On the syntax-semantics interface of idiomatic multi-word expressions

Timm Lichte

University of Düsseldorf, Germany

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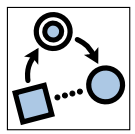

What are MWEs?

Complex expressions which have surprising properties not predictable from their component words.[5]

(1) kingdom come, by and large
(2) leave sb. in the lurch
(3) kick the bucket
(4) spill the beans
(5) take a shower (light-verb construction)
(6) call sb. up (verb-particle construction)
(7) bis der Arzt kommt
Ich glaube, mich tritt ein Pferd.[31]
(8) John loaded the hay onto the wagon.
John loaded the wagon with the hay.
(9) Telefonhäuschen, frische Luft
#Telefonhüttchen, #neue Luft (false friends)

Sorts of idiomaticity (Baldwin & Kim 2010)

- lexical idiomaticity
  - bound words: *ad hoc*, *leave sb. in the lurch*
- syntactic idiomaticity
  - ill-formed: *kingdom come*, *by and large*
- **semantic idiomaticity**
  - non-decomposable (≈ non-predictable): *kick the bucket* (‘die’)
  - decomposable (≈ predictable): *spill the beans* (‘reveal secrets’)
  - predictable with additions: *bus driver* (‘one who drives the bus’, not ‘one who drives like a bus’)
- pragmatic idiomaticity: *good morning*
- statistical idiomaticity (“collocations”)
  - adjective noun combinations: *frische*/#*neue Luft*
  - ordering of conjuncts: *black and white television*

Constraints on the emergence of idiomaticity

- lexical constraints: #*kick the pail*
- morphological constraints: #*kick the buckets*
- passivization constraints: #*The buckets were kicked.*
- linearization constraints: #*The bucket, John kicked.*
- modification constraints: *kick the social/#rusty bucket*

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- fixed — semi-fixed — flexible (Sag et al. 2002)

$\Rightarrow$ coexistence of literal and idiomatic usages

$\Rightarrow$ "a pain in the neck for NLP" (Sag et al. 2002)
- identification (types and tokens)
- lexicographic description
- grammar theory
- parsing
- machine translation

Problems for NLP (Sag et al. 2002)

compositional approaches

treat the MWE components as regular words

- overgeneration problem
- idiomaticity problem

$\Rightarrow$ pitfall of missing the irregularities

Problems for NLP (Sag et al. 2002)

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words-with-spaces approaches

treat the whole MWE as one word

- flexiblity problem (except for fixed MWEs)
- lexical proliferation problem

$\Rightarrow$ pitfall of missing the regularities

Plan for today

Introduce a novel approach using TAG
(collaboration with Laura Kallmeyer)[22]

- lexicalist or constructionist?
- syntactic or semantic ambiguity?
- compositional or non-compositional?

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- ~~syntactic~~ or semantic ambiguity?
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Outline

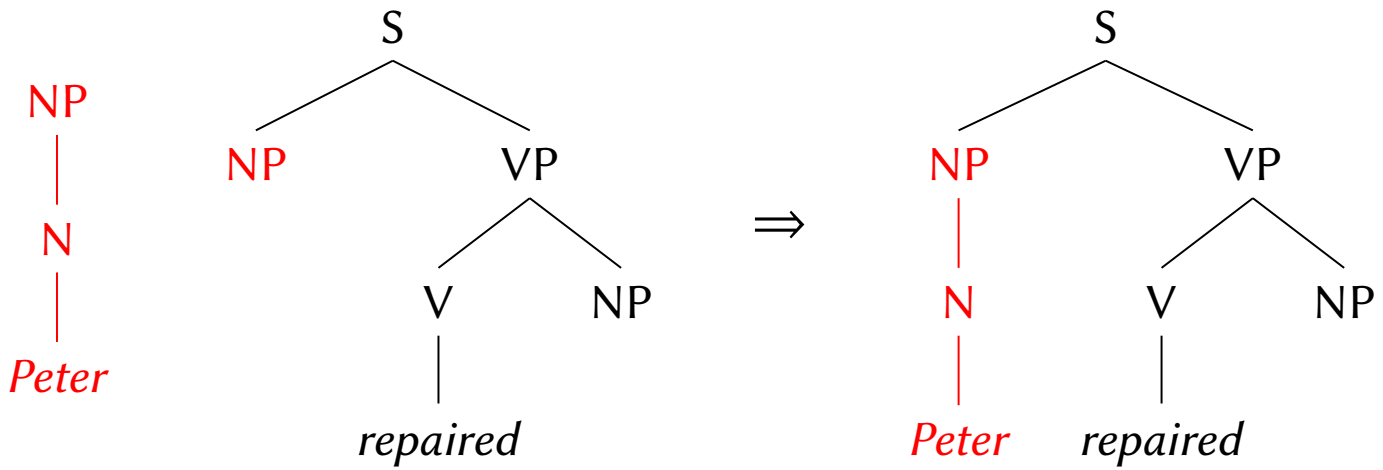
1. Tree-Adjoining Grammar + frame semantics
2. Former work
   - Syntactic ambiguity approaches with TAG
   - Semantic ambiguity approaches
3. New: Semantic ambiguity approach with TAG
4. Summary

Outline

Tree-Adjoining Grammar

Tree-Adjoining Grammar (TAG)[2,17,18]

- A grammar consists of elementary trees.
- Elementary trees can be combined by two operations:
  - **substitution:** replace a non-terminal leaf with an initial tree



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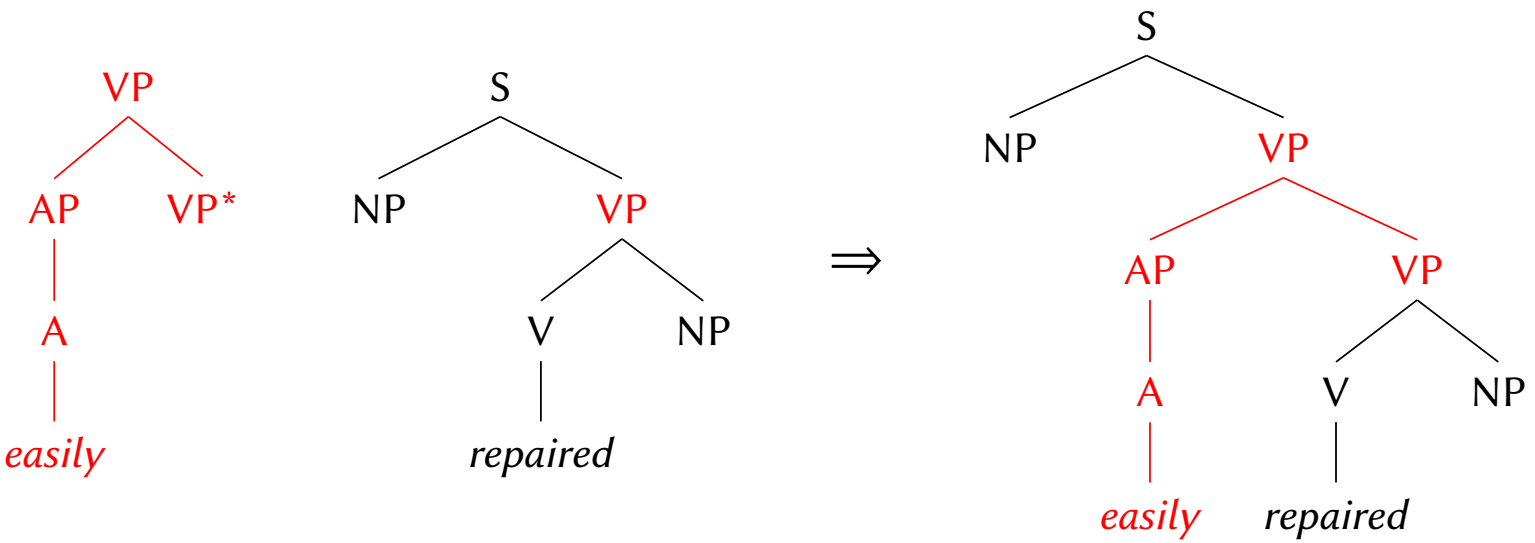

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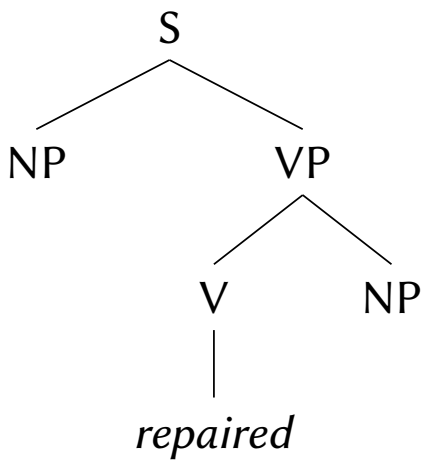
- Elementary trees cover an **extended domain of locality**.
  - The head immediately combines with its arguments.
  - no predetermined derivational order

  $\Rightarrow$ constructionist framework![15]



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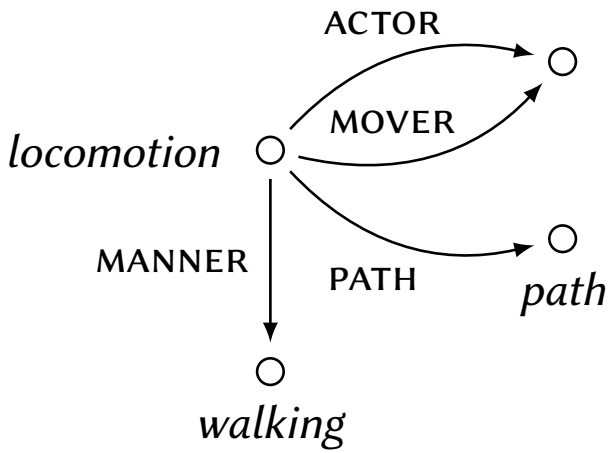
  $\Rightarrow$ constructionist framework![15]
- Lexical generalizations are expressed in the **metagrammar**.

