Glue Semantics and Locality

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Proceedings of the LFG'17 Conference

University of Konstanz

Miriam Butt, Tracy Holloway King (Editors)

2017

CSLI Publications

pages 230–242

http://csli-publications.stanford.edu/LFG/2017

Keywords: Glue Semantics, binding, locality

Gotham, Matthew. (2017). Glue Semantics and Locality. In Butt, Miriam, & King, Tracy Holloway (Eds.): *Proceedings of the LFG'17 Conference, University of Konstanz* (pp. 230–242). Stanford, CA: CSLI Publications.

Abstract

In this paper I explore the idea that Glue Semantics enriched with additional unary connectives could provide a natural account of some (positive) locality conditions on binding. I argue that the additional connectives can be independently, semantically motivated.

1 Introduction

One of the major advantages of the LFG architecture when it comes to binding theory, which is exploited in classic references such as Dalrymple (1993), is that binding constraints for pronouns can be lexically specified by the pronouns themselves. The fine degree of control afforded by this seems to be necessary to account for the variation in binding possibilities even within individual languages. But what form should those constraints take? Standardly, they are stated at the level of f-structure, possibly including reflexes in f-structure of c-structure or s-structure relations. In this paper I will suggest that some binding constraints[1] can profitably be stated in the lexical-*semantic* specifications of pronouns in Glue Semantics, in the sense that the linear logic formulae within meaning constructors contributed by lexical items make derivations of unavailable readings impossible. The advantage of this approach is that, under it, certain binding constraints are seen to be at least partly semantically motivated.

The paper is structured as follows. In Section 2 I revisit some very basic binding facts and a mainstream existing account of them in LFG. In Section 3 I define an extension to a fragment of linear logic standardly assumed for Glue Semantics, and show how it can be used to account for the data described in Section 2. In Section 4 I extend the fragment further to account for data that seem to more clearly indicate semantic constraints on binding. Section 5 concludes.

2 Obligatorily local binding in English

As an example of the binding constraints on the English third-person reflexive pronoun *herself*, we note that (1) has an interpretation paraphraseable as shown in (1-a), but not as shown in (1-b).

(1) Patricia thinks that Martha trusts herself.

a. $\Rightarrow$ Patricia thinks that Martha trusts Martha.

b. $\not\Rightarrow$ Patricia thinks that Martha trusts Patricia.

[†]My thanks to rest of the SynSem group at the University of Oslo and to the audience at the LFG17 Conference for comments, questions and suggestions.

[1]I will focus on *positive* binding constraints.

Broadly speaking, syntactic frameworks are united on the explanation for why *herself* can't refer back to *Patricia* in (1): the reflexive pronoun must find its antecedent within some domain of locality that it's contained in, and *Patricia* is outside that domain. In LFG, it is usual to define the relevant domain of locality at f-structure, and in this particular case the domain is the minimal SUBJ-containing f-structure (the 'minimal complete nucleus'). This idea can be encoded formally by giving *herself* the (partial) lexical entry shown in (2), adapted[2] from Dalrymple (1993) and Dalrymple et al. (1999), where the final line gives the lexical semantics of the pronoun in Glue Semantics (henceforth Glue).

(2) *herself* NP

$$(\uparrow \text{PRED}) = \text{`herself'}$$
$$\%A = ((\underset{\neg(\rightarrow\ \text{SUBJ})}{\text{GF*}}\ \ \text{GF}\uparrow)\ \text{GF})$$
$$\lambda x(x, x) : \%A \multimap (\%A \otimes \uparrow)$$

What is crucial to see is that, on this account, the locality condition on antecedence for the reflexive pronoun is enforced by the off-path constraint $\neg(\rightarrow$ SUBJ), so in the f-structure for (1) shown in (3), $\%A$ can't resolve to g because the path (f COMP OBJ) fails to satisfy the off-path constraint since (f COMP) ($= h$) has a subject.

