

Levels of ambiguity and underspecification in regular polysemy

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Introduction

Working definition

(e.g. Sennet 2016)

Ambiguity \leadsto multiple meanings which are

- defined independently of the context
≠ **context sensitivity** (e.g. indexicals, ‘**I** am **now here**’)
- resolved during interpretation
≠ **underspecification** (generality)
(‘I was planning to attend **one of the workshops.**’)
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≠ **vagueness** (boundary cases, precisification means regimentation)
(‘a **short** introduction’)

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(‘a **short** introduction’)

- Example** ‘**bat**’
1. mammal capable of flight
 2. stout solid stick used for hitting/striking
 3. hit/strike something as with a bat₂

Introduction

Polysemy (= a special case of ambiguity, or in contrast to it??)

- The different meanings are **related** to each other.

Regular/systematic polysemy:

- The same meaning relation applies to a **class** of expressions.

Examples

‘**bat**’, ‘**rake**’ – implement || activity (of using the implement)

‘**damage**’, ‘**decoration**’ – activity || (implicit) result object
(of the activity)

‘**book**’, ‘**letter**’ – physical information carrier || information

Introduction

Topic of this talk

- The role of ambiguity and underspecification (and context sensitivity) in the analysis of (regular) polysemy.

Motivation

- Contextual information and underspecification play a prominent role in various approaches to the formal modeling of regular polysemy (e.g. Egg 2003, 2011; Asher 2011; Mery and Retoré 2015; Babonnaud et al. 2016).

Regular polysemy

Inherent vs. **selectional** (regular) polysemy (e.g. Pustejovsky 2011):

- **inherent** polysemy:

different **facets** of interpretation inherent in the (lexical) semantics of a word

‘**book**’ – physical object || information

‘**lunch**’ – food || event

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- **selectional** polysemy:

selectional **mismatch** between predicate and argument, resolved by **coercion** (\neq inherent meaning shift)

- (1) a. Mary left the **party**. (event \rightsquigarrow location)
b. Mary began the **book**. (object \rightsquigarrow activity)

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- In ‘leave the party’ and ‘begin the book’ neither ‘leave’, ‘party’, ‘begin’ nor ‘book’ undergo a shift of meaning (irrespective of the possible ambiguity/polysemy of these expressions).
- There is apparently no ambiguity/polysemy involved in interpreting ‘leave the party’ (under *event* \rightsquigarrow *location*).
- The different possible interpretations of ‘begin the book’ (under *object* \rightsquigarrow *activity*) come about through the different possible interactions with the book being started (reading, writing, translating, memorizing, coloring, mending, etc.)

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- **Polysemy:** **Not really**

The different activities involving the book (reading, writing, translating, memorizing, coloring, mending, etc.) **do not form a circumscribed set** of clearly distinguishable alternatives (even if some of them are more salient than others);

they are **not clearly related to each other**, except for the fact that they potentially involve books.

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- **Ambiguity:** **Yes**

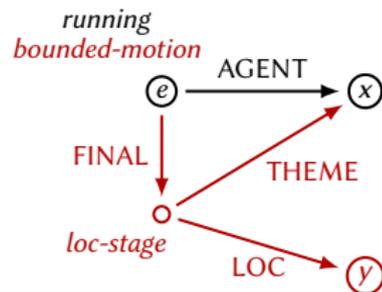
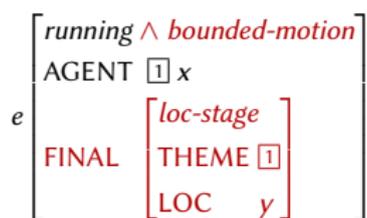
Background: LTAG + frame semantics

Frame semantics

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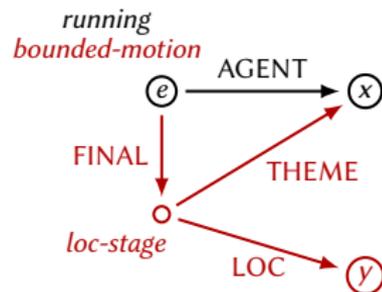
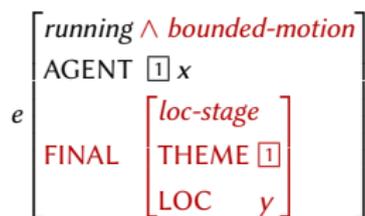
(2) Anna ran **to the station**.