Frame semantics

- Frames emerged as a representation format of lexical and conceptual knowledge.[7,13,23]



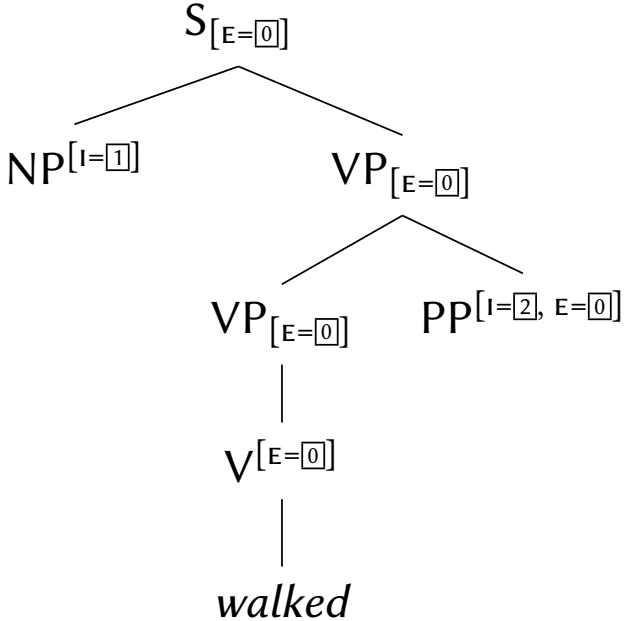
$$\begin{bmatrix} \textit{locomotion} & \\ \text{ACTOR} & \boxed{1} \\ \text{MOVER} & \boxed{1} \\ \text{PATH} & \textit{path} \\ \text{MANNER} & \textit{walking} \end{bmatrix}$$

- Frames can be formalized as (extended) typed feature structures.[19,28]
- Frames ≠ FrameNet frames[27]
- Frame semantics with quantification using e.g. Hybrid Logic[20]

TAG + frame semantics

Kallmeyer & Osswald [19]:

- lexicon: **pairs of elementary trees and frames**



$$\boxed{0}\begin{bmatrix} \textit{bounded-locomotion} & \\ \textsc{actor} & \boxed{1} \\ \textsc{mover} & \boxed{1} \\ \textsc{goal} & \boxed{2} \\ \textsc{path} & \textit{path} \\ \textsc{manner} & \textit{walking} \end{bmatrix}$$

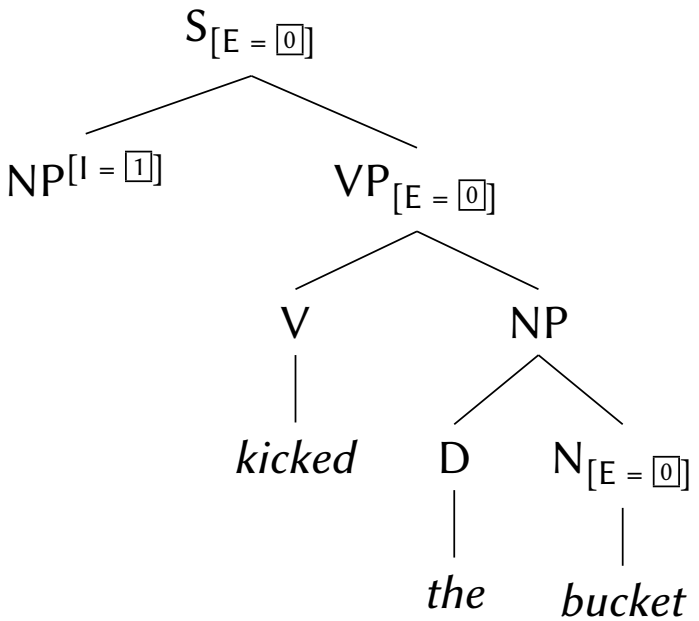
- Elementary trees are enriched with **interface features**, which contain base labels from the frame representation.
  - unification of interface features $\rightsquigarrow$ unification of frames
- parallel composition of derived trees and larger frames

Outline

Syntactic ambiguity approaches with TAG

(idea from Abeillé & Schabes)[1,3,4]

Idiomaticity through multiple anchoring: Components of an MWE jointly anchor an elementary tree.

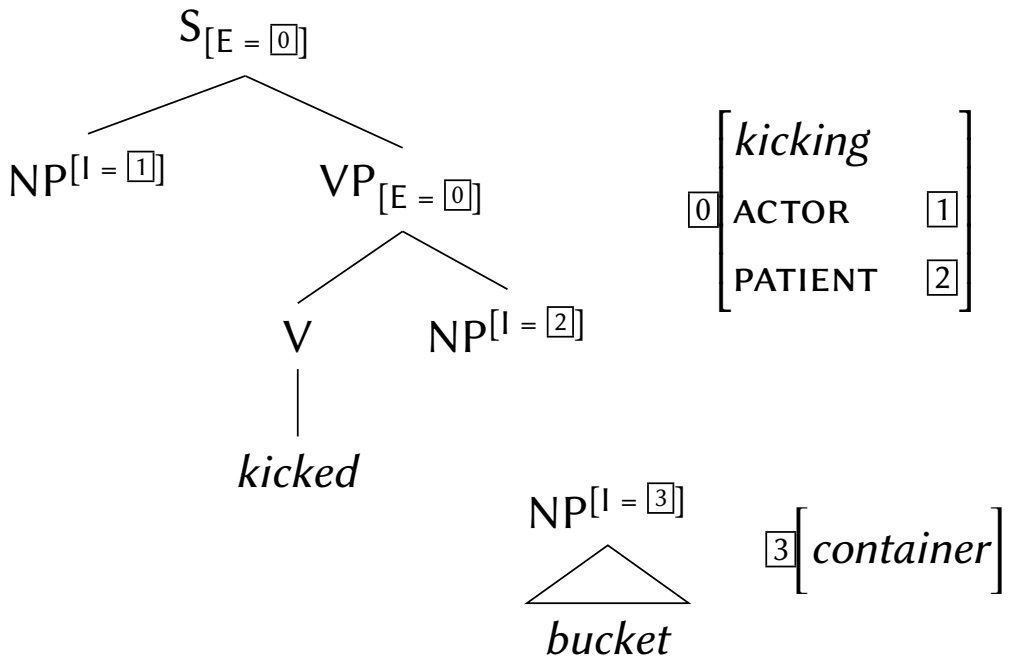


$$\boxed{0}\begin{bmatrix} \textit{dying} & \\ \textsc{patient} & \boxed{1} \end{bmatrix}$$

Syntactic ambiguity approaches with TAG

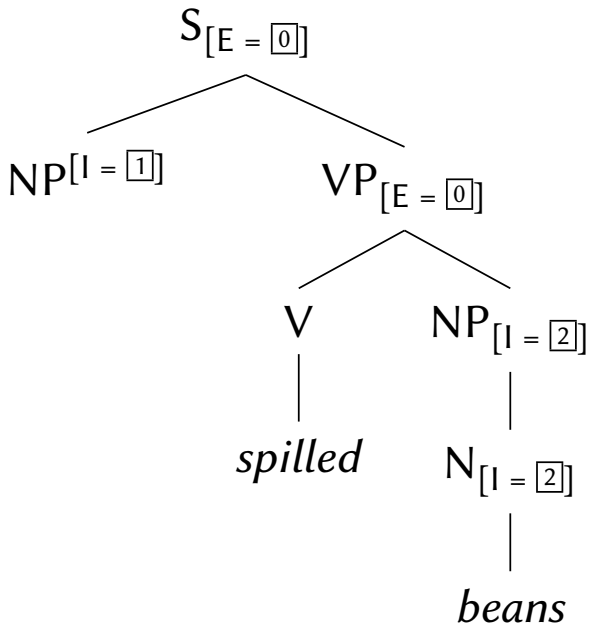
(idea from Abeillé & Schabes)[1,3,4]

The literal meaning is evoked by regular single-anchored elementary trees:



Syntactic ambiguity approaches with TAG

Example with “decomposable” *spill the beans*:



$$\begin{bmatrix} 0 & \textit{divulging} \\ & \textsc{actor} \quad 1 \\ & \textsc{theme} \quad 2 \begin{bmatrix} \textit{information} \end{bmatrix} \end{bmatrix}$$

idiomatic

Syntactic ambiguity approaches with TAG

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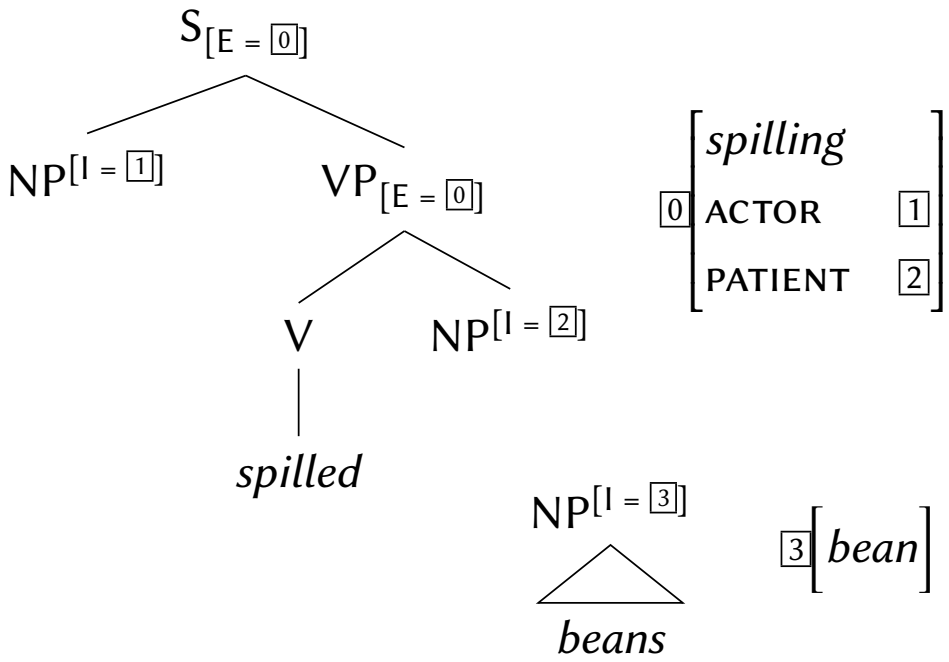

literal

Syntactic ambiguity approaches elsewhere

Syntactic ambiguity approach

There are different syntactic derivations/representations for literal and idiomatic meanings.