(3)
$$f : \begin{bmatrix} \text{PRED} & \text{`think'} \\ \text{SUBJ} & g : \begin{bmatrix} \text{PRED} & \text{`Patricia'} \end{bmatrix} \\ \text{COMP} & h : \begin{bmatrix} \text{PRED} & \text{`trust'} \\ \text{SUBJ} & i : \begin{bmatrix} \text{PRED} & \text{`Martha'} \end{bmatrix} \\ \text{OBJ} & j : \begin{bmatrix} \text{PRED} & \text{`herself'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

With respect to an example like (1), the contribution of the present paper is to eliminate the need for the off-path constraint in favour of an account that rules out the interpretation paraphrased in (1-b) at the level of meaning composition. 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, which, in turn, opens up the possibility of using ideas and techniques from categorial grammar. In this paper, I will adapt the analysis of Morrill (1990) of the clause-boundedness of expressions like *herself* to Glue, in terms of an extra, semantically-motivated, connective in the fragment of lin-

[2] One major change is that I'm use a local name instead of the s-structure attribute ANTECEDENT, because I won't be assuming s-structures at all in this paper and instead will give Glue entries based on f-structure labels. This change should not be crucial for anything that follows.

	Elimination	Introduction
$\multimap$	$\dfrac{\begin{array}{c}\vdots \\ f : A \multimap B\end{array} \quad \begin{array}{c}\vdots \\ a : A\end{array}}{f(a) : B} \multimap_E$	$\dfrac{\begin{array}{c}[v : A]^n \\ \vdots \\ f : B\end{array}}{\lambda v.f : A \multimap B} \multimap_{I,n}$ Exactly one hypothesis discharged.
$\otimes$	$\dfrac{\begin{array}{c}\vdots \\ x : A \otimes B\end{array} \quad \begin{array}{c}[a : A]^m \; [b : B]^n \\ \vdots \\ c : C\end{array}}{c[\pi_1(x)/a][\pi_2(x)/b] : C} \otimes_{E,m,n}$	$\dfrac{\begin{array}{c}\vdots \\ a : A\end{array} \quad \begin{array}{c}\vdots \\ b : B\end{array}}{(a, b) : A \otimes B} \otimes_I$
$\Box$	$\dfrac{\begin{array}{c}\vdots \\ f : \Box X\end{array}}{{}^{\vee}f : X} \Box_E$	$\dfrac{\begin{array}{c}\vdots \\ f : X\end{array}}{{}^{\wedge}f : \Box X} \Box_I$ Provided that every path back to an open premise includes an independent sub-proof of a $\Box$-formula.

Figure 1: Rules of inference

ear logic used. The result is that no proof that would generate the interpretation paraphrased in (1-b) is derivable.

3 Accounting for the locality effect in Glue

3.1 Logic

The rules of inference for the fragment of linear logic to be used in the Glue implementation are given in Figure 1 in tree-style natural deduction format, along with term assignments in the meaning representation language.[3] In a fuller fragment, some form of quantification would be added as well, but it will not be necessary for this paper.

The idea, following Montague (1973), is that the interpretation of an expression of the meaning language (here, intensional lambda calculus) is taken relative to a possible world $w \in W$, and that in this sense $^{\wedge}$ expresses intensionalization and $^{\vee}$

[3] Some people might find it more transparent to see the rules for $\Box$ stated in the sequent calculus:

$$\frac{\Gamma, f : A \vdash g : B}{\Gamma, h : \Box A \vdash g[{}^{\vee}h/f] : B} \Box_L \qquad \frac{\Box\Gamma \vdash f : A}{\Box\Gamma \vdash {}^{\wedge}f : \Box A} \Box_R$$

where Γ is a multiset of formulae and $\Box\Gamma$ is a multiset of $\Box$-formulae (formulae that have $\Box$ as their main connective).

expresses extensionalization, as defined in (4).

(4) For any term x and any type τ:

a. $s{\rightarrow}\tau$ is a type.

b. If $x :: \tau$ then ${}^\wedge x :: s{\rightarrow}\tau$, and $[\![{}^\wedge x]\!]^w =$ the function f such that for any $w' \in W$, $f(w') = [\![x]\!]^{w'}$.

c. If $x :: s{\rightarrow}\tau$ then ${}^\vee x :: \tau$, and $[\![{}^\vee x]\!]^w = [\![x]\!]^w(w)$.

The side condition on the $\Box$-introduction rule shown in Figure 1 is perhaps a little complicated, but for the cases to be discussed in this paper it can be adequately (over)simplified as 'Provided that every premise on which X depends is a $\Box$-formula'.[4] Together, these rules give $\Box$ the behaviour of necessity in S4 modal logic. It also has the same right (promotion) and left (dereliction) rules that ! has in standard linear logic—without the structural rules that ! has, of course (Moortgat, 2011, 136–138).

