

# Thematic Uniqueness and Resource Accounting

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## 1 Introduction

- This talk is based on joint work with Ida Toivonen (Asudeh and Toivonen 2007, 2012).
- Event semantics provides a useful perspective on thematic roles, in which thematic roles are relations between events and the individuals involved in the event (Parsons 1990).

(1) John kicked Bill.

(2)  $\exists e.kick(e) \wedge AGENT(e, john) \wedge PATIENT(e, bill)$   
[relational representation]

(3)  $\exists e.kick(e) \wedge AGENT(e) = john \wedge PATIENT(e) = bill$   
[equative representation]

- Carlson (1984: 271):

There are apparent constraints on thematic roles that we are hard pressed to attribute to the structure of the real world ... One of the more fundamental constraints is that of ‘thematic uniqueness’ — that no verb seems to be able to assign the same thematic role to two or more of its arguments.

(4) John stouched Bill.  
(Intended meaning: John and Bill were touched. John and Bill are both *patients* of the stouching.)

(5) John skicked Bill’s leg Bill’s shin.  
(Intended meaning: John kicked Bill on the shin part of his leg. Bill’s leg and Bill’s shin are both *locations* of the skicking.)

Carlson continues:

Clearly, such events DO exist if any exist at all, but for some reason we are not allowed to TALK about them in that way. And it seems to have nothing to do with the nature of ‘reality’. A system that did not observe thematic uniqueness would be easily definable ... (emphasis in original)

- The uniqueness of thematic roles *qua* event participants, which Carlson refers to as ‘thematic uniqueness,’ is standardly characterized, in semantic theory, in terms of model theory: thematic roles are defined as partial functions from eventualities to individuals. If a thematic role is a function, it could not map from the same event to more than one individual.

(6) **Unique Role Requirement**

If a thematic role is specified for an event, it is uniquely specified.  
(Landman 2000: 38)

(7) John stouched Bill.

$\Downarrow \exists e.stouch(e) \wedge PATIENT(e) = john \wedge PATIENT(e) = bill$

(8) John skicked Bill’s leg Bill’s shin.

$\Downarrow \exists e.skick(e) \wedge AGENT(e) = john \wedge$   
 $LOCATION(e) = leg-of(bill) \wedge LOCATION(e) = shin-of(bill)$

- **This talk:**

- Model-theoretic uniqueness is insufficient
- A purely syntactic alternative is also insufficient
- Evidence: copy raising in English and Swedish, particularly a certain feature of the latter.

- **Main proposal:** Thematic uniqueness can be adequately captured *proof-theoretically*, in resource-sensitive semantic composition.

## 2 Copy Raising

- Copy raising: a raising verb takes a non-expletive subject and a complement containing an obligatory pronominal ‘copy’ of the subject (some early references are Rogers 1974, Postal 1974, Joseph 1976; see Asudeh 2002, 2004, 2012, for further references).

- (9) a. Thora seems like she’s found the chocolate.  
b. \*Thora seems like Fred’s found the chocolate.

- (10) a. Thora verkar som om hon har hittat chokladen. *Swedish*  
T. seems as if she has found chocolate.the  
‘Thora seems like she has found the chocolate.’  
b. \* Thora verkar som om Fred har hittat chokladen.  
T. seems as if F. has found chocolate.the

- (11) Thora seems/appears like/as if/as though she adores ice cream.

- (12) Thora verkar som om hon gillar glass.  
T. seems as if she likes ice.cream.  
‘Thora seems as if she likes ice cream.’

- Standard subject-to-subject raising: infinitival complement, expletive alternant

- (13) a. Thora seems to have found the chocolate.  
b. Thora verkar ha hittat chokladen.  
T. seems have.INF found chocolate.the  
‘Thora seems to have found the chocolate.’

- (14) a. It seems that Thora has found the chocolate.  
b. Det verkar som om Thora har hittat chokladen.  
it seems as if T. has found chocolate.the  
‘It seems as if Thora has found the chocolate.’

- The copy raising subcategorization of *seem/appear* also has an expletive alternant.

- (15) a. Thora seems like she adores ice cream.  
b. It seems like Thora adores ice cream.