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Attribute-value logic

$$e \cdot (\text{running} \wedge \text{bounded-motion} \wedge \text{AGENT} : x \wedge \\ \text{FINAL} : \text{loc-stage} \wedge \text{FINAL THEME} \doteq \text{AGENT} \wedge \text{FINAL LOC} : y)$$

Translation into first-order logic

$$\text{running}(e) \wedge \text{bounded-motion}(e) \wedge \text{AGENT}(e, x) \wedge \\ \exists s(\text{FINAL}(e, s) \wedge \text{loc-stage}(s) \wedge \text{THEME}(s, x) \wedge \text{LOC}(s, y))$$

Constraints

$\text{running} \Rightarrow \text{activity}$ (short for $\forall e(\text{running}(e) \rightarrow \text{activity}(e))$),
 $\text{loc-stage} \Rightarrow \text{THEME} : T \wedge \text{LOC} : T, \dots$

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Frame semantics

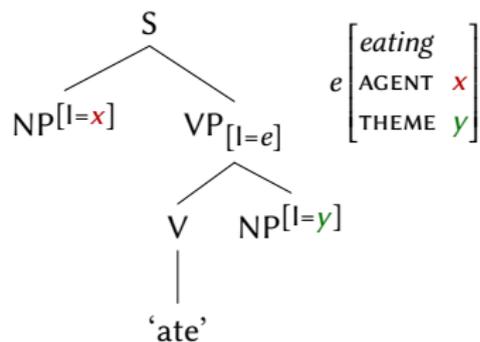
Basic assumptions

- **Attributes** (features, functional roles/relations) play a central role in the organization of semantic and conceptual knowledge and representation. [Barsalou 1992; Löbner 2014]
- Semantic components (participants, subevents) can be (recursively) addressed by **attributes**.
 - ↪ inherently **structured representations** (models);
composition by **unification** (under constraints)
- Semantic processing may be seen as the **incremental construction** of **minimal (frame) models** based on the input, the context, and background knowledge (lexicon, ...).

Background: LTAG + frame semantics

Illustration of the syntax-semantics interface

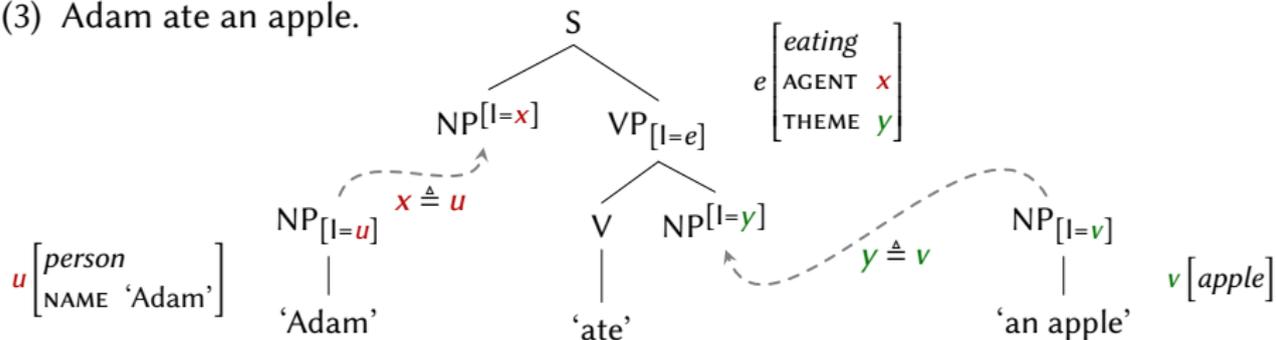
(3) Adam ate an apple.



