Topics in the Lexical Semantics–Morphosyntax Interface

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Extensions, I: Idioms and "partial" compositionality

Up to now

- Challenges of analyzing lexical semantics in composition.
- Proposal to use separate tools to analyze composition of descriptive contents from the composition of token reference.
- But no exemplification yet of how these pieces would interact.
- Verb-based idioms offer a nice case study.

Outline for Part 7

- Some familiar facts and the upshot of Gehrke and McNally (2019)
- Previous attempts to handle the data
- First ingredient for the solution: Separate composition of descriptive content from composition of reference-related expressions
- Second ingredient for the solution: Introduce distributional semantics to compose descriptive contents
- Putting the pieces together
- The bigger picture

Some familiar idiom data

Pedro pulled strings to get his son the job ('exert influence')
pull some strings
pull political strings
pull all the strings he could

We spent the afternoon shooting the breeze ('chat idly')
(?)*shoot some breeze* (found once by Bruening *et al.* 2018)
(?)*shoot interesting breeze*

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- If the idiomatic meaning is arbitrary (non-compositional), how is the meaning of the syntactic intervener composed with it?
- Why are some idioms are more flexible than others?

Gehrke and McNally (2019)

- Idioms call for two different compositional semantic mechanisms
  - One operates on descriptive contents
  - The other operates on expressions connecting the descriptive contents to referents (and referents to other referents)
  - Constituent structure tracks the latter

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  - More flexible cases reflect analogy (whether originally intended or established *post hoc*) involving event structure, including participants and potential cognate objects
  - Inflexible cases involve analogy involving something other than event structure

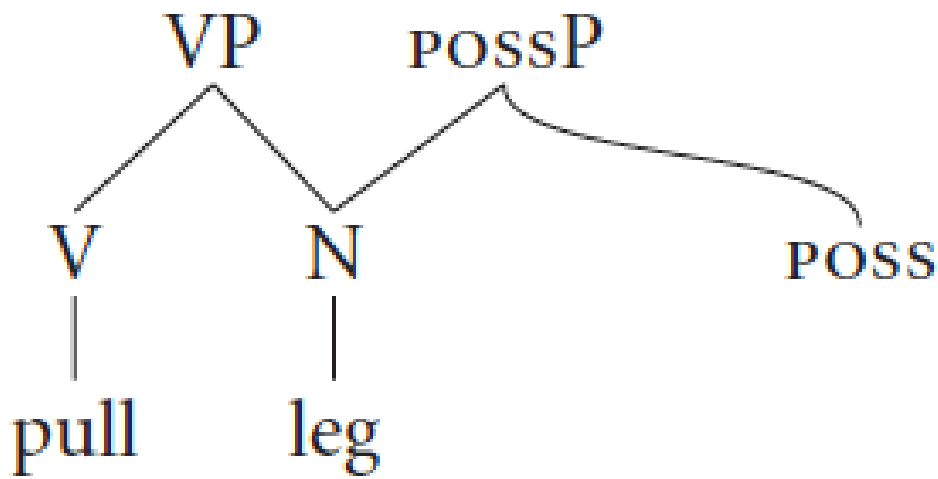
Previous accounts of the determiner data

The syntactic problem:

- The idiomatic meaning is understood as depending on local syntactic selection – no problem if V selects for NP.
- Since Abney (1987), determiners are predominantly analyzed as the head of referential expressions.
- How to reconcile this (ongoing) conflict?

Multidominance

Svenonius (2005): N appears in a multi-dominance "Banyan" tree structure in which it is related to both V and D, but the latter are not related to each other.



