

Perception and uniqueness: Evidence from English and Swedish copy raising*

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1 Introduction

Copy raising, shown in (1), has not received nearly as much attention in theoretical linguistics as subject-to-subject raising, shown in (2), which has been a mainstay in the field since Rosenbaum (1967).

(1) Chris seemed like he enjoyed the marathon.

(2) Chris seemed to enjoy the marathon.

For example, in a recent book-length overview of control and raising, copy raising is only mentioned a handful of times (Davies and Dubinsky 2004: 56, 246, 252).

In this paper, we examine copy raising in two closely related Germanic languages, English and Swedish, and offer a formal analysis of its syntax and semantics. We concentrate particularly on the latter aspect and develop a new event semantics analysis of copy raising. In addition to augmenting the body of empirical data on copy raising, we show that far from being a marginal or theoretically uninteresting phenomenon, copy raising yields novel insights into a number of key theoretical issues. It casts new light on the linguistic encoding of perceptual reports, in particular the source of perception, i.e. what it is that gives the speaker the impression that something is the case. Our analysis of perceptual sources in copy raising in turn has consequences for the distinction between arguments / thematic roles and other participants in events and states. In particular, we argue that perceptual sources are not arguments, thus enabling us to deal with otherwise recalcitrant facts. We also use perceptual sources to investigate the requirement that each thematic role must be uniquely realized (Carlson 1984, Chierchia 1984, Landman 2000). The uniqueness requirement has standardly been captured in denotational or model-theoretic terms, but we show that this is empirically inadequate when generalized to perceptual sources and offer a proof-theoretic formulation of uniqueness instead. Along the way, we observe and solve two empirical puzzles. The first concerns a contrast that holds in both Swedish and English between copy raising and subject-to-subject raising in certain contexts. The second concerns the distribution of an adjunct that encodes the source of perception in Swedish.

The paper is organized as follows. In the next section, we provide background information on copy raising in the context of the relevant English and Swedish data. In section 3.1 we observe the two puzzles mentioned above. We present an outline of our analysis and how it solves these puzzles in section 4.

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Lastly, in section 5, we present our formal analysis of the syntax and semantics of copy raising in the two languages. It is also in this section that we show how to capture the uniqueness of eventuality participants proof-theoretically. We show that existing proof-theoretic means for controlling the occurrence of arguments / thematic roles can also control the occurrence and secure the uniqueness of non-argument eventuality participants, namely perceptual sources.

2 Copy raising in English and Swedish

In this section, we review the characteristics of copy raising and illustrate the phenomenon with examples from the two languages of interest, English and Swedish. The key data are largely parallel in the two languages, but there are also some differences, which will be pointed out below.

Copy raising is a phenomenon in which a raising verb takes a non-expletive subject and a complement containing an obligatory pronominal “copy” of the subject:

- (3) a. Tina seems like she’s found the chocolate.
 b. *Tina seems like Fred’s found the chocolate.
- (4) a. Tina verkar som om hon har hittat chokladen.
 T. seems as if she has found chocolate.the
 ‘Tina seems like she has found the chocolate.’
 b. *Tina verkar som om Fred har hittat chokladen.
 T. seems as if F. has found chocolate.the

The (a) examples in (3–4) contain the pronouns *she* and *hon* which are coreferential with the main clause subjects. The (b) examples, however, do not contain coreferential pronouns (“pronominal copies”), and the sentences are ungrammatical.¹

English copy raising was initially noticed by Postal (1974: 268, fn.1) and was also touched on by Rogers (1971, 1973) in work that principally concerned what he called *flip perception verbs* (Rogers 1971, 1972, 1973, 1974). The topic has recently received renewed attention in work by Potsdam and Runner (2001) and Asudeh (2002, 2004). The first detailed investigation of copy raising was Joseph’s (1976) work on Modern Greek, which was subsequently brought to wider attention by Perlmutter and Soames (1979). Copy raising is in fact not typologically uncommon and has been attested in a number of unrelated languages, including Samoan (Chung 1978), Hebrew (Lappin 1984), Irish (McCloskey and Sells 1988), Haitian Creole (Déprez 1992), Igbo (Ura 1998), and Turkish (Moore 1998). Swedish copy raising has not to our knowledge previously been discussed in the literature, but the following example is included in a recent comprehensive reference grammar (Teleman et al. 1999: vol. 4, p.56):²

- (5) Han verkar som om han är lugnare nu.
 he seems as if he is calmer now
 ‘He seems like he is calmer now.’

Teleman et al. point out that the subjects must be coreferential, although they do not discuss the issue further.

Copy raising can be compared to “standard” raising, which has been a central area of investigation in theoretical linguistics for quite some time (Rosenbaum 1967, Postal 1974). An English raising example is given in (6a) and a Swedish example is given in (6b):

¹In both English and Swedish, there are speakers that allow examples like (3b) and (4b). Those speakers arguably have a thematic version of the raising verb, as will be discussed below.

²The example in Teleman et al. (1999) also includes *se ut* (‘look’), which is a perceptual resemblance verb (see below).

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

Raising examples alternate with sentences that have an expletive subject and a finite complement:

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

The finite complementation pattern is a key piece of evidence that the “raised” subject in the infinitival alternant is not an argument of the raising predicate, since the subject can instead be realized as an expletive.

Copy raising is similar to the finite complementation pattern, since it too apparently involves a finite complement:

- (8) Tina seems like / as if / as though she adores ice cream.
 (9) Tina verkar som om hon gillar glass.
 T. seems as if she likes ice.cream.
 ‘Tina seems as if she likes ice cream.’

Asudeh (2002, 2004) argues that the complement to copy raising is in fact not a finite clause, but rather a predicative prepositional phrase, headed by *like* or *as*, which in turn contains a finite complement. He assimilates the syntax of copy raising to predicative raising:

- (10) Kim seems crazy / out of control.
 (11) Kim verkar arg / i toppform.
 K. seems angry / in top.shape
 ‘Kim seems angry / in top shape.’

Despite taking a predicative complement, copy raising does exhibit an alternation between a non-expletive and expletive subject, similar to the alternation between subject-to-subject raising and finite complementation in (6) and (7) above:

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

If the possibility of an expletive subject for finite-complement raising verbs in (7) constitutes evidence that a raised subject is not a thematic argument of the raising verb, then the alternation in (12) and (13) similarly indicates that a copy raising subject is not an argument of the copy raising verb. We will henceforth refer to

examples of a copy raising verb in its expletive-subject alternant, as in (12b) and (13b), simply as ‘expletive examples’.³ We will take care to distinguish *that*-complement cases like (7a) when appropriate.

In English, raising examples alternate with *that*-clauses and copy raising examples alternate with complements introduced by *like* or *as if/though* clauses.⁴ In standard Swedish, however, the complement is always introduced by *som om*. Dialectally, examples such as (14) occur:

- (14) % Det verkar att han har gjort det.
 it seems that he has done it
 ‘It seems that he has done it.’

Since standard Swedish does not allow (14), *att* complements will not be discussed much in this paper.

The fact that copy raising verbs require a pronominal copy of their subject to appear in their predicative complement, as shown in (3–4) and again in (15), lends further support to the conclusion that a non-expletive copy raising subject is not an argument of the matrix verb.

- (15) a. Tina seems like she adores ice cream.
 b. *Tina seems like Fred adores ice cream.

If *Tina* were analyzed as a thematic subject in (15a), the ungrammaticality of (15b) would be mysterious. Asudeh (2002, 2004) provides an analysis of copy raising that assimilates the phenomenon to resumption, as centrally exemplified by resumptive pronouns in unbounded dependencies (McCloskey 1979, Sells 1984). On Asudeh’s analysis, the copy raising subject is not licensed by the copy raising verb and must instead compose in place of the copy pronoun, which is removed from semantic composition by a *manager resource* that is lexically contributed by the copy raising verb.

Asudeh (2002, 2004) observes that the true copy raising verbs in English are *seem* and *appear*, since these are the verbs that require a copy pronoun in their complements. He contrasts these with *perceptual resemblance verbs* (Rogers’s *flip perception verbs*; Rogers 1971, 1972, 1973, 1974): *look*, *sound*, *smell*, *feel*, and *taste*.⁵ The latter do not require a pronoun in their complement, as demonstrated by the following contrast:

- (16) *Tina seems like Chris has been baking sticky buns.
 appears as if
- (17) Tina smells like Chris has been baking sticky buns.
 looks
 sounds
 feels
 tastes

Matters are further complicated by the fact that perceptual resemblance verbs may also occur with an expletive subject, thus exhibiting the alternation in (12) above:⁶

³Although we do not discuss them explicitly, we mean remarks about expletive examples to extend to idiom chunk cases like *The cat seems like it’s out of the bag* (see Potsdam and Runner 2001, Asudeh 2002, 2004).

⁴*As if* and *as though* seem to belong to a slightly higher register than *like*. The latter seems to be preferred in colloquial speech, although there are no doubt also subtle semantic and pragmatic differences between the three forms, which we set aside here. We will principally use only *like* in what follows.

⁵These verbs occur in various other usages, such as the propositional attitude use of *feel* (*I just feel that they’re so uncaring*) or the intransitive use of *smells* (*This shoe smells*). Also, *look* and *sound* can be used with quite bleached meanings in which an appearance or sound is not necessarily involved. In this paper we are only concerned with the uses of these perception verbs with a *like*-complement and in which a sensory modality is involved.

⁶The verbs *feel* and especially *taste* do not allow the expletive variant as easily. Nevertheless, this is not a linguistic constraint, since we have found attested examples in both English and Swedish. The difficulty is rather one of construal, i.e. finding an appropriate context.

(18) Tina looks / sounds / smells / feels / tastes like Chris has been baking sticky buns.

(19) It looks / sounds / smells / feels / tastes like Chris has been baking sticky buns

Asudeh concludes that a non-expletive subject of a perceptual resemblance verb is thematic (i.e., it is an argument of the verb), but that a non-expletive subject of a copy raising verb is non-thematic (i.e., it is not an argument of the verb). He treats perceptual resemblance verbs as ambiguous between a thematic subject reading (when they have a non-expletive subject) and a non-thematic subject reading (when they have an expletive subject). The subject of a copy raising verb is always non-thematic, though.

However, other recent literature proposes that a non-expletive copy raising subject is sometimes thematic (Potsdam and Runner 2001) or even always thematic (Matushansky 2002: 221). Matushansky is not primarily concerned with copy raising and does not argue her position, so we will concentrate on Potsdam and Runner's claims. Potsdam and Runner (2001: 456–458) state that a copy raising subject is thematic in cases where the copy pronoun in the complement is in non-subject position (Potsdam and Runner 2001):

- (20) a. Bill sounds like Martha hit him over the head with the record.
(adapted from Rogers 1973: 97)
- b. Ermintrude looks like the cat got her tongue. (Rogers 1971: 219, (51))
- c. Mary appears as if her job is going well.

