

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

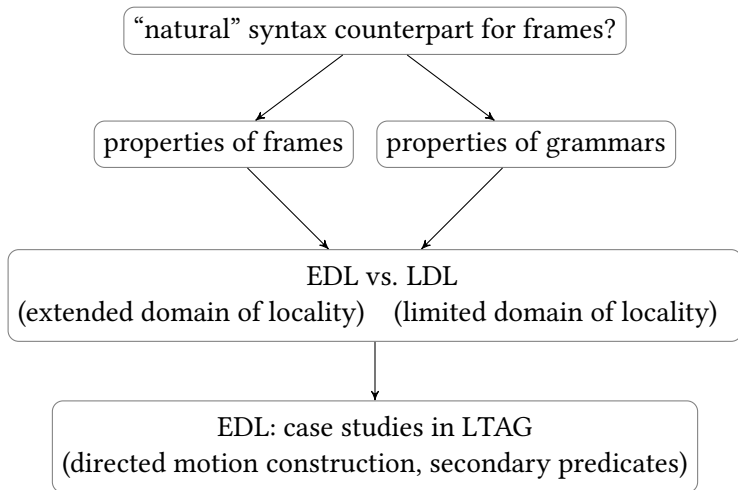
Timm Lichte, Laura Kallmeyer & Rainer Osswald

University of Düsseldorf, Germany

CTF14, August 26, 2014



# Overview



## 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:

<b>Montegovian semantics</b> $\lambda y \lambda x. \text{love}'(x, y)$	+	<b>Categorial Grammar</b> $V \backslash NP / NP$
---	---	---

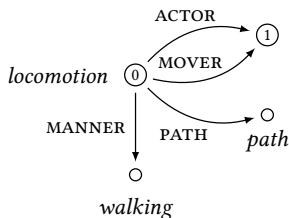
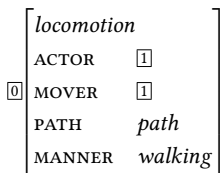
Currying, functional application  
“ordered argument systems” (Dowty, 1989)

**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

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

Frames are composed by unification, not by functional application.

$$\begin{array}{l} \boxed{0} \left[ \begin{array}{ll} \textit{locomotion} & \\ \text{ACTOR} & \boxed{1} \\ \text{MOVER} & \boxed{1} \\ \text{PATH} & \textit{path} \\ \text{MANNER} & \textit{walking} \end{array} \right] \cup \boxed{1} \left[ \begin{array}{ll} \textit{person} & \\ \text{NAME} & \textit{John} \end{array} \right] = \boxed{0} \left[ \begin{array}{ll} \textit{locomotion} & \\ \text{ACTOR} & \boxed{1} \left[ \begin{array}{ll} \textit{person} & \\ \text{NAME} & \textit{John} \end{array} \right] \\ \text{MOVER} & \boxed{1} \\ \text{PATH} & \textit{path} \\ \text{MANNER} & \textit{walking} \end{array} \right] \end{array}$$

# Formal properties of grammars

Fundamental distinction between two classes of grammar frameworks:

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

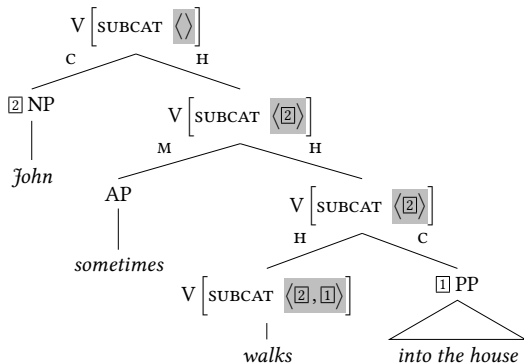
Another recently discussed distinction that is orthogonal:

- lexical vs. phrasal (Müller & Wechsler, 2014)

# Formal properties of grammars: LDL

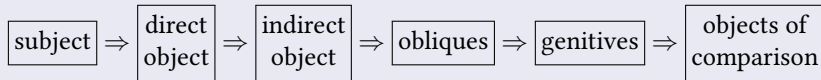
## LDL (limited domain of locality)

- 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)



List of applications (Müller, 2007, §3.1)

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

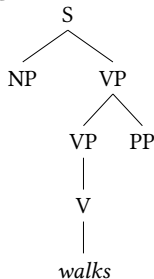


# Formal properties of grammars: EDL

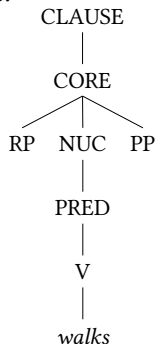
## EDL (extended domain of locality)

- 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:



RRG:



# 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

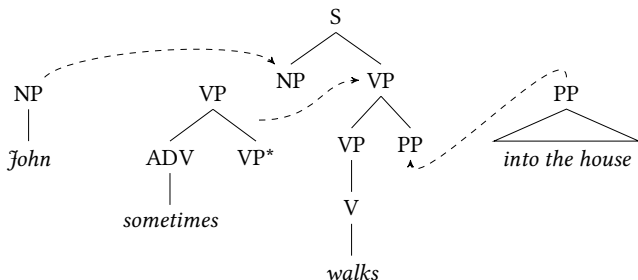
CxG (Goldberg, 2013, 2014):

	intransitive motion construction		
Form:	<b>V</b>	{ <b>Subj</b> , <b>Oblique</b> <sub>path</sub> }	
Function:	move	agent	path

# LTAG: Introduction

Ingredients:

- a set of **elementary trees**
- two combinatorial operations:
  - substitution (replace a leaf node)
  - adjunction (replace an inner node)

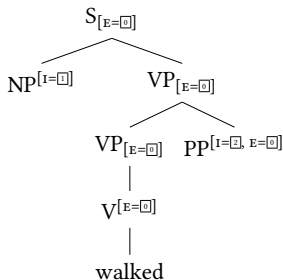


EDL  $\Rightarrow$  the attachment order of the NP and the PP is independent!

# 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

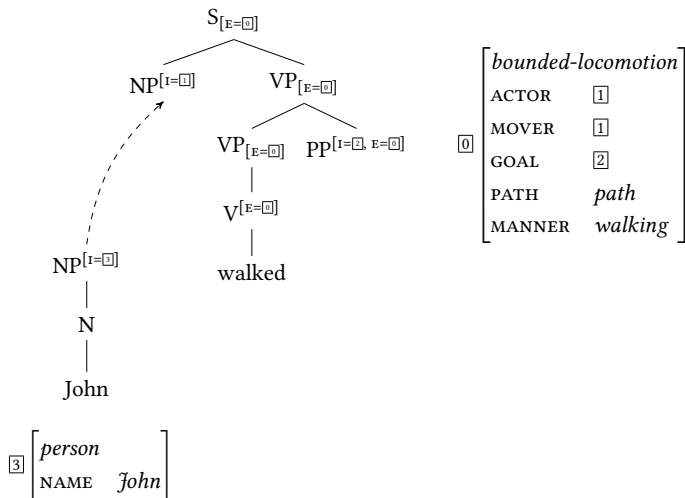


	<i>bounded-locomotion</i>
ACTOR	□
MOVER	□
GOAL	□
PATH	<i>path</i>
MANNER	<i>walking</i>

□

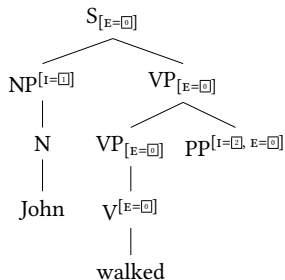
# LTAG and frames: example

(1) John walked into the house.



# LTAG and frames: example

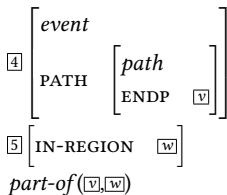
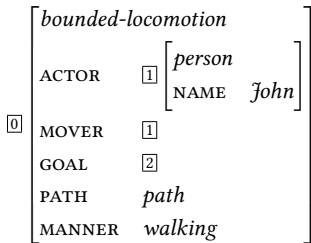
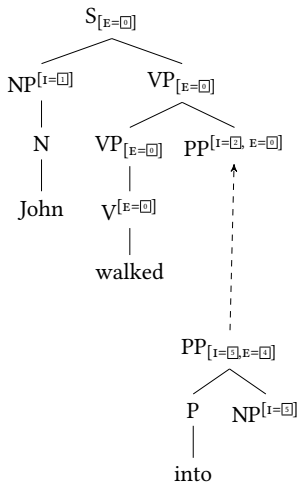
(1) John walked into the house.



	<i>bounded-locomotion</i>	
	ACTOR	[1] <i>person</i>
		NAME <i>John</i>
[0]	MOVER	[1]
	GOAL	[2]
	PATH	<i>path</i>
	MANNER	<i>walking</i>

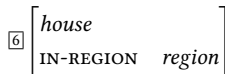
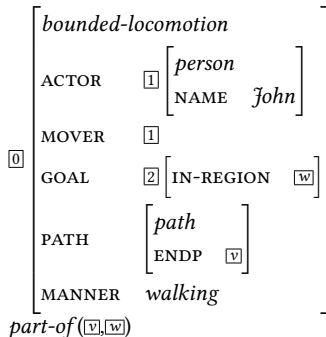
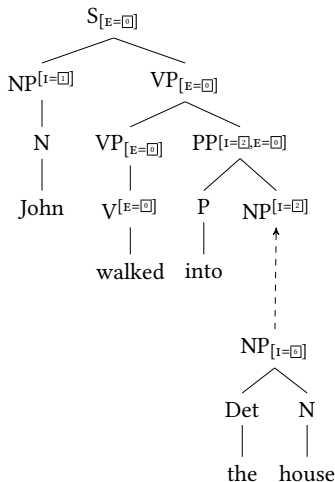
# LTAG and frames: example

(1) John walked into the house.