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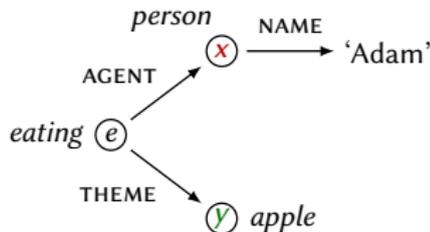
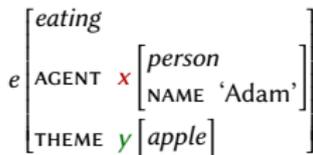
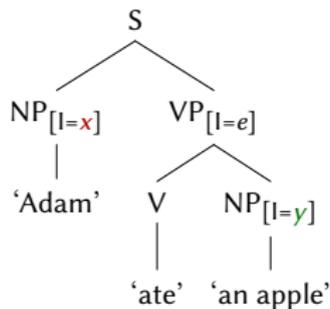
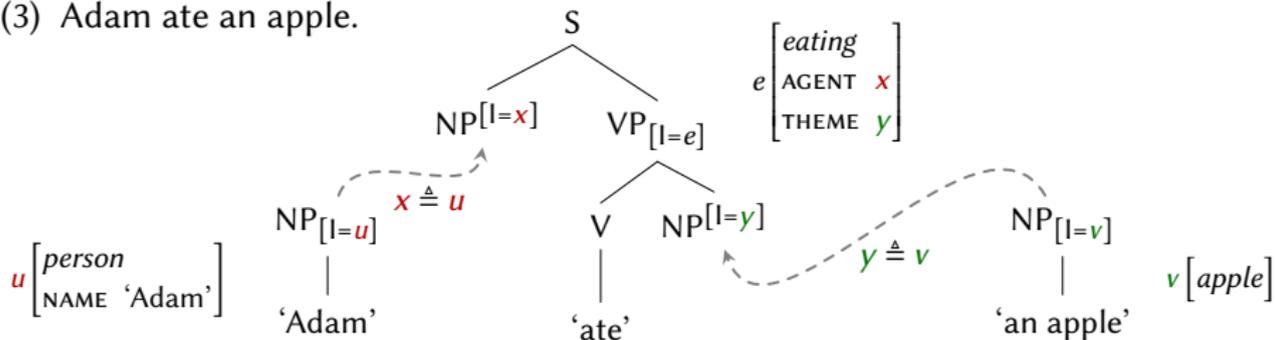
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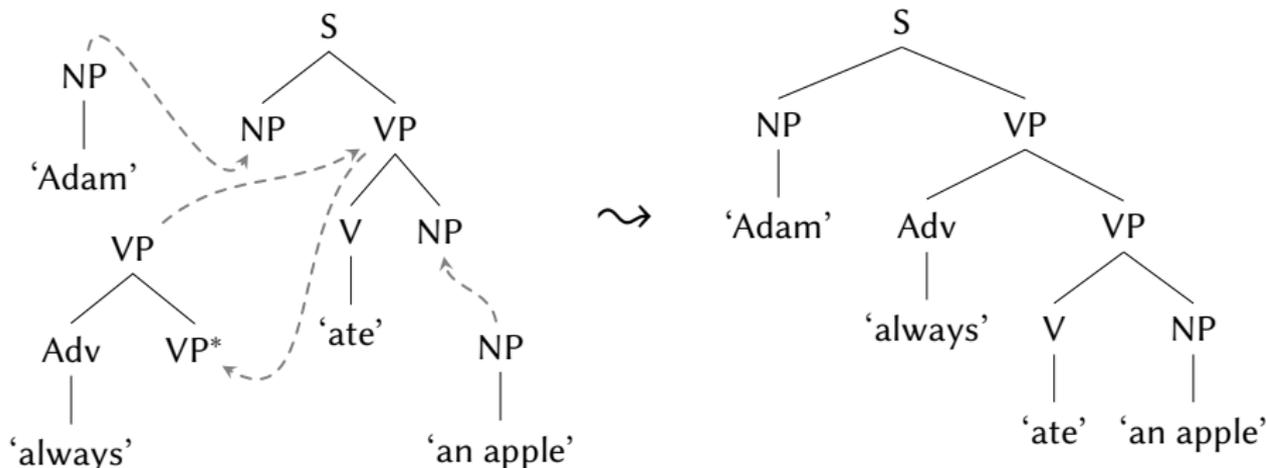


Background: LTAG + frame semantics

LTAG (Lexicalized Tree Adjoining Grammars):

Tree-rewriting system with

- a finite set of **(lexicalized) elementary trees**,
- two operations: **substitution** (replacing a leaf with a new tree) and **adjunction** (replacing an internal node with a new tree).