This data is partly problematic, since Potsdam and Runner (2001), like most work on English copy raising (e.g., Rogers 1971, 1973, 1974, Heycock 1994), do not distinguish between copy raising verbs and perceptual resemblance verbs. We have already seen that the perception verbs do not require a pronoun in their complement at all. It is therefore irrelevant whether any pronoun that happens to occur in the complement is a subject or not. However, the third example in (20) is an instance of the copy raising verb *appear*.

There are at least two problems with the claim that copy raising verbs can have thematic subjects. The first problem has to do with Potsdam and Runner's (2001: 457) claim that copy raising verbs in their thematic use are "reasonably paraphrased as 'act like' or 'put on the appearance of'". But (20c) is not synonymous with any of the following sentences:

- (21) a. Mary acts like her job is going well.
- b. Mary puts on the appearance of her job going well.
- c. Mary puts on the appearance that her job is going well.

First, notice that the most salient readings for these sentences involve a generic / habitual present tense (i.e., *Mary always / usually acts like ...*), whereas the most salient reading of (20c) is a simple present tense in which Mary at this moment appears a certain way. Second, and related to the first point, *appear* is a stative verb, whereas *act* and *put on* are not. Third, the sentences in (21) entail that Mary is doing something, and perhaps also entail that she is doing it purposefully. However, (20c) does not entail that Mary is actually doing anything that gives off the appearance that her job is going well; she could just be in a state of happiness, for example. Both of these points have to do with the fact that *appear* in (20c) is a stative verb whereas the ones in (21) are not.

Second, the predicates *act like* and *put on the appearance of* require agents capable of intentional action, but copy raising verbs with non-subject copy pronouns do not. Consider the following contrast:

- (22)
- a. The corpse seemed like the coroner had done an exceptionally bad job of dissecting it.
 - b. #The corpse acted like the coroner had done an exceptionally bad job of dissecting it.
 - c. #The corpse put on the appearance that the coroner had done an exceptionally bad job of dissecting it.
 - d. #The corpse put on the appearance of the coroner having done an exceptionally bad job of dissecting it.

The corpse cannot *do* anything to convey the impression that the coroner botched the job. Nonetheless, the copy raising sentence is well-formed and felicitous.

These arguments indicate that the particular semantic sketch that Potsdam and Runner (2001) give of putatively thematic copy raising verbs cannot be right. However, there could still be a thematic use of these verbs with some other, as yet unidentified, meaning. A more pernicious problem with the claim of thematic copy raising verbs is that it erroneously predicts the possibility of copy raising with no copy pronoun whatsoever. Potsdam and Runner (2001: 457–458) cite Heycock (1994) for well-formed examples, but these all involve perceptual resemblance verbs. Copy raising verbs, as we noted above, are in fact ungrammatical without copy pronouns. We have encountered certain speakers who accept some instances of copy raising without any copy pronoun. For these speakers, a thematic analysis may be desirable. However, there are speakers — in fact, the majority of our informants — who reject copy raising without a copy pronoun, although they accept examples where the complement contains a pronominal copy that is not necessarily a subject.⁷ This pattern of data would be completely unexpected if these speakers had a thematic use of copy raising verbs. We therefore conclude, following Asudeh (2002, 2004), that copy raising subjects are non-thematic and our formal analysis, in section 5, builds on his analysis.

Swedish has only a single true copy raising verb, *verka* ('seem'), illustrated in (23) and also in several examples above:

- (23)
- Jessica verkar som om hon har börjat jobba redan.
 - J. seems as if she has started work already
 - 'Jessica seems like she has started working already.'

Verka is also a subject-to-subject raising verb (see (34) below). Swedish has other raising verbs that are very similar to *verka* in many respects, but they are not copy raising verbs. These verbs are *förefalla* ('seem'), *tyckas* ('seem') and *se ut* ('look'):

- (24)
- a. Det förefaller / tycks / ser ut som om Maria är glad.
it seems / seems / looks out as if M. is happy
'It seems / looks as if Maria is happy.'
 - b. Maria förefaller / ser ut att vara glad.
M. seems / looks out to be.INF happy
'Maria seems / looks to be happy'
 - c. Maria förefaller / tycks vara glad.
M. seems / seems be.INF happy
'Maria seems to be happy'

The verb *se ut* requires an infinitival complement to have the marker *att* ('to'), the verb *tyckas* cannot take *att* and *förefalla* can take a complement with or without *att*.⁸ The verbs *tyckas* and *förefalla* can only take a

⁷See (20c) and (22a) for examples of pronominal copies that are not subjects. Although most copies in our examples are subjects, this is not a requirement of copy raising.

⁸The infinitival marker *att* is written the same as the complementizer *att* (see example (14)), but the two can be pronounced differently, which indicates that they are separate lexical items.

finite complement if the matrix subject is an expletive, as in (24a), and (25) is thus ungrammatical:

- (25) * Maria förefaller / tycks som om hon är glad.
 M. seems / seems as if she is happy

The verbs *förefalla* and *tyckas* are thus not copy raising verbs.

The verb *se ut* also has a perceptual resemblance alternant. However, like in English, Swedish perceptual resemblance verbs are not true copy raising verbs, because they do not require a pronominal copy in their complement. The perceptual resemblance verbs in Swedish are thus parallel to their counterparts in English: although they can take an expletive subject, as in (26), they can also appear with a thematic subject, as in (27):

- (26) Det ser ut / låter / luktar / känns / smakar som om Chris har bakat kladdkaka.
 It looks out / sounds / smells / feels / tastes as if C. has baked sticky cake
 ‘It looks / sounds / smells / feels / tastes like Chris has baked “sticky cake”.’
- (27) Tina ser ut / låter / luktar / känns / smakar som om Chris har bakat kladdkaka.
 T. looks out / sounds / smells / feels / tastes as if C. has baked sticky cake
 ‘Tina looks / sounds / smells / feels / tastes like Chris has baked “sticky cake”.’

The generalizations concerning copy raising verbs and perceptual resemblance verbs are thus parallel in English and Swedish.

Let us now summarize the main points of this section. Copy raising is a phenomenon where a raising verb that cannot take a thematic subject takes a non-expletive subject and a complement that contains an obligatory pronominal copy of the matrix subject. The copy raising verbs in English are *seem* and *appear* and the copy raising verb in Swedish is *verka* (‘seem’). Copy raising verbs must be distinguished from perceptual resemblance verbs, which may take a thematic subject.

3 Two puzzles

This section introduces two empirical generalizations that do not follow immediately from what is already known about copy raising. The first generalization has to do with the interpretation of copy raising sentences and leads to what we call *the puzzle of the absent cook*. This puzzle arises in both English and Swedish. The second set of data concerns a PP adjunct that occurs in Swedish, but not English. The PP in question is headed by the preposition *på* and it gives rise to a puzzle that we call *the ‘på’ puzzle*: a *på*-PP cannot be used in a copy raising sentence.

In sections 4 and 5, we show that the two puzzles are connected, as both have to do with the source of information in perceptual reports. The subject of a copy raising sentence is interpreted as the source, and the NP complement of a *på*-PP is also interpreted as the source of perception. Sources (and goals) of perception are reminiscent of thematic roles, but are ultimately different, as they are not necessarily tied to arguments. Our analysis is described in section 4 and formalized in section 5.

3.1 The puzzle of the absent cook

There is a contrast between copy raising verbs and ordinary raising verbs that is surprising given the fact that both classes of verb have a non-thematic subject and a single, propositional argument. Consider the following context:

- (28) A and B walk into Tom's kitchen. Tom is at the stove doing something, but exactly what is a little unclear.

In this context, the following statements by A to B are all felicitous:

- (29) a. i. Tom seems to be cooking.
 ii. Tom verkar laga mat.
 T. seems make.INF food
 b. It seems that Tom is cooking.
- (30) a. i. Tom seems like he's cooking.
 ii. Tom verkar som om han lagar mat.
 T. seems as if he makes food
 'Tom seems as if he's cooking.'
 b. i. It seems like Tom's cooking.
 ii. Det verkar som om Tom lagar mat.
 it seems as if T. makes food
 'It seems as if Tom's cooking.'

Now consider the following alternative context:

- (31) A and B 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.

Given this context, (29a), (29b), and (30b) are still felicitous, but (30ai-ii) are odd:

- (32) 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.'

If *Tom* is not a thematic subject of *seems/verkar*, why are these sentence not felicitous like the infinitival versions? We will call this *the puzzle of the absent cook*.

3.2 The *på* puzzle

According to the data that has been presented so far, the Swedish verb *verka* is exactly parallel to English *seem*. In examples (33–35), the Swedish sentences correspond closely to the English translations. Example (36) is ungrammatical, as is its English equivalent.

- (33) Det verkar som om Tom har vunnit.
 it seems as if T. has won
 'It seems as if Tom has won.'
- (34) Tom verkar ha vunnit.
 T. seems have.INF won
 'Tom seems to have won.'
- (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 som om Kalle har vunnit.
 T. seems as if K. has won

Examples shown in previous sections and examples (33–36) demonstrate the close similarity between *seem* and *verka*.

However, Swedish *verka* allows a type of expression that is not available in English:

- (37) 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.’

Example (37) is close in meaning to example (35). The *på*-PP specifies that the impression that the referent of the pronoun *han* (i.e., Tom or someone else) has won originates with Tom. 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, which we will call the *p-source*. This PP is an adjunct: it is not selected for by *verka*, which as a raising verb only takes a single argument. Moreover, the PP is syntactically optional, as is typical of adjuncts.⁹

However, a crucial difference between (37) and (35) is that (37) does not require a copy pronoun in its complement:

- (38) 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 thus gives Swedish speakers the capacity to express what (36) and the following English sentence would arguably express if they were grammatical:

- (39) *Tom seems like Kalle has won.

Although the intended meaning of (36) and (39) is intuitively clear, speakers all but uniformly reject them.

The *på*-PP can be contrasted with the English *to*-PP, which specifies the *goal* of perception (*p-goal*; i.e., the perceiver):

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

The verbs *verka* and *tyckas* can take a plain NP object with the same interpretation as the English *to*-PP, as exemplified in (41–42).

- (41) % Det verkade mig som om Tom hade vunnit.
 it seemed me as if T. had won
 ‘It seemed to me as if Tom had won.’

- (42) Det tycktes mig som om Tom hade vunnit.
 it seemed me as if T. had won
 ‘It seemed to me as if Tom had won.’

The PP *to Tom* in (40) and the goal NP in (41–42) do not have the same interpretation as *på Tom* in (37): in (37), there is something about Tom that makes it seem as if he has won. Examples (40–42), on the other hand, leave unspecified what gives off the impression that Tom has won, but rather express to whom the

⁹Danish allows a PP which corresponds to the Swedish *på*-PP (Line Mikkelsen, p.c.). However, there are differences between Swedish and Danish raising and copy raising. A comparative Scandinavian study of the topics covered in this paper is a potentially promising area for future research.

impression has been given. A note on the Swedish data: The Swedish goal NP illustrated in (41–42) does not appear to be as commonly used as the English *to*-PP. Some speakers find (41) unacceptable. Example (42) is more generally accepted, although some find it quite formal. In contrast, the *på*-PP is not marginal or particularly formal.

