Dynamic Iconicity

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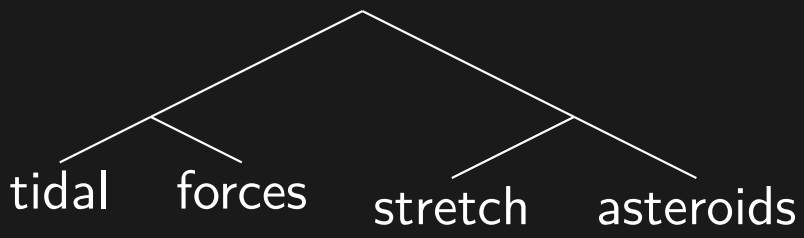
Section 1

Introduction

Two kinds of meaning



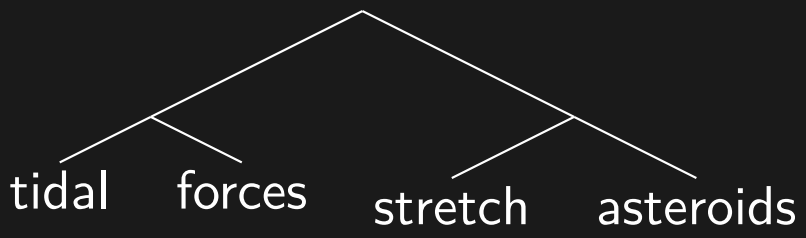
grammar

combinatorial & descriptive

iconicity

holistic & depictive

Two kinds of meaning



grammar
combinatorial & descriptive

iconicity
holistic & depictive

- In sign language, even more intertwined!

Dynamic semantics

Today's main proposal:

- Both descriptive and depictive meaning should be represented using **dynamic semantics**, in parallel but interacting systems.

Dynamic semantics

Information and discourse referents are introduced gradually into context as a discourse unfolds.

- Two key properties of dynamic semantics:

(1) Left-to-right evaluation

a. [A man]^i entered the room. He$_i$ began to sing.

b. * He$_i$ began to sing. [A man]^i entered the room.

(2) Sensitivity to local contexts

a. Nobody got [a prize]^i and bragged about it$_i$.

b. * Nobody got [a prize]^i. It$_i$ was made of gold.

Dynamic semantics

- **Claim:** a dynamic system also governs iconicity
  - *Intuitively:* 'You need to create a picture before you can point to it.'
  - The system runs in parallel to the grammar, but interfaces with it.
- Empirical motivation (French Sign Language):
  - Cataphora ('backwards anaphora')
  - Iconic inferences in embedded contexts

Section 1

Introduction

Descriptive meaning over time

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b. Mary saw him.

Descriptive meaning over time

- Consider how a series of linguistic utterances change a discourse representation:

(3) a. John entered.
b. Mary saw him.
c. She called Susan over.

Depictive meaning over time

- Consider how a pictorial preduction changes a discourse representation:

  (4)

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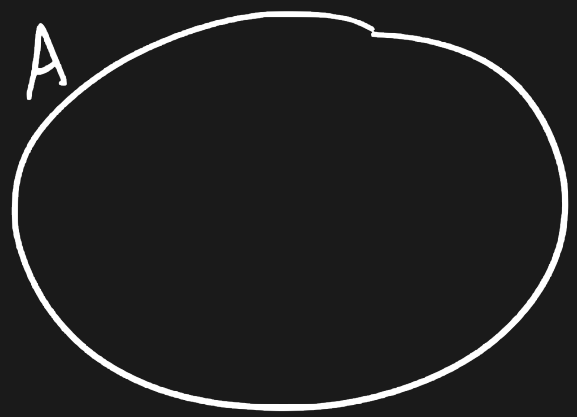
(4)



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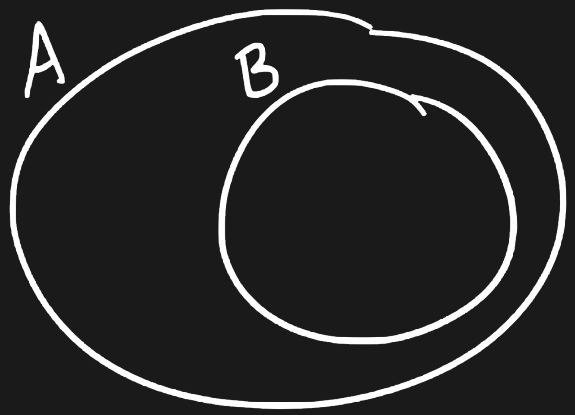

