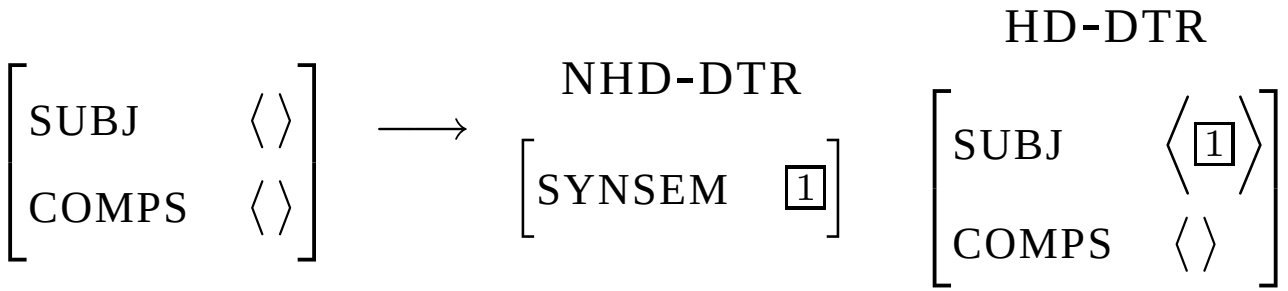
- *synsem* = collection of syntactic and semantic properties (category, bar level, semantic index, predicate)
- three subtypes: *canonical* (ordinary syntactic realization), *gap* (extracted), *affix* (clitic)
- VALENCE lists (underespecified in lexical entries) instantiated by ARG-ST to VAL mapping constraints

Valence and syntactic combination

- Head-Complements Schema



- Head-Subject Schema



Difficulties for implementation

- lack of “bottom-up” type inference and automatic type resolution
- no complex antecedents, disjunction, negation
- limited list manipulation functions (no generalized `append`, `member`, `shuffle`)

theoretical approach can be approximated in implementation but highly inefficient

- multiplication of recursive lexical rules
- massive lexical ambiguity

Modified approach to VALENCE

valence	
SUBJ	*list-of-synsems*
SPR	*list-of-synsems*
VCOMPS	*list-of-words*
DO	*list-of-synsems*
A-OBJ	*list-of-synsems*
DE-OBJ	*list-of-synsems*
XCOMP	*list-of-synsems*

ARG-ST maintained for SLASH amalgamation, etc.

“Grammatical functions”

- SUBJ, SPR: no change
- DO: NP[*acc*] ou S[*fin*], typically corresponds to an accusative clitic (*le*, *la*, *les*) or partitive *en*
- A-OBJ: NP[*dat*] corresponding to dative clitic (*lui*, *leur*) or NP[*loc*] corresponding to “locative” *y*
- DE-OBJ: NP[*de*] (clitic *en*)
- XCOMP: VP[*inf*] (no corresponding clitic!) or predicative XP (sometimes *le*)
- VCOMPS: bare V in complex predicate constructions (argument inheritance with temporal and causative auxiliaries), “lite” complements (*avoir faim*, *prendre froid*)

Related changes

- `head-comp-rule` replaced by more specific rules
  $\rightsquigarrow$ `head-do`, `head-aobj-rule`, `head-xcomp-rule`, ...
- flat structures (`head-comp-rule`, `head-2comps-rule`, `head-3comps-rule`, ...)
  $\rightsquigarrow$ (mostly) binary structures
- preverbal clitics realized syntactically (no longer in morphology)
- $\longrightarrow$ improved efficiency (many fewer edges)
- extraction, passive still analyzed by lexical rule

Aspects of the analysis

- free order among complements and adjuncts achieved with few rules, but...
- VCOMPS must be realized first
  Jean a parlé [de Marie]. (*John has talked about Mary*)
  *Jean a [de Marie] parlé.
- two items on one list ⇒ order fixed
  - VCOMPS: Jean [a fait couler] le navire. (*John has made the ship sink*)
    but *Jean [a couler fait] le navire.
  - DO: Jean informe Marie [que le navire va couler]. (*John informs Mary that the ship is going to sink.*)
    but *Jean informe [que le navire va couler] Marie.

Accommodating exceptions

- VPs generally cannot be pronominalized
  - Je promets [de faire qqch] (*I promise to do sth*)
    *J'en promets.
    Je le promets. (source: Je promets qqch. '*I promise sth*')
- Rare counterexamples
  - Je peux [faire qqch] (*I can do sth*)
    Je le peux. (but no nominal source: *Je peux qqch)
    $\Rightarrow$ add frame with clitic in DO
  - Je l'empêche [de faire qqch] (*I keep her from doing sth*)
    Je l' en empêche (but no nominal source:
    *Je l'empêche [de qqch]. '*I keep her from sth*')
    $\Rightarrow$ add frame with clitic in DE-OBJ

Problems

- more lists will be needed (e.g., OBLIQUE)
- importing lexical information from external resource (e.g., SynLex)
  - predefined valence templates (intransitive, direct transitive, subject raising with bare VP, *à*-NP controlling *de*-VP, . . .) and/or
  - predictable mapping from subcat frame elements to the appropriate valence list

Generation

- HPSG grammars are bidirectional.
- LKB grammars are (more or less) bidirectional.
- Generation is now possible with the LKB.
  - depends on a particular implementation of Minimal Recursion Semantics
  - poorly documented for the moment

The Grammar Matrix

http://www.delph-in.net/

- "universal type hierarchy" (with parameters)
- quick-start tool for new grammars
- questionnaire about simple syntactic properties of the language
  - Are there determiners? Optional or obligatory? Precede or follow N?
  - Yes/no questions: indicated by marking on V, word order, clausal marker?
  - Negation: expressed as a marking on V, modifier of VP, or operator on S?
- small number of lexical entries with semantic relations

Matrix for French

$\rightsquigarrow$ tiny but fully-formed LKB grammar capable of analyzing and generating 3-4 sentences

- `chien` (dog), `Paul`, `dort` (sleeps), `voit` (sees), `le` (masc sing def art)
- accepts: `Paul dort`, `Le chien voit Paul`
- rejects: `*Paul dort le chien`, `*Chien dort`
- "overgeneration":
  `dort le chien`, `le Paul dort`, `voit Paul le chien`

$\approx$ 2000 lines (cf. $\approx$ 5000 lines in current French grammar)

MRS “extraction” and “importation”

100% non-automatic. . .

- all necessary type declarations to introduce appropriate attributes and values for semantic representation
- encoding semantics in lexical entries
- preserving/modifying semantics in lexical rules
- determining semantic composition in syntactic combinations

. . . and ongoing

Implications for development

- new constructions require both syntactic and semantic analysis
- grammar maintenance wrt both parsing and generation
- default unification: not bidirectional
- LKB morphological component *is* bidirectional
- semantically empty elements
  - huge strain on generator if unconstrained
  - solution: trigger rules licensing the hypothesis of a particular empty element

Demo

- . . .