Let us now return to copy raising, which is surprisingly not compatible with *på*-PPs. Compare (35) above, repeated here as (43), to (44):

- (43) Tom verkar som om han har vunnit.
 T. seems as if he has won
 ‘Tom seems as if he has won.’
- (44) * Tom verkar på Lisa som om han har vunnit.
 T. seems on L. as if he has won

The ungrammaticality of (44) is unexpected, as copy raising sentences like (43) are generally considered to be equivalent to expletive sentences like (45),¹⁰ which are grammatical with *på*-PPs, as shown in (46):

- (45) Det verkar som om Tom har vunnit.
 it seems as if T. has won
 ‘It seems like Tom has won.’
- (46) 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.’

Why should the PP adjunct be excluded in (44), although it can be included in (46)? This is our second puzzle, which we have called *the på puzzle*. It is easy to understand what the intended meaning of (44) is: it is the same as that of (46). Yet the example is ungrammatical. Example (44) can be contrasted with (47), which contains a *to*-PP, and Swedish (48–49), which contain plain NP objects comparable to the English *to*-NP:¹¹

- (47) Tom seemed to me as if he had won.
- (48) % Tom verkade mig som om han hade vunnit.
 T. seemed me as if he had won
 ‘Tom seemed to me as if he had won.’
- (49) Tom tycktes mig ha vunnit.
 T. seemed me have.INF won
 ‘Tom seemed to me to have won.’

The PP *to me* in (47) and the NP *mig* in (48–49) denote a perceptual goal (the perceiver), not a perceptual source. Comparing these examples to (44), we see that p-goals are compatible with copy raising, but p-source PPs are not.

We propose that the two puzzles, the puzzle of the absent cook and the *på* puzzle, are connected. The essence of our proposal is as follows. 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.

¹⁰See the literature on copy raising referred to above, and see also Teleman et al. (1999: vol. 4, p.56).

¹¹Example (49) is a raising example instead of a copy raising example, as *tyckas* is not a copy raising verb.

4 Copy raising and perceptual reports: An outline of the analysis

We present our formal analysis in section 5, but let us first further spell out our proposal in general terms. In copy raising sentences, the subject of the copy raising verb is interpreted as the source of perception (*p-source*). This is why (50) and its Swedish equivalent (51) are both odd in a context where the speaker does not have perceptual evidence of Tom, as discussed in section 3.1:

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

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

Examples (50) and (51) can be paraphrased as follows: It seems like Tom is cooking and what gives this impression is Tom himself. The example is thus not felicitous in a situation where Tom is not available to be the source of the report. Swedish and English are equivalent with respect to the interpretation of copy raising, and so (51) is equally odd in the given context.

Copy raising is thus different from standard raising in that there is a crucial difference in interpretation between the 'raised' version and the expletive version. Compare the raising alternation in (52) to the copy raising alternation in (53):

- (52) a. Tom seems to be the smartest guy in the world.
b. It seems that Tom is the smartest guy in the world.
- (53) a. Tom seems like he's the smartest guy in the world.
b. It seems like Tom is the smartest guy in the world.

Whereas the two examples in (52) have the same interpretation (Rosenbaum 1967, Postal 1974), the two examples in (53) differ. In (53a), Tom is necessarily interpreted as the source of perception. In (53b), and also in the examples in (52), the source of perception is unspecified.

It is important to note that *p-sources* are not the same as the thematic role *source*. First, the thematic role *source* proto-typically encodes a spatial argument and *p-source* does not. Second, thematic roles are connected to arguments, but the subject of a copy raising verb is not a thematic argument of that verb. Copy raising subjects are licensed only through their connection to the obligatory copy pronoun in the complement. Thus, the subject *Henrika* is not a *thematic* subject of *seem* in (54):

(54) Henrika seems like she's had enough.

We contend that the verbs *seem* and *appear* and their Swedish counterpart *verka* entail a source of perception, but that this source is not connected to an argument. Rather, we analyze *p-sources* (and *p-goals*) as entailed participants in the states that these verbs denote. There are thus parallels between perceptual sources / goals and temporal and locative modifiers of eventualities, where we understand the latter term to be a cover term for different kinds of events and states (Bach 1981). Eventualities in general entail a time and location, yet these entailments are only sometimes overtly realized. In sum, the solution to the puzzle of the absent cook is that a copy-raised subject is interpreted as the *p-source* — the source of perception — and ascribing the role of *p-source* to the subject is infelicitous if the individual in question is not perceivable as the source of the report.

Since we treat the Swedish *på*-PP as contributing a *p-source*, our analysis treats (55) as synonymous to (51), if *Tom* and *han* are understood co-referentially:

- (55) Det verkar på Tom som om han lagar mat.
 It seems on T. as if he makes food
 ‘Tom seems like he’s cooking.’

Given our solution to the puzzle of the absent cook, this predicts that (55) is infelicitous in the same contexts as (51). This prediction is correct. For example, in the scenario where Tom is absent but the kitchen shows signs of cooking, (55) cannot be felicitously uttered.

Let us now turn to puzzle number two, the *på* puzzle, which concerned the ungrammaticality of examples like the following:

- (56) * Maria verkar på Per som om hon är glad.
 M. seems on P. as if she is happy

In (56), both Maria and Per are specified as the source of perception, and the example is ungrammatical.

Now the question is: Why can’t two p-sources be specified? The restriction cannot be due to the state of the world or our knowledge of it. It is after all possible to report that Maria gives the impression that Per gives the impression that she is happy or that Maria and Per together give the impression that she is happy. However, (56) cannot express either of these propositions. We therefore conclude that there is a linguistic constraint against expressing multiple perceptual sources. This can be understood as a generalization of the notion that eventualities have at most one instance of each thematic role (Carlson 1984, Chierchia 1984, 1989, Dowty 1989, Parsons 1990, Landman 2000), which Carlson (1984: 271) similarly argues cannot be due to “the nature of the world itself”. Just as an eventuality cannot have more than one theme, for example, an eventuality cannot have more than one perceptual source. Landman (2000: 38) proposes the following principle for thematic roles:

(57) **Unique Role Requirement**

If a thematic role is specified for an event, it is uniquely specified.

Following Chierchia (1984, 1989), Landman (2000: 44) captures this requirement formally by defining thematic roles as partial functions from eventualities to individuals. Unlike thematic roles, p-sources are not arguments, but we can extend the uniqueness requirement to p-sources by similarly defining them as partial functions on eventualities. We will subsequently revise this model-theoretic treatment of uniqueness with a proof-theoretic version, in light of certain empirical problems with the former.

The range of the p-source function is however not the set of individuals, but rather the union of the set of individuals and the set of eventualities, thus further distinguishing p-sources from thematic roles. This means that eventualities, in addition to individuals, can be p-sources. For example, a state-as-p-source analysis is appropriate for the felicitous expletive-subject sentence in the absent cook scenario:

A and B 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.

- (58) It seems like Tom is cooking.

In this case, the p-source is the state of the kitchen. Recall that we refer to examples of a copy raising verb in its expletive-subject alternant simply as ‘expletive examples’.

We treat such expletive examples as having an existentially bound p-source. This existential closure is obligatory in English expletive examples, but only optional in Swedish, since Swedish allows a *på*-PP expression of the p-source to co-occur with an expletive subject, as in (55) and the following example:

- (59) Det verkar på Per som om Maria är glad.
 it seems on P. as if M. is happy
 ~ ‘Per gives the impression that Maria is happy.’

However, when the *på*-PP is absent, as in (60), the existential closure is obligatory. Our analysis therefore assigns the following Swedish sentence the same broad interpretation as English (58) above:

- (60) Det verkar som om Tom lagar mat.
 it seems as if T. makes food
 ‘It seems like Tom is cooking.’

In sum, expletive examples involve existential closure of the p-source: obligatorily in English and optionally in Swedish.

There is reason to believe that there is also existential p-source closure in Swedish subject-to-subject raising and that in this case it is obligatory. This assumption explains why it is ungrammatical to have a *på*-PP in such cases:

- (61) * Maria verkar på Jonas vara glad.
 M. seems on J. be happy.

Recall from section 2 that in subject-to-subject raising, the subject of the raising verb is not tied to the perceptual source interpretation, since such sentences can be felicitous in the absence of the individual in question (i.e., subject-to-subject raising does not give rise to the puzzle of the absent cook). Example (61) is thus not ruled out because of a p-source clash between *Maria* and *Jonas*. However, if the verb has an existentially bound p-source, the definition of p-source as a (partial) function ensures that there cannot be another p-source with a different denotation. Proof-theoretic uniqueness further prevents the presence of even a denotationally equivalent p-source. As a result there cannot be a *på*-PP contributing a p-source. We do not have direct evidence that English subject-to-subject raising involves an existentially bound p-source, but it is reasonable to assume parity with Swedish, given the lack of evidence to the contrary and given the general similarities between English and Swedish raising.¹²

4.1 Summary

Let us now review our proposal and how it accounts for the English and Swedish data. The key point is that verbs like *seem* and *verka* entail a source of perception, *p-source*, which may or may not be overtly expressed. The p-source is not an argument of the raising verb, and therefore not a thematic role, but rather an entailed participant in its eventuality. A further difference between thematic roles and p-sources is that the latter can be realized by eventualities, in addition to individuals. The pattern of p-source expression in English and Swedish is as follows:

1. English and Swedish copy raising: The copy-raised subject is the p-source.
2. English and Swedish subject-to-subject raising: The p-source is obligatorily existentially closed.
3. Expletive subjects:
 - (a) English: The p-source is obligatorily existentially closed
 - (b) Swedish: The p-source is optionally existentially closed.

¹²This leaves the matter of English *seem/appear* with *that*-complements. It is possible that in this alternant the p-source is entirely absent. This is discussed further in the conclusion.

We can thus see that one principal typological difference between the two languages with respect to p-source realization lies in whether existential closure of the p-source is obligatory or only optional in expletive examples. The evidence for this difference comes from another typological difference, which is the capacity of Swedish to alternatively express the p-source in a *på*-PP adjunct.

We pointed out two puzzles along the way: the puzzle of the absent cook and the *på* puzzle. The first puzzle was solved by the assumption of an obligatory p-source contributed by the copy-raised subject. The attribution of p-source to the subject is infelicitous in a scenario where the subject is not available as the source of perception. The assumption of a subject p-source in copy raising, along with the extension of the uniqueness requirement to p-source, also solved the second puzzle. If each eventuality has a unique p-source and the p-source is either filled by the subject (copy raising) or existentially bound (subject-to-subject raising), then the p-source cannot also be realized by a *på*-PP adjunct. However, since existential closure of the p-source is only optional in Swedish expletive examples, a *på*-PP is possible.