- (16) a. Thora verkar som om hon gillar glass.  
T. seems as if she likes ice cream.  
‘Thora seems like she likes ice cream.’  
b. Det verkar som om Thora gillar glass.  
it seems as if T. likes ice cream  
‘It seems like Thora likes ice cream.’

This is evidence that the subject of the copy raising verb is non-thematic: i.e., a non-expletive copy raising subject is not a true argument of the copy raising verb, just as in standard subject-to-subject raising.

## 2.1 Perceptual Resemblance Verbs

- *Perceptual resemblance verbs* are related to copy raising, but do not require a copy pronoun.
  - (17) a. Thora smells/looks/sounds/feels/tastes like/as if/as though she has been baking sticky buns.
  - b. It smells/looks/sounds/feels/tastes like/as if/as though Thora has been baking sticky buns.
  - c. Thora smells/looks/sounds/feels/tastes like/as if/as though Chris has been baking sticky buns.
- I will set these aside for the remainder of the talk. See Asudeh and Toivonen (2012) for further discussion.

## 2.2 Variation in Copy Raising

- We conducted surveys of copy raising in Dutch, English, German, and Swedish.<sup>1</sup> I report only the English and Swedish results here.
- The surveys asked for grammaticality judgements, on a forced three-point scale (can be said/cannot be said/don't know), for the following kinds of sentences, presented without context, mixed with grammatical and ungrammatical fillers:
  - (18) It seems like Harry fell.
  - (19) Alfred seems like he hurt Thora.
  - (20) Alfred seems like Madeline claimed that he hurt Thora.
  - (21) Alfred seems like Thora hurt him.
  - (22) Alfred seems like Thora's hurt.
- The survey results are summarized in Tables 1 and 2. I do not attempt to account for the variation here (see Asudeh 2012).
- English: 93% of speakers who allowed a non-expletive matrix subject with the copy raising verb, i.e. setting aside Dialect A, required a copy pronoun in the complement.
- Swedish: 58% of speakers who allowed a non-expletive matrix subject with the copy raising verb, i.e., setting aside Dialect A, required a copy pronoun in the complement.

Example	Dialect			
	A	B	C	D
It seems like Harry fell.	✓	✓	✓	✓
Alfred seems like he hurt Thora.	*	✓	✓	✓
Alfred seems like Madeline claimed that he hurt Thora.	*	*	✓	✓
Alfred seems like Thora hurt him.	*	*	✓	✓
Alfred seems like Thora's hurt.	*	*	*	✓

Table 1: Grammaticality patterns for copy raising

	English (n = 110)	Swedish (n = 39)	Description
Dialect A	6.35%	7.7%	No copy raising subcategorization with non-expletive matrix subject
Dialect B	45.1%	28.2%	True copy raising I — copy pronoun must be highest subject in complement of <i>like/as</i>
Dialect C	42.2%	25.6%	True copy raising II — copy pronoun not necessarily highest subject
Dialect D	6.35%	38.5%	Copy raising subcategorization with non-expletive matrix subject and no copy pronoun in complement

Table 2: Variation for English copy raising

<sup>1</sup>The surveys were designed and the data were collected and compiled by Ida Toivonen, Ilka Ludwig, Anna Pucilowski, Marie-Elaine van Egmond, and me.

### 2.3 A Puzzle

- Context 1:  
John and Bill walk into Tom's kitchen. Tom is at the stove doing something, but exactly what is a little unclear. John says to Bill ...
  - (23) ✓ It seems that Tom is cooking.
  - (24) a. ✓ Tom seems to be cooking.  
b. ✓ Tom verkar laga mat.  
T. seems make.INF food
  - (25) a. ✓ It seems like Tom's cooking.  
b. ✓ Det verkar som om Tom lagar mat.  
it seems as if T. makes food  
'It seems as if Tom's cooking.'
  - (26) a. ✓ Tom seems like he's cooking.  
b. ✓ Tom verkar som om han lagar mat.  
T. seems as if he makes food  
'Tom seems as if he's cooking.'
- Context 2: John and Bill walk into Tom's kitchen. There's no sign of Tom, but there are various things bubbling away on the stove and there are several ingredients on the counter, apparently waiting to be used. John says to Bill ...
  - (27) ✓ It seems that Tom is cooking.
  - (28) a. ✓ Tom seems to be cooking.  
b. ✓ Tom verkar laga mat.  
T. seems make.INF food
  - (29) a. ✓ It seems like Tom's cooking.  
b. ✓ Det verkar som om Tom lagar mat.  
it seems as if T. makes food  
'It seems as if Tom's cooking.'
  - (30) a. #Tom seems like he's cooking.  
b. # Tom verkar som om han lagar mat.  
T. seems as if he makes food  
'Tom seems as if he's cooking.'
- This is *the puzzle of the absent cook*.

