Glue Semantics and Locality

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Background

- In LFG, the standard way of expressing constraints on possible anaphor-antecedent relationships is via statements about the c-/f-/s-structure correspondences.
- For example, the requirement for the English reflexive pronoun *-self* to find its antecedent within the same clause can be stated by means of the correspondences shown below, where the final line of the lexical entry gives the lexical semantics in Glue ([1, 2]).

$$(\uparrow_\sigma \text{ ANTECEDENT}) = ((\text{GF}^*_{\neg(\rightarrow\ \text{SUBJ})}\ \text{GF} \uparrow)\ \text{GF})_\sigma$$

$$\lambda x(x,x) : (\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANTECEDENT}) \otimes \uparrow_\sigma)$$

Idea

The locality condition on *-self* can be accounted for in Glue, without the need for an off-path constraint.

Key ideas

- In Glue, interpretations of constituents are paired with formulae of a fragment of linear logic, constraining their combinatory potential according to linear logic proof theory.
- This makes the linear logic fragment a **type logic** in the style of (type-logical) categorial grammar.
- Therefore, we can make use of ideas from categorial grammar.
- I propose to use the idea from [3] of accounting for some cases of locality by **adding a unary connective** to the fragment of linear logic used.
- As in [5], this connective can be given a **semantic motivation** in terms of intensionality.
- This poster focuses on positive binding constraints.

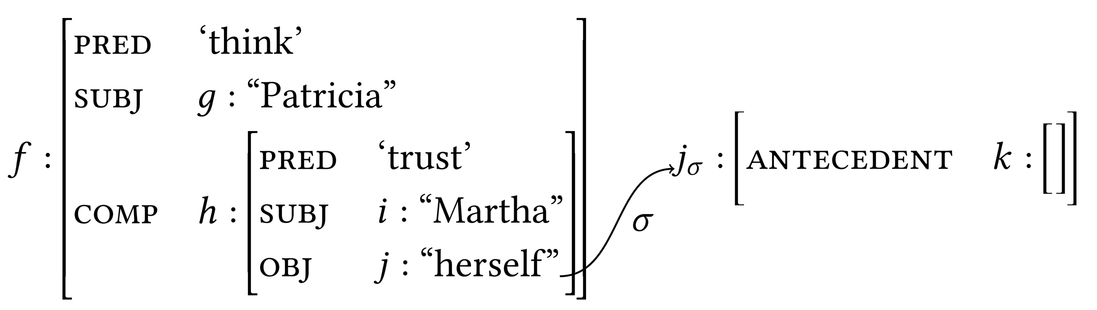
The extra connective

$\Box$ elimination	$\Box$ introduction	
$\dfrac{f : \Box X}{^\vee f : X}\Box_E$	$\dfrac{f : X}{^\wedge f : \Box X}\Box_I$	Provided that every path back to an open premise includes an independent sub-proof of a $\Box$-formula.

- These rules give $\Box$ the behaviour it has in S4 modal logic.
- Given $f : A$ and $g : \Box A$, if f is of type τ then g is of type $s{\rightarrow}\tau$.
- $^\wedge$ is intensionalization, and $^\vee$ is extensionalization, as in [4].

Example

(1) Patricia thinks that Martha trusts herself



$\Rightarrow$ Patricia thinks that Martha trusts Martha (requires $k := i_\sigma$)

$\nRightarrow$ Patricia thinks that Martha trusts Patricia (requires $k := g_\sigma$)