3.2 Implementation

Given that the semantic effect of $\Box$ is intensionalization, we expect that at the level of meaning composition in Glue, some expressions will be required to combine with $\Box$-formulae, for example, verbs that take a propositional complement like *think*. This is reflected in the skeleton lexicon for (1) shown in (5) which, for example, gives think the type $s{\rightarrow}((e{\times}(s{\rightarrow}t)){\rightarrow}t)$. (5) also shows how the labels are resolved when instantiated as shown in the f-structure (3).

(5)
$$\begin{array}{lll}
\textit{Patricia} & \rightsquigarrow & {}^\wedge\mathsf{p} : \Box\uparrow \\
 & \Rightarrow & {}^\wedge\mathsf{p} : \Box g \\
\textit{thinks} & \rightsquigarrow & \mathsf{think} : \Box(((\uparrow \textsc{subj}) \otimes \Box(\uparrow \textsc{comp})) \multimap \uparrow) \\
 & \Rightarrow & \mathsf{think} : \Box((g \otimes \Box h) \multimap f) \\
\textit{Martha} & \rightsquigarrow & {}^\wedge\mathsf{m} : \Box\uparrow \\
 & \Rightarrow & {}^\wedge\mathsf{m} : \Box i \\
\textit{trusts} & \rightsquigarrow & \mathsf{trust} : \Box(((\uparrow \textsc{subj}) \otimes (\uparrow \textsc{obj})) \multimap \uparrow) \\
 & \Rightarrow & \mathsf{trust} : \Box((i \otimes j) \multimap h)
\end{array}$$

For *herself* I propose the lexical entry shown in (6). On the syntax side, the

[4]That the simplified condition is inadequate can be seen from the example deduction below, which is invalid according to the simplified condition but valid according to the official condition.

$$\dfrac{\dfrac{\dfrac{a \multimap \Box b \quad a}{\Box b}\multimap_E \qquad \dfrac{\Box(\Box b \multimap c)}{\Box b \multimap c}\Box_E}{c}\multimap_E}{\Box c}\Box_I$$

Neither of the premises $a \multimap \Box b$ or a is a $\Box$-formula, but from them $\Box b$ is derived.

$$\cfrac{\cfrac{\mathsf{trust} : \Box((i \otimes j) \multimap h)}{{}^{\vee}\mathsf{trust} : (i \otimes j) \multimap h}\,\Box_E \qquad \cfrac{\cfrac{{}^{\wedge}\mathsf{m} : \Box i}{\mathsf{m} : i}\,\Box_E \quad [x : j]^1}{(\mathsf{m}, x) : i \otimes j}\,\otimes_I}{\cfrac{{}^{\vee}\mathsf{trust}(\mathsf{m}, x) : h}{* * *}\,\Box_I}\,\multimap_E$$

Figure 2: An unsuccessful attempted derivation of ${}^{\vee}\mathsf{think}(\mathsf{p}, {}^{\wedge}({}^{\vee}\mathsf{trust}(\mathsf{m}, \mathsf{p})))$

sole difference from 2 is the lack of an off-path constraint, as discussed above.

(6) *herself* NP

$\%A = ((\text{GF}^{+} \uparrow)\ \text{GF})$

${}^{\wedge}(\lambda x(x, x)) : \Box(\%A \multimap (\%A \otimes \uparrow))$

This time, the functional description alone does not rule out the resolution $\%A := g$, identifying the antecedent of *herself* with *Patricia*. However, that identification is ruled out at the level of Glue in that no linear logic proof of a type-t conclusion can be constructed given the premises that result from making that identification. Two failed attempts to derive such a conclusion are shown in Figures 2 and 3. The attempt shown in Figure 2 fails because $\Box$ introduction is not valid: the path back to the open premise $x : j$ does not contain an independent sub-proof of a $\Box$-formula. The attempt shown in 3 fails because $\otimes$ elimination is not valid, since j was not hypothesized ($\Box j$ was). Meanwhile, given the resolution $\%A := i$, whereby the antecedent of *herself* is identified with *Martha*, a type-t conclusion *is* derivable. This is shown in Figure 4.