Depictive meaning over time

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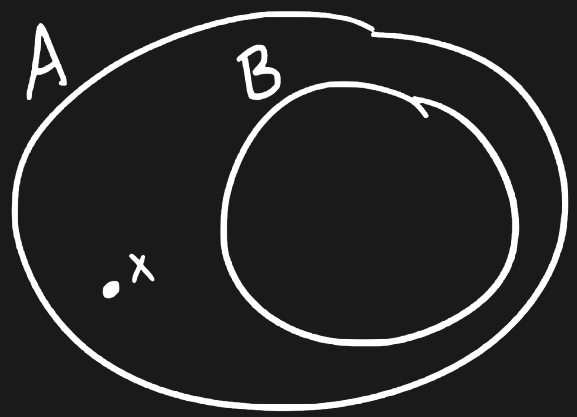

Meaning over time

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  - Introduction
  - Predication
  - Retrieval

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  - Iconic inferences may involve linguistic referents

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- Sign language: a rich case study

Spatial features in sign language

- Sign languages are well known to use space to index discourse referents

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Spatial features in sign language

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- The use of space mirrors the use of *variables*.

(Lillo-Martin & Klima 1990; Schlenker 2011)

Spatial features in sign language

- Are loci a syntactic spell-out of variable names?
- Kuhn (2016): No.
- Multiple individuals may share the same locus, just as they may share the same gender feature.

(5) ONLY JEAN QUESTION POSS-a MOTHER POSS-a FAVORITE COLOR. MVI_3390

(6) Only Jean quizzed his$_{[+\text{masc}]}$ mother about his$_{[+\text{masc}]}$ favorite color.

(7) [only Jean$_j$] $\lambda x.x$ ask j's mother x's favorite color.

Spatial features in sign language

One implementation:

- A presupposition on the value of the pronoun:

(8) a. $[\![\text{she}]\!] = \lambda x : \text{fem}(x) \,.\, x$

b. $[\![\text{IX-a}]\!] = \lambda x : \text{at}(\text{a})(x) \,.\, x$

Spatial features in sign language

One implementation:

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b. $[\![\textsc{ix-a}]\!] = \lambda x : \textsf{at}(\textsf{a})(x) \,.\, x$

Still to be explained:

- What is the meaning of a locus?
- What does it mean to be ‘at’ this locus?

Spatial features in sign language

My answer:

- Loci are referents in a iconic, pictorial representation that grows as discourse develops.
  - A pictorial discourse referent must be introduced before it can be retrieved.
- Additionally, iconic inferences arising from a mapping that preserves structural properties.
  - More or less structure may be preserved.
  - We assume: a single individual cannot be at two different loci at the same time.

Section 3

Cataphora and order sensitivity

Order sensitivity

- Dynamic systems show order sensitivity:

(9) a. [A man]^i entered the room. He$_i$ began to sing.
b. * He$_i$ began to sing. [A man]^i entered the room.

- If iconic representations are dynamic, they should also show order sensitivity.

Order sensitivity

Evidence of order sensitivity: **cataphora**.

- In the definition of IX-a, there are two variables
  - The pronoun (x), and the locus (a)
  - $[\![\text{IX-a}]\!] = \lambda x : \text{at(a)}(x) \,.\, x$
- Even when x is subject to quantificational binding, the locus still needs dynamic binding.
- Cataphora allows a dissociation of the two.

Cataphora

Cataphora: when a pronoun precedes its binder

(10) Before he$_i$ left the office, Jean^i turned out the lights.

Cataphora

Cataphora: when a pronoun precedes its binder

(10) Before he$_i$ left the office, Jean^i turned out the lights.

- How to analyze cataphora is an open question.
  - Quantificational binding or dynamic binding?

Cataphora

But at least some examples seem to involve quantificational, in-scope binding.

- Disrupted by sentence boundaries:

(11) * He$_i$ left the office. Jean^i didn't turn out the lights.