### 2.4 Another Puzzle

- Swedish has thus far patterned like English.
  - (31) \* Tom verkar som om Kalle har vunnit.  
T. seems as if K. has won

- Swedish *verka* allows a type of expression that is not available in English.

(32) Det verkar på Tom som om han har vunnit.  
 it seems on T. as if he has won  
 ~ ‘Tom gives the impression that he has won.’

The *på*-PP specifies that the impression that the referent of the pronoun *han* has won originates with Tom. The pronoun is just a regular free pronoun that can refer to Tom or some other entity in the discourse.

It is not specified how Tom gives off this impression: it could be the way he looks or acts, it could be something he said, or it could be something else. The verb *verka* thus allows for a *på*-PP which specifies the *source* of perception (PSOURCE).

For the purpose of this talk, we can think of PSOURCE as analogous to the thematic role STIMULUS (although see Asudeh and Toivonen 2012 for more careful distinctions).

- Examples with *på*-PPs do not require pronouns in their complements; see the following variant of (32):

(33) Det verkar på Tom som om Kalle har vunnit.  
 it seems on T. as if K. has won  
 ~ ‘Tom gives the impression that Kalle has won.’

- The *på*-PP contrasts with the English *to*-PP, which specifies the *goal* of perception (PGOAL; i.e., the perceiver). For the purpose of this talk, we can think of PGOAL as analogous to the thematic role EXPERIENCER (although, again see Asudeh and Toivonen 2012).

(34) It seemed to Tom as if Kalle had won.

- Copy raising is surprisingly not compatible with *på*-PPs.

(35) Tom verkar som om han har vunnit.  
 T. seems as if he has won  
 ‘Tom seems as if he has won.’

(36) \* Tom verkar på Lisa som om han har vunnit.  
 T. seems on L. as if he has won

- The ungrammaticality of (36) is unexpected, as copy raising sentences like (35) are generally considered to be equivalent to expletive sentences like (37), which are grammatical with *på*-PPs, as shown in (38):

(37) Det verkar som om Tom har vunnit.  
 it seems as if T. has won  
 ‘It seems as if Tom has won.’

(38) Det verkar på Lisa som om Tom har vunnit.  
 it seems on L. as if T. has won  
 ~ ‘Lisa gives the impression that Tom has won.’

It is easy to understand what the intended meaning of (36) is: it is the same as that of (38). Yet the example is ungrammatical.

- Why should the PP adjunct be excluded in (36), although it can be included in (38)? This is *the på puzzle*.

### 3 Proposal

- The two puzzles are connected.
- Both puzzles arise due to the linguistic expression of perceptual reports.
- The examples that led to the puzzle of the absent cook are odd because the subject of the copy raising verb is interpreted as the source of perception when it is unavailable to offer perceptual evidence.
- The examples that led to the *på* puzzle are ungrammatical because two distinct linguistic expressions simultaneously specify the source of perception.
- This last point is the key point today: the explanation of the *på* puzzle seems to be that the ungrammatical copy raising + *på*-PP constitutes a violation of thematic uniqueness.

### 4 Outline of the Analysis

- The puzzle of the absent cook

Context

John and Bill walk into Tom's kitchen. There's no sign of Tom, but there are various things bubbling away on the stove and there are several ingredients on the counter, apparently waiting to be used. John says to Bill . . .

(39) #Tom seems like he's cooking.

(40) # Tom verkar som om han lagar mat.  
T. seems as if he makes food  
'Tom seems as if he's cooking.'