Components of the syntax-semantics interface

- **Elementary construction**

- = elementary tree (argument projection) + semantic frame
 - + linking of frame node variables to interface features in the tree

- Semantic **composition** \approx frame unification via identification of interface variables during substitution and adjunction.

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Slogan: “**Simplify globally, complicate locally**”

■ A small set of (global) operations for syntactic composition: substitution and adjunction.

■ Many linguistic regularities and generalizations (including linking rules) are encoded within elementary constructions → further decomposition in the so-called **metagrammar**

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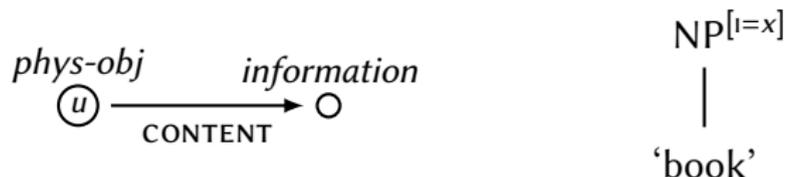
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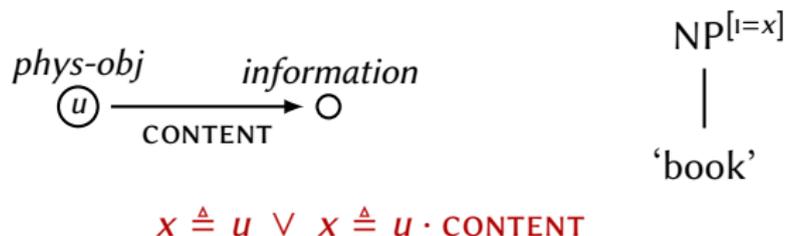
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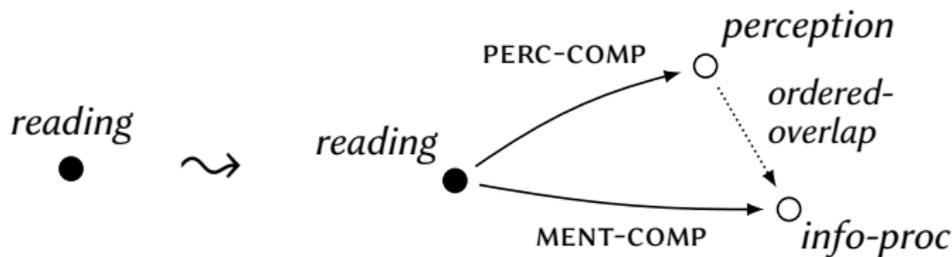
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$reading \Rightarrow \text{PERC-COMP} : perception \wedge \text{MENT-COMP} : info-proc$
 $\wedge \langle \text{PERC-COMP}, \text{MENT-COMP} \rangle : ordered-overlap$



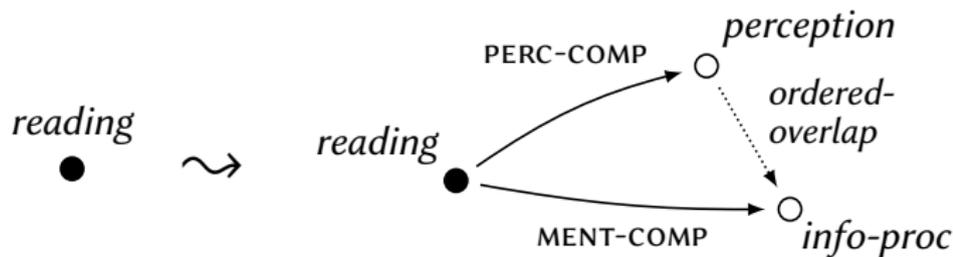
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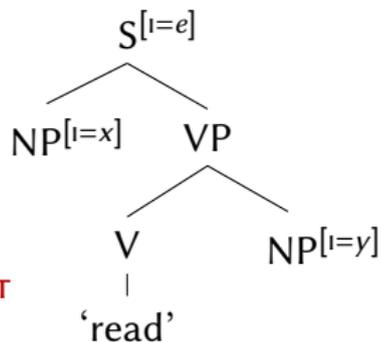