Also found in:[30]

- Transformational Grammar (Chomsky 1980)
- Lexical-functional Grammar (Bresnan 1982)
- Head-driven Phrase Structure Grammar (Sailer 2000)[31,35]
- Sign-based Construction Grammar (Kay, Sag & Flickinger To appear)

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But there are (general?) problems …

Syntactic ambiguity approaches: Problems

- bad for parsing: non-delayable ambiguity resolution
- missing compatibility with psycholinguistic results (Müller & Wechsler): MWEs cause an increased semantic rather than syntactic processing load.[29,36,37]
- missing connection between literal and idiomatic meaning
- missing account of the "extendability" of literal senses (Egan):

  (10) *If you let this cat out of the bag, a lot of people are going to get scratched.*

- missing generalizations on lexical variability (Pulman):
  {*put*/*lay*/*spread*} *the cards on the table*
  {*let the cat* / *the cat is*} out of the bag
- difficult to deal with partial uses:

  (11) *Eventually she spilled all the beans. But it took her a few days to spill them all.* (Riehemann)

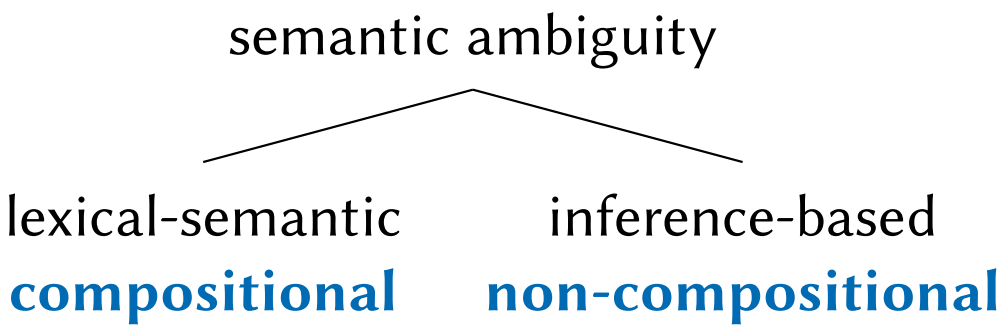
  (12) *Pat pulled some strings for Chris. But Alex didn't have access to any strings.* (Manfred Sailer, pc)

Semantic ambiguity approaches

Semantic ambiguity approach

There is one syntactic derivation/representation for literal and idiomatic meanings.

$\Rightarrow$ There is no special lexical entry for MWEs;
kick and *spill* each have only one lexical entry.



Lexical-semantic: Gazdar et al. (1985)

Components of decomposable MWEs are assigned disjunctions over meaning constants (of intensional logic):

(13) a. *spill* $\rightsquigarrow$ spill′ ‖ spill-idiom′
beans $\rightsquigarrow$ beans′ ‖ beans-idiom′

b. spill-idiom′ (beans-idiom′): defined
spill-idiom′ (beans′): undefined
spill′ (beans-idiom′): undefined

partial functions

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partial functions

Also applicable to non-decomposable idioms (not in Gazdar et al. 1985):

(14) a. *kick* $\rightsquigarrow$ kick′ ‖ kick-idiom′
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Advantages of Gazdar et al.'s partial function approach:

- unified syntax of literal and idiomatic readings
- delayable ambiguity resolution
- adequate in terms of human processing

  (Prediction: increased semantic processing load; **no** categorical difference between lexical and idiomatic meanings)
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Drawbacks:

- invention of masses of meaning constants that essentially reflect morphological properties
- partial functions have to be defined explicitly

Inference-based: Pulman (1993)

The idiomatic meaning is deduced from the literal one by means of "quasi-inference". Hence MWE-components are equipped with their literal meaning only!

(15) kick′(x,y) $\wedge$ bucket′(y) $\approx$ die′(x)

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Drawbacks of Pulman's quasi-inference approach:

- poorly constrained surface: **The bucket was kicked.*

  ⇒ Pulman: due to information structure!
  (*The bucket will be kicked.* (Manfred Sailer))

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Drawbacks of Pulman's quasi-inference approach:

- poorly constrained surface: **The bucket was kicked.*
  - $\Rightarrow$ Pulman: due to information structure!
    (*The bucket will be kicked.* (Manfred Sailer))
- MWEs with bounded/cranberry words: *leave sb. in the lurch*
- MWEs with ill-formed syntax: *trip the light fantastic*
- computationally very powerful: non-monotonic inference rules.

Outline

A lexical-semantic approach with TAG

Main problem of Gazdar et al. (1985): tons of extra meaning constants; partial functions have to be defined explicitly.

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Our proposal: decompose meaning constants + constraint-based composition!

kick-idiom′ $\rightsquigarrow$

$$\begin{bmatrix} \textsc{frame} & \begin{bmatrix} \textit{dying} & \\ \textsc{patient} & \boxed{1} \end{bmatrix} \\ \textsc{morph} & \begin{bmatrix} \textsc{lemma} & \text{kick} \end{bmatrix} \end{bmatrix}$$

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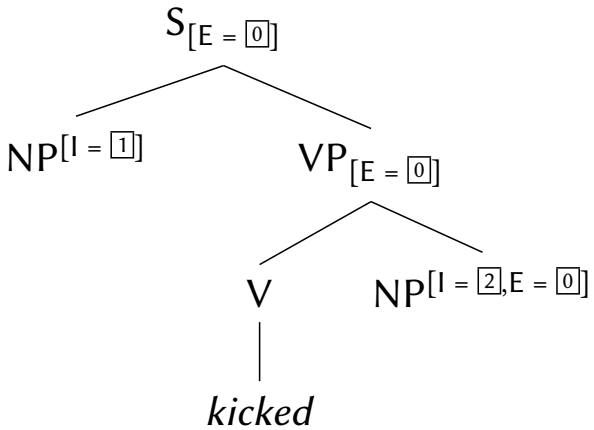
$\Rightarrow$ How to combine those two?

A lexical-semantic approach with TAG



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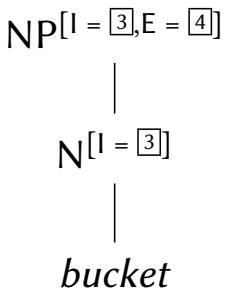

$$\boxed{3}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{container}\end{bmatrix} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{bucket} \\ \text{NUM} & \text{sing}\end{bmatrix}\end{bmatrix} \Vert \boxed{3}\begin{bmatrix}\text{FRAME} & \boxed{6}\begin{bmatrix}\textit{dying}\end{bmatrix} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{bucket} \\ \text{DEF} & + \\ \text{NUM} & \text{sing}\end{bmatrix}\end{bmatrix} \Vert \ldots$$

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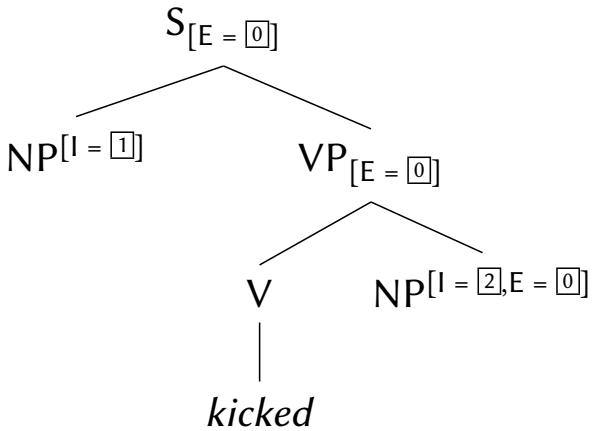

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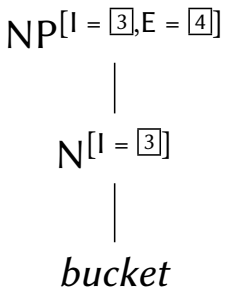
idiomatic mirroring



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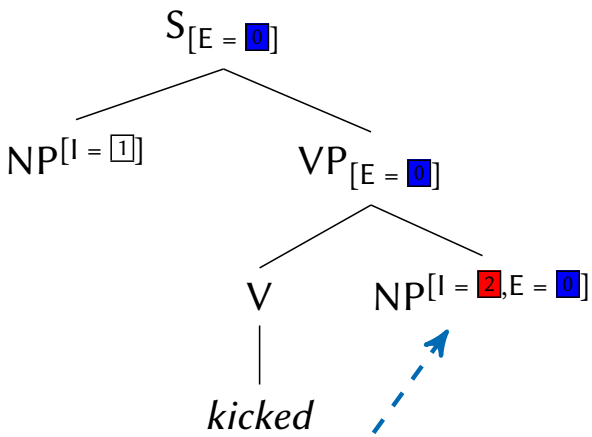
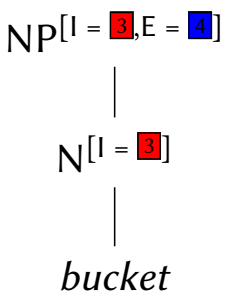
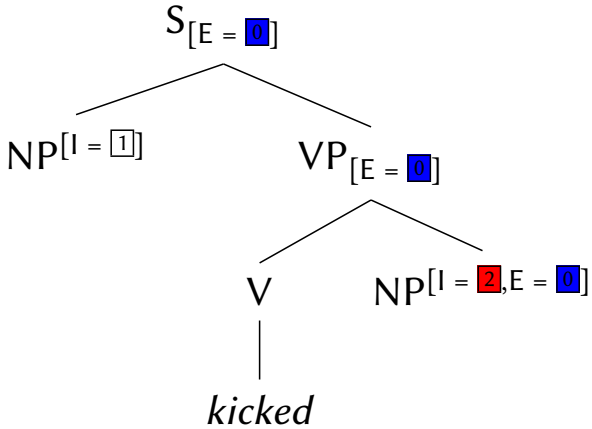


$$\left[\begin{array}{ll} 0 & \text{FRAME} \quad \left[\begin{array}{ll} \textit{kicking} & \\ \text{ACTOR} & 1' \\ \text{PATIENT} & 2' \end{array}\right] \\ & \text{MORPH} \quad \left[\text{LEMMA} \quad \text{kick}\right] \end{array}\right] \Vert \left[\begin{array}{ll} 0 & \text{FRAME} \quad 7\left[\begin{array}{ll} \textit{dying} & \\ \text{PATIENT} & 1' \end{array}\right] \\ & \text{MORPH} \quad \left[\text{LEMMA} \quad \text{kick}\right] \end{array}\right] \Vert \left[\begin{array}{ll} 2 & \text{FRAME} \quad 7 \\ & \text{MORPH} \quad \left[\begin{array}{ll} \text{LEMMA} & \text{bucket} \\ \text{DEF} & + \\ \text{NUM} & \text{sing} \end{array}\right] \end{array}\right] \Vert \ldots$$