Solution: The subject of the copy raising verb is interpreted as the source of perception. The example is not felicitous in a situation where Tom is not perceptually available as the source of the report.

- The *på* puzzle

(41) Tom verkar som om han har vunnit.  
T. seems as if he has won  
'Tom seems as if he has won.'

(42) \* Tom verkar på Lisa som om han har vunnit.  
T. seems on L. as if he has won

Solution: PSOURCE is a partial function on eventualities, such that there cannot be two distinct PSOURCE for a single state or event. In other words, (42) is out for the same reason as the Carlson examples with *stouch* and *skick*.

- Sketch of the formal analysis

(43) John seems to Mary like he's upset.

(44)  $\exists s.seem(s, upset(john)) \wedge PSOURCE(s) = john \wedge PGOAL(s) = mary$

This analysis leaves aside the role of *like*; see Asudeh (2012).



- Example of English and Swedish copy raising

(45) Tom seems like he is laughing.

(46) Tom verkar som om han skrattar.  
T. seems as if he laughs  
'Tom seems like he is laughing.'

$$\begin{array}{c}
 \vdots \\
 \lambda P \lambda x \lambda s. seem(s, P(x)) \wedge \text{PSOURCE}(s) =_{\tau} x \quad \lambda y. \exists e [laugh(e, y) \wedge \text{AGENT}(e) = y] \\
 \hline
 tom \quad \lambda x \lambda s. seem(s, \exists e [laugh(e, x) \wedge \text{AGENT}(e) = x]) \wedge \text{PSOURCE}(s) =_{\tau} x \quad \text{FA} \\
 \hline
 \lambda s [seem(s, \exists e [laugh(e, tom) \wedge \text{AGENT}(e) = tom])] \wedge \text{PSOURCE}(s) =_{\tau} tom \quad \text{FA} \\
 \hline
 \exists s [seem(s, \exists e [laugh(e, tom) \wedge \text{AGENT}(e) = tom])] \wedge \text{PSOURCE}(s) =_{\tau} tom \quad \exists\text{-clos.}
 \end{array}$$

[FA: Functional Application;  $\exists$ -clos.: Existential closure of eventuality]

- Well-formed Swedish *på*-PP example

(47) Det verkar på Tom som om John vann.  
it seems on T. as if J. won  
~'Tom gives the impression that John won.'

$$\begin{array}{c}
 \vdots \\
 tom \quad \lambda x \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_{\tau} x \quad \lambda p \lambda s. seem(s, p) \quad \exists e [win(e, john) \wedge \text{AGENT}(e) = john] \\
 \hline
 \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_{\tau} tom \quad \lambda s. seem(s, \exists e [win(e, john) \wedge \text{AGENT}(e) = john]) \quad \text{FA} \\
 \hline
 \lambda s [seem(s, \exists e [win(e, john) \wedge \text{AGENT}(e) = john])] \wedge \text{PSOURCE}(s) =_{\tau} tom \quad \text{FA} \\
 \hline
 \exists s [seem(s, \exists e [win(e, john) \wedge \text{AGENT}(e) = john])] \wedge \text{PSOURCE}(s) =_{\tau} tom \quad \exists\text{-clos.}
 \end{array}$$

- Ill-formed Swedish *på*-PP example

(48) \* Tom verkar på Robin som om han skrattar.  
T. seems on R. as if he laughs

$$\begin{array}{c}
 \vdots \\
 \lambda s' \lambda P. seem(s', P(tom)) \wedge \text{PSOURCE}(s) =_{\tau} tom \quad \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_{\tau} robin \\
 \hline
 \lambda s \lambda P. seem(s, P(tom)) \wedge \text{PSOURCE}(s) =_{\tau} tom \wedge \text{PSOURCE}(s) =_{\tau} robin \quad \text{FA}
 \end{array}$$

## 5 The Uniqueness Problem

- Model-theoretic uniqueness is inadequate for *på*-PPs: it is too weak.

(49) \* Tom verkar på Robin som om han skrattar.  
 T. seems on R. as if he laughs

If *Tom* and *Robin* are different names for the same individual, then there is no violation of model-theoretic uniqueness.