4 Another case of locality corresponding to opacity

A crucial factor in the account presented in Section 3.2 is that $\Box$-introduction is required in order to derive any interpretation of (1-b), because semantically the verb *think* selects for a proposition (not just a truth value) as its complement, and so the interpretation of the embedded clause must be intensionalized, which corresponds to $\Box$-introduction on the linear logic side. On this account, then, the relevant domain of locality for *herself* is defined semantically, as a proposition. A proposition naturally corresponds syntactically to a minimal complete nucleus at f-structure, and so it is not surprising that the domain of locality should be definable in that way as well.

The account also relies on the lexical semantics given to the reflexive pronoun in Glue; if, instead of (6), it had the lexical semantics shown in 7, then it *would* be able to take an antecedent outside the minimal proposition containing it (the interested reader is invited to check that the strategy pursued in Figure 3 would succeed in this case). This point will become important when we consider other domains of locality.

(7) ${}^{\wedge}(\lambda x(x, {}^{\wedge}x)) : \Box(\%A \multimap (\%A \otimes \Box\uparrow))$

$$
\dfrac{
\dfrac{
\dfrac{{}^\wedge(\lambda x(x,x)) : \Box(g \multimap (g \otimes j))}{\lambda x(x,x) : g \multimap (g \otimes j)}\,\Box_E
\quad
\dfrac{{}^\wedge\mathsf{p} : \Box g}{\mathsf{p} : g}\,\Box_E
}{(\mathsf{p},\mathsf{p}) : g \otimes j}\,\multimap_E
\quad
\dfrac{
\dfrac{\mathsf{think} : \Box((g \otimes \Box h) \multimap f)}{{}^\vee\mathsf{think} : (g \otimes \Box h) \multimap f}\,\Box_E
\quad
\dfrac{
[y : g]^2
\quad
\dfrac{
\dfrac{
\dfrac{\mathsf{trust} : \Box((i \otimes j) \multimap h)}{{}^\vee\mathsf{trust} : (i \otimes j) \multimap h}\,\Box_E
\quad
\dfrac{
\dfrac{{}^\wedge\mathsf{m} : \Box i}{\mathsf{m} : i}\,\Box_E
\quad
\dfrac{[\chi : \Box j]^1}{{}^\vee\chi : j}\,\Box_E
}{(\mathsf{m}, {}^\vee\chi) : i \otimes j}\,\otimes_I
}{{}^\vee\mathsf{trust}(\mathsf{m}, {}^\vee\chi) : h}\,\multimap_E
}{{}^\wedge({}^\vee\mathsf{trust}(\mathsf{m}, {}^\vee\chi)) : \Box h}\,\Box_I
}{(y, {}^\wedge({}^\vee\mathsf{trust}(\mathsf{m}, {}^\vee\chi))) : g \otimes \Box h}\,\otimes_I
}{{}^\vee\mathsf{think}(y, {}^\wedge({}^\vee\mathsf{trust}(\mathsf{m}, {}^\vee\chi))) : f}\,\multimap_E
}{***}\,\otimes_{E\ 2,1}
$$

Figure 3: Another unsuccessful attempted derivation

$$
\dfrac{
\dfrac{\mathsf{think} : \Box((g \otimes \Box h) \multimap f)}{{}^\vee\mathsf{think} : (g \otimes \Box h) \multimap f}\,\Box_E
\quad
\dfrac{
\dfrac{{}^\wedge\mathsf{p} : \Box g}{\mathsf{p} : g}\,\Box_E
\quad
\dfrac{
\dfrac{
\dfrac{\mathsf{trust} : \Box((i \otimes j) \multimap h)}{{}^\vee\mathsf{trust} : (i \otimes j) \multimap h}\,\Box_E
\quad
\dfrac{
\dfrac{{}^\wedge(\lambda x(x,x)) : \Box(i \multimap (i \otimes j))}{\lambda x(x,x) : i \multimap (i \otimes j)}\,\Box_E
\quad
\dfrac{{}^\wedge\mathsf{m} : \Box i}{\mathsf{m} : i}\,\Box_E
}{(\mathsf{m},\mathsf{m}) : i \otimes j}\,\otimes_I
}{{}^\vee\mathsf{trust}(\mathsf{m},\mathsf{m}) : h}\,\multimap_E
}{{}^\wedge({}^\vee\mathsf{trust}(\mathsf{m},\mathsf{m})) : \Box h}\,\Box_I
}{(\mathsf{p}, {}^\wedge({}^\vee\mathsf{trust}(\mathsf{m},\mathsf{m}))) : g \otimes \Box h}\,\otimes_I
}{{}^\vee\mathsf{think}(\mathsf{p}, {}^\wedge({}^\vee\mathsf{trust}(\mathsf{m},\mathsf{m}))) : f}\,\multimap_E
$$