5 Formal analysis

We hope that we have been sufficiently clear in our informal presentation that the empirical generalizations and the solutions to the two puzzles are already apparent. We will therefore present a formal analysis that will capture the key points, but which is succinct and will leave certain details aside. Our analysis builds on the work of Asudeh (2002, 2004) and some further details can be found therein, although the present analysis makes considerable innovations. A particular detail that we leave aside, and that Asudeh discusses in some depth, is the syntactic and semantic contributions of the prepositions *like* and *as*, and by extension Swedish *som*, in copy raising and expletive examples, although we will present aspects of their syntax that cannot be avoided. Another detail we leave aside is how the presence of a copy pronoun is guaranteed in copy raising, which is the central concern of Asudeh (2004: ch. 9).

There is, however, one aspect of the analysis that we will delve into in some detail. We show in section 5.3 that a model-theoretic or denotational treatment of the uniqueness of participants in eventualities — specifically, thematic roles and perceptual sources — is empirically inadequate and makes false predictions in cases of denotational equivalence of participants. We argue that it is preferable to capture uniqueness proof-theoretically, rather than model-theoretically.

The section is organized as follows. First, we sketch the syntax of raising and copy raising, with particular reference to functional structures in Lexical Functional Grammar (LFG; Kaplan and Bresnan 1982, Bresnan 2001, Dalrymple 2001). Next, we present an event semantics analysis (Davidson 1967) of the facts discussed in sections 2–4, especially the semantics of *p-sources*. Third, we present arguments for proof-theoretic uniqueness and formalize the notion using Glue Semantics (Dalrymple 1999, 2001). Fourth, we present LFG lexical entries for English *seem* and Swedish *verka* that bring together the syntactic and semantic details. Lastly, we present certain refinements and extensions of our analysis, in particular concerning *p-goals* and perceptual resemblance verbs.

5.1 Syntax

We do not show c(onstituent)-structure trees for raising and copy raising, because these are rather straightforward. Asudeh (2002, 2004) argues that the complement phrases in copy raising are predicative PPs, headed by *like* or *as*. We make standard assumptions about the syntax of raising in f(unctional)-structures (Bresnan 1982). In particular, we assume that raising involves functional control of an open complement's subject by the raised subject. Following Asudeh, we similarly treat copy raising verbs as functionally con-

trolling the *like/as*-complement's subject. English finite *that*-complements are analyzed as closed complements, with the subject of the raising verb realized as an expletive *it*. This gives us the following f-structures for the sentences below:

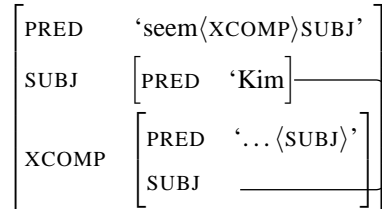
(62) Subject-to-subject raising

a. Infinitival complement

- i. Kim seems to have left.
- ii. Kim verkar ha åkt.
K. seems have.INF left

b. Predicative complement

- i. Kim seems crazy.
- ii. Kim verkar tokig.
K. seems crazy



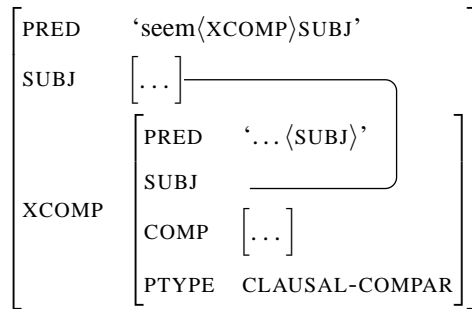
(63) Copy raising

a. True copy raising

- i. Tom seems like he is cooking.
- ii. Tom verkar som om han lagar mat.
T. seems as if he makes food

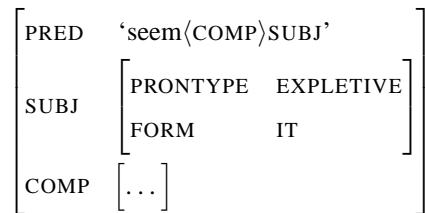
b. Expletive examples

- i. It seems like Tom is cooking.
- ii. Det verkar som om Tom lagar mat.
It seems as if T. makes food



(64) *That*-complement

- a. It seems that Tom has left.



The f-structure in (62) shows the standard LFG treatment of subject-to-subject raising as equality between the raised SUBJ and the SUBJ of an open complement XCOMP. We assume that this is the syntax for raising from an infinitival or predicative complement in both English and Swedish. In (63), we show the f-structure for copy raising and expletive examples in both English and Swedish. Notice that, as far as the raising verb is concerned, f-structure (63) is identical to (62). The XCOMP complement contains the further information that its PREPOSITION-TYPE is CLAUSAL-COMPARATIVE; we assume that this PTYPE is contributed by the prepositions *like*, *as*, and *som* when they take full clausal complements. Two further comments are in order about (63). First, it is important to realize that we treat expletive examples and copy raising as equally involving raising of the subject of the *like/as/som*-complement. In particular, expletive subjects of copy raising verbs are raised from the complement and not generated in matrix subject position (Horn 1981: 353–356). Second, as is already evident, we group Swedish *som* with *like* and *as* and treat Swedish expletive examples as having the same syntax as English copy raising expletive examples. However, since the *som om* complement is for most speakers of Swedish the only way for a raising verb to combine with

an expletive subject and a finite clause, it might be that the syntax of Swedish expletive examples is more like that of (64). This would be somewhat surprising, though, given the general similarity of meaning and complementation possibilities between English *like/as* and Swedish *som*. Furthermore, some Swedish speakers do produce complements to *verka* ('seem') that are headed by the complementizer *att* ('that'), which is the complementizer used with factives, propositional attitudes, beliefs, etc. It is a reasonable assumption that these *att*-complements have the syntax in (64) and that *som*-complements have the syntax in (63). Having said that, it does not really matter for our semantic analysis, just for the organization of our lexical entries in section 5.4; the lexical entries would have to be reorganized appropriately if the facts turn out to be different.

Lastly, *på*-PP and *to*-PP adjuncts in Swedish and English contribute to the ADJ(UNCT) grammatical function of the verb they modify:

- (65) PP adjuncts
- | | | | | |
|----|---|---|------|--|
| a. | It seems to me like Kim has left. | [| PRED | ‘seem⟨...⟩SUBJ’ |
| | | | ... | |
| b. | Det verkar på Kim som om Tom har åkt.
It seems on K. as if T. has left
~‘Kim gives the impression that Tom has left.’ | | ADJ | { [PRED ‘to/on⟨OBJ⟩’]
[OBJ [...]] } |

Note that the value of ADJ is a set containing all of an item’s adjuncts.

5.2 Semantics

We adopt a neo-Davidsonian event semantics (Davidson 1967, Higginbotham 1983, 1985, Parsons 1990, Kratzer 1995, Landman 2000), in which verbs have an implicit eventuality argument, where the set of eventualities is the union of the set of events and states, following Bach (1981). We will not spell out our entire logic, but rather the basic type theory (66) and the denotations of the types (67):

- (66)
1. $e, \epsilon, s,$ and t are types.
 2. $\varepsilon = \epsilon \cup s$
 3. $\delta = e \cup \varepsilon$
 4. If σ and τ are types, then $\langle \sigma, \tau \rangle$ is a type.
- (67)
1. The domain D_e of e is the set of individuals, A .
 2. The domain D_t of t is the set of propositions, $\mathcal{P}(W)$ (the power set of the set of worlds).
 3. The domain D_ϵ of ϵ is the set of events, E .
 4. The domain D_s of s is the set of states, S .
 5. The domain D_ε of ε is the set of eventualites, $E \cup S$.
 6. The domain D_δ of δ is the union of the set of individuals and the set of eventualities, $A \cup E \cup S$.
 7. The domain of a functional type $\langle \sigma, \tau \rangle$ is the set of all functions from D_σ to D_τ .

We adopt the following variable conventions:

- (68)
1. For every type a , v_a, v'_a, v''_a, \dots are type a variables.
 2. x, y, z, \dots are type e variables over individuals.

3. P, Q, \dots are type $\langle e, t \rangle$ variables over properties.
4. p, q, \dots are type t variables over propositions.
5. e, e', e'', \dots are type ϵ variables over events.
6. s, s', s'', \dots are type s variables over states.
7. S, S', S'', \dots are type $\langle s, t \rangle$ variables over state properties.

We depart from typical neo-Davidsonian treatments (e.g., Parsons 1990) in not treating verbs as one-place predicates on eventualities. Instead, we treat a verb as a relation with an eventuality argument and places for its arguments, as in Davidson (1967). We treat thematic roles as further restrictions on the nature of these arguments. The verb *kiss*, for example, has the following meaning:¹³

$$(69) \quad \lambda x \lambda y \lambda e. \textit{kiss}(e, x, y) \wedge \text{AGENT}(e) = x \wedge \text{THEME}(e) = y$$

We thus adopt a mix of what Parsons (1990: 94) calls the “incorporation analysis” and the “independent conjunct analysis”. Our reasons for doing this are twofold. First, we do not think it makes much sense to assign predicative or propositional complements thematic roles, unless one is willing to rob the notion *thematic role* of much of its intuitive meaning and theoretical utility. Since we are dealing with the verb *seem* we would have to assign the complement a thematic role if we stuck to a strict independent conjunct analysis. Secondly, this allows us to maintain a distinction between arguments and thematic roles on the one hand and PSOURCES and PGOALS on the other. A thematic role necessarily restricts an argument, where an argument is something that occurs in the verbal relation. In contrast, PSOURCES and PGOALS may or may not be arguments, depending on whether they are part of the verbal relation or not. It is thus possible for a copy-raised subject to be a PSOURCE without being a thematic subject.

We define PSOURCE as follows:

$$(70) \quad \text{PSOURCE is a partial function from eventualities to eventualities or individuals.}$$

$$\text{PSOURCE} : D_\epsilon \rightarrow D_\delta$$

The uniqueness requirement on PSOURCE in general follows from its definition as a partial function: If an eventuality has a PSOURCE, then it has only one PSOURCE denotation.

The Swedish *på*-PP adjunct contributes a PSOURCE to the eventuality that it modifies. We assign the preposition *på* in this use the following meaning:

$$(71) \quad \lambda x \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_p x$$

Notice that PSOURCE attribution involves a special kind of equality, which we define as follows:

$$(72) \quad \text{If } \alpha \text{ and } \beta \text{ have the same type, then } \llbracket \alpha =_p \beta \rrbracket = \llbracket \alpha = \beta \rrbracket.$$

Otherwise, $\llbracket \alpha =_p \beta \rrbracket$ is undefined.

Thus, $=_p$ is a kind of partial equality. In particular, unlike standard equality, $=_p$ is undefined if two disjoint types are equated, rather than returning the empty set (see footnote 13).