Lexical entries

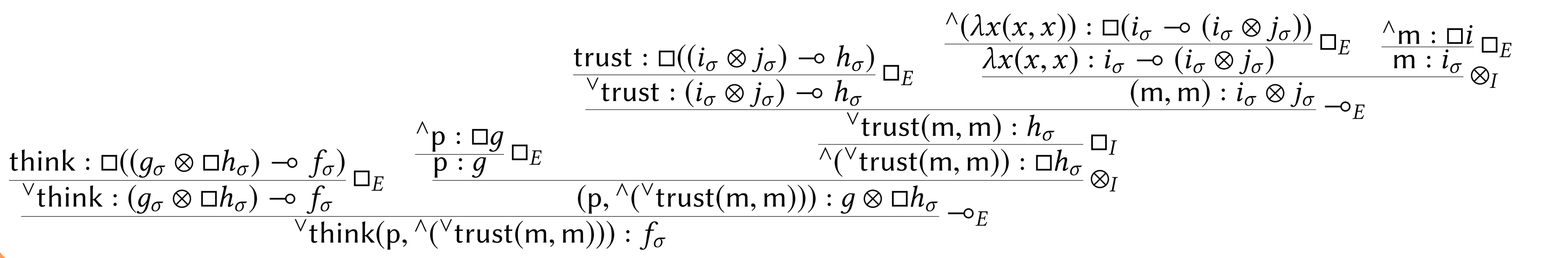
Patricia	$\rightsquigarrow$	$^\wedge \text{p} : \Box \uparrow_\sigma$
	$\Rightarrow$	$^\wedge \text{p} : \Box g_\sigma$
thinks	$\rightsquigarrow$	$\text{think} : \Box(((\uparrow \text{SUBJ})_\sigma \otimes \Box(\uparrow \text{COMP})_\sigma) \multimap \uparrow_\sigma)$
	$\Rightarrow$	$\text{think} : \Box((g_\sigma \otimes \Box h_\sigma) \multimap f_\sigma)$
Martha	$\rightsquigarrow$	$^\wedge \text{m} : \Box \uparrow_\sigma$
	$\Rightarrow$	$^\wedge \text{m} : \Box i_\sigma$
trusts	$\rightsquigarrow$	$\text{trust} : \Box(((\uparrow \text{SUBJ})_\sigma \otimes (\uparrow \text{OBJ})_\sigma) \multimap \uparrow_\sigma)$
	$\Rightarrow$	$\text{trust} : \Box((i_\sigma \otimes j_\sigma) \multimap h_\sigma)$
herself	$\rightsquigarrow$	$^\wedge(\lambda x(x,x)) : \Box((\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANTECEDENT}) \otimes \uparrow_\sigma))$
	$\Rightarrow$	$^\wedge(\lambda x(x,x)) : \Box(k \multimap (k \otimes j_\sigma))$

Semantically, *thinks* requires its complement to be of type $s{\rightarrow}t$, which therefore means that in Glue it must be paired with a $\Box$-formula. This makes the complement of *thinks* a proof-theoretic 'island' that the reflexive pronoun can't 'escape from'. We therefore have a semantically-motivated account of the locality condition on the reflexive pronoun.

Proofs

The attested reading is derivable

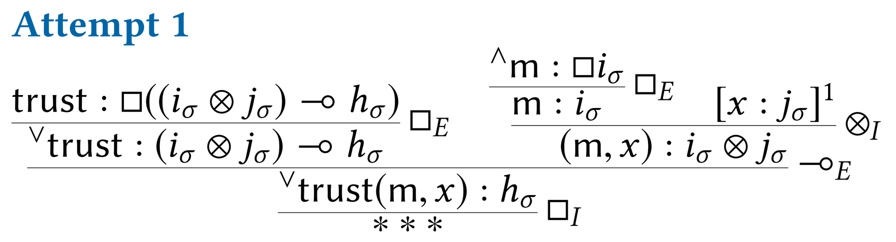
Successful derivation of $^\vee\text{think}(\text{p}, {}^\wedge({}^\vee\text{trust}(\text{m},\text{m})))$ (with $k := i_\sigma$):