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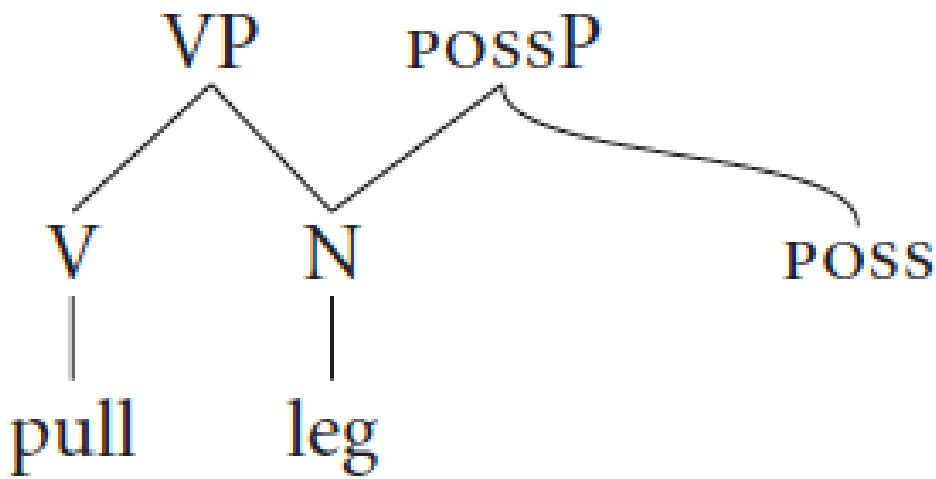

Problems:

- Unclear how syntax will drive the semantics
- Multidominance strains tree structures as models of constituent structure

Discontinuous D and NP

Sportiche (2005); Cecchetto and Donati (2015): NP is generated next to V (or merged low), D is generated in a higher position to which NP moves (or merged high).

Empirical support from "idiom chunks" and reconstruction:

Much care$_t$ seems to have been taken t of the victims.

... [D NP$_t$] ... [[$_{NP}$ t] V ...] ...

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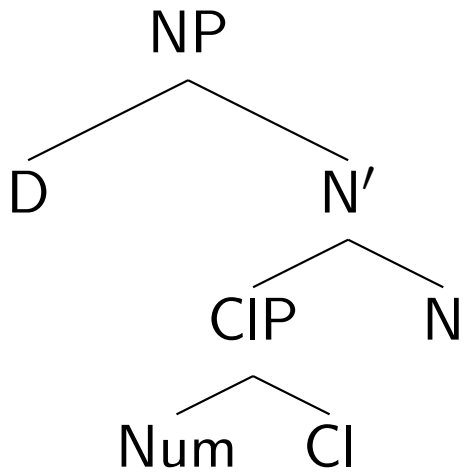
Problems:

- Not obvious how to do the semantic compositional (though a theory of reconstruction might help, e.g. Sauerland 2004)
- Separating D from the rest of the nominal strains tree structures as models of constituent structure

D as non-selected

Bruening et al. (2018): Reject DP-Hypothesis – allow V to select features of N(P).



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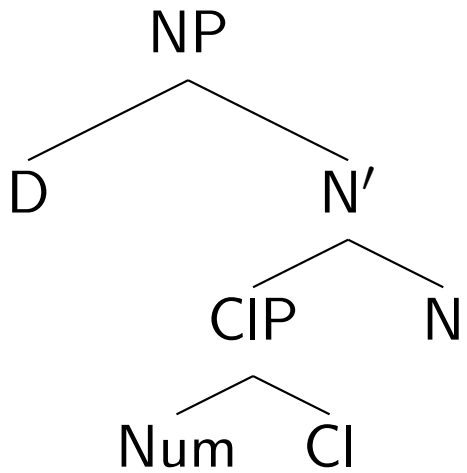

Problem: Loses advantages of DP hypothesis (if you like that hypothesis)

Multiple representations

Chae (2015): Disconnect local selection from rest of syntax/semantics interface (based on Jackendoff 1997, LCS = Lexical Conceptual Structure).

bury the hachet

Phrase structure: $[_{VPx}$ V $[_{NPy}$ Det N]]

LCS: [RECONCILE $([]_A$, $[\text{DISAGREEMENT}]_y)]_x$

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Problem: Getting the semantic details to work.

Strategy

Put together two ideas from the literature on (pseudo-)incorporation:

- (Pseudo-)incorporation involves composition of complex **type-level** (rather than **token-level**) descriptions (Carlson 2003)
- (Pseudo-)incorporation involves two distinct types of semantic composition processes (Farkas and de Swart 2003)

Incorporation as a complex type-level expression

Step 1:

- **Carlson (1977):** Generic nominals do not denote token entities/events, but rather (abstract) kinds (or types) of entities: x_k, e_k

  Rhinos (??*at the zoo*) *are almost extinct*.
  Cycling (??*today*) *is Gus's favorite sport*.