Having defined PSOURCE, we can begin analyzing the various kinds of PSOURCE realization identified in section 4, which were reviewed in section 4.1. The first case we consider is that of copy raising. The copy raising verb has the following interpretation (using English as the meta-language for both English and Swedish object languages):

¹³ We have defined the domain of type t as the power set of the set of worlds. We therefore define \wedge and $=$ in set-theoretic terms as follows (note that ‘ $=$ ’ in the meta-language is set-theoretic equality):

1. For $\alpha, \beta \in D_t$, $\llbracket \alpha \wedge \beta \rrbracket = \alpha \cap \beta$.
2. $\llbracket \alpha = \beta \rrbracket$ is the set of worlds in which $\llbracket \alpha \rrbracket$ is identical to $\llbracket \beta \rrbracket$.

$$(73) \quad \lambda x \lambda P \lambda s. seem(s, P(x)) \wedge \text{PSOURCE}(s) =_p x$$

The copy raising verb applies to its subject and composes the subject with its one argument, the property corresponding to the *like/as/som*-complement. The reason for this mode of composition concerns the status of the copy pronoun, which we have glossed over here (see Asudeh 2004). What matters for our purposes is that the copy raising verb contributes a PSOURCE and requires that its subject is the PSOURCE.

English and Swedish copy raising sentences like those in (74) receive the interpretation in (75), leaving aside a number of details, including tense, the interpretation of *like/as/som*, and the composition of the copy raising verb's complement:

- (74) a. Tom seems like he is laughing.
 b. Tom verkar som om han skrattar.
 T. seems as if he laughs
 'Tom seems as if he is laughing.'

$$(75) \quad \frac{\text{tom} \quad \lambda x \lambda P \lambda s. seem(s, P(x)) \wedge \text{PSOURCE}(s) =_p x \quad \vdots}{\lambda P \lambda s. seem(s, P(\text{tom})) \wedge \text{PSOURCE}(s) =_p \text{tom} \quad \lambda y. \exists e [laugh(e, y) \wedge \text{AGENT}(e) = y]} \\ \frac{\lambda s. seem(s, \exists e [laugh(e, \text{tom}) \wedge \text{AGENT}(e) = \text{tom}]) \wedge \text{PSOURCE}(s) =_p \text{tom}}{\exists s. seem(s, \exists e [laugh(e, \text{tom}) \wedge \text{AGENT}(e) = \text{tom}]) \wedge \text{PSOURCE}(s) =_p \text{tom}}$$

We make the standard assumption of existential closure of the eventuality variable in the absence of other quantification.

The ungrammaticality of Swedish copy raising with a *på*-PP adjunct, which we discussed above as the *på* puzzle, follows from the presence of two PSOURCES — one contributed by the copy raising verb and one contributed by the *på*-PP adjunct. The relevant part of the semantic derivation for (76) is shown in (77):¹⁴

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

$$(77) \quad \frac{\vdots \quad \vdots}{\lambda s' \lambda P. seem(s', P(\text{tom})) \wedge \text{PSOURCE}(s) =_p \text{tom} \quad \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_p \text{robin}} \\ \lambda s \lambda P. seem(s, P(\text{tom})) \wedge \text{PSOURCE}(s) =_p \text{tom} \wedge \text{PSOURCE}(s) =_p \text{robin}$$

The resulting specification of two denotationally distinct PSOURCES is impossible, due to PSOURCE denoting a function. However, this breaks down in cases where multiple PSOURCE are denotationally equivalent, a problem which we deal with in section 5.3.

The second case to consider is that of subject-to-subject raising, which we argued involves existential closure of the PSOURCE in both English and Swedish; the interpretation is shown in (78). We represent the core verbal semantics and the existential closure separately, as this will facilitate discussion of expletive examples below.

$$(78) \quad \lambda p \lambda s'. seem(s', p) \\ \lambda S \lambda s. \exists v_\delta [S(s) \wedge \text{PSOURCE}(s) =_p v_\delta]$$

Notice that the existential closure is over a variable of type δ , i.e. something that is either an eventuality or an individual. Thus, in contrast to copy raising and the *på*-PP, which respectively require their individual-denoting subject and complement to be the PSOURCE, this existential closure allows the possibility of an eventuality being the source of perception. Also, notice that, in contrast to copy raising, subject-to-subject

¹⁴We have curried the *seem* function so that we can leave aside the verb's composition with its complement.

raising takes a propositional complement that has already combined with the raised subject. This again has to do with the copy pronoun, but also underlies how Asudeh (2004) derives the differing scopal behaviour of copy raising and subject-to-subject raising (Lappin 1984).

The equivalent English and Swedish subject-to-subject raising sentences in (79) receive the interpretation in (80) (\mathbf{G} is a generic quantifier; Carlson and Pelletier 1995):

- (79) a. Tom seems to paint.
 b. Tom verkar måla.
 T. seems paint.INF
 ‘Tom seems to paint.’

$$(80) \frac{\lambda p \lambda s' . seem(s', p) \quad \mathbf{G} e [paint(e, tom) \wedge \text{AGENT}(e) = tom]}{\lambda s' . seem(s', \mathbf{G} e [paint(e, tom) \wedge \text{AGENT}(e) = tom]) \quad \lambda S \lambda s . \exists v_\delta [S(s) \wedge \text{PSOURCE}(s) =_p v_\delta]} \\ \frac{\lambda s . \exists v_\delta [seem(s, \mathbf{G} e [paint(e, tom) \wedge \text{AGENT}(e) = tom]) \wedge \text{PSOURCE}(s) =_p v_\delta]}{\exists s \exists v_\delta [seem(s, \mathbf{G} e [paint(e, tom) \wedge \text{AGENT}(e) = tom]) \wedge \text{PSOURCE}(s) =_p v_\delta]}$$

There is a perceptual source contributed in these sentences, but its precise identity is left unspecified. It could be Tom who is the source, or the state of his studio, or the state of his clothes, etc.

Although the exact nature of the PSOURCE is left unspecified in subject-to-subject raising, there is nonetheless a PSOURCE contributed by the verb. Thus, we correctly predict that Swedish subject-to-subject raising cannot occur with a $p\grave{a}$ -PP:

- (81) * Tom verkar på Sara måla.
 T. seems on S. paint.INF

$$(82) \quad \exists s \exists v_\delta [seem(s, \mathbf{G} e [paint(e) \wedge \text{AGENT}(e) = tom]) \wedge \text{PSOURCE}(s) =_p v_\delta \wedge \text{PSOURCE}(s) =_p Sara]$$

There cannot be two PSOURCES , due to the functional definition of PSOURCE , even if they are of different types.

The last case to consider is that of expletive examples. In English, this involves obligatory existential closure and it is therefore equivalent to the subject-to-subject raising case. In Swedish, the existential closure is only optional, since expletive examples can occur with or without a $p\grave{a}$ -PP. Examples (83) demonstrates English expletive examples and Swedish expletive examples and their shared interpretation. Example (84) demonstrates a Swedish expletive example with a $p\grave{a}$ -PP and its interpretation on the reading where *Tom* and *han* are co-referential.

- (83) a. It seems like Tom is laughing.
 b. Det verkar som om Tom skrattar.
 $\exists s \exists v_\delta [seem(s, \exists e [laugh(e, tom) \wedge \text{AGENT}(e) = tom]) \wedge \text{PSOURCE}(s) =_p v_\delta]$

(84) Det verkar på Tom som om han skrattar.
 $\exists s [seem(s, \exists e [laugh(e, tom) \wedge \text{AGENT}(e) = tom]) \wedge \text{PSOURCE}(s) =_p tom]$

The interpretation of (83) is the same as the subject-to-subject case in (79–80), except for the interpretation of the complement, which is not our main concern here. In particular, the PSOURCE in both cases is existentially closed and is not specified to be an individual, since the existentially bound variable is over individuals or eventualities. The interpretation of (84) is the same as the interpretation of (74a–b), shown in (75).

Let us now return to the puzzle of the absent cook to see how our semantics for PSOURCE solves the puzzle. First, consider the scenario in which Tom is present and any of the utterances in (86) by A to B is felicitous:

- (85) A and B walk into Tom's kitchen. Tom is at the stove doing something, but exactly what is a little unclear.
- (86) a. Tom seems to be cooking.
b. It seems like Tom's cooking.
c. Tom seems like he's cooking.

Our semantics assigns the first two sentences an existentially bound PSOURCE and allows the PSOURCE to be either an individual or an event. It may be Tom who conveys the impression, or the state of the kitchen, or the smell, or the fact that he's at the stove, and so on. In the last sentence, the speaker is making the more specific claim that it is Tom who is the source of the perception. The PSOURCE function in this case returns the individual Tom and since the subject denotes the individual Tom, the sentence is true.

Now consider the scenario where Tom is absent, in which the copy raising sentence is no longer felicitous:

- (87) A and B 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.
- (88) a. Tom seems to be cooking.
b. It seems like Tom's cooking.
c. #Tom seems like he's cooking.

In this scenario, the PSOURCE function cannot return Tom, because Tom is not present in the state that it applies to. The likeliest actual PSOURCE in this scenario is the state of the kitchen, a type s state, and the expression $\text{PSOURCE}(s) =_p \text{tom}$ has to be evaluated with the first argument of type s and the second of e . Given our definition of $=_p$ in (72), the result of evaluating $=_p$ with arguments of different types is undefined. Therefore, the conjunction $\text{seem}(s, \dots) \wedge \text{PSOURCE}(s) =_p \text{tom}$ cannot be assigned a truth value. The presupposition that Tom is the PSOURCE therefore fails. This correctly predicts that the negation of (61c) is equally infelicitous in this scenario, if the PSOURCE is the state of the kitchen or any other non-individual type:

- (89) #Tom doesn't seem like he's cooking.

Our account thus solves the puzzle of the absent cook and treats the infelicity of copy raising in the absence of perceptual evidence of the subject as presupposition failure.

This contrasts with a scenario that we have not so far considered in which there is an individual present to serve as a PSOURCE, but it is not the individual named in the sentence (and both A and B know that the two individuals are not the same):

- (90) A and B walk into Tom's kitchen. Robin is at the stove doing something, but exactly what is a little unclear. A and B recognize Robin and know that Robin is not Tom.
- (91) a. A: Tom seems like he's cooking.

In this scenario, our analysis treats this sentence as simply false. The PSOURCE is Robin, not Tom, and since Robin and Tom are both of the same type (e), then $\text{PSOURCE}(s) =_p \text{tom}$ is defined as $\text{robin} = \text{tom}$, which does not include the world of the scenario.

5.3 Proof-theoretic versus model-theoretic uniqueness

We have thus far captured the uniqueness requirement on PSOURCES in model-theoretic or denotational terms: PSOURCES are partial functions and therefore cannot denote distinct elements in the model. This is a generalization of the uniqueness requirement on thematic roles, which has been similarly captured in the model theory by defining thematic roles as partial functions from eventualities to individuals (Chierchia 1984, 1989, Landman 2000). The underlying explanation for the ill-formedness of (92) and (93) is thus the same:

(92) * Tom kissed Robin's face Robin's cheek.

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

Example (92) is adapted from Carlson's (1984: 271) discussion of "thematic uniqueness". Carlson assumes that (92) involves an attempt to assign two instances of a location thematic role and therefore violates the requirement that each event have at most one instance of a given role. Under the model-theoretic treatment of the uniqueness requirement, this follows from the definition of thematic roles as functions. Similarly, (93) involves two instances of the PSOURCE function and is blocked for the same reason.