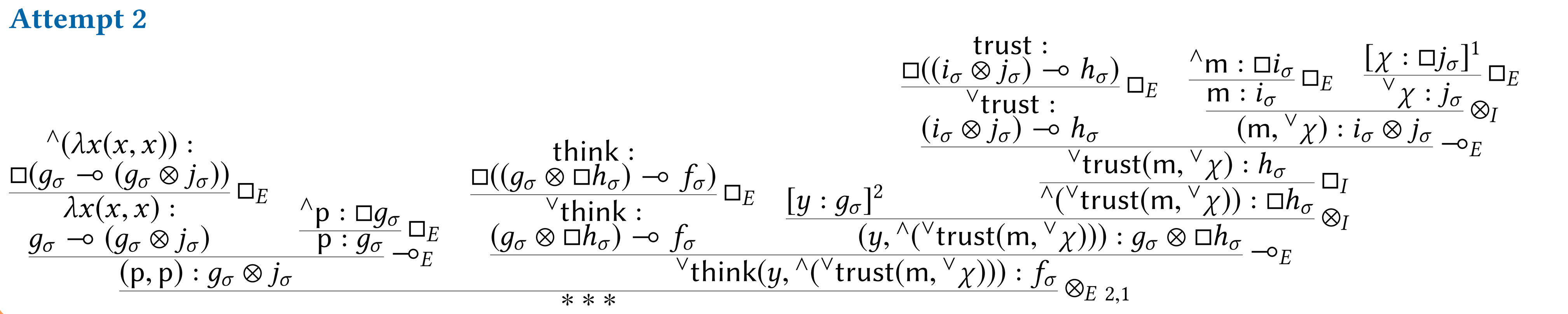
The unattested reading is not derivable

Unsuccessful attempted derivations of $^\vee\text{think}(\text{p}, {}^\wedge({}^\vee\text{trust}(\text{m},\text{p})))$ (with $k := g_\sigma$):

Attempt 1



Attempt 2



- **Attempt 1 fails** because $\Box$ introduction is not valid: the path back to the open premise j_σ does not contain an independent sub-proof of a $\Box$-formula.
- **Attempt 2 fails** because $\otimes$ elimination is not valid: j_σ was not hypothesized ($\Box j_\sigma$ was).
- A reflexive prounoun that **can** take a clause-external antecedent is easy to define: $^\wedge(\lambda x(x, {}^\wedge x)) : \Box((\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANTECEDENT}) \otimes \Box\uparrow_\sigma))$.

Another potential application

In Østfold Norwegian, the reflexive pronoun *seg* can take a non-local antecedent under certain conditions that are **independent of finiteness** ([7]).

(2) a. *Reven$_i$ frykta at noen jakta på seg$_i$
the fox feared that someone hunted on REFL

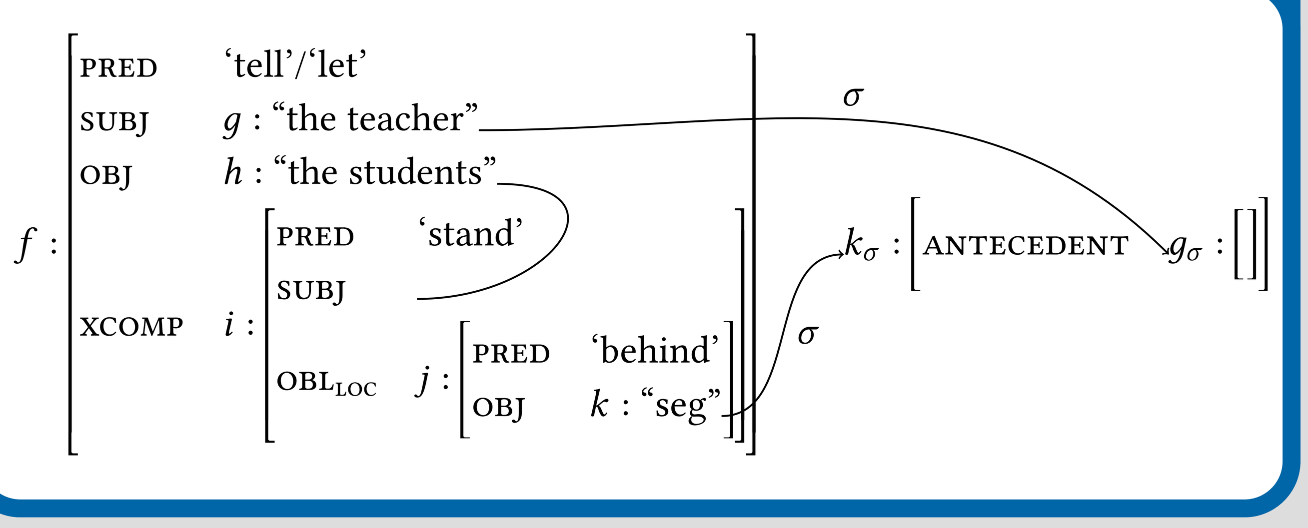
b. Reven$_i$ hørte at noen jakta på seg$_i$
the fox heard that someone hunted on REFL