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Step 2:

- Zamparelli 1995 takes this idea from generics to the lexicon:
  Nouns denote kind-level entities.
  rhino : **r**, a kind-level entity

Incorporation as a complex type-level expression

Step 3:

Recall:

(1) a. [[*tener pareja*]] $\leq$ [[*tener*]], both of type e_k

b. tener pareja estable vs. ??tener pareja alta

- Kind/type-denotation for nominal accounts for modification restriction.
- Notion of sub-kind/type might account for "extra meaning" facts.
- But Carlson does not offer details on how to compose V and N if both denote entities: $\mathbf{t}_k$, $\mathbf{p}_k \Rightarrow$??

Help from Farkas & de Swart 2003

Recall:

- Discourse Representation Theory analysis (DRT, Kamp 1981).
- Distinguish variables for **discourse referents** (u_x), which instantiate the arguments of a predicate, from variables for **thematic arguments** (x) (Koenig and Mauner 1999).

beteget: $\langle \{\}, \{\textbf{patient}(x)\} \rangle$
egy beteget: $\langle \{u_x\}, \{\textbf{patient}(u_x)\} \rangle$

Note! Equivalent alternative to "box" notation to save space.

Two kinds of composition

Unification of thematic arguments: Replace the relevant thematic argument z of a verbal predicate with the thematic argument x contributed by a nominal argument of the verb.

viszgált: $\langle\{\}, \{\textbf{examine}(e, y, z)\}\rangle$
beteget viszgált: $\langle\{\}, \{\textbf{patient}(x), \textbf{examine}(e, y, x)\}\}\rangle$

Two kinds of composition

Argument-Instantiation (first subtype):

- D(eterminer)-Instantiation: Instantiate the thematic argument z of the NP by the discourse referent u contributed by material under D, and subscript u with the index x, writing u_x.

  egy beteget viszgált:
  $\langle \{u_x\}, \{\textbf{patient}(u_x), \textbf{examine}(e, y, u_x)\} \rangle$

Two kinds of composition

Argument-Instantiation (second subtype):

- **Secondary Instantiation:** Instantiate the thematic argument x of a nominal with a **presupposed** discourse referent a_x that it is co-indexed with.
- Farkas and de Swart use it only with bare plurals, which presuppose, but do not encode, a discourse referent.
  betegetet: $\langle\{\}, \{\textbf{patient}(x)\}, \{u_x\}\rangle$
- And they use it only as a 'last resort": Dissociates the point at which discourse referents are instantiated from the point at which thematic arguments are unified.
- But: No strong reason to limit it to a last resort mechanism.

Interim summary

- Carlson provides the insight that combining descriptive contents in VPs amounts to forming complex, concept-like eventuality subtype descriptions.
- Farkas and de Swart provide the insight that there could be different mechanisms for composing descriptive contents and instantiating these with discourse referents.
- These discourse referents can be explicitly introduced by e.g. determiners, but also presupposed, e.g. due to the use of number.
- Remaining step: A technique for combining descriptive contents conceived of as type- or concept-like things.

Combining approaches

- Use vector-based semantics to model (simple and complex) type/concept descriptions.
- Mediate with some syntactic information, e.g. of the sort contributed by thematic arguments in DRT.

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- Use vector-based semantics to model (simple and complex) type/concept descriptions.
- Mediate with some syntactic information, e.g. of the sort contributed by thematic arguments in DRT.
- Connect these representations to DRT
  - Borrow general model of type/token discourse referent relation from Zamparelli, Carlson
  - Borrow mechanism of secondary instantiation of discourse referents from Farkas & de Swart

Basics: Descriptive contents

- Vector-based representations are assigned to content expressions (including phrases) via a function d.
- In general, descriptive contents of expressions are inherited by the phrases that contain them, irrespective of functional material.