There is, however, reason to believe that denotational or model-theoretic uniqueness is not a sufficiently strong uniqueness requirement. In particular, model-theoretic uniqueness makes false empirical predictions in cases of denotational equivalence. We therefore introduce a proof-theoretic notion of uniqueness that guarantees uniqueness irrespective of denotation. It is important to realize that the two notions do not conflict: proof-theoretic uniqueness is independent of the model-theory and it can therefore supplement model-theoretic denotation rather than necessarily supplanting it. Furthermore, proof-theoretic uniqueness does not introduce any new mechanisms into the theory, since it relies only on the mechanism that already regulates functor-argument composition and, specifically, proper predicate saturation and argument consumption.

Consider example (93) if *Tom* and *Robin* are different names for the same individual. If the names are denotationally equivalent, then there is no violation of model-theoretic uniqueness, since the PSOURCE function is simply returning two different instances of the same individual. This particular case is perhaps not too worrying, though, since it can be handled through the use of intentions (assuming that the names are functioning as descriptions and are not rigid designators).

A potentially more problematic case is where there are two occurrences of the same individual under the same description, which is equally ill-formed:

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

Here we have very strong denotational equivalence between the two individuals designated by *Tom* and model-theoretic uniqueness breaks down. It may be, however, that independent factors account for the ill-formedness of (94). First, there is a potential Principle C violation in terms of binding theory (Chomsky 1981), although given the weakness of Principle C (Evans 1980) this seems like a tenuous explanation for the strong ungrammaticality of (94). One might instead contend that repeated uses of the same name use different guises (Heim 1998). This would also explain the ungrammaticality of (93).

However, none of these explanations can readily account for the ungrammaticality of a parallel example with a reflexive in the *på*-PP:

(95) * 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 model-theoretic / denotational equivalence of the subject and the adjunct.

We are therefore led to reconsider denotational uniqueness in the model as the means of capturing the Unique Role Requirement, which we repeat here:

- (96) **Unique Role Requirement** (Landman 2000: 38)
 If a thematic role is specified for an event, it is uniquely specified.

The conclusion we have reached is that in generalizing this notion to PSOURCES, the term “uniquely specified” cannot be understood as “having a unique denotation in the model”, which is what the functionality requirement on thematic roles and its extension captures. The data in (93–95) indicates that — when extended to eventuality participants in general, including PSOURCES — the uniqueness requirement is that eventuality participants are uniquely linguistically realized, i.e. that they have at most one syntactic realization. Thus, it is insufficient to capture the uniqueness requirement solely in terms of the model-theoretic semantics. Rather, it must somehow be stated as a condition on the mapping from the syntax to the semantics.

A method for correctly capturing the uniqueness requirement becomes apparent if we consider thematic roles with respect to uniqueness, instead of PSOURCES:¹⁵

- (97) * Tom skrattar sig själv.
 Tom laughs him self

The model-theoretic treatment of the uniqueness requirement on thematic roles does not block this sentence, since the subject and the reflexive are denotationally equivalent. They could both be assigned the thematic role AGENT, for example.

In theory-neutral terms, what actually blocks (97) is instead whatever ensures proper predicate saturation or, equivalently, argument consumption. The sentence is bad because *skratta* (‘laugh’) takes only one argument and the second argument cannot be handled properly. It is instructive to consider this in light of the Theta Criterion (Chomsky 1981: 36):

- (98) **Theta Criterion**
 Each argument bears one and only one θ -role and each θ -role is assigned to one and only one argument.

Chierchia (1984) explicitly relates the uniqueness requirement on thematic roles to the Theta Criterion. He argues that treating thematic roles as functions captures the second part of the Theta Criterion. We have seen that this is in fact only true up to denotational equivalence. However, it is if anything the first part of the Theta Criterion that blocks (97): the object does not bear a theta role, since the sole theta role of the verb is assigned to the subject.

In more recent work in the Minimalist Program, the first clause of the Theta Criterion has been abandoned (Brody 1993, Boškovič 1994, Hornstein 1999) and Chomsky (1995: 200) has argued that the entire principle can be subsumed under Full Interpretation (FI). However, FI cannot explain the ungrammaticality of (95), since it receives a perfectly valid compositional interpretation, namely:

- (99) $\exists s[seem(s, \exists e[laugh(e, tom) \wedge AGENT(e) = tom]) \wedge PSOURCE(s) =_p tom \wedge PSOURCE(s) =_p tom]$

¹⁵We use a Swedish example to ensure that the reflexive is not understood emphatically, as it could be in the equivalent English sentence (on a par with *Tom himself laughs*). The emphatic reflexive in Swedish would just be *själv* without *sig*.

Asudeh (2004: 99ff.) argues that Full Interpretation can be reduced to a proof-theoretic notion of *Resource Sensitivity*. 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. Premises in linear logic proofs are resources whose use is tightly controlled: A successful linear logic proof requires each premise to be used exactly once. Asudeh (2004) calls the Resource Sensitivity that stems purely from properties of the underlying logic *Logical Resource Sensitivity*. A related notion that is more useful for linguistics, *Linguistic Resource Sensitivity*, is derived by stating a linguistically motivated goal condition on the linear logic proof for semantic composition (Asudeh 2004: 82–87); 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:

$$(100) \quad \Gamma \vdash \phi : s$$

From a premise set Γ , the goal is to establish an atomic conclusion s that corresponds to the semantics of the sentence, represented as ϕ .¹⁶

On this view, (95) 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):

$$(101) \quad \frac{\frac{\text{SUBJECT} \quad \text{SUBJECT} \multimap \text{VERB}}{\text{VERB}} \quad \text{OBJECT}}{\text{VERB} \otimes \text{OBJECT}}$$

Notice that argument consumption corresponds to implication elimination. The goal condition (100) is not met, since the result is a conjunction, not an atomic term.

We propose to address the problem of denotational uniqueness 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 from the previous section 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. Note that 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. Rather than attempting to demonstrate proof-theoretic uniqueness in the abstract, we will work through the relevant cases.

First let us consider subject-to-subject raising and expletive examples in English and Swedish:

(102) a. Tom seems to be laughing.

b. Tom verkar skratta.

T. seems laugh.INF
'Tom seems to be laughing.'

(103) a. It seems like Tom is laughing.

b. Det verkar som om Tom skrattar.

It seems as if T. laughs
'It seems as if Tom is laughing.'

¹⁶The linear logic terms are also typed and the type of the conclusion is normally t . We leave typing aside here, since it is not relevant to the point at hand.

We presented the semantics for these cases in (78), repeated here:

$$(104) \quad \lambda p \lambda s'.seem(s', p) \\ \lambda S \lambda s. \exists v_\delta [S(s) \wedge \text{PSOURCE}(s) =_p v_\delta]$$

Recall that the existential closure is obligatory in both English and Swedish subject-to-subject raising and in English expletive examples. The closure is only optional in Swedish expletive examples, to allow composition with a *på*-PP adjunct.

We embed these meanings in Glue meaning constructors, which pair terms of the meaning language with linear logic terms. The meaning constructors are given more precisely, using LFG-theoretic means, in section 5.4. For now we represent the linear logic terms schematically:

$$(105) \quad \lambda p \lambda s'.seem(s', p) : \\ \text{COMPLEMENT} \multimap \text{PSOURCE} \multimap \text{EVENT} \multimap \text{RESULT} \\ \lambda S \lambda s. \exists v_\delta [S(s) \wedge \text{PSOURCE}(s) =_p v_\delta] : \\ (\text{PSOURCE} \multimap \text{EVENT} \multimap \text{RESULT}) \multimap (\text{EVENT} \multimap \text{RESULT})$$

Crucially, we introduce a linear logic term for the PSOURCE. This will serve as a resource that must be properly consumed in the linear logic proof. The other linear terms stand for the raising verb's sentential complement, the event variable, and the result of composition. It is important to bear in mind that linear logic terms with identical names in proofs are meant to be understood as token-identical.

The composition of the examples in (102–103) proceeds as in (106), leaving aside details of the complement, which were shown in section 5.2. We have abbreviated the linear logic terms in order to save space.

$$(106) \quad \begin{array}{c} \vdots \\ \lambda p \lambda s'.seem(s', p) : \quad \quad \quad laugh(\dots) : \\ C \multimap P \multimap E \multimap R \quad \quad \quad C \\ \hline \lambda s'.seem(s', laugh(\dots)) : \quad \quad \quad \lambda S \lambda s. \exists v_\delta [S(s) \wedge \text{PSOURCE}(s) =_p v_\delta] : \\ P \multimap E \multimap R \quad \quad \quad (P \multimap E \multimap R) \multimap (E \multimap R) \\ \hline \lambda S. \exists s [S(s)] : \quad \quad \quad \lambda s. \exists v_\delta [seem(s, laugh(\dots)) \wedge \text{PSOURCE}(s) =_p v_\delta] : \\ (E \multimap R) \multimap R \quad \quad \quad E \multimap R \\ \hline \exists s \exists v_\delta [seem(s, laugh(\dots)) \wedge \text{PSOURCE}(s) =_p v_\delta] : R \end{array}$$

Notice that implication elimination in the linear logic corresponds to functional application in the meaning language (via the Curry-Howard isomorphism; Curry and Feys 1958, Howard 1980). As before, we assume existential closure of the event variable in the absence of other quantification. The crucial step is the one where the existential closure applies to the raising verb's meaning. On the linear logic side, the existential closure needs to consume an implication from a PSOURCE, which is provided by the raising verb. This is a standard higher-type functor-argument application for a generalized quantifier combining with its scope. The final result is an atomic linear logic term corresponding to the sentential semantics, which satisfies the goal condition (100) above.

Let us next introduce the meaning constructor for the Swedish preposition *på* in a *på*-PP PSOURCE adjunct:

$$(107) \quad \lambda x \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_p x : \\ \text{OBJECT} \multimap \\ (\text{MODIFIEE'S PSOURCE} \multimap \text{MODIFIEE'S EVENT} \multimap \text{MODIFIEE'S RESULT}) \multimap \\ (\text{MODIFIEE'S EVENT} \multimap \text{MODIFIEE'S RESULT})$$

The meaning side is the same as (71) from section 5.2. The linear logic side treats the adjunct as a modifier on a term that depends on a PSOURCE.

In this respect, the *på*-adjunct is like the existential closure. Both contribute linear logic terms that want to consume a dependency on a PSOURCE. This is sufficient to explain the ungrammaticality of Swedish subject-to-subject raising with a *på*-PP:

- (108) * Tom verkar på Sara skratta.
 T. seems on S. laugh.INF

The existential closure of PSOURCE is obligatory in this case. This means that both the existential closure meaning constructor and the *på*-PP meaning constructor are seeking to consume a term of the form PSOURCE \multimap EVENT \multimap RESULT. However, only one instance of this term has been contributed by the verb. The resource sensitivity of linear logic entails that once one of these PSOURCE consumers has consumed the dependency on the verb's PSOURCE, there is no way to satisfy the other consumer.