- Binding by quantificational expressions possible:

(12) When his$_i$ child is in pain, [no father]^i can sit idly by.

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NB: other examples are are harder to analyze in this way.

Cataphora

Observation: cataphora is *less available* in sign lang.

(van Hoek, 1997; Koulidobrova & Lillo-Martin, 2016)

(13) SINCE JEAN-a MISS PLANE, IX-a CAN'T GO NYC
'Since Jean missed the plane, he can't go to NYC.'

MVI_9650

(14) * SINCE IX-a MISS PLANE, JEAN-a CAN'T GO NYC
Intended: 'Since he missed the plane, Jean can't go to NYC.'

MVI_9652

- *Intuition:* you can't point to something until it has been introduced

Cataphora

If this is a constraint on iconicity, then a prediction:

- Cataphora should become possible if a non-spatial pronominal form is used.

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If this is a constraint on iconicity, then a prediction:

- Cataphora should become possible if a non-spatial pronominal form is used.
- This seems to be correct:

(17) SINCE __ MISS PLANE, JEAN-a CAN'T GO NYC
'Since he missed the plane, Jean can't go to NYC.'
MVI_9651

(18) WHEN NEIGHBOR NOISE, MARIE-a CALL POLICE
'When (her) neighbor makes noise, Marie calls the police.'
MVI_1403

Cataphora

Another paradigm with the same pattern:

(19) JEAN-a LEAVE OFFICE BEFORE, IX-a LIGHT-OFF

MVI_9629

(20) * IX-a LEAVE OFFICE BEFORE, JEAN-a LIGHT-OFF

MVI_9632

(21) __ LEAVE OFFICE BEFORE, JEAN-a LIGHT-OFF

MVI_9630

'Before he left the office, Jean turned out the lights.'

Cataphora

Another prediction:

- Cataphora becomes worse in spoken language if an iconic form is used.

Cataphora

Another prediction:

- Cataphora becomes worse in spoken language if an iconic form is used.
- *Former* and *latter* as 'temporal loci'? (Schlenker '11)

  (23) Alice and Claire both did well in the class, but the former is clearly the better student.

Cataphora

This seems correct!

(24) a. By the time he reported the bad news publicly, the CEO had already sold all his stocks in the company.

b. By the time the bastard reported the bad news publicly, the CEO had already sold all his stocks in the company.

c. * By the time the former reported the bad news publicly, the CEO and the CFO had already sold all their stocks in the company.

(25) The CEO and the CFO had already sold all their stocks in the company by the time the former reported the bad news publicly.

Section 4

Analysis: cataphora and iconicity

Cataphora with iconicity

- We analyze our examples of cataphora as in-scope, quantificational binding.
  - At deep structure, the antecedent c-commands and binds the pronoun.
  - After leftwards dislocation, reconstruction occurs to interpret the pronoun in the lower position.

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See Appendix for details!

Cataphora with iconicity

- To this, we add a dynamic component that manages the pictorial representation.
  - Meaning is a tuple that pairs the static meaning of an expression with its dynamic (pictorial) effect.
  - For non-iconic expressions, their static meaning is converted via the 'unit' operator:

(26) $\eta(x) = \lambda\mathcal{P}.\langle x, \mathcal{P}\rangle$

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  - NB: One difference with standard dynamic models: No nondeterminism. A picture is always *definite*.

Cataphora with iconicity

- NPs and pronouns indexed in space manipulate or reference the pictorial representation.

(27) $[\![\text{JEAN-a}]\!] = \lambda\mathcal{P}.\left\langle \begin{array}{ll} j & \text{if at(a)}(j) \text{ in } \mathcal{P}+\text{a} \\ \# & \text{otherwise} \end{array}, \mathcal{P}+\text{a} \right\rangle$

(28) $[\![\text{IX-a}]\!] = \lambda\mathcal{P}.\left\langle \begin{array}{ll} \lambda x.x & \text{if at(a)}(x) \text{ in } \mathcal{P} \\ \# & \text{otherwise} \end{array}, \mathcal{P} \right\rangle$

Cataphora with iconicity

- A Categorial Grammar syntax.
- The rules of composition pass dynamic info from left to right. (Charlow 2014, Bumford 2015)

(34) a.