  $d(\text{N})$: $\mathbb{N}$
  $d(\text{NP}) = d(\text{N})$
  $d([_{DP}\ \text{D NP}]) = d(\text{NP})$

- If there are multiple descriptive contents in a single phrase, these will be composed by operations on the combining vectors.

Combining Descriptive contents

- But how are the vectors for two descriptive contents combined?
- How do we get the contents to combine while ignoring intervening determiners?

  [[*tener pareja estable*]] $\leq$ [[*tener pareja*]] $\leq$ [[*tener*]]

  [[*pull strings*]] $\leq$ [[*pull*]]
- Paperno *et al.* (2014) propose composition rules that take into account grammatical function.

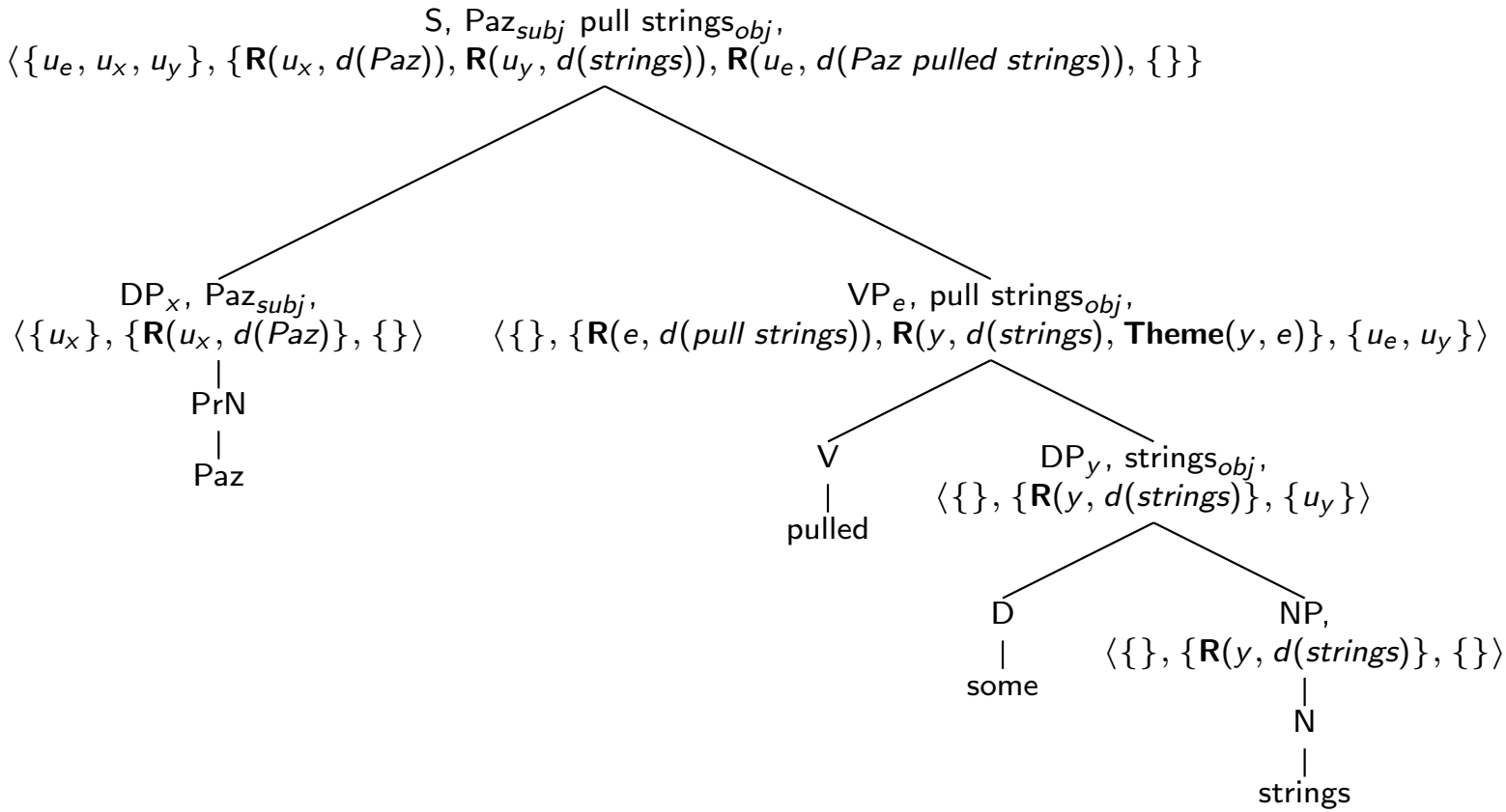
  If $d(\text{V}) = \langle \text{V}^{v}, \text{V}^{su}, \text{V}^{ob} \rangle$, and $d(\text{DP}) = \text{N}$,
  then $d([_{VP}\ \text{V DP}]) = \langle \text{V}^{v} + \text{V}^{ob} \otimes \text{N}, \text{V}^{su} \rangle$