However, perhaps an intensional or structured approach, such as one that involves guises (Heim 1998), could account for this model-theoretically.

(50) \* Tom verkar på Tom som om han skrattar.  
 T. seems on T. as if he laughs

In this example, no appeal can even be made to a distinction that is due to how reference is made to the individual.

However, it may be that this is a Principle C violation or, once again, perhaps an intensional or structured approach could account for it.

(51) \* Tom verkar på sig själv som om han skrattar.  
 T. seems on him self as if he laughs

The reflexive in this example is not logophoric or special in any way: it must be denotationally equivalent to its antecedent. Yet the sentence is ill-formed despite the denotational equivalence of the subject and the adjunct.

It is unclear how model-theoretic uniqueness could account for (51) without hopelessly complicating the interpretation of reflexives. But surely that is too high a price to pay, unless independently motivated.

- The problem posed by reflexives for model-theoretic uniqueness is in fact revealed in even simpler examples.

(52) \*Tom laughed himself.

(53) \* Tom skrattar sig själv.  
 T. laughs him self  
 ‘Tom laughs himself.’

The intended interpretation of the English example is not one where the reflexive is emphatic. This interpretation is in any case unavailable for the Swedish example, since the emphatic reflexive is just *själv*.

Model-theoretic uniqueness should not have a problem with the following resulting interpretation:

(54)  $\exists e. laugh(e, tom) \wedge \text{AGENT}(e) = tom \wedge \text{AGENT}(e) = tom$

- There may be a syntactic solution to the preceding problem, but such a syntactic solution is still inadequate for *på*-PPs: it is still too weak, and arguably not explanatory.
  - Independent syntactic constraints ought to rule out (52) and (53): Theta Criterion (Chomsky 1981), Completeness and Coherence (Kaplan and Bresnan 1982), Full Interpretation (Chomsky 1995), etc. These are all constraints on proper realization of ‘polyadicity’ (Bresnan 1982b): there are syntactic restrictions on the number of arguments a predicate can occur with.
  - Polyadicity is insufficient, as originally pointed out by Carlson (1984: 272).
    - (55) John tried it with an axe.
    - (56) John opened the present with an ax.
    - (57) John tried to open the present with an ax.
    - (58) \*John tried, with a sharp instrument, to open the present with an ax.

*Try* and *open* can each occur with an instrument, but if *try* controls *open*, only one such occurrence is permitted, even though, as Carlson (1984) observes, “‘an ax’ and ‘a sharp instrument’ could denote the same object.”
- The polyadicity problem can be approached from another direction, given certain assumptions of the Minimalist Program (Chomsky 1995) that have become quite standard in transformational syntax theory. Full Interpretation has been argued to render the Theta Criterion superfluous (Chomsky 1995: 200). If this is the case, then (51), (52), and (53) should only be ungrammatical if they fail to receive a proper interpretation. But if ‘proper interpretation’ is understood as ‘coherent model-theoretic interpretation,’ this is obviously inadequate for the reasons already noted. For example, (52) does receive a full interpretation, namely the one in (54).

- Most importantly, there is a general problem with any appeal to polyadicity to explain the ungrammatical Swedish *på*-PP cases and this problem cuts across all theories. Constraints on polyadicity are constraints on arguments, but the *på*-PP is an *adjunct*.
- The *på*-PP in Swedish copy raising can be deleted, but argument *på*-PPs cannot be deleted.

(59) Det verkade på Jenny som om hon var lite tokig.  
 it seemed on J. as if she was little crazy  
 ‘Jenny seemed as if she was a little crazy.’

(60) Per såg på Jenny som om hon var lite tokig.  
 P. looked on J. as if she was little crazy  
 ‘Per looked at Jenny as if she was a little crazy.’

Example (59) contains a PSOURCE *på*-PP, while example (60) contains an oblique argument in a PP headed by *på*.

The PP in (59) can trivially be left out, as in (61). In contrast, the PP in (60) is obligatory, and excluding it renders the example ungrammatical, as shown in (62).

(61) Det verkade som om hon var lite tokig.  
 it seemed as if she was little crazy  
 ‘It seemed as if she was a little crazy.’