Figure 4: Successful derivation of ${}^\vee\mathsf{think}(\mathsf{p}, {}^\wedge({}^\vee\mathsf{trust}(\mathsf{m},\mathsf{m})))$

4.1 The Østfold Norwegian data

The correspondence between semantically and syntactically-definable domains when considering (1) invites the question: are there any examples of a semantically-definable domain that is relevant for binding constraints and that doesn't obviously correspond to a syntactically-definable domain? Stausland Johnsen (2009, 103) contends that the answer to this question is 'yes', specifically that

> In Østfold Norwegian, (ØN), the 3. person reflexive *seg* can be bound out of a tenseless complement clause.

Here, 'tenseless' is to be understood as a semantic property. In particular, Stausland Johnsen (2009) argues that for ØN the relevant constraint in this case is not finiteness, as is claimed by Hellan (1988). As evidence, he offers the contrasts shown in (8) and (9) below, for finite and non-finite complements respectively.

(8) a. *Reven$_i$ sa/trudde/frykta at noen jakta på seg$_i$
the fox said/believed/feared that someone chased on REFL
'The fox said/believed/feared that someone was hunting him.'

b. Reven$_i$ hørte/så/lukta at noen jakta på seg$_i$
the fox heard/saw/smelled that someone chased on REFL
'The fox heard/saw/smelled that someone was hunting him.'

(9) a. *Læreren$_i$ ba elevene stå bak seg$_i$
the teacher told the students stand.INF behind REFL
'The teacher told the students to stand behind him.'

b. Læreren$_i$ lot elevene stå bak seg$_i$
the teacher let the students stand.INF behind REFL
'The teacher allowed the students to stand behind him.'

The surface observation is that whether or not *seg* can be bound from outside its minimal clause depends on the verb embedding that clause, and not the finiteness or otherwise of that clause; contrary to Hellan's generalizations, in (8-b) *seg* can be bound from outside a finite clause containing it, and in (9-a) *seg* cannot be bound from outside a non-finite clause containing it. Furthermore, the generalization can be made that the verbs that allow a *seg* in their complement to be bound from outside it are exactly those verbs that select a semantically tenseless complement, in the sense that the complement cannot 'carry temporal reference non-overlapping with the matrix' (Wiklund, 2007, 39). See (Stausland Johnsen, 2009, §4.1) for the relevant evidence for finite complements and (Wiklund, 2007, Chapter 3) for non-finite complements.

4.2 Extending the logic

To handle the semantics of temporality, we will take interpretations of expressions relative to a time $t \in T$ in addition to a possible world as characterized in (4).

In this sense, $^\blacktriangle$ expresses intensionalization and $^\blacktriangledown$ expresses extensionalization, as defined in (10).

(10) For any term x and any type τ:

a. $i{\rightarrow}\tau$ is a type.

b. If $x :: \tau$ then $^\blacktriangle x :: i{\rightarrow}\tau$, and $[\![^\blacktriangle x]\!]^t =$ the function f such that for any $t' \in W$, $f(t') = [\![x]\!]^{t'}$.

c. If $x :: i{\rightarrow}\tau$ then $^\blacktriangledown x :: \tau$, and $[\![^\blacktriangledown x]\!]^t = [\![x]\!]^t(t)$.

In Glue, we add another unary connective to the linear logic fragment to handle int/extensionalization with respect to times: $\blacksquare$. The rules of inference for this connective are the same as those for $\Box$; they are shown (along with term assignments) in (11).

(11)

$\blacksquare$-elimination	$\blacksquare$-introduction
$\dfrac{\stackrel{\vdots}{f : \blacksquare X}}{^\blacktriangledown f : X}\ \blacksquare_E$	$\dfrac{\stackrel{\vdots}{f : X}}{^\blacktriangle f : \blacksquare X}\ \blacksquare_I$ Provided that every path back to an open premise includes an independent sub-proof of a $\blacksquare$-formula.