A/B	B	→	A		
m	n		$\lambda\mathcal{P}.\langle f(x), \mathcal{P}''\rangle$	where	$\langle x, \mathcal{P}''\rangle = n(\mathcal{P}')$ $\langle f, \mathcal{P}'\rangle = m(\mathcal{P})$

b.

B	B\A	→	A		
m	n		$\lambda\mathcal{P}.\langle f(x), \mathcal{P}''\rangle$	where	$\langle f, \mathcal{P}''\rangle = n(\mathcal{P}')$ $\langle x, \mathcal{P}'\rangle = m(\mathcal{P})$

Cataphora with iconicity

- When we apply to a case of cataphora...

(30) $[\![$IX-a LEAVE OFFICE BEFORE, JEAN-a LIGHT-OFF$]\!] =$

$$\lambda\mathcal{P}.\left\langle \begin{array}{c} \text{light-off}(j) \text{ before leave}(j) \\ \# \end{array} \quad \begin{array}{l} \text{if at(a)}(j) \text{ in } \mathcal{P} \\ \text{and at(a)}(j) \text{ in } \mathcal{P}\text{+a} \\ \text{otherwise} \end{array} , \mathcal{P}\text{+a} \right\rangle$$

- The pronoun evaluated before 'a' introduced!
  - The meaning thus presupposes that the value of the pronoun (Jean) is at a in the input context $\mathcal{P}$.
  - This is not satisfied, so the sentence is infelicitous.

The status of variables

- A debate: to what extent are variables needed to model the behavior of loci?
- Here, two different objects are 'variable-like':
  - Pronouns (x), which can be bound, and
  - Loci (a), which are passed through discourse.
- But both of these systems are weaker, in telling ways, than the full power afforded by variables.

The status of variables

- In the core semantics, the presupposition is a constraint on the *value* of the pronoun, not a constraint on a *variable name* itself.
  - Cf. constraints on variable names to account for phenomena like Binding Theory. (Chomsky 1981)
- But, constraints on *values* don't need variables; they can also be stated in variable-free terms!
  - That's what I've done: $[\![\text{IX-a}]\!] = \lambda x : \text{at}(\text{a})(x) \,.\, x$

The status of variables

- In the dynamics, the iconic representation is basically equivalent to an assignment function.
  - Indeed, it's an even richer representation since it can include iconic information.
- But! The discourse referents in these iconic representations are *never bound*. (cf. Szabolcsi 2003)
  - No operation like abstraction that selectively alters the value of a free variable.
  - Indeed, the iconic discourse referents are not even indeterminate: at any given point in time, there is a single, definite iconic representation.

The status of variables

- Naturally, the analysis here can be restated in terms of variables.
- But the variable-free perspective offers unique insights regarding what the compositional system can and cannot do.

Section 5

Iconicity and local contexts

The problem with the global context

- Kuhn (2016) considers a similar hypothesis:

(31) A locus i denotes a set $S_c(i)$, provided by the global context c. This set constrains the value of a pronoun: $[\![\text{IX-a}]\!] = \lambda x : x \in S_c(i) \,.\, x$

- But this hypothesis fails when two quantifiers range over the same set of individuals.

(32) EACH-TIME SOMEONE-a HELP SOMEONE-b, IX-b THANK-a
'When someone helps someone, they thank them.'

MVI_1183

The problem with the global context

- The source of the problem is that the presupposition is taken to be a constraint on the *global context*.
- We can avoid these problems if we relativize to the *local context* of a locus.

Local contexts

- Global context $\approx$ the common ground
- Local context $=$ the immediate scope in which an expression is interpreted
  - Incorporates information about the syntactic environment in which the expression appears

(33) If it's raining, I'll bring an umbrella.

Local contexts

- Constraints on discourse reference are sensitive to the local context.

1. Availability of a pronoun

(34) a. If a farmer has a cow, he milks it.
b. * If a farmer has a cow, he's happy. I milked it.

(35) a. Nobody received a prize and bragged about it.
b. * Nobody received a prize. It was made of gold.

Local contexts

2. Presupposition of *other* (and *else*)

(36) One boy coughed. Another boy laughed.

(37) a. When a kid sees another kid, they say hi.

b. ? When a kid is happy, they laugh. When another kid is sad, they cry.