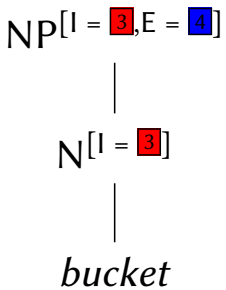
$$\left[\begin{array}{ll} 3 & \text{FRAME} \quad \left[\textit{container}\right] \\ & \text{MORPH} \quad \left[\begin{array}{ll} \text{LEMMA} & \text{bucket} \\ \text{NUM} & \text{sing} \end{array}\right] \end{array}\right] \Vert \left[\begin{array}{ll} 3 & \text{FRAME} \quad 6\left[\textit{dying}\right] \\ & \text{MORPH} \quad \left[\begin{array}{ll} \text{LEMMA} & \text{bucket} \\ \text{DEF} & + \\ \text{NUM} & \text{sing} \end{array}\right] \end{array}\right] \Vert \ldots \left[\begin{array}{ll} 4 & \text{FRAME} \quad 6 \\ & \text{MORPH} \quad \left[\text{LEMMA} \quad \text{kick}\right] \end{array}\right]$$

A lexical-semantic approach with TAG



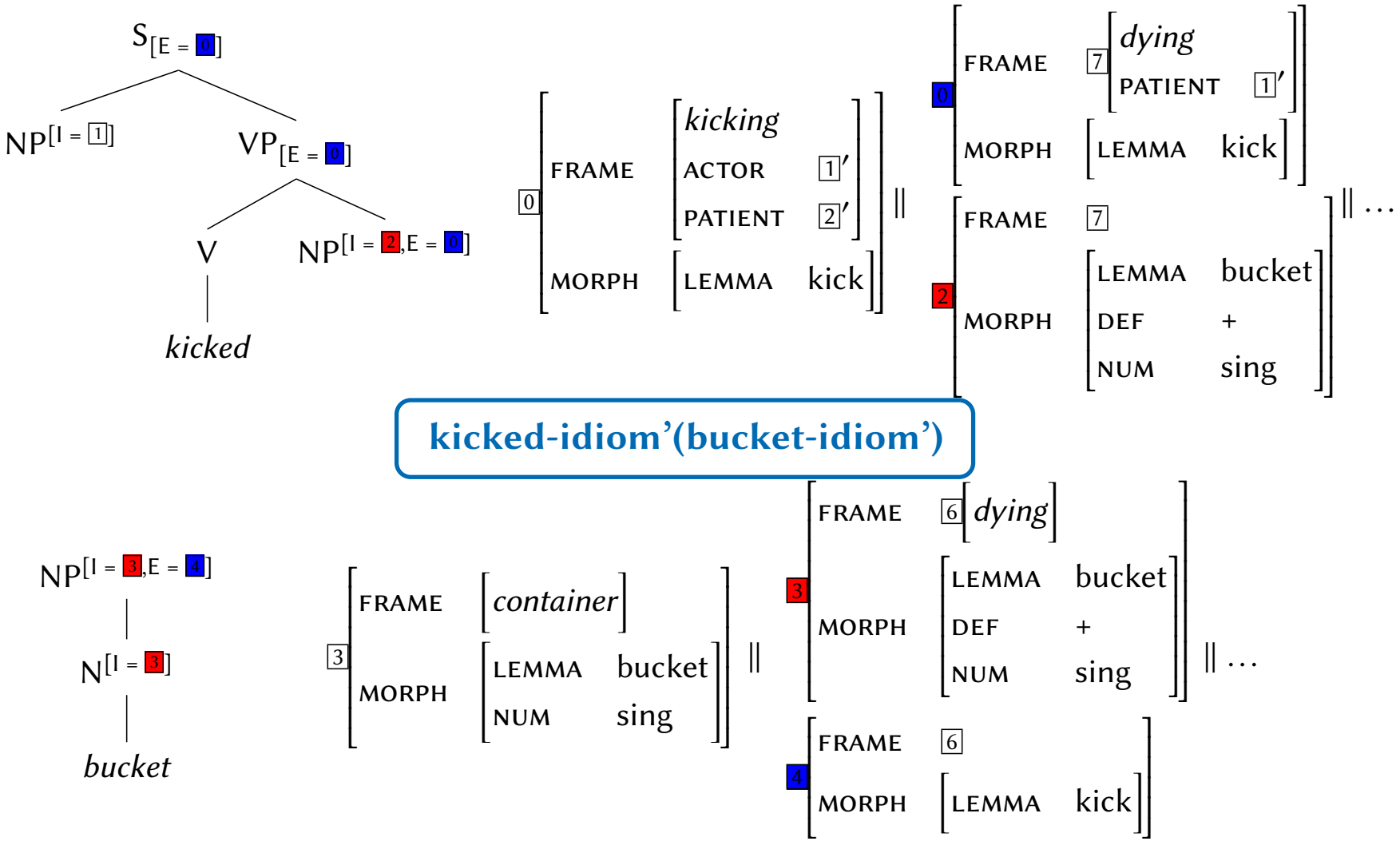
$$\boxed{0}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{kicking} & \\ \text{ACTOR} & \boxed{1}' \\ \text{PATIENT} & \boxed{2}'\end{bmatrix} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{kick}\end{bmatrix}\end{bmatrix} \parallel \boxed{0}\begin{bmatrix}\text{FRAME} & \boxed{7}\begin{bmatrix}\textit{dying} & \\ \text{PATIENT} & \boxed{1}'\end{bmatrix} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{kick}\end{bmatrix}\end{bmatrix} \parallel \boxed{2}\begin{bmatrix}\text{FRAME} & \boxed{7} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{bucket} \\ \text{DEF} & + \\ \text{NUM} & \text{sing}\end{bmatrix}\end{bmatrix} \parallel \dots$$

kicked'(bucket')

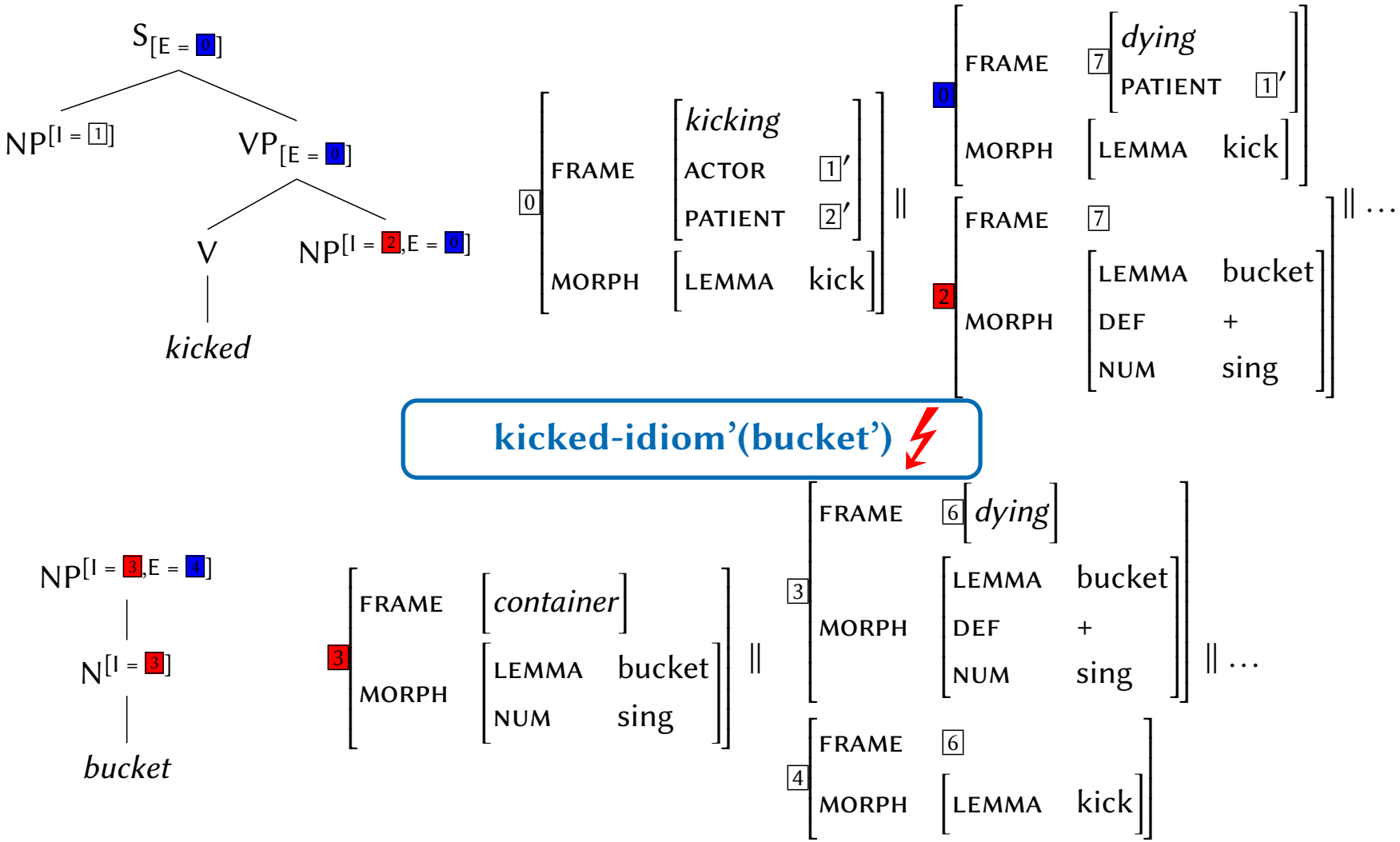


$$\boxed{3}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{container}\end{bmatrix} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{bucket} \\ \text{NUM} & \text{sing}\end{bmatrix}\end{bmatrix} \parallel \boxed{3}\begin{bmatrix}\text{FRAME} & \boxed{6}\begin{bmatrix}\textit{dying}\end{bmatrix} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{bucket} \\ \text{DEF} & + \\ \text{NUM} & \text{sing}\end{bmatrix}\end{bmatrix} \parallel \dots \quad \boxed{4}\begin{bmatrix}\text{FRAME} & \boxed{6} \\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{kick}\end{bmatrix}\end{bmatrix}$$