This is shown schematically in the following packed proof:

$$(109) \quad \frac{\frac{\frac{\text{raising verb}}{C \multimap P \multimap E \multimap R} \quad \frac{\text{complement}}{C}}{P \multimap E \multimap R} \quad \frac{\text{på-PP}}{(P \multimap E \multimap R) \multimap (E \multimap R)}}{(P \multimap E \multimap R) \multimap (E \multimap R)} \quad \frac{\text{på-PP}}{(P \multimap E \multimap R) \multimap (E \multimap R)}}{[(P \multimap E \multimap R) \multimap (E \multimap R)] \otimes (E \multimap R)}$$

It is readily apparent that the final result is not an atomic term and that (100) is therefore not satisfied.

Lastly, let us consider copy raising:

- (110) a. Tom seems like he is laughing.
 b. Tom verkar som om han skrattar.
 T. seems as if he laughs
 'Tom seems as if he is laughing.'

In both English and Swedish, the copy-raised subject serves as the PSOURCE. This is captured by embedding the copy raising verb's meaning, shown in (73) above, in the following meaning constructor:

$$(111) \quad \lambda x \lambda P \lambda s. seem(s, P(x)) \wedge PSOURCE(s) =_p x : \\ \text{SUBJECT/PSOURCE} \multimap (\text{SUBJECT} \multimap \text{COMPLEMENT}) \multimap \text{EVENT} \multimap \text{RESULT}$$

The copy-raised subject is structure-shared with the subject of the *like/as/som* complement (see section 5.1) and the copy raising verb composes its subject with the property corresponding to its complement (see section 5.2).

From a resource-logical perspective, the important aspect of the linear logic term in (111) is that the only consumer of the matrix subject/PSOURCE is the copy raising verb. If a *på*-PP modifies a copy raising verb, there are two possible proofs, but neither terminates in an atomic linear logic term. The first possibility is if the copy raising verb composes with its subject directly. There is then no dependency on a PSOURCE left in the proof and the *på*-PP modifier cannot find its scope. This is shown schematically here:

$$(112) \quad \frac{\frac{\frac{\text{subject}}{S} \quad \frac{\text{CR verb}}{S/P \multimap (S \multimap C) \multimap E \multimap R}}{(S \multimap C) \multimap E \multimap R} \quad \frac{\text{complement}}{S \multimap C}}{E \multimap R} \quad \frac{\text{på-PP}}{(P \multimap E \multimap R) \multimap (E \multimap R)}}{(E \multimap R) \otimes (P \multimap E \multimap R) \multimap (E \multimap R)}$$

(115) *seem* $(\uparrow \text{ PRED}) = \text{'seem}\langle \text{CF} \rangle \text{SUBJ}'$

$$\left(\begin{array}{l}
\left\{ \begin{array}{l}
(\uparrow \text{ SUBJ}) = (\uparrow \text{ XCOMP SUBJ}) \\
\{ (\uparrow \text{ XCOMP PTYPE}) \neq \text{CLAUSAL-COMPAR} \mid \neg(\uparrow \text{ SUBJ PRED}) \} \\
(\uparrow \text{ SUBJ PRONTYPE}) = \text{EXPLETIVE} \\
(\uparrow \text{ SUBJ FORM}) = \text{IT} \\
(\uparrow \text{ COMP MOOD}) = \text{DECLARATIVE}
\end{array} \right. \\
\lambda p \lambda s'. \text{seem}(s', p) : (\uparrow \text{ CF})_{\sigma} \multimap (\uparrow_{\sigma} \text{ PSOURCE}) \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma} \\
\lambda S \lambda s. \exists v_{\delta} [S(s) \wedge \text{PSOURCE}(s) =_p v_{\delta}] : \\
[(\uparrow_{\sigma} \text{ PSOURCE}) \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma}] \multimap [(\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma}] \\
(\uparrow \text{ SUBJ}) = (\uparrow \text{ XCOMP SUBJ}) \\
(\uparrow \text{ XCOMP PTYPE}) =_c \text{CLAUSAL-COMPAR} \\
\lambda x \lambda P \lambda s. \text{seem}(s, P(x)) \wedge \text{PSOURCE}(s) =_p x : \\
(\uparrow \text{ SUBJ})_{\sigma} \multimap [(\uparrow \text{ SUBJ})_{\sigma} \multimap (\uparrow \text{ XCOMP})_{\sigma}] \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma} \\
(\uparrow \text{ SUBJ})_{\sigma} = (\uparrow_{\sigma} \text{ PSOURCE}) \\
[\text{MANAGER RESOURCE}]
\end{array} \right)$$

The grammatical function CF stands for COMPLEMENT FUNCTION and can be realized as either COMP or XCOMP. The first part of (115) assigns the same semantics to English *seem* in subject-to-subject raising, in expletive examples, and with a *that*-complement. The latter case will be discussed further in the conclusion. Notice that we have introduced a semantic structure feature PSOURCE, as per the discussion in the previous section. The feature EVAR is also a semantic structure feature and represents the event variable (Fry 1999). The second part of the entry deals with copy raising. The last line is a place-holder for the *manager resource* that licenses the copy pronoun in Asudeh's (2002, 2004) theory.

Next, we present Swedish *verka*:

(116) *verka* $(\uparrow \text{ PRED}) = \text{'seem}\langle \text{XCOMP} \rangle \text{SUBJ}'$

$$\left(\begin{array}{l}
\left(\begin{array}{l}
(\uparrow \text{ SUBJ}) = (\uparrow \text{ XCOMP SUBJ}) \\
\lambda p \lambda s'. \text{seem}(s', p) : (\uparrow \text{ XCOMP})_{\sigma} \multimap (\uparrow_{\sigma} \text{ PSOURCE}) \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma} \\
\lambda S \lambda s. \exists v_{\delta} [S(s) \wedge \text{PSOURCE}(s) =_p v_{\delta}] : \\
[(\uparrow_{\sigma} \text{ PSOURCE}) \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma}] \multimap [(\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma}]
\end{array} \right) \\
\neg(\uparrow \text{ SUBJ PRED}) \\
\lambda p \lambda s'. \text{seem}(s', p) : (\uparrow \text{ XCOMP})_{\sigma} \multimap (\uparrow_{\sigma} \text{ PSOURCE}) \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma} \\
\left(\begin{array}{l}
\lambda S \lambda s. \exists v_{\delta} [S(s) \wedge \text{PSOURCE}(s) =_p v_{\delta}] : \\
[(\uparrow_{\sigma} \text{ PSOURCE}) \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma}] \multimap [(\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma}]
\end{array} \right)
\end{array} \right)$$

$$\left(\begin{array}{l}
(\uparrow \text{ SUBJ}) = (\uparrow \text{ XCOMP SUBJ}) \\
(\uparrow \text{ XCOMP PTYPE}) =_c \text{CLAUSAL-COMPAR} \\
\lambda x \lambda P \lambda s. \text{seem}(s, P(x)) \wedge \text{PSOURCE}(s) =_p x : \\
(\uparrow \text{ SUBJ})_{\sigma} \multimap [(\uparrow \text{ SUBJ})_{\sigma} \multimap (\uparrow \text{ XCOMP})_{\sigma}] \multimap (\uparrow_{\sigma} \text{ EVAR}) \multimap \uparrow_{\sigma} \\
(\uparrow \text{ SUBJ})_{\sigma} = (\uparrow_{\sigma} \text{ PSOURCE}) \\
[\text{MANAGER RESOURCE}]
\end{array} \right)$$

This entry is largely the same as (115). Since we analyze *verka* as involving raising from XCOMP in all cases, the verb subcategorizes for XCOMP, rather than CF. The first main part of the entry deals with subject-to-subject raising and with expletive examples. The difference between the two is that existential closure is obligatory in the first case but only optional in the second. The second main part, which deals with copy raising, is identical to the second part of (115).

Lastly, we present the lexical entry for *på*:

(117) *på* $(\uparrow \text{ PRED}) = \text{'on}\langle \text{OBJ} \rangle'$ $\lambda x \lambda S \lambda s. S(s) \wedge \text{PSOURCE}(s) =_p x :$ $(\uparrow \text{ OBJ})_{\sigma} \multimap$ $[[((\text{ADJ} \in \uparrow)_{\sigma} \text{ PSOURCE}) \multimap ((\text{ADJ} \in \uparrow)_{\sigma} \text{ EVAR}) \multimap (\text{ADJ} \in \uparrow)_{\sigma}] \multimap$ $[[((\text{ADJ} \in \uparrow)_{\sigma} \text{ EVAR}) \multimap (\text{ADJ} \in \uparrow)_{\sigma}]]$

5.5 Refinements and extensions

We have defined PSOURCE as a partial function from eventualities. However, all *perceptual* eventualities — eventualities involved in perceptual reports — must have a source of perception, i.e. something that is perceived. To capture this, we make PSOURCE a total function on perceptual eventualities:

(118) PSOURCE is a total function from perceptual eventualities to eventualities or individuals:

$$\text{PSOURCE} : P \rightarrow D_{\delta}, \text{ where } P \text{ is the set of perceptual eventualities and } P \subseteq D_{\epsilon}.$$

Perceptual eventualities must equally have a perceiver, i.e. what we have called a PGOAL. We define PGOAL similarly to PSOURCE, as a partial function on eventualities in general (see (70) in section 5.2) and as a total function on perceptual eventualities:

(119) PGOAL is a partial function from eventualities to individuals.

$$\text{PGOAL} : D_\varepsilon \rightarrow D_e$$

PGOAL is a total function from perceptual eventualities to individuals:

$$\text{PGOAL} : P \rightarrow D_e, \text{ where } P \text{ is the set of perceptual eventualities and } P \subseteq D_\varepsilon.$$

Note that the PGOAL function returns only individuals, since only individuals can be perceivers.

PGOALS would now have to be added to our semantics for *seem* and *verka*. English can express the PGOAL as a *to*-PP adjunct and this can occur in all of the alternations we have looked at. We therefore add optional existential closure of PGOAL to the semantics of each *seem* alternant. Swedish, in contrast, only marginally has the ability to express a PGOAL with a direct object. The grammar of speakers for whom this is ungrammatical has obligatory existential closure of PGOAL in the relevant cases. The grammar of speakers who allow PGOAL expression in a direct object has optional PGOAL closure, on a par with English. The existential closure in all cases can be represented as a separate function, equivalently to PSOURCE closure:

$$(120) \quad \lambda S \lambda s. \exists x [S(s) \wedge \text{PGOAL}(s) = x]$$

Notice that since PGOAL only returns individuals, we use simple equality here.