  If $d(\text{VP}_1) = \langle \text{V}^{v}, \text{V}^{su} \rangle$, and d(DP) $= \text{N}$,
  then $d([_{VP_2}\ \text{DP VP}_1]) = \langle \text{V}^{v} + \text{V}^{su} \otimes \text{N} \rangle$

Composing Idiom representations

- We replace Farkas and de Swart's standard predications with the realization of thematic arguments by kinds.
- We replace kinds with representations interpreted as vectors.
- We replace Unification with vector composition rules.
- We use Secondary Argument Instantiation for discourse referent introduction.

Syntax/semantics interface (some details omitted)



Factors in determiner variability: some brief examples

- If the idiomatic analogy is based on something other than event structure, it seems that the syntactic flexibility is lost:

  shoot the breeze

- If the event described on the idiomatic use involves a unique participant that can be used to individuate the event, the determiner can be modified to introduce reference to a plurality of events.

  to kick the bucket

  Far more people pass on, push up daisies, kick buckets, visit Davy Jones locker, or Journey to the great beyond, than simply die.

The bigger picture: Semantics

- The notion of type/kind in formal semantics has been poorly modeled.
- Complex type/kind description formation has received even less insightful treatment – still more work to do.
- Idioms offer a great argument for modeling descriptive content and reference in distinct ways.

The bigger picture: Syntax

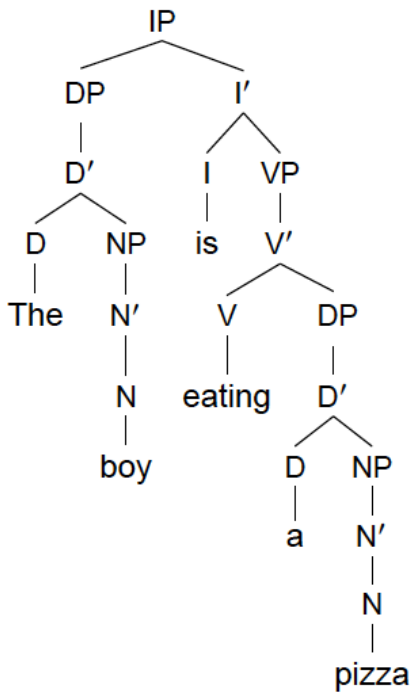
- The semantic analysis sheds some light on puzzling analyses in the syntax literature.
- It suggests why there are competing intuitions about headedness (NP vs. DP): Distinct mechanisms for the composition of descriptive contents and complex referential expressions are conflated into a single representation.
- It also suggests new ways to look at syntactic frameworks.

Levels of representation in syntax

- Most syntactic frameworks use just one *theoretical vocabulary* – e.g. phrase structure trees in Minimalism.
- 1980s: Debate about role of phrase structure vs. grammatical relations like subject, object, as **primitives** in syntactic theory:
  - Most frameworks chose one or the other (e.g., Minimalism, Dependency Grammar).
  - One framework chose **both**: Lexical Functional Grammar.
- 2000s: Debate died out, frameworks "agreed to disagree".
- But if there are two semantic composition operations, perhaps it is worth reconsidering mechanisms for maintaining both phrase structure and dependency structure (however one wants to encode it).