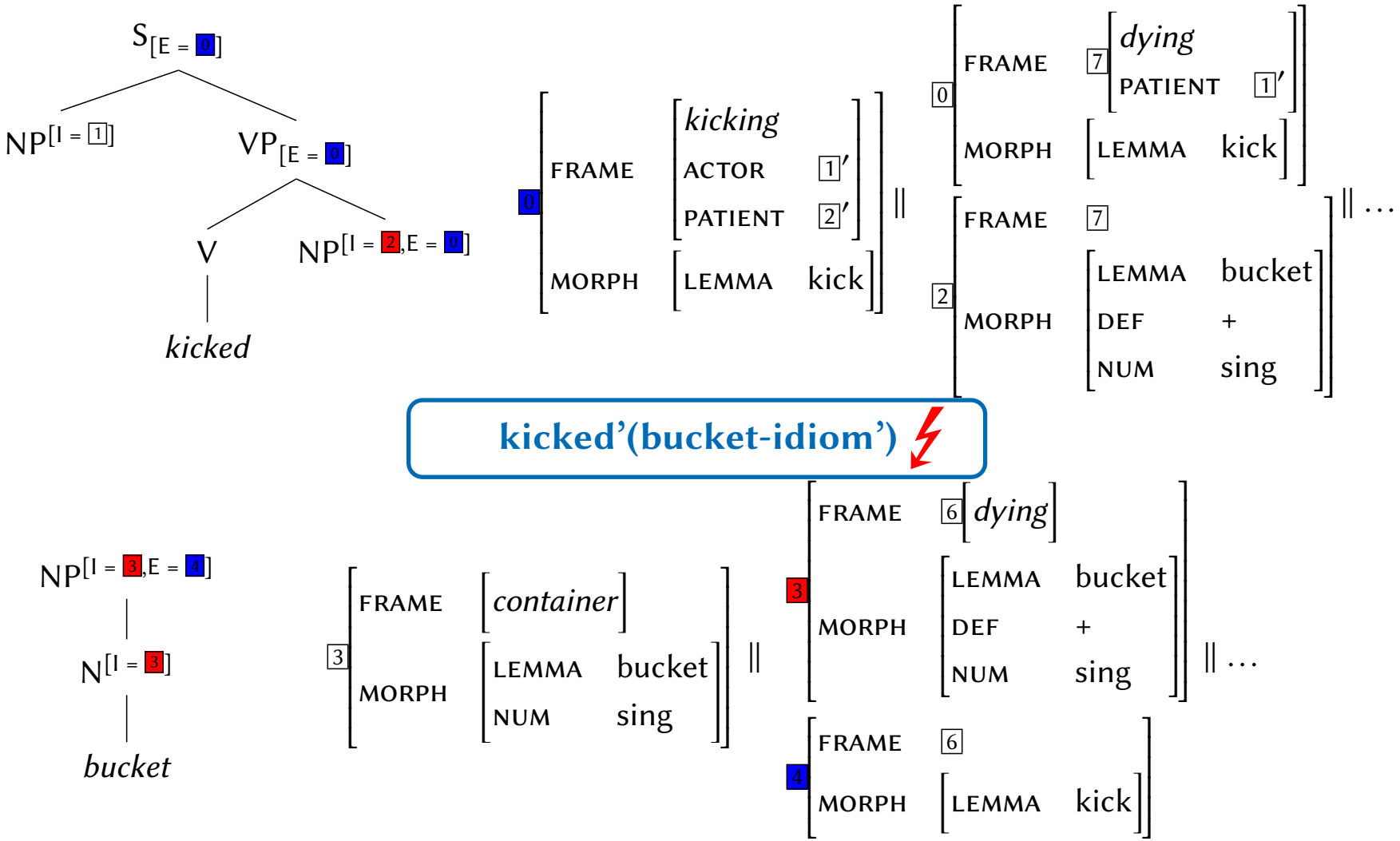
A lexical-semantic approach with TAG



A lexical-semantic approach with TAG

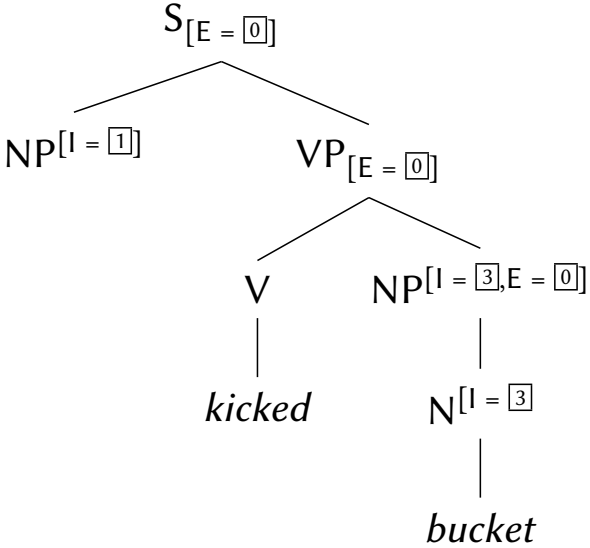


A lexical-semantic approach with TAG



A lexical-semantic approach with TAG

Result of combining *kicked* and *bucket*:



$$\left[\begin{array}{l} 0 \left[\begin{array}{ll} \text{FRAME} & \left[\begin{array}{ll} \textit{kicking} & \\ \text{ACTOR} & 1' \\ \text{PATIENT} & 3' \end{array}\right] \\ \text{MORPH} & \left[\begin{array}{ll} \text{LEMMA} & \text{kick} \end{array}\right] \end{array}\right] \\ 3 \left[\begin{array}{ll} \text{FRAME} & \left[\textit{container}\right] \\ \text{MORPH} & \left[\begin{array}{ll} \text{LEMMA} & \text{bucket} \\ \text{NUM} & \text{sing} \end{array}\right] \end{array}\right] \end{array}\right] \Vert \left[\begin{array}{l} 0 \left[\begin{array}{ll} \text{FRAME} & 7 \left[\begin{array}{ll} \textit{dying} & \\ \text{PATIENT} & 1' \end{array}\right] \\ \text{MORPH} & \left[\begin{array}{ll} \text{LEMMA} & \text{kick} \end{array}\right] \end{array}\right] \\ 3 \left[\begin{array}{ll} \text{FRAME} & 7 \\ \text{MORPH} & \left[\begin{array}{ll} \text{LEMMA} & \text{bucket} \\ \text{DEF} & + \\ \text{NUM} & \text{sing} \end{array}\right] \end{array}\right] \end{array}\right] \Vert \ldots$$

Bargmann's challenge

Here is a challenge from Bargmann (2015):

(16) *The whole idea of the really talented/successful person in their 20s isn't a real thing. Or at the very least, it isn't an actual attainable thing. All those people have people behind them* ***pulling string after string*** *for them.*

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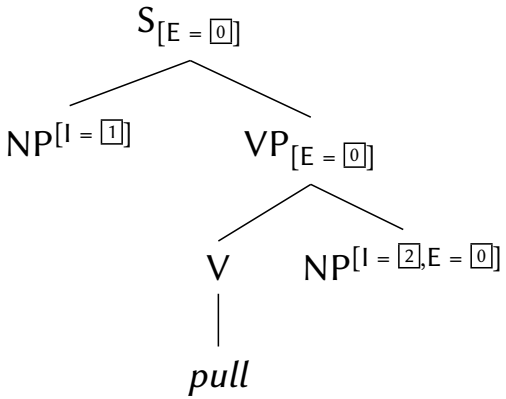
Working with HPSG, Bargmann proposes a "Semantic Representation approach":

- idiom constants pull'_{id} and $\text{string}'_{\text{id}}$ have to co-occur
- $\text{string}'_{\text{id}}$ is in the scope of a "non-specific plural quantifier" (Mel'čuk)

Bargmann's challenge: Analysis with TAG



$$\left[\begin{array}{ll} 0 & \left[\begin{array}{ll} \textsc{frame} & \left[\begin{array}{ll} \textit{assistance-activity} & \\ \textsc{actor} & 1' \\ \textsc{instr} & 2' \end{array}\right] \\ \textsc{morph} & \left[\textsc{lemma} \quad \text{pull}\right] \end{array}\right] \\ 2 & \left[\textsc{morph} \quad \left[\begin{array}{ll} \textsc{lemma} & \text{string} \\ \textsc{num} & \text{pl} \end{array}\right]\right] \end{array}\right] \| \ldots$$

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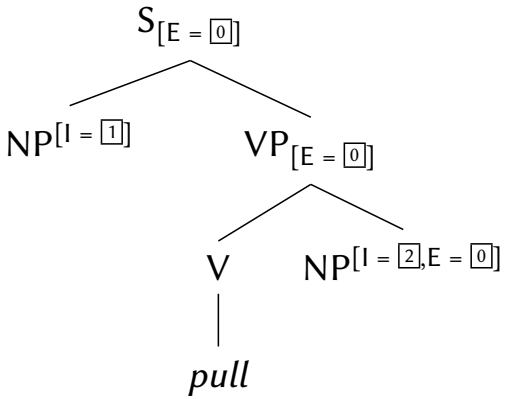
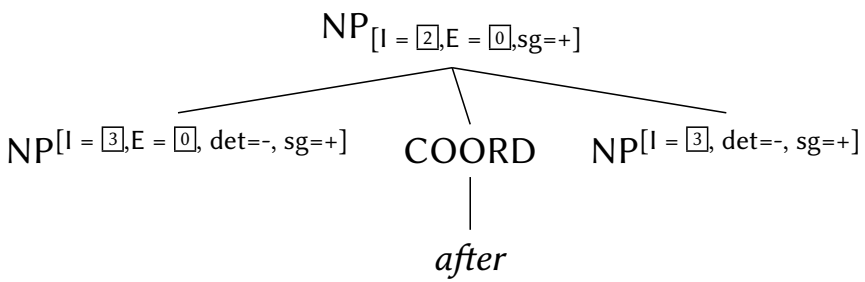


$$\boxed{0}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{assistance-activity}\\ \text{ACTOR} & \boxed{1}'\\ \text{INSTR} & \boxed{2}'\end{bmatrix}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{pull}\end{bmatrix}\end{bmatrix} \| \ldots$$

