Towards a New Degree of Modularity: Parallel Constraint-Based Dependency Grammar

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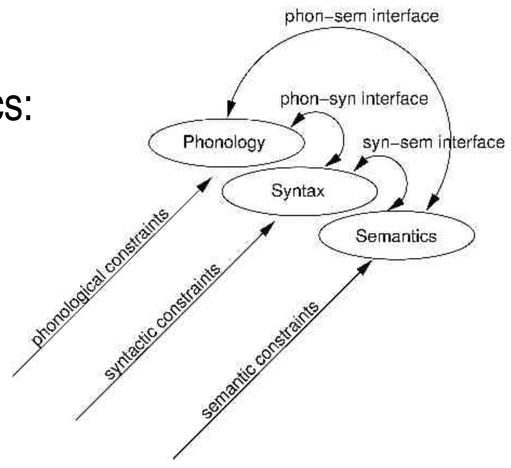
Parallel Grammar: Theory

- introduced in (Sadock 1991) and (Jackendoff 2002)
- phonology, syntax and semantics: parallel, autonomous modules related by interfaces
- each structure licensed by individual constraints
- no primacy of syntax
- new degree of modularity

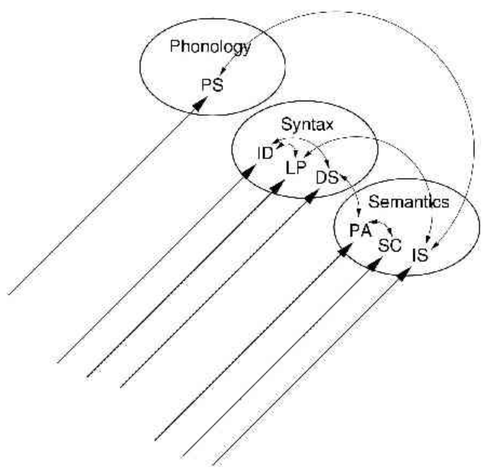


Parallel Grammar: Practice

- first formalization: *Extensible Dependency Grammar (XDG)* (Debusmann et al. 2004, (Debusmann et al. 2005)
- linguistic structures: dependency graphs
- same set of nodes (corresponding to words)
- different edge labels
- graph description by constraints: *principles*
- constraint-based implementation: *XDG Development Kit (XDK)* (Debusmann et al. 2004a)

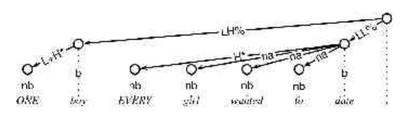
Dimensions

- linguistic structures subdivided into *dimensions*
- Prosodic Structure (PS)
- Immediate Dominance (ID), Linear Precedence (LP), Deep Syntax (DS)
- Predicate-Argument (PA) SCope (SC) Information Structure (IS)

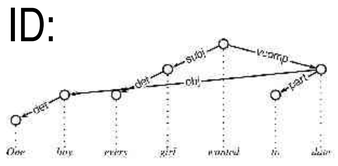


Example Analysis

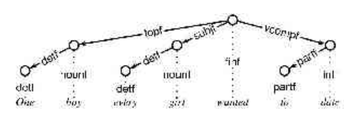
PS:



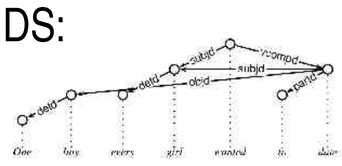
ID:



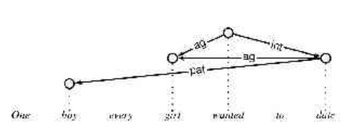
LP:



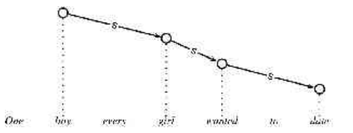
DS:



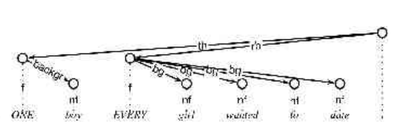
PA:



SC:



IS:



One-dimensional Principles

- graph: tree (PS), tree(ID), tree(LP), tree(SC), tree(IS), dag (DS), dag(PA)
- valency (all dimensions)
- agreement: agreement (ID)

$$wants \xrightarrow{\text{subj}}_{ID} girl \quad \rightarrow \quad \text{agr}(wants) - \text{agr}(girl) - \$\ 3\ \&\ sg$$

  government (ID)

$$wants \xrightarrow{\text{subj}}_{ID} girl \quad \rightarrow \quad \text{agr}(girl) \in \text{govern}(wants)(\text{subj}) - \$\ \text{nom}$$

- order (PS), order(LP)

$$\{\text{L+H*, LH\%, H*, LL\%, na, nb}\} \prec \{\text{b}\}$$

$$\begin{array}{c} \text{topf} \prec \text{subjf} \prec \text{finf} \prec \text{vcompf} \\ \text{detf} \prec \text{nounf} \\ \text{partf} \prec \text{inff} \end{array}$$

Multi-dimensional Principles

- climbing: climbing (LP, ID), (ID, DS) barriers (LP, ID)
- linking: daughter and endpoint (PA, DS)

$$date \xrightarrow{\text{ag}}_{PA} girl \quad \rightarrow \quad date \xrightarrow{\text{subjd}}_{DS} girl$$

  below and startpoint (PA, SC)

$$wants \xrightarrow{\text{int}}_{PA} date \quad \Rightarrow \quad wants \xrightarrow{\text{s}}_{SC} \rightarrow^{*}_{SC} date$$

  above and endpoint (PA, SC)

$$date \xrightarrow{\text{pat}}_{PA} boy \quad \Rightarrow \quad boy \xrightarrow{\text{s}}_{SC} \rightarrow^{*}_{SC} date$$

References

- R. Debusmann, D. Duchier, A. Koller, M. Kuhlmann, G. Smolka, S. Thater: *A Relational Syntax-Semantics Interface Based on Dependency Grammar*. In: Proceedings of the 20th Int. Conf. on Computational Linguistics, Geneva (2004)
- R. Debusmann, D. Duchier, J. Niehren: *The XDG Grammar Development Kit.* In: Proceedings of the 2nd International Mozart/Oz Conference, Charleroi. (2004)
- R. Debusmann, O. Postolache, M. Traat: *A Modular Account of Information Structure in Extensible Dependency Grammar.* In: Proceedings of the 6th Int. Conf. on Intelligent Text Processing and Computational Linguistics, Mexico City. Springer Verlag. (2005)
- R. Jackendoff: *Foundations of Language: Brain, Meaning, Grammar, Evolution.* Oxford University Press (2002)
- J. M. Sadock: Autolexical Syntax: *A Theory of Parallel Grammatical Representations*. University of Chicago Press (1991)

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