Multi-level syntactic architecture

Constituent structure:

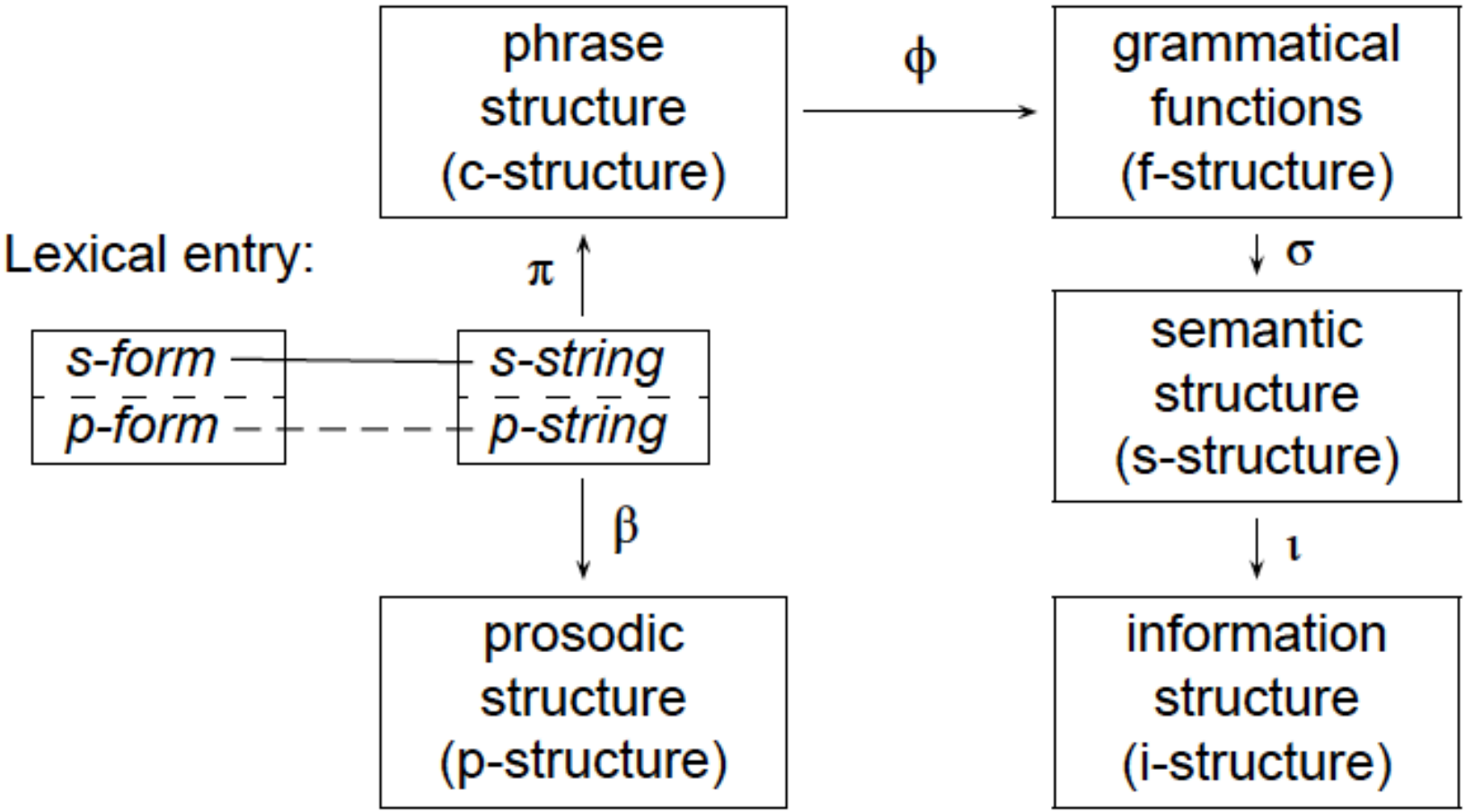


Functional structure:

$$\begin{bmatrix} \text{PRED} & \text{'eat⟨SUBJ, OBJ⟩'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'boy'} \\ \text{DEF} & + \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'pizza'} \\ \text{DEF} & - \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{TENSE} & \text{PRS} \\ \text{ASPECT} & \text{PROG} \end{bmatrix}$$