# LTAG and frames: example

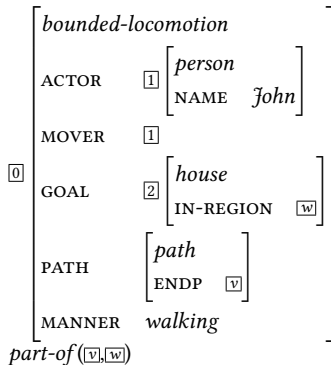
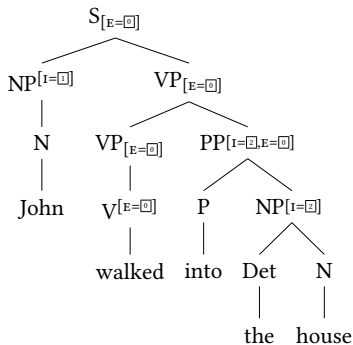
(1) John walked into the house.





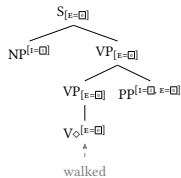
# LTAG and frames: example

(1) John walked into the house.

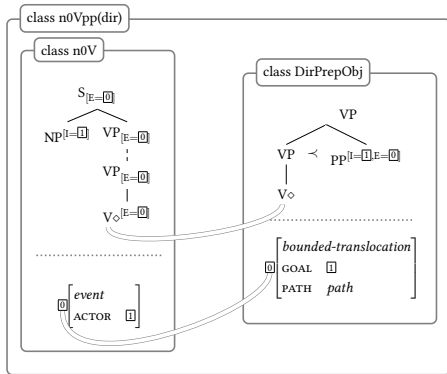


# LTAG and frames: factorization with metagrammars

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



	<i>bounded-locomotion</i>
	ACTOR 1
0	MOVER 1
	GOAL 2
	PATH <i>path</i>



## Comming back to EDL vs. LDL

They are different:

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

But are there fundamentally different ramifications?

- depictive secondary predicates
  - ⇒ 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<sub>i</sub> walked into the house naked<sub>i</sub>.

What are the scope possibilities of depictives?

**EDL-analysis (LTAG, on the next slides):**

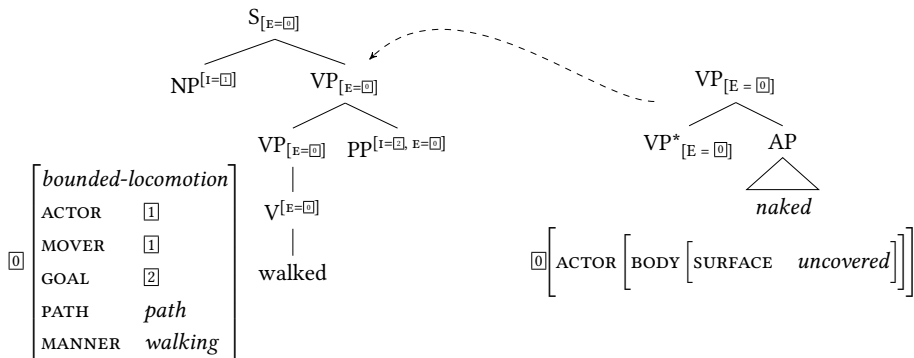
- The depictive can ‘see’ the whole frame of the matrix sentence.
- But the valency status of frame components is **not** accessible!

**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”

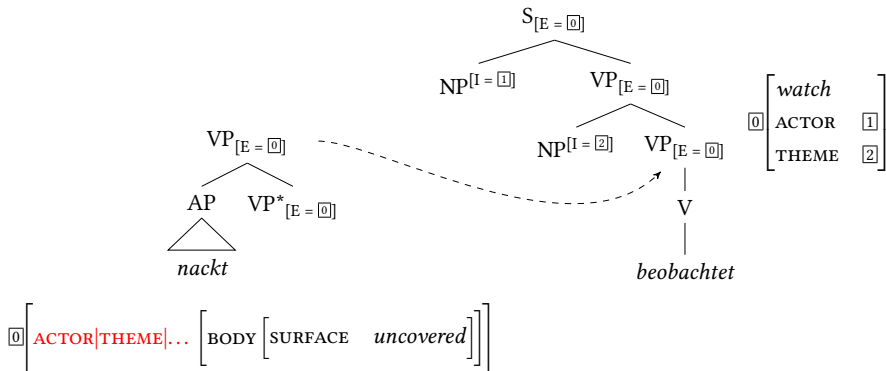
## Depictive secondary predicates

(2) He<sub>i</sub> walked into the house naked<sub>i</sub>.