(38) a. Every boy told every other boy that he'd win.

b. ? Every boy coughed. Every other boy laughed.

Local contexts

- Let's reconsider the LSF data in this light:

(39) EACH-TIME SOMEONE-a HELP SOMEONE-b, IX-b THANK-a
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MVI_1183

- We have assumed simple iconic constraint:
  Two distinct loci $\rightarrow$ two distinct values

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MVI_1183

- We have assumed simple iconic constraint:
  Two distinct loci $\rightarrow$ two distinct values
- In the local context, this is (trivially) satisfied!

Local contexts

- NB: the iconic inference is redundant with existing inferences of the sentence.
- What evidence in favor of an iconic inference?

(40) *Context:* Explaining the rules of a card game

a. IF SOMEONE-a DRAW IX SWORD, SOMEONE-a LOSE
'If someone draws the sword card, someone loses.'
MVI_0765

b. IF SOMEONE-a DRAW IX SWORD, SOMEONE-b LOSE
'If someone draws the sword card, someone else loses.'
MVI_0765

Local contexts

- NB: there may often be a *tendency* to interpret iconicity with respect to the global context.

  (Kuhn 2020)

- This would derive...
  - A preference to avoid bound pronouns under negative quantifiers (Graf & Abner 2012)
  - A preference for a 'two group' readings for some embedded quantifiers (Kuhn 2016)

Modeling local contexts

- Should we build sensitivity to local contexts into the definitions of our dynamic operators?

(cf. Groenendijk & Stokhof 1991)

(41) Externally static definition of *if* (to be rejected):

$$[\![\text{IF}]\!] = \lambda\mathcal{P}mn.\left\langle \begin{array}{ll} p \rightarrow q & \text{where } \langle p, \mathcal{P}' = m(\mathcal{P})\rangle \\ & \text{and } \langle q, \mathcal{P}'' = n(\mathcal{P}')\rangle \end{array}, \mathcal{P} \right\rangle$$

Modeling local contexts

- For linguistic discourse representations, it seems that we *don't* discard a representation.
- In cases of *modal subordination*, we are able to recreate the needed context.

(42) a. * If a woman had won the election in 2008, it would have made history. She was the first female president of the U.S.

b. If a woman had won the election in 2008, it would have made history. She would have been the first female president of the U.S.

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Modeling local contexts

- Kuhn (2020): evidence that pictorial discourse referents are subject to similar rules.

(43) NEXT-YEAR PRESIDENT ELECTION, WHO GOING-TO WIN? PERSON-a BLACK OR PERSON-b ASIAN. THEN IX-b ESTABLISH LAW EQUALITY CITIZEN.
'In next year's presidential election, who is going to win? A Black person or an Asian person. The Asian would then establish a law on citizen equality.' MVI_0757

- In global context, locus b may be empty.
- But under modal subordination ('*if elected*...'), the local context *does* entail an individual at b.

Modeling local contexts

A better analysis:

1. A simple denotation of IF:

$$(44) \quad [\![\text{IF}]\!] = \lambda\mathcal{P}\langle\lambda pq.p \rightarrow q, \mathcal{P}\rangle$$

2. Allow the local context to modulate the presuppositions that relate these discourse referents to the values of nouns and pronouns.

Section 6

Conclusion

Conclusion

- Iconicity is manipulated by a dynamic system.
  - It is *order sensitive*.
  - It is mediated by *local contexts*.
- I proposed a system that threads a growing iconic representation through the discourse.

Thanks!