(LFG, Dalrymple and Findlay 2019: (1))

LFG interface to semantics



(LFG, Dalrymple and Findlay 2019: (4))

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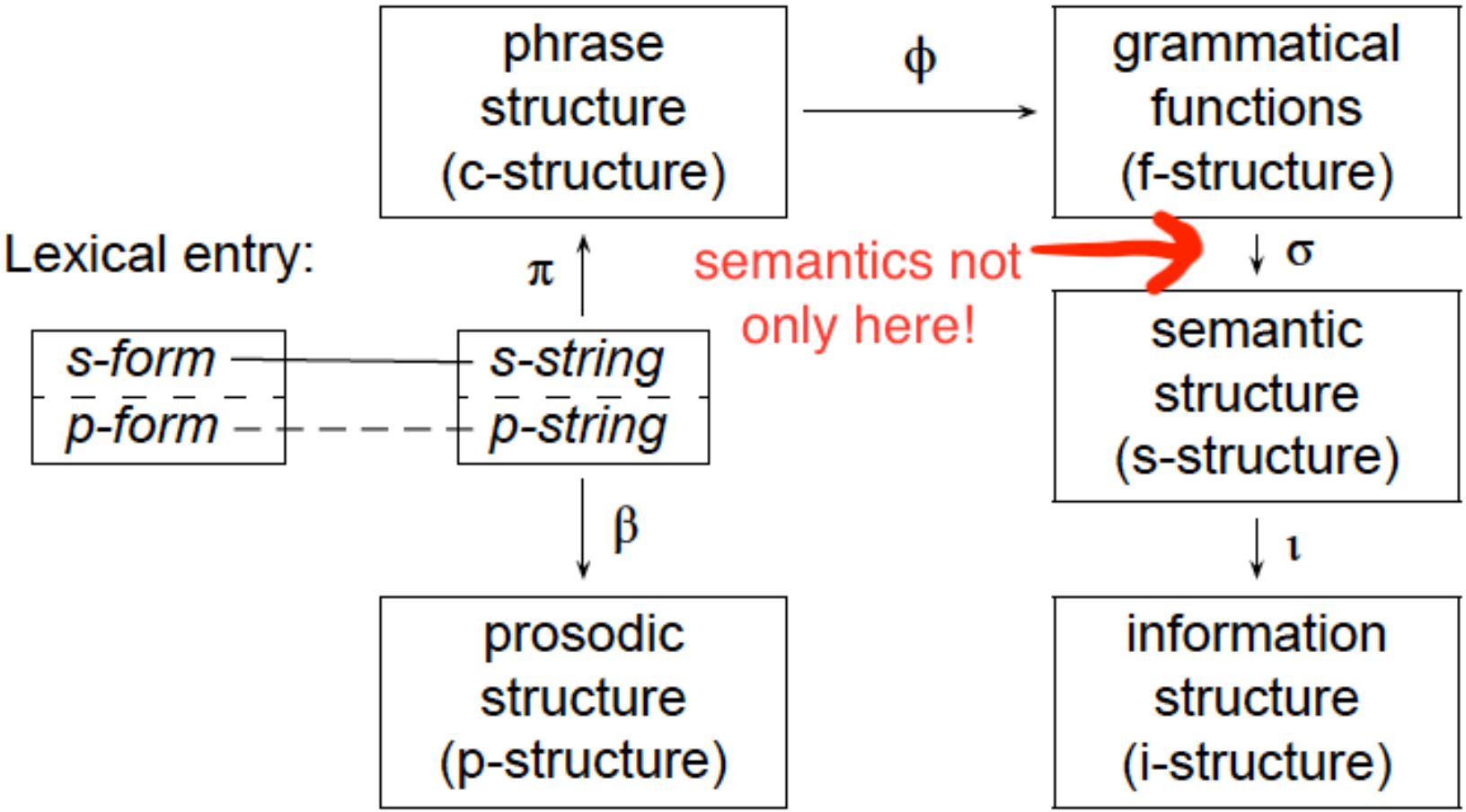

