Depictives in English: An LTAG Approach

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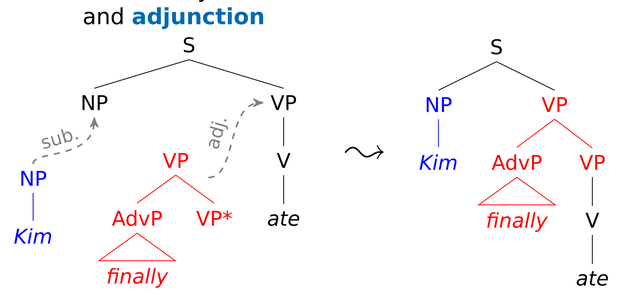
Overview

- Analysis of depictive secondary predicates in English in terms of **Lexicalized Tree Adjoining Grammar (LTAG)** [1] and **Düsseldorf Frames** [8; 10], first described in Burkhardt, Lichte & Kallmeyer [3].
  - **Target ambiguity** of depitives modeled as disjunction in the frame descriptions of depictives.
  - Linking of syntax and semantcs using **macroroles** [5; 6; 11]
- **NEW:** Implementation using **eXtensible MetaGrammar (XMG)** [4; 9]
- **NEW:** Parsing with **Tübingen Linguistic Parsing Architecture (TuLiPA)** [2; 7]

Framework: LTAG & frames

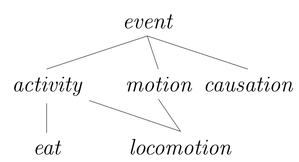
LTAG: elementary trees combined via **substitution** and **adjunction**



syntax-semantics interface [8] (see below)

Düsseldorf Frames: basically typed feature structures

$$\begin{bmatrix} causation \\ \text{ACTOR} \quad \boxed{1} \\ \text{THEME} \quad \boxed{2} \\ \boxed{0} \\ \text{CAUSE} \quad \begin{bmatrix} activity \\ \text{ACTOR} \quad \boxed{1} \\ \text{THEME} \quad \boxed{2} \end{bmatrix} \\ \text{EFFECT} \quad \begin{bmatrix} event \end{bmatrix} \end{bmatrix}$$



Depictive Secondary Predicates: Data & LTAG Analysis

Depictive secondary predicates: typically sentence final, adjectival elements that predicate one of the verbal predicate's arguments; we call the predicated element the **target**.

The characterized state holds for at least some **initial** part of the event time.

(1) a. Kim ate the steak$_i$ raw$_i$. (depictive)
b. Sean stomped the can$_i$ flat$_i$. (non-initial, event-final ⇒ resultative)

Possible targets are the subject and object of the main verb, depending on semantic compatibility.

(2) a. Kim ate the steak$_i$ raw$_i$.
b. Kim$_i$ ate the steak hungry$_i$.
c. Kim$_i$ ate the apple$_j$ unwashed$_{i/j}$. (**target ambiguity**)

Depictive stacking is possible, but generally seems to decrease acceptability.

(3) a. ? Kim$_i$ ate the steak$_j$ raw$_j$ hungry$_i$. (well-nested)
b?? Kim$_i$ ate the steak$_j$ hungry$_i$ raw$_j$. (ill-nested)
c?? Kim ate the steak$_j$ raw$_j$ salted$_j$.

Depictives may target **unrealized arguments**.

(4) a. The book$_j$ is to be read naked$_{i/*j}$.
b. We$_i$ usually bake gluten-free$_{*i/j}$.

