What is a natural syntactic model for frame-semantic composition?
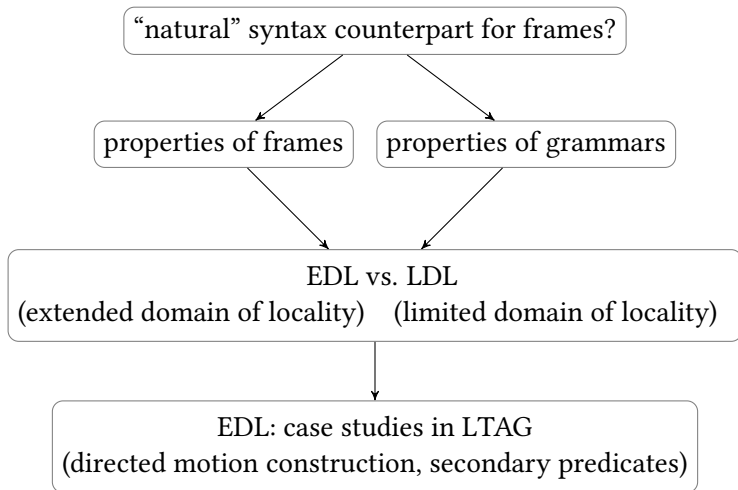
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SFB 991

HEINRICH HEINE
UNIVERSITÄT DÜSSELDORF

Overview

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            ┌──────────────────────────────────────┐
            │ "natural" syntax counterpart for frames? │
            └──────────────────────────────────────┘
                  ↙                      ↘
      ┌─────────────────────┐   ┌──────────────────────────┐
      │ properties of frames │   │ properties of grammars   │
      └─────────────────────┘   └──────────────────────────┘
                  ↘                      ↙
      ┌──────────────────────────────────────────────────────┐
      │                   EDL vs. LDL                          │
      │ (extended domain of locality)    (limited domain of locality) │
      └──────────────────────────────────────────────────────┘
                              ↓
         ┌────────────────────────────────────────────────┐
         │            EDL: case studies in LTAG            │
         │ (directed motion construction, secondary predicates) │
         └────────────────────────────────────────────────┘
```

What does *natural* mean?

Sparse and transparent in terms of the syntax-semantics interface, and similar with respect to compositional aspects:

- syntax and semantics are **homomorphic**
- classical example:

| **Montegovian semantics**		**Categorial Grammar**
$\lambda y \lambda x.love'(x, y)$	+	$V \backslash NP / NP$

Currying, functional application
"ordered argument systems" (Dowty, 1989)

frame semantics   +   ???

Formal properties of frame semantics

Frames are formalized as **extended typed feature structures**
(Petersen, 2007; Kallmeyer & Osswald, 2013)

- no inherent ordering on the attributes of the same node
- no overt/explicit distinction between arguments and modifiers
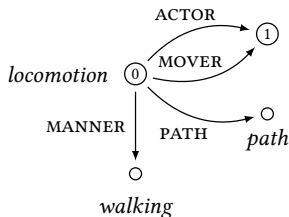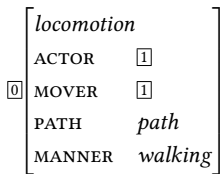
Formal properties of frame semantics

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Frames are composed by unification, not by functional application.