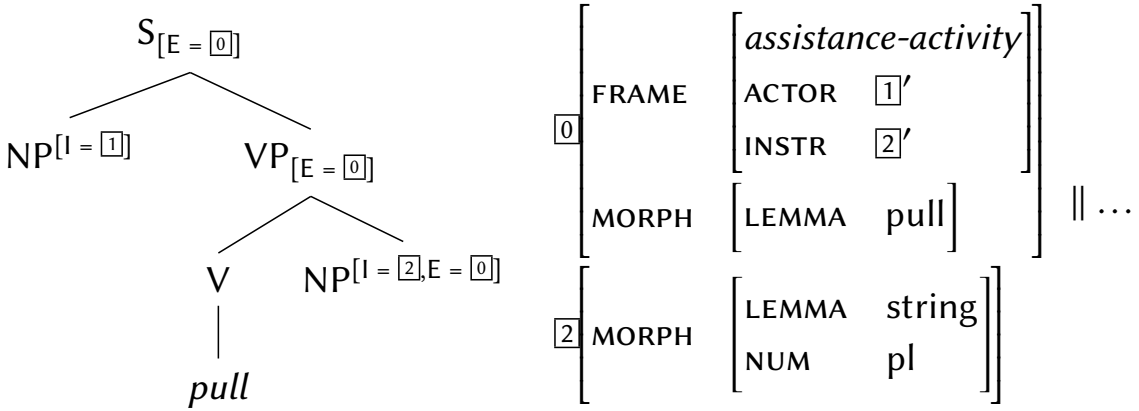
$$\boxed{2}\begin{bmatrix}\text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{string}\\ \text{NUM} & \text{pl}\end{bmatrix}\end{bmatrix}$$

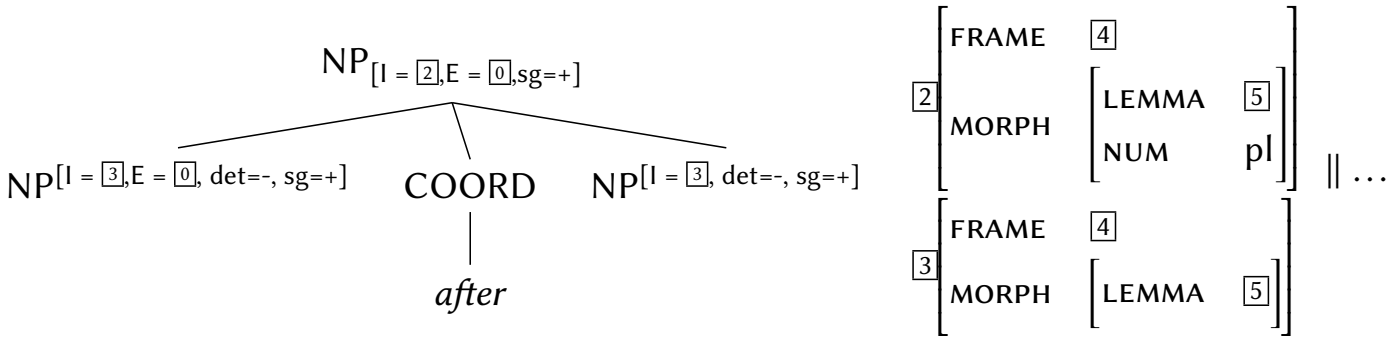


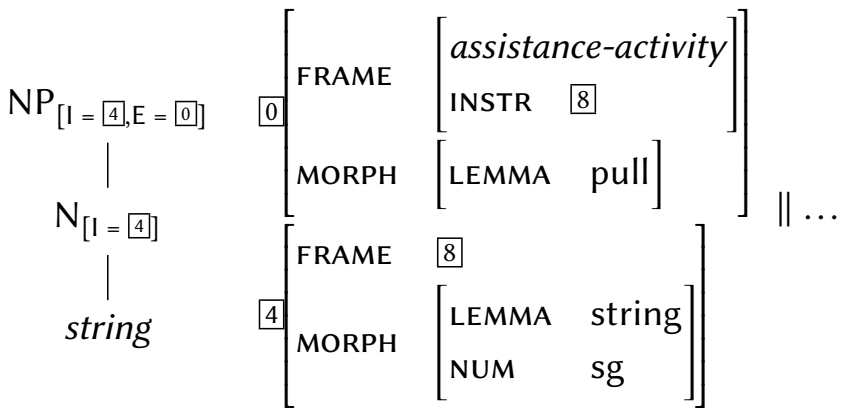
$$\boxed{2}\begin{bmatrix}\text{FRAME} & \boxed{4}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \boxed{5}\\ \text{NUM} & \text{pl}\end{bmatrix}\end{bmatrix} \| \ldots$$

$$\boxed{3}\begin{bmatrix}\text{FRAME} & \boxed{4}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \boxed{5}\end{bmatrix}\end{bmatrix}$$

Bargmann's challenge: Analysis with TAG







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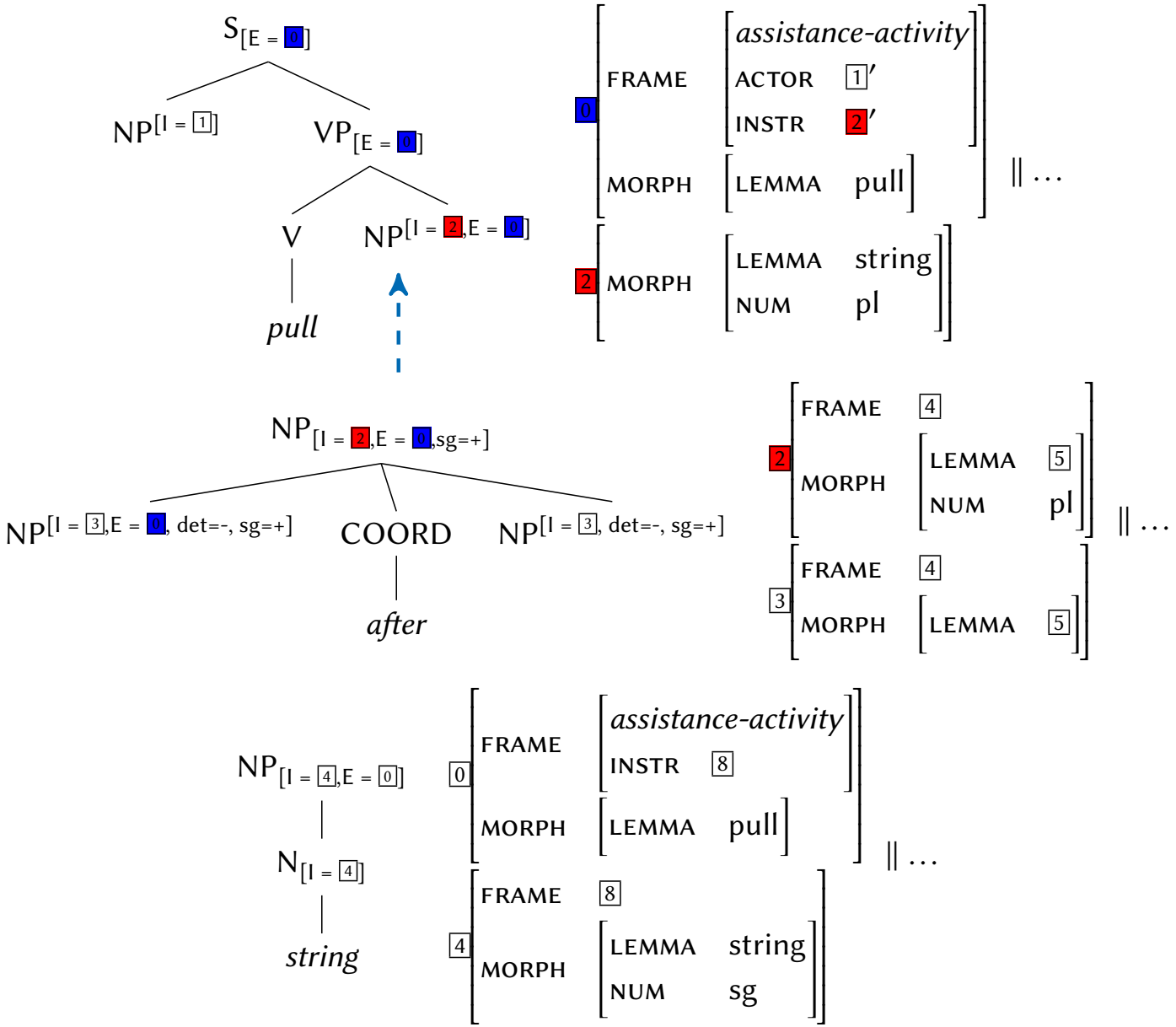