(3) a. *Læreren$_i$ ba elevene stå bak seg$_i$
the teacher told the students stand.INF behind REFL

b. Læreren$_i$ lot elevene stå bak seg$_i$
the teacher let the students stand.INF behind REFL

- Analysis from [7]: the verbs that allow *seg* in their complement clause to be bound from outside it are exactly those verbs that select a **semantically tenseless** complement.
- Evidence: (i) sequence of tenses, (ii) double access readings, and (iii) temporal adverb disagreement.
- Proposal from [7]: *seg* can be bound out of a complement clause only if that clause is **semantically tenseless**.

Example (3)



Ideas

- We continue to use $\Box$ to handle int/extensionalization with respect to possible words, $^\wedge$ and $^\vee$.
- We add a new connective with the same rules, $\blacksquare$, to handle int/extensionalization with respect to times, $^\blacktriangle$ and $^\blacktriangledown$, as in [6]. Given $f : A$ and $g : \blacksquare A$, if f is of type τ then g is of type $i{\rightarrow}\tau$.
- The reflexive pronoun *seg* can escape the embedding induced by $\Box$, but not that induced by $\blacksquare$.
- Meaning constructors introducing tense operators require arguments of type $i{\rightarrow}t$, which means that in Glue they require $\blacksquare$-formulae.
- Therefore, if a tense operator is present in the same clause as *seg*, then it will not be able to take an antecedent outside that clause.

læreren	$\rightsquigarrow$	$^\wedge{}^\blacktriangle(\iota z.{}^\blacktriangledown{}^\vee\text{teacher}(z)) : \Box\blacksquare \uparrow_\sigma$	$\Rightarrow \Box\blacksquare g_\sigma$
ba/lot	$\rightsquigarrow$	$\text{tell/let} : \Box\blacksquare(((\uparrow \text{SUBJ})_\sigma \otimes ((\uparrow \text{OBJ})_\sigma \otimes \Box(\uparrow \text{XCOMP})_\sigma)) \multimap \uparrow_\sigma)$	$\Rightarrow \Box\blacksquare((g_\sigma \otimes (h_\sigma \otimes \Box i_\sigma)) \multimap f_\sigma)$
		$^\wedge{}^\blacktriangle(\lambda p.\text{P}({}^\blacktriangledown p)) : \Box\blacksquare(\blacksquare \uparrow_\sigma \multimap \uparrow_\sigma)$	$\Rightarrow \Box\blacksquare(\blacksquare f_\sigma \multimap f_\sigma)$
studentene	$\rightsquigarrow$	$^\wedge{}^\blacktriangle(\iota x.{}^\blacktriangledown{}^\vee{}^*\text{student}(x)) : \Box\blacksquare \uparrow_\sigma$	$\Rightarrow \Box\blacksquare h_\sigma$
stå	$\rightsquigarrow$	$^\wedge{}^\blacktriangle(\lambda P.\lambda y.{}^\blacktriangledown{}^\vee\text{stand}(y) \wedge P(y)) : \Box\blacksquare((\uparrow \text{OBL}_{\text{LOC}})_\sigma \multimap ((\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma))$	$\Rightarrow \Box\blacksquare(j_\sigma \multimap (h_\sigma \multimap i_\sigma))$
		$^\wedge{}^\blacktriangle(\lambda p.\text{F}({}^\blacktriangledown p)) : \Box\blacksquare(\blacksquare \uparrow_\sigma \multimap \uparrow_\sigma)$	$\Rightarrow \Box\blacksquare(\blacksquare i_\sigma \multimap i_\sigma)$
bak	$\rightsquigarrow$	$\text{behind} : \Box\blacksquare((\uparrow \text{OBJ})_\sigma \multimap \uparrow_\sigma)$	$\Rightarrow \Box\blacksquare(k_\sigma \multimap j_\sigma)$
seg	$\rightsquigarrow$	$^\wedge{}^\blacktriangle(\lambda y(y, {}^\wedge y)) : \Box\blacksquare((\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANTECEDENT}) \otimes \Box \uparrow_\sigma))$	$\Rightarrow \Box\blacksquare(g_\sigma \multimap (g_\sigma \otimes \Box k_\sigma))$