(62) \* Per såg som om hon var lite tokig.  
 P. looked as if she was little crazy

While arguments can sometimes be optional, optionality is a consistent characteristic of adjuncts. The contrast shown in (61–62) is explained under the assumption that the *på*-PP in (59) is an adjunct whereas the *på*-PP in (60) is an argument.

- The complement of an argument *på*-PP can be extracted, but the complement of a copy raising *på*-PP cannot be extracted.

(63) \* Vem verkade det på som om hon var lite tokig?  
 who seemed it on as if she was little crazy

(64) Vem såg Per på som om hon var lite tokig?  
 who looked P. on as if she was little crazy  
 ‘Who did Per look at as if she was a little crazy?’

The NP-complement of the PSOURCE PP in (63) cannot be extracted, but the NP-complement of the argument PP in (64) can.

It is generally possible to extract out of arguments but it is much harder to extract out of adjuncts (Ross 1967), so (63) provides another piece of evidence that the PSOURCE PP of *verka* is an adjunct.

- If the *på*-PP is an adjunct, then constraints on polyadicity should not apply to it, since adjuncts can be freely added and their interpretation is precisely the intersective interpretation that we have seen above.

## 6 Proof-Theoretic Uniqueness

- Full Interpretation, and possibly also syntactic constraints on polyadicity, can be reduced to a proof-theoretic notion of *Resource Sensitivity* (Asudeh 2004, 2012).
- Resource Sensitivity is captured through the use of a resource logic for semantic composition, as in Glue Semantics (Dalrymple 1999, 2001), which uses the resource logic *linear logic* (Girard 1987) for composition. A successful linear logic proof requires each premise to be used exactly once.
- A linguistically useful version, *Linguistic Resource Sensitivity*, is derived by stating a linguistically motivated goal condition on the linear logic proof for semantic composition (Asudeh 2004, 2012). In the absence of such a goal condition, the premises could be properly used up by simply conjoining them all together, but this does not derive a properly composed meaning.
- A typical goal condition in Glue Semantics is the following:

$$(65) \quad \Gamma \vdash \phi : s$$

From a premise set  $\Gamma$ , the goal is to establish an atomic conclusion  $s$  that corresponds to the interpretation of the sentence, represented as  $\phi$ .

- On this view, (52) (*\*Tom laughed himself*) is ill-formed because there are resources contributed by the subject and object, but the verb only consumes the subject resource, illicitly leaving behind the object resource. This is schematized in the following proof ( $\multimap$  is linear implication and  $\otimes$  is linear conjunction):

$$(66) \quad \frac{\frac{\text{SUBJECT} \quad \text{SUBJECT} \multimap \text{VERB}}{\text{VERB}} \quad \text{OBJECT}}{\text{VERB} \otimes \text{OBJECT}}$$

Argument consumption corresponds to implication elimination (modus ponens). The goal condition (65) is not met, since the result is a conjunction, not an atomic term.

- The uniqueness problem can be solved by replacing the model-theoretic version of the uniqueness requirement with a proof-theoretic version. The basic idea is to extend the calculus of argument consumption to PSOURCES, but without treating them as arguments. This is accomplished by embedding the meanings for raising verbs and the *på* adjuncts in a Glue Semantics (Glue) analysis that introduces a PSOURCE resource in the linear logic term for semantic composition. Linguistic Resource Sensitivity will then yield a proof-theoretic uniqueness requirement that works regardless of denotation. This proof-theoretic treatment does not conflict with model-theoretic uniqueness and we will continue to assume that PSOURCES and thematic roles are partial functions.
- The Glue meaning constructor for a standard, expletive-subject raising verb is specified as follows, where the Glue logic terms are represented schematically:

$$(67) \quad \lambda p \lambda s'. \text{seem}(s', p) : \\ \text{COMPLEMENT} \multimap \text{PSOURCE} \multimap \text{EVENT} \multimap \text{RESULT}$$