The crucial elements of the analysis of ØN *seg* to be presented here are that:

- Meaning constructors introducing temporal operators require arguments of type $i{\rightarrow}t$, which means that in Glue they require $\blacksquare$-formulae. This follows from the semantic definitions of the meaning language.
- Verbs like *å be* 'to request' project a temporal operator onto their complement clause, whereas verbs like *å se* 'to see' don't. This operationalizes the claim that *å be* requires its complement to be semantically tensed, while *å se* requires its complement to be semantically tenseless, and also implements (for *å be* and verbs like it) the suggestion from Stowell (1982) that some infinitive clauses are semantically marked for (something like) future tense.[5]
- The lexical semantics of *seg* is such that it can escape the embedding induced by $\Box$, but not that induced by $\blacksquare$. This is a stipulation.

The result is that the temporal operator projected by verbs like *å be* acts as a 'trap' that prevents *seg* from 'escaping' from the embedded clause.

[5]This future tense marking is not explicit in the notation given. We can make it explicit by defining the term tell like this:

$$\mathsf{tell} \stackrel{\text{def}}{=} {}^{\wedge\blacktriangle}(\lambda a.{}^{\blacktriangledown\vee}\mathsf{tell}_*(\pi_1(a), \pi_1(\pi_2(a)), {}^\wedge(\lambda x.\mathbf{F}({}^{\blacktriangledown\vee}\pi_2(\pi_2(a))(x)))))$$

Concretely, suppose that we have the f-structure shown in (12) and the skeleton lexical entries shown in (13)–(14), which are instantiated as shown based on the f-structure labels in (12).[6]

(12)
$$f:\left[\begin{array}{ll} \mathrm{PRED} & \text{‘tell’/‘let’} \\ \mathrm{SUBJ} & g:\text{“the teacher”} \\ \mathrm{OBJ} & h:\text{“the students”} \\ \mathrm{XCOMP} & i:\left[\begin{array}{ll} \mathrm{PRED} & \text{‘stand’} \\ \mathrm{SUBJ} & \\ \mathrm{OBL}_{\mathrm{LOC}} & j:\left[\begin{array}{ll}\mathrm{PRED} & \text{‘behind’} \\ \mathrm{OBJ} & k:\text{“seg”}\end{array}\right]\end{array}\right]\end{array}\right]$$

(13) *læreren* $\rightsquigarrow$ ${}^{\wedge\blacktriangle}\mathsf{t} : \Box\blacksquare\uparrow$
$\Rightarrow\ \Box\blacksquare g$

lot $\rightsquigarrow$ let :
$\Box\blacksquare(((\uparrow \mathrm{SUBJ}) \otimes ((\uparrow \mathrm{OBJ}) \otimes \Box((\uparrow \mathrm{XCOMP\ SUBJ}) \multimap (\uparrow \mathrm{XCOMP})))) \multimap \uparrow)$
$\Rightarrow\ \Box\blacksquare((g \otimes (h \otimes \Box(h \multimap i))) \multimap f)$
${}^{\wedge\blacktriangle}(\lambda p.\mathbf{P}({}^{\blacktriangledown}p)) : \Box\blacksquare(\blacksquare\uparrow \multimap \uparrow)$
$\Rightarrow\ \Box\blacksquare(\blacksquare f \multimap f)$

ba $\rightsquigarrow$ tell :
$\Box\blacksquare(((\uparrow \mathrm{SUBJ}) \otimes ((\uparrow \mathrm{OBJ}) \otimes \Box\blacksquare((\uparrow \mathrm{XCOMP\ SUBJ}) \multimap (\uparrow \mathrm{XCOMP})))) \multimap \uparrow)$
$\Rightarrow\ \Box\blacksquare((g \otimes (h \otimes \Box\blacksquare(h \multimap i))) \multimap f)$
${}^{\wedge\blacktriangle}(\lambda p.\mathbf{P}({}^{\blacktriangledown}p)) : \Box\blacksquare(\blacksquare\uparrow \multimap \uparrow)$
$\Rightarrow\ \Box\blacksquare(\blacksquare f \multimap f)$