Following [8], the embedded infinitive has future tense, but **only** when embedded under *ba*, **not** when embedded under *lot*.

Without embedded tense, as in (3-b), the long-distance binding reading is derivable:

$$\Box\blacksquare g_\sigma, \Box\blacksquare((g_\sigma \otimes (h_\sigma \otimes \Box i_\sigma)) \multimap f_\sigma), \Box\blacksquare(\blacksquare f_\sigma \multimap f_\sigma), \Box\blacksquare h_\sigma, \Box\blacksquare(j_\sigma \multimap (h_\sigma \multimap i_\sigma)), \Box\blacksquare(k_\sigma \multimap j_\sigma), \Box\blacksquare(g_\sigma \multimap (g_\sigma \otimes \Box k_\sigma)) \vdash f_\sigma$$

With embedded tense, as in (3-a), the long-distance binding reading is not derivable:

$$\Box\blacksquare g_\sigma, \Box\blacksquare((g_\sigma \otimes (h_\sigma \otimes \Box i_\sigma)) \multimap f_\sigma), \Box\blacksquare(\blacksquare f_\sigma \multimap f_\sigma), \Box\blacksquare h_\sigma, \Box\blacksquare(j_\sigma \multimap (h_\sigma \multimap i_\sigma)), \underline{\Box\blacksquare(\blacksquare i_\sigma \multimap i_\sigma)}, \Box\blacksquare(k_\sigma \multimap j_\sigma), \Box\blacksquare(g_\sigma \multimap (g_\sigma \otimes \Box k_\sigma)) \nvdash f_\sigma$$

References

[1] Mary Dalrymple. *The Syntax of Anaphoric Binding*. Stanford, CA: CSLI, 1993. **[2]** Mary Dalrymple, John Lamping, Fernando Pereira, and Vijay Saraswat. "Quantification, Anaphora and Intensionality". In: *Semantics and Syntax in Lexical Functional Grammar*. Ed. by Mary Dalrymple. Cambridge, MA: MIT Press, 1999, pp. 39–89. **[3]** Mark Hepple. "The Grammar and Processing of Order and Dependency". PhD thesis. University of Edinburgh, 1990. **[4]** Richard Montague. "The Proper Treatment of Quantification in Ordinary English". In: *Approaches to Natural Language*. Ed. by Patrick Suppes, Julius Moravcsik, and Jaakko Hintikka. Dordrecht: D. Reidel, 1973, pp. 221–242. **[5]** Glyn Morrill. "Intensionality and Boundedness". In: *Linguistics and Philosophy* 13.6 (1990), pp. 699–726. **[6]** Glyn Morrill. *Type Logical Grammar*. Dordrecht, Netherlands: Kluwer Academic Publishers, 1994. **[7]** Sverre Stausland Johnsen. "Non-local binding in tenseless clauses". In: *Proceedings from the Annual Meeting of the Chicago Linguistic Society* 45.2 (2009), pp. 103–116. **[8]** Tim Stowell. "The Tense of Infinitives". In: *Linguistic Inquiry* 13.3 (1982), pp. 561–570.