English *to*-PPs are then equivalent to Swedish *på*-PPs, except that they contribute a PGOAL instead of a PSOURCE. The interpretation of *to* in this usage is:

$$(121) \quad \lambda x \lambda S \lambda s. S(s) \wedge \text{PGOAL}(s) = x$$

Since PGOAL is a function, we correctly predict the impossibility of having two denotationally distinct PGOAL PP adjuncts:

$$(122) \quad * \text{Tom seemed tired to me to you.}$$

We can also extend proof-theoretic uniqueness to PGOAL by assigning them the same linear logic term as PSOURCE, which was outlined in section 5.3 and which we will not repeat here.

We capture the requirement that all perceptual eventualities have a perceived PSOURCE and a perceiver PGOAL with the following meaning postulate:

$$(123) \quad \forall v_\varepsilon \exists v_\delta \exists x \square [v_\varepsilon \in P \rightarrow \text{PSOURCE}(v_\varepsilon) =_p v_\delta \wedge \text{PGOAL}(v_\varepsilon) = x]$$

Lastly, let us consider the perceptual resemblance verbs, which pattern similarly to copy raising. Recall that the key difference between these verbs and copy raising verbs is that the perceptual resemblance verbs do not require a copy pronoun in their complements:

- (124) a. Tina looks / sounds / smells / feels / tastes like Chris has baked sticky buns.
 b. Tina ser ut / låter / luktar / känns / smakar som om Chris har bakat kladdkaka.
 T. looks out / sounds / smells / feels / tastes as if C. has baked sticky cake
 ‘Tina looks / sounds / smells / feels / tastes like Chris has baked “sticky cake”.’

Asudeh (2004) ties this to the fact that the subject of a perceptual resemblance verb is an argument of the verb, unlike a copy-raised subject. In terms of the semantics we have been developing here, this basically boils down to mode of composition. A perceptual resemblance verb states that its subject is the PSOURCE and composes with its complement without the requirement that the subject compose in place of a copy pronoun.

There is one other difference between copy raising verbs and perceptual resemblance verbs. Namely, the latter restrict the nature of the PSOURCE to an appropriate perceptual dimension as follows:

- (125) **look:** *visual* is a partial function of type $\langle \delta, e \rangle$ that returns the visual aspect of its argument (i.e., the argument's look).
- sound:** *aural* is a partial function of type $\langle \delta, e \rangle$ that returns the aural aspect of its argument (i.e., the argument's sound).
- smell:** *olfactory* is a partial function of type $\langle \delta, e \rangle$ that returns the olfactory aspect of its argument (i.e., the argument's smell).
- feel:** *tactile* is a partial function of type $\langle \delta, e \rangle$ that returns the tactile aspect of its argument (i.e., the argument's feel).
- taste:** *gustatory* is a partial function of type $\langle \delta, e \rangle$ that returns the gustatory aspect of its argument (i.e., the argument's taste).

The interpretation of the verb *sound*, for example, is:

$$(126) \quad \lambda x \lambda p \lambda s. sound(s, aural(PSOURCE(s)), p) \wedge PSOURCE(s) =_p x$$

The verb *sound* denotes a relation between the aural aspect of its PSOURCE (i.e., the PSOURCE's sound) and the verb's complement.

Example (124) with the verb *sound* or *låta* has the following interpretation (setting aside the interpretation of the perception verb's complement):

$$(127) \quad \exists s. [sound(s, aural(PSOURCE(s)), \dots) \wedge PSOURCE(s) =_p tina]$$

Perceptual resemblance verbs in both English and Swedish can also occur with expletive subjects and are therefore ambiguous between a thematic and non-thematic subject reading:

- (128) a. It smells / looks / sounds / feels / tastes like Chris has been baking sticky buns.
- b. Det ser ut / låter / luktar / känns / smakar som om Chris har bakat kladdkaka.
It looks out / sounds / smells / feels / tastes as if C. has baked sticky cake
'It looks / sounds / smells / feels / tastes like Chris has baked "sticky cake".'

In this second case, the PSOURCE is existentially closed and the interpretation is as follows, once again using *sound* as the exemplar:

$$(129) \quad \lambda p \lambda s'. sound(s', aural(PSOURCE(s')), p) \\ \lambda S \lambda s. \exists v_\delta [S(s) \wedge PSOURCE(s) =_p v_\delta]$$

Example (128) with the verb *sound* or *låta* has the following interpretation:

$$(130) \quad \exists s \exists v_\delta [sounds(s, aural(PSOURCE(s)), \dots) \wedge PSOURCE(s) =_p v_\delta]$$

A perceptual resemblance verb thus consistently denotes a relation between a perceptual aspect of its PSOURCE and the verb's complement, whether the PSOURCE is the verb's subject, as in (126), or is existentially bound, as in (129).

The existential closure is once again obligatory in English but only optional in Swedish, since the latter allows a *på*-PP expressing the PSOURCE to occur with expletive-subject perceptual-resemblance verbs:

- (131) Det luktar på Tina som om Chris har bakat kladdkaka.
It smells on T. as if C. has baked sticky cake
~ 'Tina smells like Chris has baked "sticky cake".'

The interpretation of (131) is the same as (127), but this time the PSOURCE is contributed by the *på*-PP rather than the perceptual resemblance verb's subject. In all cases, the verb takes a function on its PSOURCE as an argument, whether the PSOURCE itself is contributed by the verb (from its subject or through existential closure) or is contributed by an adjunct. Thus, a non-expletive subject (*qua* PSOURCE sensory aspect) is an argument of a perceptual resemblance verb (it is represented in the verbal relation), but even when the subject is an expletive the perceptual resemblance verb still takes the PSOURCE's sensory aspect as an argument, although the PSOURCE itself is either existentially closed or contributed by a *på*-PP adjunct.

6 Conclusion

We have carried out a comparative study of copy raising in two Germanic languages, English and Swedish. We showed that there were strong similarities between the two languages, but also important differences. In particular, English and Swedish have adjuncts that encode different participants in a perceptual eventuality. English allows expression of the goal of perception (PGOAL) in a *to*-PP and Swedish allows the expression of the source of perception (PSOURCE) in a PP adjunct headed by the preposition *på* ('on'). Our formal analysis concentrated on the semantics of copy raising and other instances of the verbs *seem* and *verka*, but we also extended the analysis to related perceptual resemblance verbs (*sound*, *look*, *smell*, *feel*, and *taste*). With respect to the adjuncts, the formal analysis concentrated on the Swedish PSOURCE adjunct, but also extended the analysis to the English PGOAL adjunct.

A puzzle, which we called the *på* puzzle, arose concerning why the Swedish *på*-PP cannot occur in a copy raising sentence. We argued that this is because both the copy-raised subject and the *på*-PP are contributing the source of perception, PSOURCE. Although the PSOURCE is not an argument, it must be uniquely specified, on a par with thematic roles. However, we showed that the standard model-theoretic method for capturing thematic uniqueness is empirically inadequate for PSOURCE and suggested a proof-theoretic method for capturing uniqueness, based on the proof-theoretic method that ultimately governs proper argument consumption and which therefore also applies to thematic roles. This demonstration of the utility of proof-theoretic methods constitutes a further argument for taking proof theory seriously in linguistic semantics (Asudeh and Crouch 2002a,b), alongside model theory, which has received by far the bulk of theoretical attention. Another puzzle, which we called the puzzle of the absent cook, also concerned PSOURCES and was likewise explained by the fact that the copy-raised subject encodes the source of perception. Our analysis treats as presupposition failure a copy raising sentence uttered in a situation where the source of perception indicated by the subject is absent and the PSOURCE is existentially bound. In contrast, the analysis predicts that a copy raising sentence uttered in a situation where the PSOURCE is an individual, but not the copy-raised subject, is false.

The analysis of PSOURCES bears a potential relationship to other evidentiary phenomena in the semantics literature. For example, Gunlogson (2003) observes that rising declarative questions, as in (132), have stricter felicity conditions than simple interrogatives, as in (133):¹⁷

(132) It's raining?

(133) Is it raining?

Consider a scenario where the issue of whether it is raining is unresolved, A is in a room that does not allow observation of the weather (e.g., it has no windows) and B enters wearing a raincoat. In such a

¹⁷We thank Line Mikkelsen for bringing these cases to our attention.

scenario, both of these utterances are felicitous. However, if B enters without a raincoat on and does not give any other indication that it may be raining, the rising declarative is infelicitous, although the simple interrogative is not. It seems suggestive that the rising declarative entails a source of perception, whereas the simple interrogative does not.

Linguistic encoding of evidentials, as found in languages such as Quechua (Faller 2002) and Tibetan (Garrett 2002), is another potential point of connection with the present work. In terms of Willet's (1988) taxonomy of sources of information, PSOURCES would seem to belong to the *attested* subcategory of *direct* sources. It would be interesting to see if data from a language with both evidentials and Germanic-type copy raising bore this out, if such a language can be identified. Copy raising is especially relevant to the relationship between evidentiality/perception on the one hand and epistemic modality on the other (Garrett 2002), because it constitutes a case in which the speaker is asserting direct perception of something about which s/he nevertheless remains epistemically uncertain.

The relationship between perception and epistemic knowledge is also particularly salient in English *seem/appear* with *that*-complements, as in (134), which we have treated as also requiring a PSOURCE, on a par with expletive alternants of copy raising sentences.

(134) It seems that Tom is cooking.

If arguments that this sort of *seem/appear* is purely epistemic and does not involve a perceptual report are correct (see Matushansky 2002 and references therein), then the *that*-complement cases lack PSOURCES (and PGOALS) entirely.

We think a more tenable position is that this use of the verb *seem* also involves both an epistemic and a perceptual aspect. It is otherwise unexplained why a PP expressing a PGOAL (perceiver) can be used with a *that*-complement:

(135) It seemed to her that they did not pose a threat.

Furthermore, Swedish speakers who allow *that*-complements with raising verbs (recall that this is dialectal) allow them to occur with *på*-PPs expressing PSOURCE:

(136) % Det verkar på Tom att han har gjort det.
 it seems on T. that he has done it
 ~ 'Tom gives the impression that he has done it.'

However, neither English nor Swedish allows a PGOAL or PSOURCE to occur in related examples with the epistemic verb *know*:

(137) a. *Tom knows to me that it is raining.
 b. * Tom vet på Robin att det regnar.
 T. knows on R. that it rains

The verb *know* is surely as good a candidate for a purely epistemic verb as there is. The fact that PGOAL and PSOURCE adjuncts cannot freely occur with *know* but can occur with *seem* in its *that*-complement guise is therefore a strong indication that even this use of *seem* is not purely epistemic and involves a perceptual component.

This pattern of data also gives further evidence for the proof-theoretic control of PSOURCES (and, by extension, PGOALS) developed in section 5.3. In the absence of a PSOURCE resource, the adjunct cannot felicitously occur. Thus, if *seem* lexically provides a dependency on a PSOURCE, but *know* does not, then the pattern of data in (135–137) is explained. In contrast, if the PSOURCE and PGOAL adjuncts are simply

modifiers that can freely occur, then it would be difficult to derive the ungrammaticality of (137a–b). In particular, it does not seem purely semantically inconsistent with the meaning of *know* to add a further perceptual dimension to its meaning.

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