$$
[0]\begin{bmatrix} \textit{locomotion} \\ \text{ACTOR} \quad [1] \\ \text{MOVER} \quad [1] \\ \text{PATH} \quad \textit{path} \\ \text{MANNER} \quad \textit{walking} \end{bmatrix}
\cup\;
[1]\begin{bmatrix} \textit{person} \\ \text{NAME} \quad \textit{John} \end{bmatrix}
=\;
[0]\begin{bmatrix} \textit{locomotion} \\ \text{ACTOR} \quad [1]\begin{bmatrix} \textit{person} \\ \text{NAME} \quad \textit{John} \end{bmatrix} \\ \text{MOVER} \quad [1] \\ \text{PATH} \quad \textit{path} \\ \text{MANNER} \quad \textit{walking} \end{bmatrix}
$$

Formal properties of grammars

Fundamental distinction between two classes of grammar frameworks:

- limited domain of locality (LDL)
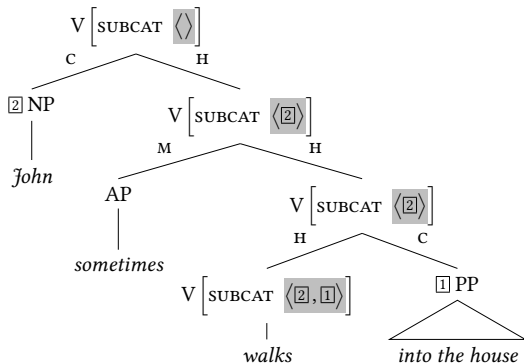- extended domain of locality (EDL)

Another recently discussed distinction that is othogonal:

- lexical vs. phrasal (Müller & Wechsler, 2014)
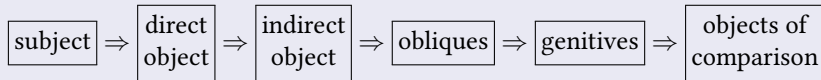
Formal properties of grammars: LDL

LDL (limited domain of locality)

- predetermined derivational order (specified in the lexicon)
- indicator: valency lists, which are stepwise processed
- CG, (binarized) HPSG, SBCG, MG

What are ordered valency lists good for?

Implement the obliqueness hierarchy (Keenan & Comrie, 1977)

$$\boxed{\text{subject}} \Rightarrow \boxed{\substack{\text{direct} \\ \text{object}}} \Rightarrow \boxed{\substack{\text{indirect} \\ \text{object}}} \Rightarrow \boxed{\text{obliques}} \Rightarrow \boxed{\text{genitives}} \Rightarrow \boxed{\substack{\text{objects of} \\ \text{comparison}}}$$

List of applications (Müller, 2007, §3.1)

- binding theory
- passive
- ellipsis
- free relative clauses
- secondary predicates

Formal properties of grammars: EDL

EDL (extended domain of locality)

- no predetermined derivational order
- capability to immediately access arbitrarily distant parts of a sentence within one lexical entry or syntactic rule
- LTAG, RRG, *some* versions of CxG, Dependency Grammar

LTAG:
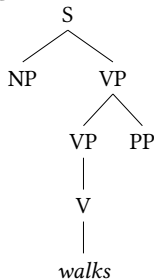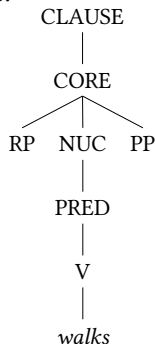
```
        S
      /   \
    NP     VP
          /  \
        VP    PP
        |
        V
        |
      walks
```

RRG:

```
      CLAUSE
        |
       CORE
      /  |  \
    RP  NUC  PP
         |
       PRED
         |
         V
         |
       walks
```

Formal properties of grammars: EDL

EDL (extended domain of locality)

- no predetermined derivational order
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- LTAG, RRG, *some* versions of CxG, Dependency Grammar

CxG (Goldberg, 2013, 2014):

$$
\begin{bmatrix}
\text{intransitive motion construction} \\
\text{Form:} \quad \mathbf{V} \quad \{\, \mathbf{Subj,} \quad \mathbf{Oblique_{path}}\} \\
| \qquad | \qquad\qquad | \\
\text{Function:} \quad \text{move} \quad \text{agent} \qquad \text{path}
\end{bmatrix}
$$

LTAG: Introduction

Ingredients:

- a set of **elementary trees**
- two combinatorial operations:
  - substitution (replace a leaf node)
  - adjunction (replace an inner node)
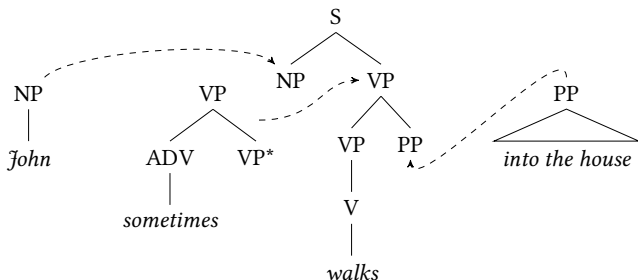
EDL $\Rightarrow$ the attachment order of the NP and the PP is independent!

LTAG and frames

Kallmeyer & Osswald (2013):

- lexicon: pairs of elementary trees and base-labelled typed feature structures
- Elementary trees are enriched with **interface features**, which contain base labels from the frame representation.