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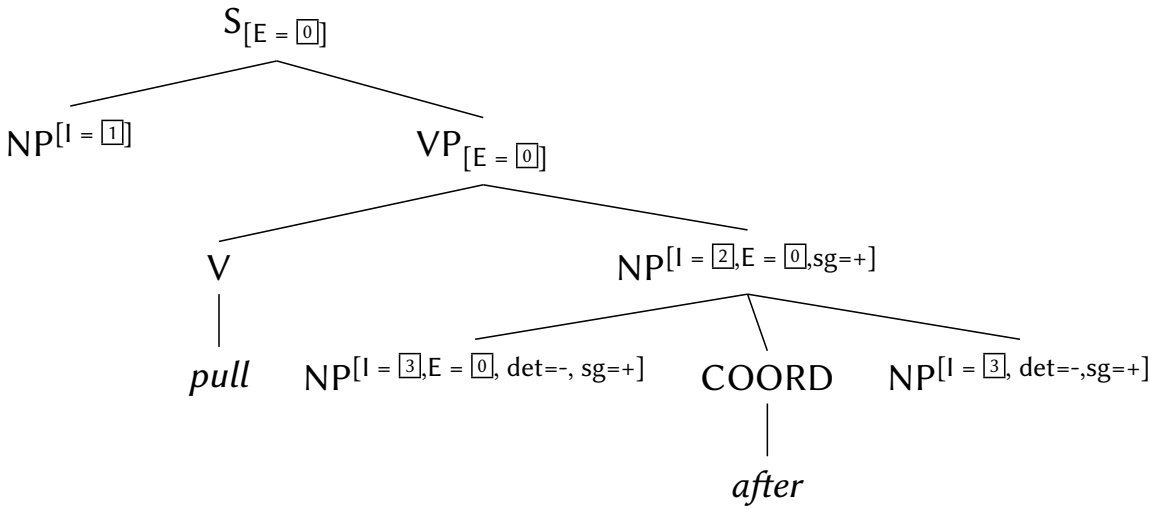
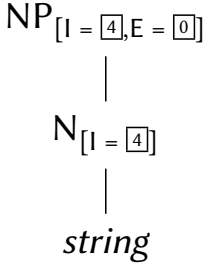


$$\boxed{0}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{assistance-activity}\\ \text{ACTOR} & \boxed{1}'\\ \text{INSTR} & \boxed{2}'\end{bmatrix}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{pull}\end{bmatrix}\end{bmatrix}$$

$$\boxed{2}\begin{bmatrix}\text{FRAME} & \boxed{4}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \boxed{5}\ \text{string}\\ \text{NUM} & \text{pl}\end{bmatrix}\end{bmatrix} \parallel \ldots$$

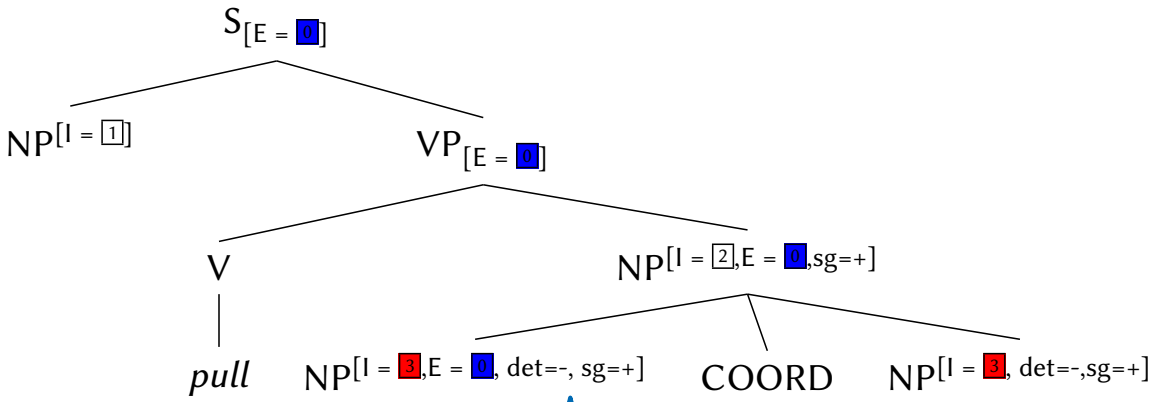
$$\boxed{3}\begin{bmatrix}\text{FRAME} & \boxed{4}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \boxed{5}\end{bmatrix}\end{bmatrix}$$



$$\boxed{0}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{assistance-activity}\\ \text{INSTR} & \boxed{8}\end{bmatrix}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{pull}\end{bmatrix}\end{bmatrix} \parallel \ldots$$

$$\boxed{4}\begin{bmatrix}\text{FRAME} & \boxed{8}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{string}\\ \text{NUM} & \text{sg}\end{bmatrix}\end{bmatrix}$$

Bargmann's challenge: Analysis with TAG



$$\boxed{0}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{assistance-activity}\\ \text{ACTOR} & \boxed{1}'\\ \text{INSTR} & \boxed{2}'\end{bmatrix}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{pull}\end{bmatrix}\end{bmatrix}$$

$$\boxed{2}\begin{bmatrix}\text{FRAME} & \boxed{4}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \boxed{5}\ \text{string}\\ \text{NUM} & \text{pl}\end{bmatrix}\end{bmatrix} \parallel \ldots$$

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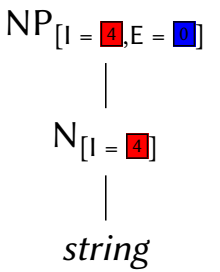

$$\boxed{0}\begin{bmatrix}\text{FRAME} & \begin{bmatrix}\textit{assistance-activity}\\ \text{INSTR} & \boxed{8}\end{bmatrix}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{pull}\end{bmatrix}\end{bmatrix} \parallel \ldots$$

$$\boxed{4}\begin{bmatrix}\text{FRAME} & \boxed{8}\\ \text{MORPH} & \begin{bmatrix}\text{LEMMA} & \text{string}\\ \text{NUM} & \text{sg}\end{bmatrix}\end{bmatrix}$$

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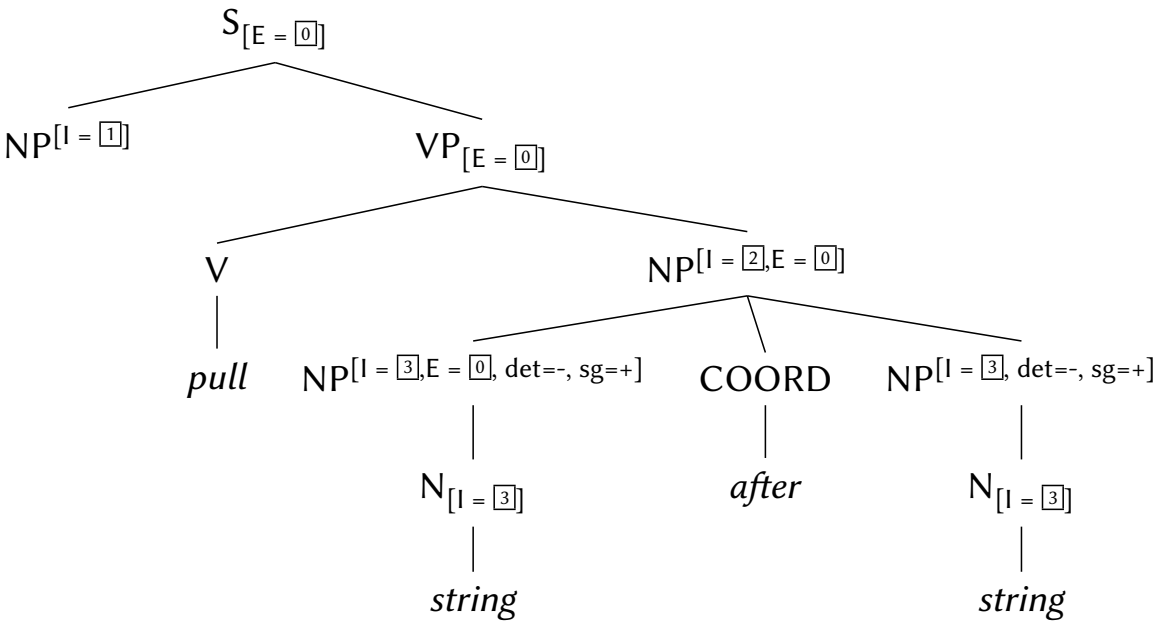


$$
\left[\begin{array}{ll}
0 & \left[\begin{array}{ll}
\textsc{frame} & \left[\begin{array}{ll} \textit{assistance-activity} & \\ \textsc{actor} & 1' \\ \textsc{instr} & 2' \ 4 \end{array}\right] \\
\textsc{morph} & \left[\textsc{lemma} \quad \text{pull}\right]
\end{array}\right] \\
2 & \left[\begin{array}{ll}
\textsc{frame} & 4 \\
\textsc{morph} & \left[\begin{array}{ll} \textsc{lemma} & 5\ \text{string} \\ \textsc{num} & \text{pl} \end{array}\right]
\end{array}\right] \\
3 & \left[\begin{array}{ll}
\textsc{frame} & 4 \\
\textsc{morph} & \left[\begin{array}{ll} \textsc{lemma} & 5\ \text{string} \\ \textsc{num} & \text{sg} \end{array}\right]
\end{array}\right]
\end{array}\right] \| \ldots
$$

A lexical-semantic approach with TAG

Advantages:

- unified syntax of literal and idiomatic readings
- delayable ambiguity resolution
- adequate in terms of human processing

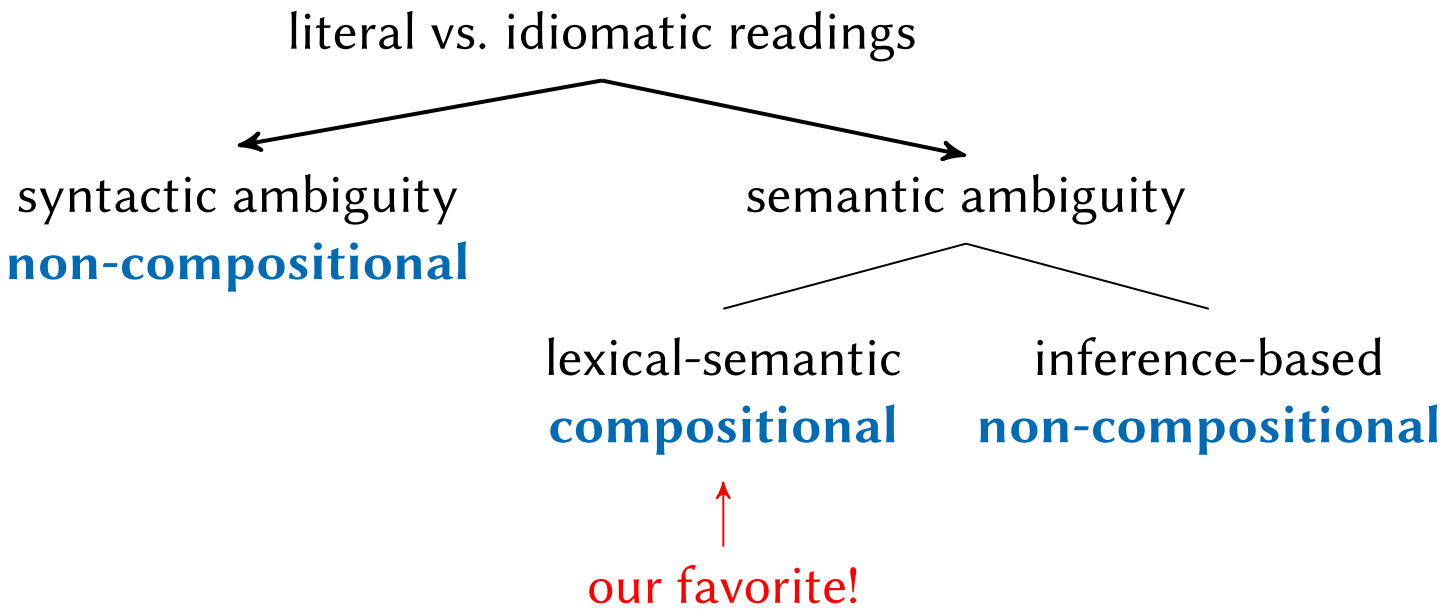
  (Prediction: increased semantic processing load; **no** categorical difference between lexical and idiomatic meanings)
- closer connection between literal and idiomatic meanings