Section 7

Appendix

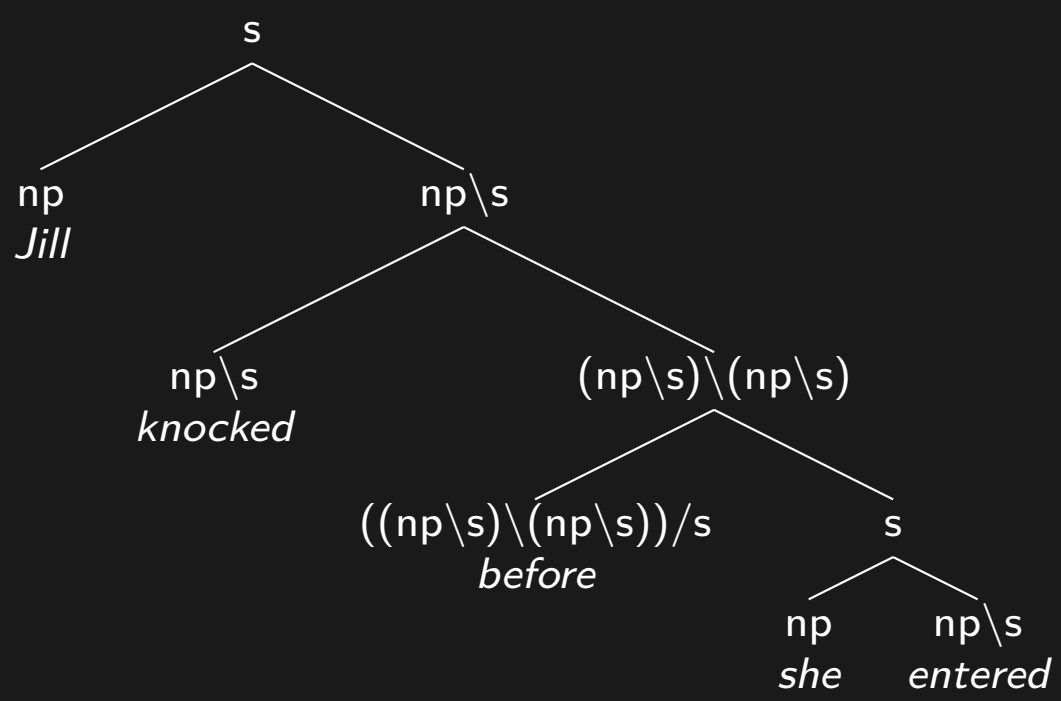
Cataphora without iconicity

- We assume a Categorial Grammar syntax.

(45) a. $A/B \quad B \rightarrow A$

b. $B \quad B\backslash A \rightarrow A$

(46)



- CG allows us to build *linear order* into the semantics.

Cataphora without iconicity

- Binding is done however you want.
- Here's a variable-free analysis:

(47)
a. $\text{Lift} = \lambda xf.f(x)$
b. $\mathbf{g} = \lambda ghx.g(h(x))$
c. $\mathbf{z} = \lambda Vfx.V(f(x))(x)$

- Example:

(48)
a. $\text{before she entered}' = \lambda xPz.P(z)$ before $\text{enter}(x)$
b. $\text{Lift}(\text{knocked}') = \lambda g.g(\lambda x.\text{knock}(x))$
c. $\mathbf{z}(\text{Lift}(\text{knocked}')) = \lambda fy[(f(y)(\lambda x.\text{knock}(x)))(y)]$
d. $\mathbf{z}(\text{Lift}(\text{knocked}'))(\text{before she entered}')(\text{Jill}')$
$= \text{knock}(j)$ before $\text{enter}(j)$

Cataphora without iconicity

- And a (too) simple analysis of reconstruction:

(49) a. Front :: (X\s)/(s/X)
b. Front = $\lambda x.x$

- Syntax:

(50) Before she entered, Jill knocked.

(51) a. before she entered′ :: vp\vp
b. Lift(before she entered′) :: (s/(vp\vp))\s
c. Front(Lift(before she entered′)) :: s/(s/(vp\vp))

- Semantics:

(52) a. $\mathbf{z}(\text{Lift}(\text{knocked}')) = \lambda fy[(f(y)(\lambda x.\text{knock}(x)))(y)]$
b. $\text{Lift}(\text{Jill}') = \lambda P.P(j)$
c. $\mathbf{g}(\text{Lift}(\text{Jill}'))(\mathbf{z}(\text{Lift}(\text{knocked}'))) = \lambda f[(f(j)(\lambda x.\text{knock}(x)))(j)]$
d. $\text{Front}(\text{Lift}(\text{before she entered}')) = \lambda h.h(\lambda xPz.P(z)\ \text{bef.}\ \text{enter}(j))$
e. $\text{Front}(\text{Lift}(\text{before she entered}'))(\mathbf{g}(\text{Lift}(\text{Jill}'))(\mathbf{z}(\text{Lift}(\text{knocked}'))))$
$= \text{knock}(j)\ \text{before}\ \text{enter}(j)$