- The Glue meaning constructor for  $p\hat{a}$  in the adjunct  $p\hat{a}$ -PP in copy raising is specified as follows:

$$(68) \quad \lambda x \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_{\tau} x : \\ \text{OBJECT} \multimap \\ (\text{MODIFIEE'S PSOURCE} \multimap \text{MODIFIEE'S EVENT} \multimap \text{MODIFIEE'S RESULT}) \multimap \\ (\text{MODIFIEE'S EVENT} \multimap \text{MODIFIEE'S RESULT})$$

- First, let us establish that a well-formed  $p\hat{a}$ -PP example gets a valid proof.

$$\begin{array}{c} \vdots \\ \text{raising verb} \quad \text{complement} \\ C \multimap P \multimap E \multimap R \quad C \\ \hline P \multimap E \multimap R \quad \text{p}\hat{a}\text{-PP} \\ (P \multimap E \multimap R) \multimap (E \multimap R) \\ \hline E \multimap R \\ \hline R \quad \exists\text{-clos.} \end{array}$$

- The Glue meaning constructor for the copy raising verb is specified as follows:

$$(69) \quad \lambda x \lambda P \lambda s. \text{seem}(s, P(x)) \wedge \text{PSOURCE}(s) =_{\tau} x : \\ \text{SUBJECT/PSOURCE} \multimap (\text{SUBJECT} \multimap \text{COMPLEMENT}) \multimap \text{EVENT} \multimap \text{RESULT}$$

- If this meaning constructor combines with the  $p\hat{a}$ -PP meaning constructor, there are two possible proofs, but neither terminates properly.

$$\textcircled{1} \quad \begin{array}{c} \vdots \\ \text{subject} \quad \text{CR verb} \quad \text{complement} \\ S \quad S/P \multimap (S \multimap C) \multimap E \multimap R \quad \text{property} \\ \hline (S \multimap C) \multimap E \multimap R \quad S \multimap C \quad \text{p}\hat{a}\text{-PP} \\ \hline E \multimap R \quad (P \multimap E \multimap R) \multimap (E \multimap R) \\ \hline (E \multimap R) \otimes (P \multimap E \multimap R) \multimap (E \multimap R) \end{array}$$

$$\textcircled{2} \quad \begin{array}{c} \vdots \\ \text{CR verb} \quad \text{complement} \\ (S \multimap C) \multimap S/P \multimap E \multimap R \quad \text{property} \\ \hline P \multimap E \multimap R \quad S \multimap C \quad \text{p}\hat{a}\text{-PP} \\ \hline P \multimap E \multimap R \quad (P \multimap E \multimap R) \multimap (E \multimap R) \\ \hline E \multimap R \\ \hline S \otimes (E \multimap R) \end{array}$$

- A  $p\hat{a}$ -PP therefore cannot co-occur with a copy raising verb for proof-theoretic reasons: there are not enough instances of the subject/PSOURCE to satisfy all consumers (the copy raising verb and the adjunct).
- This proof-theoretic treatment of uniqueness is entirely independent of denotations and depends solely on the linear logic terms for semantic composition. Proof-theoretic uniqueness therefore blocks all instances of copy raising with  $p\hat{a}$ -PP adjuncts, including the denotationally equivalent instances, even the particularly pernicious reflexive case.

## 7 Conclusion

- Linear logic proofs are essentially structural representations of the syntax-semantics interface (Asudeh and Crouch 2002a,b).
- Proof-theoretic uniqueness therefore has the desired property of controlling for the linguistic realization of thematic roles through the mapping from syntax to semantics, based on the resources underlying contributions of thematic roles, rather than controlling for denotational equivalence in the model theory.
- The basis for proof-theoretic uniqueness is Linguistic Resource Sensitivity, which controls proper argument consumption by predicates. It is this latter notion that is arguably responsible for blocking cases involving thematic roles that denotational uniqueness lets slip through, in particular unlicensed reflexives.
- The proof-theoretic control on functor-argument combination effected by Linguistic Resource Sensitivity was generalized to PSOURCES by assigning them a resource that must be properly consumed in the proof, although in the model-theoretic semantics they are still not treated as arguments.
- Proof-theoretic uniqueness is thus a stronger condition than model-theoretic uniqueness, although the independence of the two kinds of uniqueness means that there is no conflict between the two and they can be captured simultaneously in one system, as they have been here.

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