  - unification of interface features $\rightsquigarrow$ identification of base labels
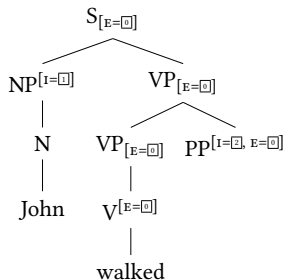- parallel composition of derived trees and larger frames

LTAG and frames: example

(1) John walked into the house.

LTAG and frames: example

(1) John walked into the house.

$$S_{[E=\boxed{0}]}$$

```
            S[E=⓪]
           /      \
      NP[I=①]     VP[E=⓪]
        |         /      \
        N     VP[E=⓪]   PP[I=②, E=⓪]
        |        |
      John    V[E=⓪]
                 |
              walked
```
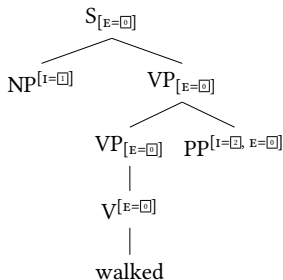
$$\boxed{0}\begin{bmatrix} \textit{bounded-locomotion} \\ \textsc{actor} \quad \boxed{1}\begin{bmatrix} \textit{person} \\ \textsc{name} \quad \textit{John} \end{bmatrix} \\ \textsc{mover} \quad \boxed{1} \\ \textsc{goal} \quad \boxed{2} \\ \textsc{path} \quad \textit{path} \\ \textsc{manner} \quad \textit{walking} \end{bmatrix}$$
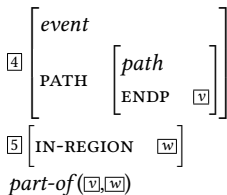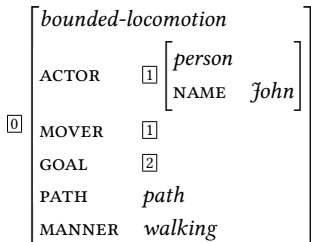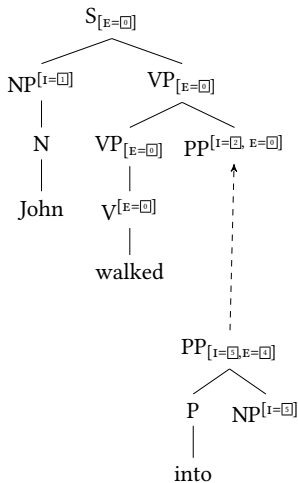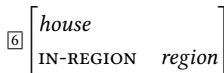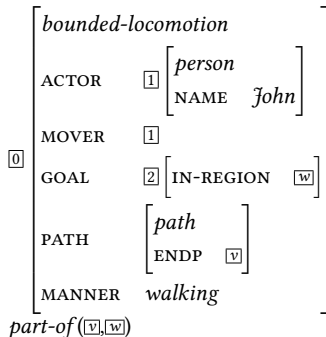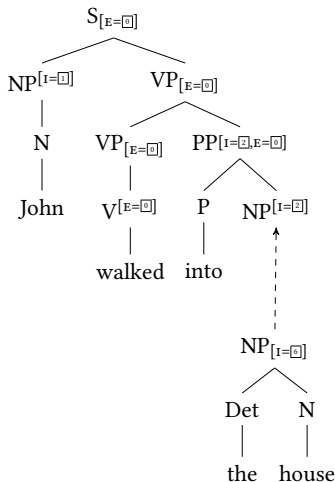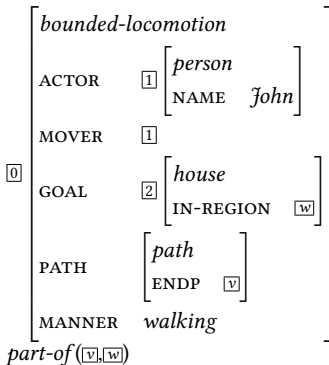
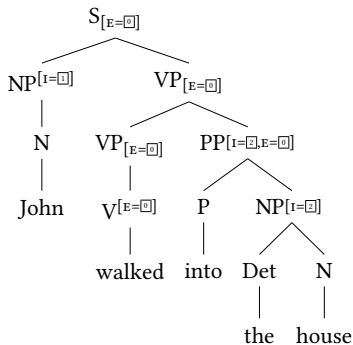# LTAG and frames: example

(1) John walked into the house.