## Depictive secondary predicates

- (3) *dass sie<sub>i</sub> ihn<sub>j</sub> nackt<sub>i/j</sub> beobachtet*  
that she him naked watches



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<sub>i</sub> [neben Maria<sub>j</sub>] nackt<sub>i/\*j</sub> 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<sub>i</sub>] wird nur nüchtern<sub>i</sub> 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*]<sub>i</sub>, sei [*auf ihn*]<sub>i</sub> eingetreten worden.  
still on.the floor lying be on him PART.kicked got  
(Müller, 2002, (422))

(8) *In das Haus*<sub>i</sub> ging er ungelüftet<sub>?i</sub>.  
in the house walked he unaired

### ■ The target can be a non-argument?

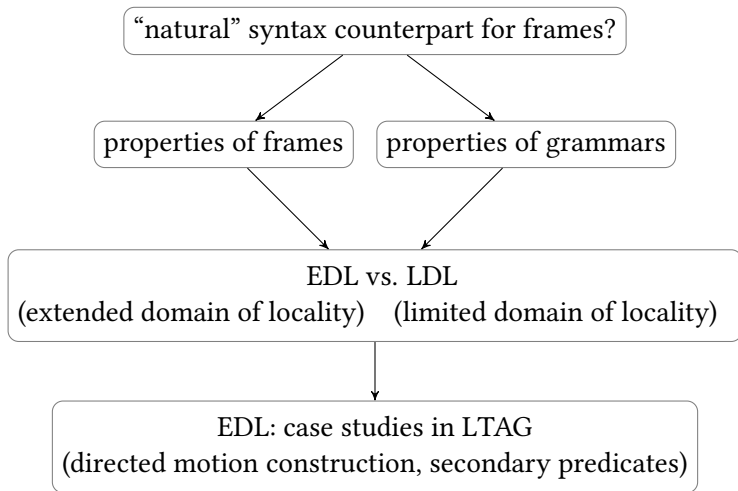
(9) *Deiner Oma*<sub>i</sub> bis du [*ohne Gehhilfe*]<sub>i</sub> zu schnell.  
your.DAT grandma are you without walker too fast

(10) *In der Wohnung*<sub>i</sub> hält man es nur gut gelüftet<sub>i</sub> aus.  
in the apartment bear one it only well aired PART

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



# Summary



- Dowty, David R. 1989. On the semantic content of the notion of 'thematic role'. In Gennaro Chierchia, Barbara H. Partee & Raymond Turner (eds.), *Properties, types and meaning*, 69–129. Kluwer Academic Publishers.
- Goldberg, Adele. 2014. Fitting a slim dime between the verb template and argument structure construction approaches. *Theoretical Linguistics* 40(1–2). 113–135.
- Goldberg, Adele E. 2013. Argument structure constructions versus lexical rules or derivational verb templates. *Mind & Language* 28(4). 435–465.
- Kallmeyer, Laura & Rainer Osswald. 2013. Syntax-driven semantic frame composition in Lexicalized Tree Adjoining Grammar. *Journal of Language Modelling* 1. 267–330.
- Keenan, Edward L. & Bernard Comrie. 1977. Noun phrase accessibility and universal grammar. *Linguistic Inquiry* 8(1). 63–99. <http://www.jstor.org/stable/4177973>.
- Müller, Stefan. 2002. *Complex predicates. Verbal complexes, resultative constructions, and particle verbs in German Studies in Constraint-Based Lexicalism*. Stanford: CSLI Publications.
- Müller, Stefan. 2007. *Head-Driven Phrase Structure Grammar: Eine Einführung* Stauffenburg Einführungen No. 17. Tübingen: Stauffenburg Verlag.
- Müller, Stefan. 2008. Depictive secondary predicates in German and English. In Christoph Schroeder, Gerd Hentschel & Winfried Boeder (eds.), *Secondary predicates in Eastern European languages and beyond* (Studia Slavica Oldenburgensia 16), 255–273. Oldenburg: BIS-Verlag. <http://hpsg.fu-berlin.de/~stefan/Pub/depiktiv-2006.html>.
- 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>.
- Petersen, Wiebke. 2007. Representation of concepts as frames. *The Baltic International Yearbook of Cognition, Logic and Communication* 2. 151–170.