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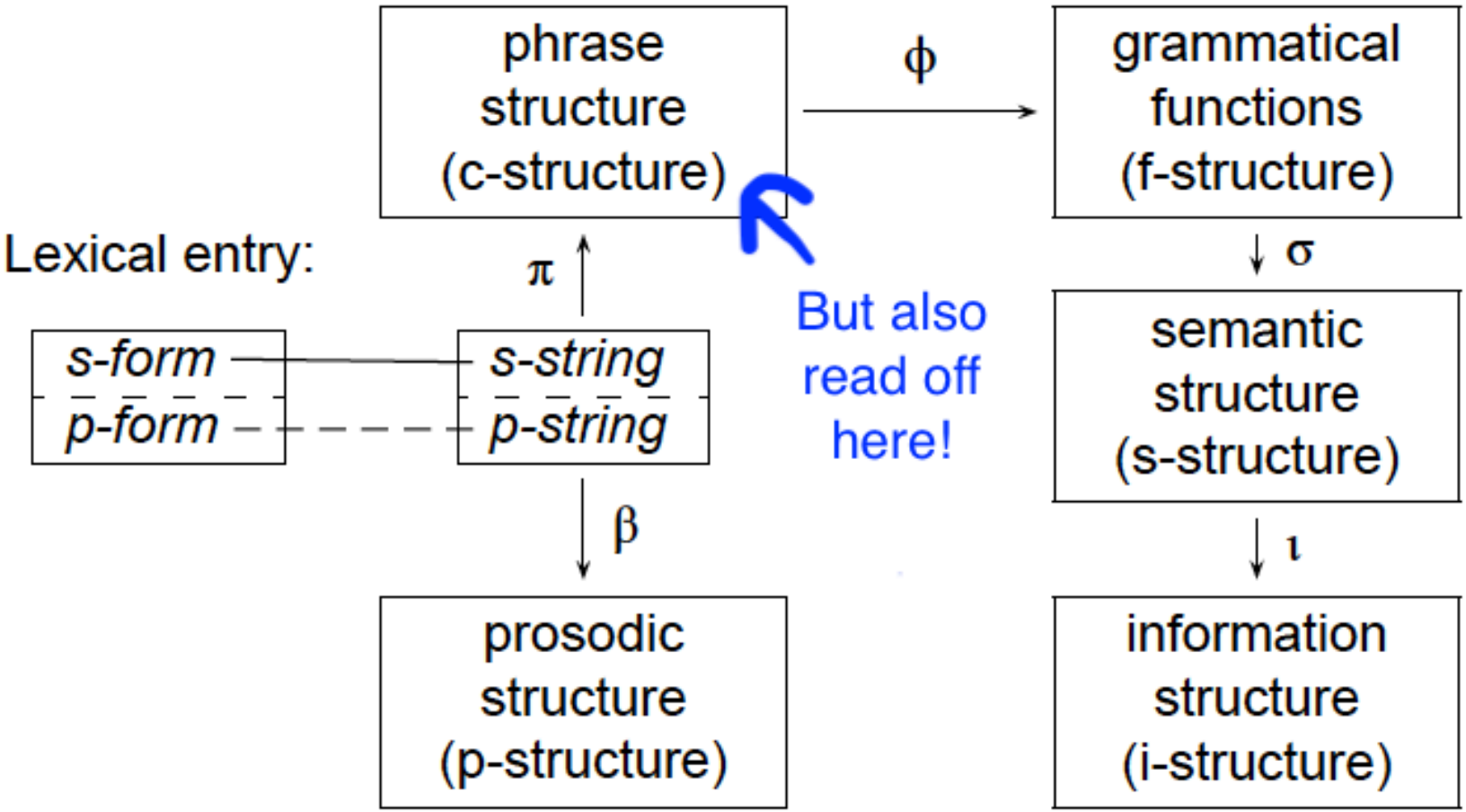

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Summary

- Partially compositional idioms exemplify among the most complex interactions between lexical semantics, compositional semantics, and syntax.
- They offer arguments to partially separate the computation of descriptive content from that of reference.
- Bringing together distinct intuitions about (non-)referentiality and kind relations in the analysis of incorporation suggests a new way to make idioms (and other figurative language) more tractable for formal semantic analyses.

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