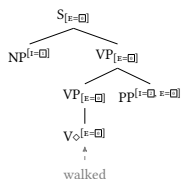# LTAG and frames: example

(1) John walked into the house.

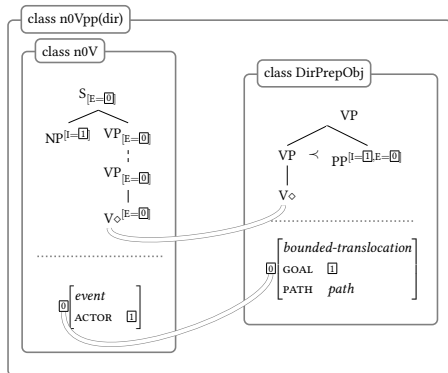# LTAG and frames: example

(1) John walked into the house.

LTAG and frames: factorization with metagrammars

- Lexical entries can be further decomposed/factorized using **metagrammars** (e. g. XMG, see the other talk!).

Comming back to EDL vs. LDL

They are different:

- representation of valency; order of derivation
  - $\Rightarrow$ EDL with set-like valency, LDL with list-like valency
- transparency of the syntax-semantics interface
  - $\Rightarrow$ EDL more transparent than LDL

But are there fundamentally different ramifications?

- depictive secondary predicates
  - $\Rightarrow$ probably yes: see next slides.

- passive (probably no)
- binding theory
- ellipsis
- free relative clauses

- idioms, multi-word expressions

Depictive secondary predicates

A case of **cross modification**: the modifier is disconnected from the modified phrase:

(2) He$_i$ walked into the house naked$_i$.

What are the scope possibilities of depictives?

EDL-analysis (LTAG, on the next slides):
- The depictive can 'see' the whole frame of the matrix sentence.
- But the valency status of frame components is **not** accessible!

LDL-analysis (HPSG, Müller 2002; Müller 2008):
- The depictive only 'sees' the members of the valency list (in SUBCAT).
- non-cancellation approach: arguments are not removed during the derivation, but they remain there as "ghosts"

Depictive secondary predicates

(2) He$_i$ walked into the house naked$_i$.
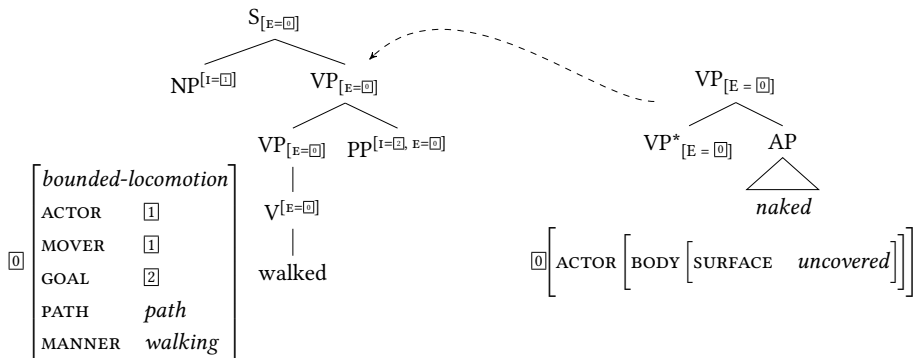
Depictive secondary predicates

(3) *dass sie$_i$ ihn$_j$ nackt$_{i/j}$ beobachtet*
  that she him naked   watches

$S_{[E\,=\,\boxed{0}]}$

$NP^{[I\,=\,\boxed{1}]}$ $VP_{[E\,=\,\boxed{0}]}$

$VP_{[E\,=\,\boxed{0}]}$

$NP^{[I\,=\,\boxed{2}]}$ $VP_{[E\,=\,\boxed{0}]}$

AP $VP^{\star}{}_{[E\,=\,\boxed{0}]}$

$\boxed{0}\begin{bmatrix} watch \\ \text{ACTOR} & \boxed{1} \\ \text{THEME} & \boxed{2} \end{bmatrix}$

nackt

V

beobachtet

$\boxed{0}\begin{bmatrix} \text{ACTOR|THEME}\ldots & \begin{bmatrix} \text{BODY} & \begin{bmatrix} \text{SURFACE} & uncovered \end{bmatrix} \end{bmatrix} \end{bmatrix}$
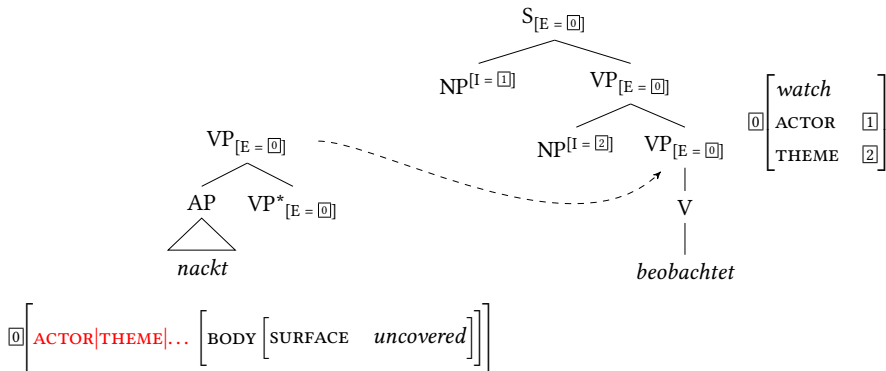
What is the set of valid target attributes? And how to represent it?