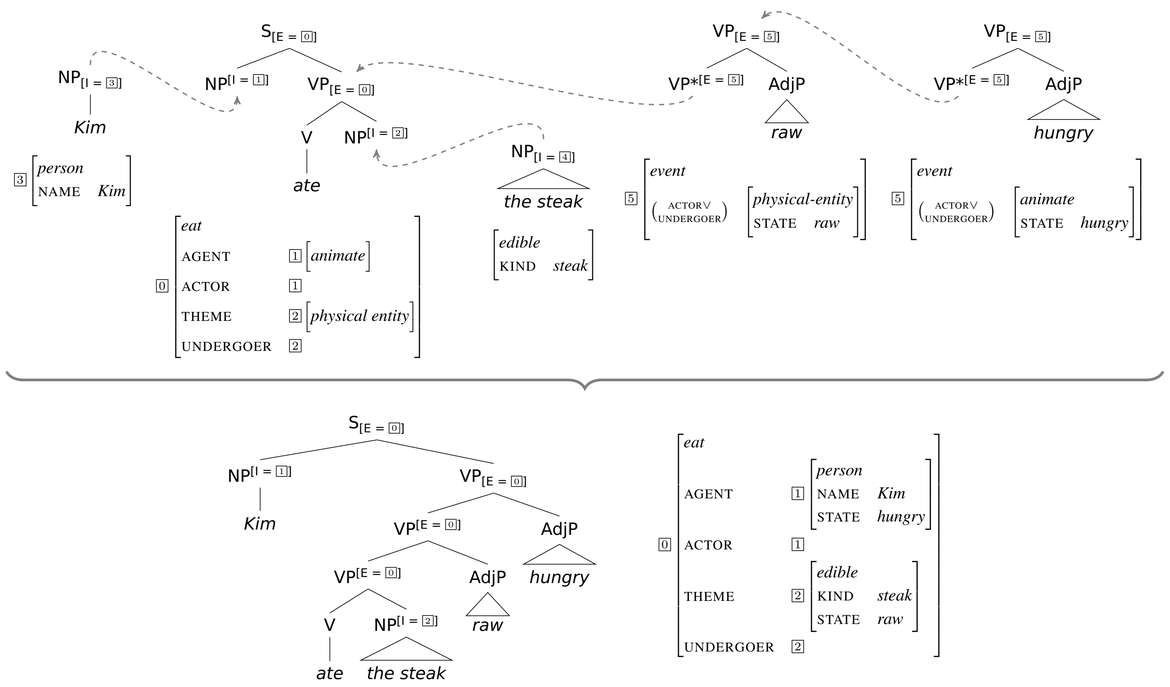
Impossible targets are indirect/oblique objects and modifying constituents.

(5) a. The cash machine$_i$ gave John$_j$ the money$_k$ hungry$_{*i/*j/*k}$. (indirect object)
b. Peter crashed into him$_i$ tired$_{*i}$. (PP-object)
c. John drilled a hole with a power tool$_i$ new$_{*i}$. (adjunct)

There are also strict locality restrictions.

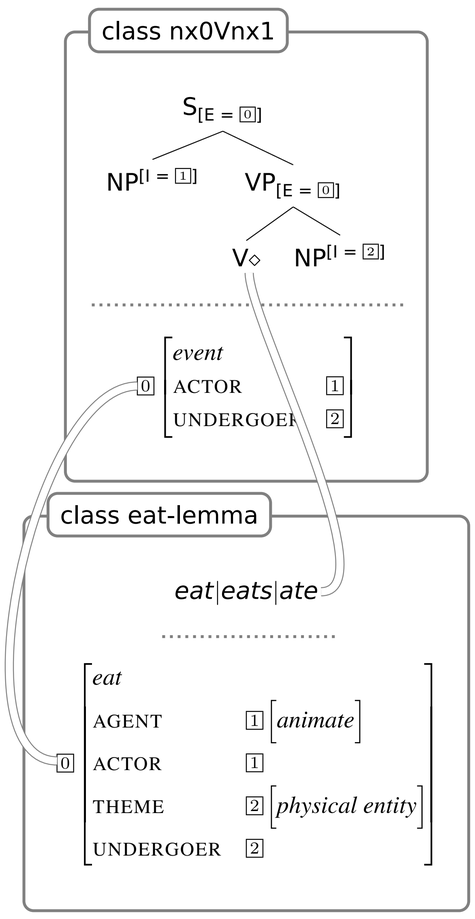
(6) a. John met [Maria's$_i$ father] naked$_{*i}$.
b. [John$_i$ and Paul$_j$]$_k$ met [Maria$_m$ and her boyfriend$_n$]$_o$ naked$_{*i/*j/k/*m/*n/o}$.