$perception \Rightarrow STIMULUS : phys-obj$

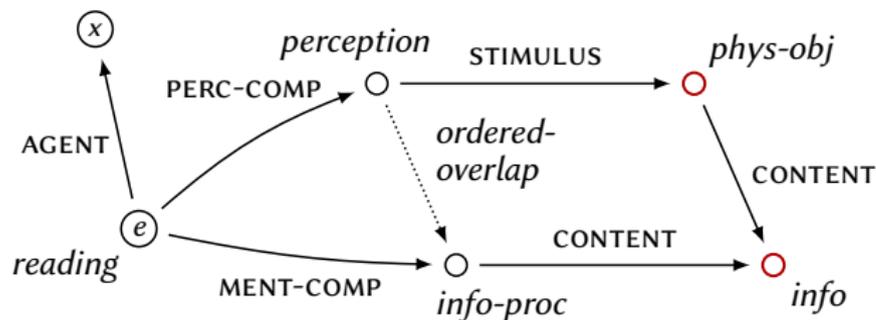
$info-proc \Rightarrow CONTENT : info$

Modeling inherent polysemy

(Canonical) **argument structure construction** associated with 'read'.



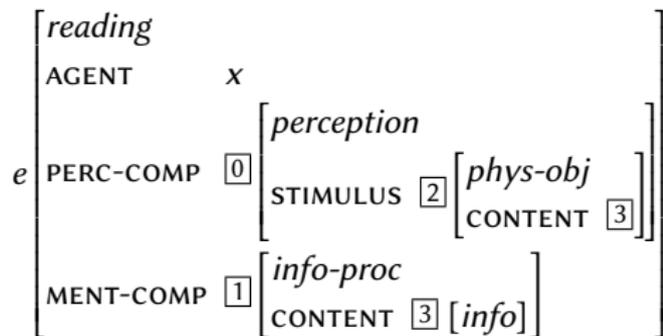
$y \triangleq e \cdot \text{PERC-COMP} \cdot \text{STIMULUS}$
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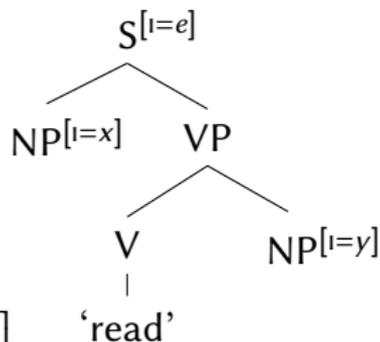
Modeling inherent polysemy

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$$y \triangleq [2] \vee y \triangleq [3]$$



$\langle [0], [1] \rangle$: *ordered-overlap*



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The “Quantificational Puzzle”

[e.g., Asher 2011]

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Issues related to the analysis of (5b):

- Usually there is **no one-to-one correspondence** between the physical books in the library and the book contents.
- (5b) may be true even if **no physical copy** from the library has ever been used by Mary.

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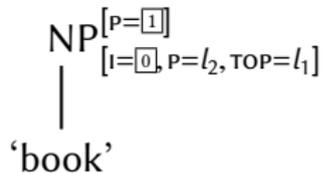
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A meta-level approach: **underspecified** attribute value formulas

$$\begin{aligned}l_1 &: \exists u(u \cdot \boxed{1}), & \boxed{1} &\triangleleft^* l_2, \\l_2 &: \textit{phys-obj} \wedge \text{CONTENT} : \boxed{2}, & \boxed{2} &\triangleleft^* l_3, \\l_3 &: \textit{information}\end{aligned}$$



($h \triangleleft^* l$ iff expression l is a subexpression of h .)