\+ contraint-based composition

Outline

Summary

The landscape of approaches to idiomatic MWEs from a TAG perspective:



⇒ One approach for all types of MWEs?

⇒ How to formalize inference-based approaches?

⇒ Connection between literal and idiomatic meaning?

- What is the meaning of ||?

Appendix: Inference-based approach

Pulman's quasi inference rule

$$\forall x, y.\text{kick}'(x, y) \wedge \text{bucket}'(y) \approx \text{die}'(x)$$

Our interpretation

$$a \approx b \quad := \quad a \Rightarrow_{\|} b \quad := \quad a \Rightarrow (a \| b)$$

$$\left[\begin{array}{ll} \boxed{0} & \left[\begin{array}{ll} \textsc{sem} & \left[\begin{array}{ll} \textit{kicking} & \\ \textsc{agent} & \boxed{1} \\ \textsc{patient} & \boxed{2}' \end{array}\right] \\ \textsc{morph} & \left[\textsc{lem} \quad \text{kick}\right] \end{array}\right] \\ \boxed{2} & \left[\begin{array}{ll} \textsc{sem} & \boxed{2}'\left[\textit{container}\right] \\ \textsc{morph} & \left[\begin{array}{ll} \textsc{lem} & \text{bucket} \\ \textsc{def} & + \\ \textsc{num} & \text{sing} \end{array}\right] \end{array}\right] \end{array}\right] \Rightarrow_{\|} \left[\begin{array}{ll} \boxed{0} & \left[\begin{array}{ll} \textsc{sem} & \boxed{3}\left[\begin{array}{ll} \textit{dying} & \\ \textsc{patient} & \boxed{1} \end{array}\right] \\ \textsc{morph} & \left[\textsc{lem} \quad \text{kick}\right] \end{array}\right] \\ \boxed{2} & \left[\begin{array}{ll} \textsc{sem} & \boxed{3} \\ \textsc{morph} & \left[\begin{array}{ll} \textsc{lem} & \text{bucket} \\ \textsc{def} & + \\ \textsc{num} & \text{sing} \end{array}\right] \end{array}\right] \end{array}\right]$$

Appendix: Connection btw. literal and idiomatic meaning?

Modifiability of components:

(17) The federal agency decided to take the project under its well-muscled, federally-funded wing.[12]

(18) auf den tatowierten Arm nehmen

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(17) The federal agency decided to take the project under its well-muscled, federally-funded wing.[12]

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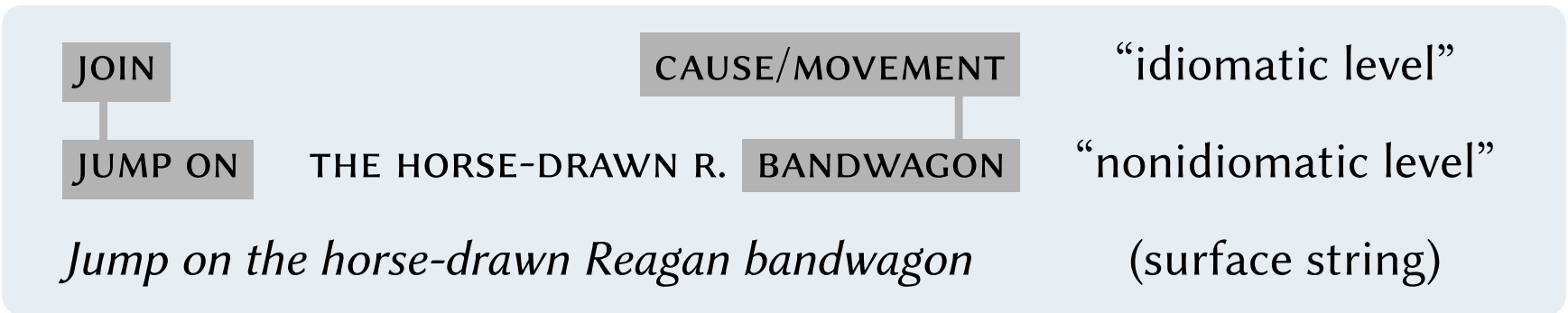
Concurrency of meaning dimensions (Ernst 1981):



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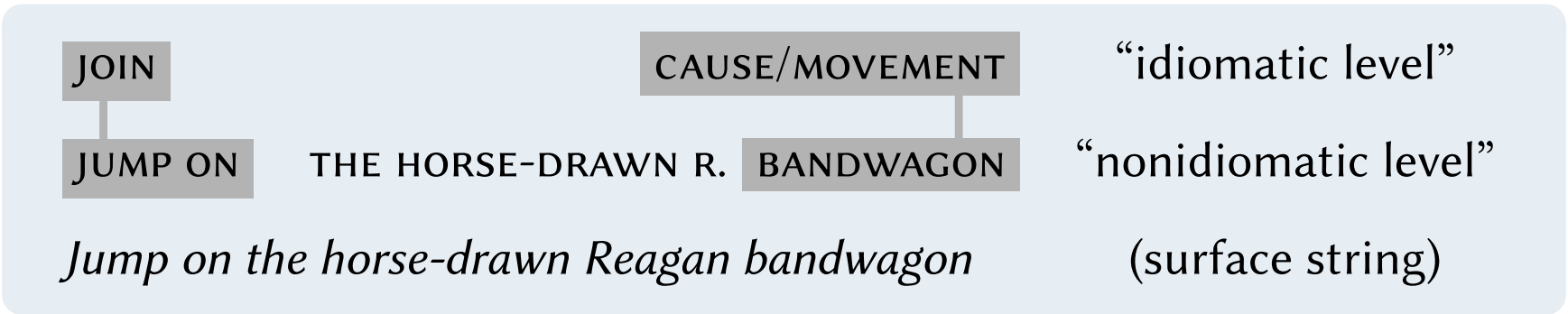

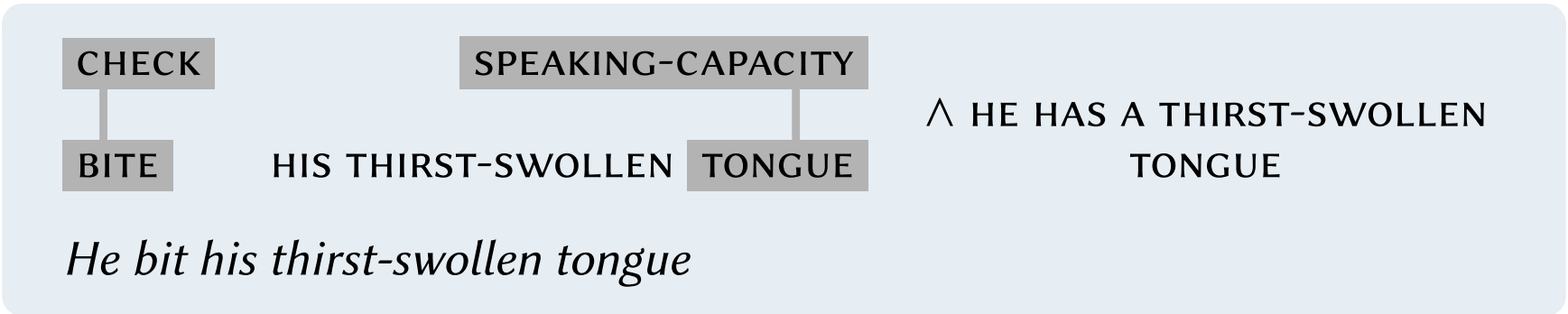

Appendix: What does || mean?

(work in collaboration with Christian Wurm)[38]

Intentionality

$$a \| b \leq a \vee b \tag{1}$$

$$a \leq a \vee b \tag{2}$$

$$\textbf{But: } a \not\leq a \| b \tag{3}$$

I need some money! $\not\leq$ *I need some dough!*

I need some pastry or some money! $\neq$ *I need some dough!*

Universal distribution

$$\sim (a \| b) \;=\; \sim a \| \sim b \tag{4}$$

$$\ldots$$

Problem: If we add || to a Boolean algebra, it has linguistically unappealing properties. (uniformity lemma: || is not commutative)

[1] Abeillé, Anne. 1995. The flexibility of French idioms: A representation with Lexicalized Tree Adjoining Grammar. In Martin Everaert, Erik-Jan van der Linden, André Schenk & Rob Schreuder (eds.), *Idioms: Structural and psychological perspectives*, 15–42. Hillsdale, NJ: Lawrence Erlbaum Associates.

[2] Abeillé, Anne & Owen Rambow. 2000. Tree Adjoining Grammar: An overview. In Anne Abeillé & Owen Rambow (eds.), *Tree Adjoining Grammars: Formalisms, linguistic analyses and processing* (CSLI Lecture Notes 107), 1–68. Stanford, CA: CSLI Publications.

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