- Three strategies for modeling **target ambiguity**: (i) syntactic ambiguity, (ii) interface ambiguity, (iii) semantic ambiguity. We opt for **semantic ambiguity** (⇒ uniform trees for depictives).
- **Problem:** How to select only semantic roles of syntactic arguments?
  Solution: Use syntactically grounded semantic macroroles **actor** and **undergoer** [11].
  Macrorole linking is performed in the metagrammar [6].



The Implementation: Extensible Metagrammar & CYKTAG Parser (TuLiPA)

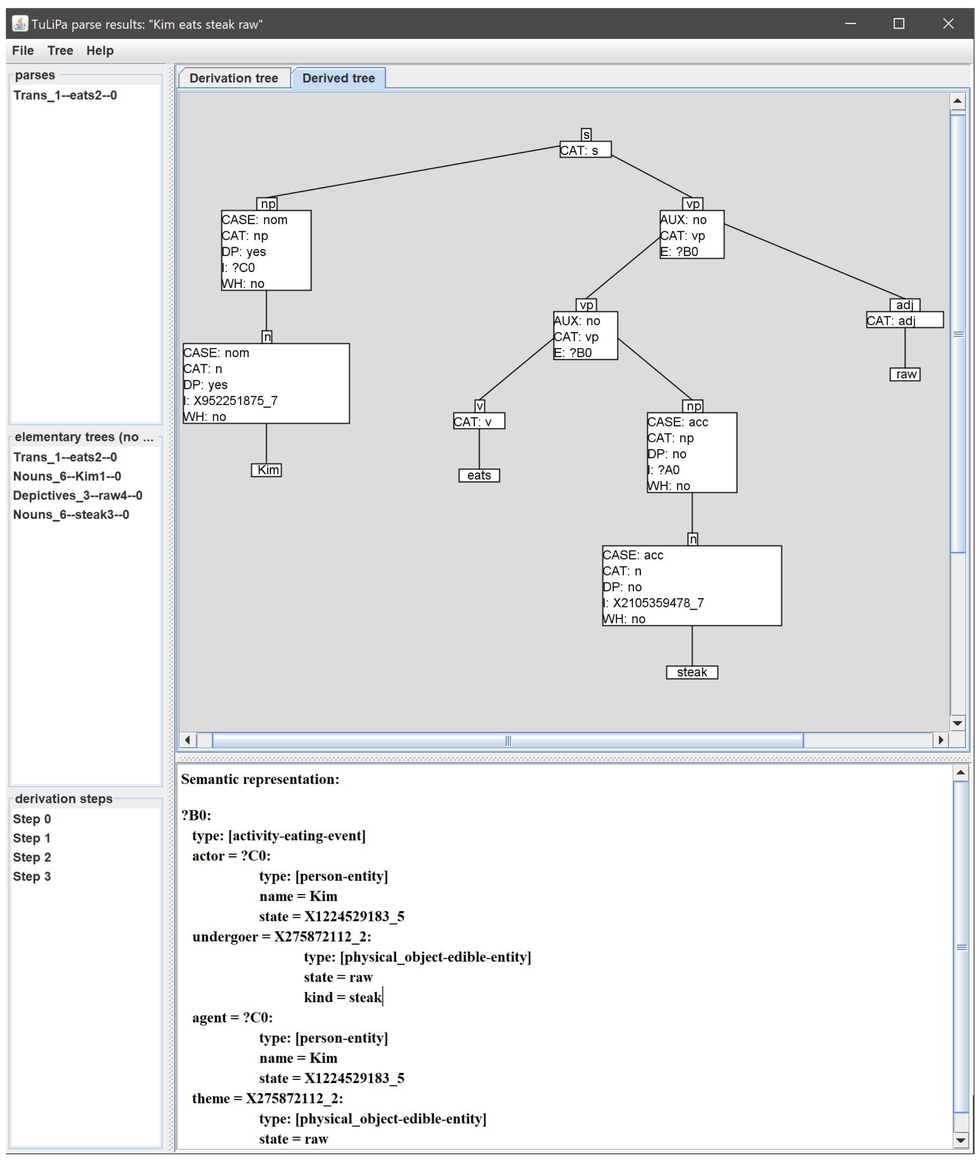
- **Grammar description**: XMG provides description language(s) for **multi-dimensional grammars** (syntax, lexicon (i.e. lemmas & morphology), semantics) including **interface of components**.
- **Grammar factorization**: in XMG, descriptions can be combined and reused to yield larger fragments, tree templates or tree families.
- **Metagrammar compiler**: XMG provides the relevant **compilers** to create grammars (the models) from metagrammar descriptions.
- A **WebGUI** is available here:



This is greatly simplified.
Ask us about it!

```
1  class nx0Vnx1
2  declare  ?S ?NP1 ?VP ?V ?NP2 ?E ?ARG1 ?ARG2
3  {
4  <syn>{node ?S [cat=s]{
5          node ?NP1(mark=subst)[cat=np, i=?ARG1]
6          node ?VP [cat=vp, e=?E]{
7            node ?V (mark=anchor)[cat=v, e=?E]
8            node ?NP2 (mark=subst)[cat=np, i=?ARG2]
9          }}};
10 <iface>{[e = ?E]};
11 <frame>{?E[ event,
12              actor: ?ARG1,
13              undergoer: ?ARG2]}
14 }
15
16
17
18 class eat-lemma-morpho-frame
19 {
20 <iface>{[e = ?E]}
21 <lemma>{entry <- eat;
22         fam   <- nx0Vnx1;
23         sem   <- ?E}
24 <morpho>{morph <- @{"eat","eats", "ate"};
25          lemma <- "eat";}
26 <frame>{?E[ eating,
27             agent :?ARG1[person],
28             theme :?ARG2[edible],
29             actor: ?ARG1,
30             undergoer: ?ARG2]}
31 }
```

- **CYKTAG Parser for TuLiPA**: Employs the compiled grammar descriptions. Syntax and semantics is parsed in parallel [2].



References

[1] Abeillé, A. & O. Rambow. 2000. Tree Adjoining Grammar: an overview. In A. Abeillé & O. Rambow (eds.), *Tree Adjoining Grammars: Formalisms, linguistic analyses and processing* (CSLI Lecture Notes 107), 1–68. Stanford, CA: CSLI Publications. [2] Arps, D. & S. Petitjean. to appear. A parser for ltag and frame semantics. In *Eleventh international conference on language resources and evaluation (lrec 2018)*. [3] Burkhardt, B., T. Lichte & L. Kallmeyer. 2017. Depictives in English: An LTAG approach. In *Proceedings of the 13th International Workshop on Tree Adjoining Grammars and Related Formalisms*, 21–30. Umeå, Sweden. [4] Crabbé, B., D. Duchier, C. Gardent, J. Le Roux & Y. Parmentier. 2013. XMG: eXtensible MetaGrammar. *Computational Linguistics* 39(3). 1–66. [5] Dowty, D. 1991. Thematic proto-roles and argument selection. *Language* 67(3). 547–619. [6] Kallmeyer, L., T. Lichte, R. Osswald & S. Petitjean. 2016. Argument linking in LTAG: A constraint-based implementation with XMG. In *Proceedings of the 12th international workshop on Tree Adjoining Grammars and related formalisms (TAG+12)*, 48–57. Düsseldorf, Germany. [7] Kallmeyer, L., W. Maier, Y. Parmentier & J. Dellert. 2010. TuLiPA - parsing extensions of TAG with Range Concatenation Grammars. *Bulletin of the Polish Academy of Sciences* 58(3). 377–392. [8] Kallmeyer, L. & R. Osswald. 2013. Syntax-driven semantic frame composition in Lexicalized Tree Adjoining Grammar. *Journal of Language Modelling* 1. 267–330. [9] Lichte, T. & S. Petitjean. 2015. Implementing semantic frames as typed feature structures with XMG. *Journal of Language Modelling* 3(1). 185–228. [10] Petersen, W. 2007. Representation of concepts as frames. In *The baltic international yearbook of cognition, logic and communication*, vol. 2, 151–170. [11] Van Valin, Jr., R. 2005. *Exploring the syntax-semantics interface*. Cambridge: Cambridge University Press.

Prospects

- Evaluation of the macrorole-hypothesis: corpus study on English and German
- Non-adjectival depictives, e.g. PP-adjuncts with similar semantic properties:

  (7) Kim$_i$ left the poster in anger$_i$.