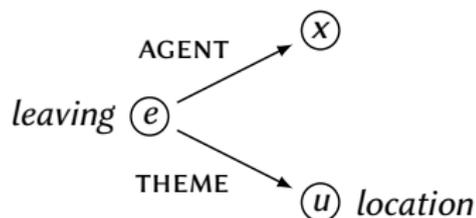
Modeling “selectional polysemy”

(6) Mary left the party.

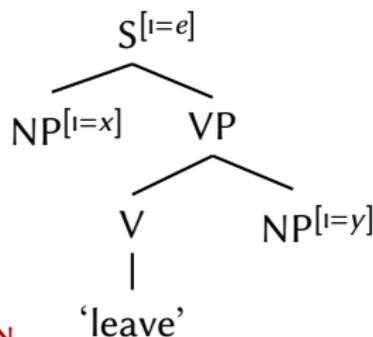
[= (1a)]

Assumptions:

- *leaving* has a THEME attribute whose value is of type *location*.
- The object NP denotes either an entity of type *location* or something which has a LOCATION attribute.



$$u \triangleq y \vee u \triangleq y \cdot \text{LOCATION}$$



Corresponding AV formula:

$$e \cdot (\textit{leaving} \wedge \text{AGENT} : x \wedge \text{THEME} : (u \cdot \textit{location}))$$

Modeling “selectional polysemy”

(7) Mary began the book.

[= (1b)]

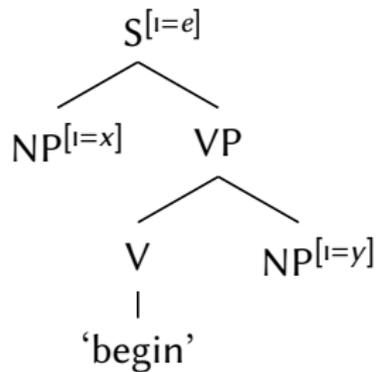
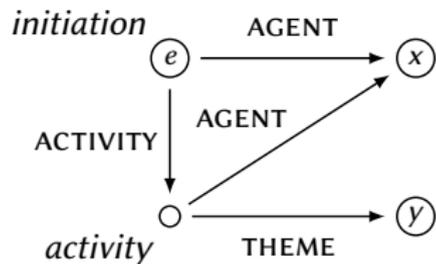
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Sketch of a preliminary analysis:

- NP-V-NP construction available for ‘begin’.



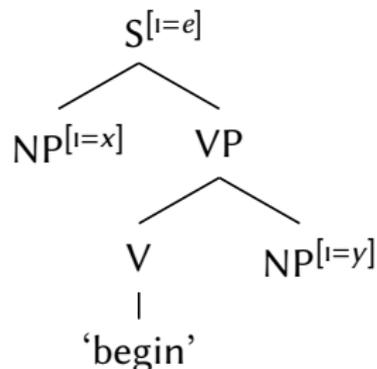
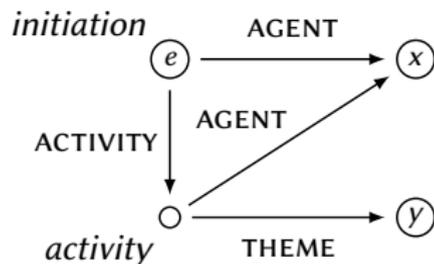
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- Additional requirement:

activity needs to be specialized to an appropriate subtype (partly dependent on the type of y).

Summary & Conclusion

- Underspecification in the lexicon and at the syntax-semantics interface of inherently polysemous expressions is generally resolved through their integration into the context.
- In certain cases of selectional polysemy, ambiguity or underspecification may not play a role at all, even if disjunctive information is present at the syntax-semantics interface.
- If underspecification plays a role in the analysis of selectional polysemy then necessarily at some intermediate level of the coercion process.

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