Depictive secondary predicates

Unfortunately, not every attribute seems to be accessible:

(4) *weil Karl$_i$ [neben Maria$_j$] nackt$_{i/*j}$ schlief*
   because Karl   next.to Maria   naked   slept

But also the valency-based generalization in Müller (2002) seems
problematic: "Depictives can target exactly the arguments from the
valency list."

- The target may be unrealized:

(5) *Hier wird nackt geschlafen.*
   here is   naked slept

- The target can be inside an argument?

(6) *[Die Untersuchung an dem Patienten$_i$] wird nur nüchtern$_i$ durchgeführt.*
   the examination of the patient   is only sober   performed

Depictive secondary predicates

- Not every argument is a good target?

(7) *[Noch am   Boden liegend]$_i$, sei [auf ihn$_i$] eingetreten   worden.*
    still   on.the floor lying   be on   him PART.kicked got
    (Müller, 2002, (422))

(8) *In das Haus$_i$ ging   er ungelüftet$_{?i}$.*
    in the house walked he unaired
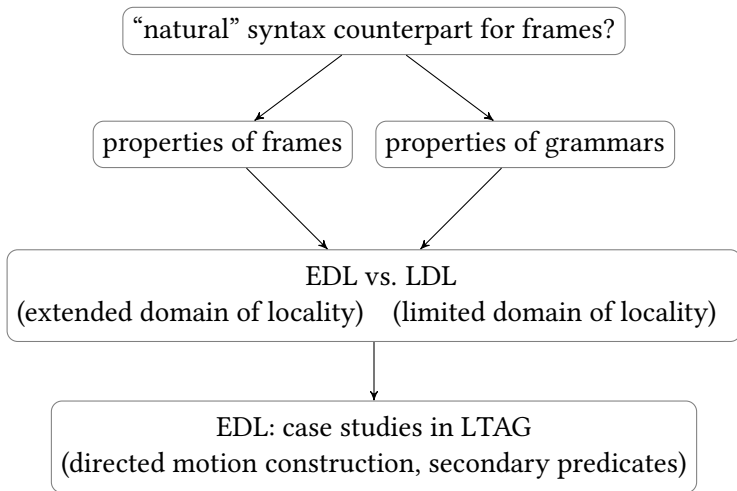
- The target can be a non-argument?

(9) *Deiner   Oma$_i$ bis du [ohne   Gehhilfe]$_i$ zu schnell.*
    your.DAT grandma are you without walker   too fast

(10) *In der Wohnung$_i$ hält man es nur gut gelüftet$_i$ aus.*
     in the appartment bear one it only well aired   PART

The exact scope potential of depictives still is an open question.

Summary

"natural" syntax counterpart for frames?

properties of frames

properties of grammars

EDL vs. LDL
(extended domain of locality) (limited domain of locality)

EDL: case studies in LTAG
(directed motion construction, secondary predicates)

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Müller, Stefan & Stephen M. Wechsler. 2014. Lexical approaches to argument structure. *Theoretical Linguistics* 40(1–2). 1–76. http://hpsg.fu-berlin.de/~stefan/Pub/arg-st.html.

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