studentene $\rightsquigarrow$ ${}^{\wedge\blacktriangle}\mathsf{s} : \Box\blacksquare\uparrow$
$\Rightarrow\ \Box\blacksquare h$

stå $\rightsquigarrow$ $\mathsf{stand} : \Box\blacksquare(((\uparrow \mathrm{SUBJ}) \otimes (\uparrow \mathrm{OBL}_{\mathrm{LOC}})) \multimap \uparrow)$
$\Rightarrow\ \Box\blacksquare((h \otimes j) \multimap i)$

bak $\rightsquigarrow$ $\mathsf{behind} : \Box\blacksquare((\uparrow \mathrm{OBJ}) \multimap \uparrow)$
$\Rightarrow\ \Box\blacksquare(k \multimap j)$

(14) *seg* NP
$\%A = ((\mathrm{GF}^{+}\uparrow)\ \mathrm{GF})$
${}^{\wedge\blacktriangle}(\lambda y(y, {}^{\wedge}y)) : \Box\blacksquare(\%A \multimap (\%A \otimes \Box\uparrow))$
$\Rightarrow\ \Box\blacksquare(g \multimap (g \otimes \Box f))$

Note that the lexical entry for *ba* requires its complement to be $\blacksquare$-marked as well as $\Box$-marked. Where (with *lot*) only $\Box$-marking is required, e.g. in the interpretation of (9-b), it is possible to derive an interpretation in which *seg* is bound to

[6]For simplicity's sake, the definite descriptions have been represented as constants.

læreren, as shown in Figure 5. Where $\blacksquare$-marking is required, e.g. in the interpretation of (9-a), it is not possible to derive such an interpretation. One attempt to do so is shown in Figure 6, which is analogous to the failed attempted derivation of (1-b) shown in Figure 2, in that it fails because $\blacksquare$ introduction is not valid: the path back to the open premise $v : \Box k$ does not contain an independent sub-proof of a $\blacksquare$-formula. Assuming a linear logic hypothesis of the form $\blacksquare k$ or $\Box\blacksquare k$ instead of $\Box k$ would also fail, this time in way analogous to the failed attempted derivation of (1-b) shown in Figure 3.

5 Conclusion

In this paper I have shown that certain positive binding constraints can be stated in Glue, following on from Morrill's analysis in a a categorial grammar setting. That analysis, in turn, is at least partly based on Hepple's treatment of extraction islands. Hepple (1990), though, does not give his unary connectives the semantic interpretation in terms of intensionalization presented here; in fact, for him they are semantically inert.

A semantically inert modality is likewise possible in Glue, and/or we could have (like Hepple) a family of modalities with an inclusion relation among them to model different kinds of locality conditions. In an LFG setting, however, there is no obvious motivation that I can see for approaching binding constraints from Glue unless, as is the case for the examples considered in this paper, the modalities used are semantically motivated, because binding theory on the basis of f-structure is so well-developed. However, it may well be worth considering a Glue approach to other constraints on interpretation, for example constraints on quantifier scope, which are comparatively much less-widely discussed in LFG. I leave this to future research.

Figure 5: Interpretation of (9-b) with long-distance binding

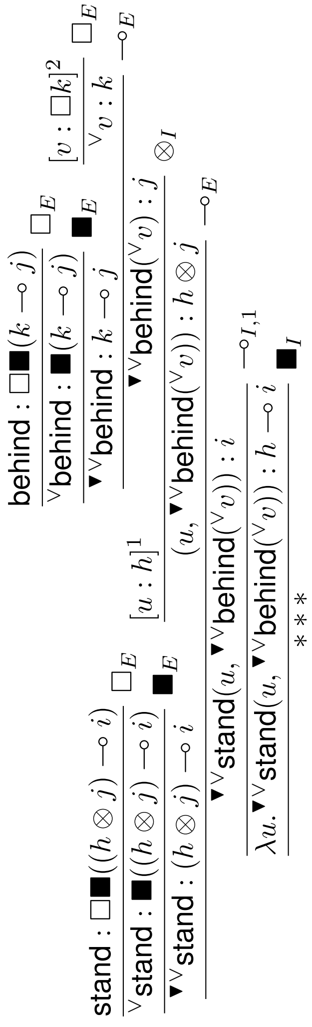

Figure 6: A failed attempt to derive an interpretation of (9-a) with long-distance binding

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