A plea for optional QR

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1 Introduction

Generative linguists commonly make the following two assumptions:

1. When an element moves to a different position, it leaves behind a full copy of itself rather than a trace — the Copy Theory of Movement (Chomsky, 1993)

2. When a quantifier occurs in object position, the type clash between it and the lexical item it combines with is resolved by using QR

Result

(1)   Some cat ruined every piece of furniture.

(2)   a.   [$_{VP}$ ruined every piece of furniture]
       b.   [$_{vP}$ some cat [$_{VP}$ ruined every piece of furniture]]
       c.   [$_{TP}$ every piece of furniture [$_{vP}$ some cat [$_{VP}$ ruined every piece of furniture]]]
       d.   [$_{TP}$ some cat [$_{TP}$ every piece of furniture [$_{vP}$ some cat [$_{VP}$ ruined every piece of furniture]]]]

The PF and LF interface now each delete one copy of each quantifier.

PF:

(3)   [$_{TP}$ some cat [$_{TP}$ ~~every piece of furniture~~ [$_{vP}$ ~~some cat~~ [$_{VP}$ ruined every piece of furniture]]]]

LF1, surface scope:

(4)   [$_{TP}$ some cat [$_{TP}$ every piece of furniture [$_{vP}$ ~~some cat~~ [$_{VP}$ ruined ~~every piece of furniture~~]]]]

LF2, inverse scope:

(5)   [$_{TP}$ ~~some cat~~ [$_{TP}$ every piece of furniture [$_{vP}$ some cat [$_{VP}$ ruined ~~every piece of furniture~~]]]]

Result: <u>no extra movement step is required to get an inverse scope reading</u>

Aims of this talk

- To show that the combination of these two assumptions leads to a number of problems

- To propose to solve this problem by assuming that object quantifiers should be interpreted *in situ*

2 Three problems

2.1 Scope Economy

2.1.1 Problem 1: Scope Economy

(6)   *Scope Economy*
      Scope Shifting Operations that are not forced for type considerations must have a semantic effect
      (Fox, 2000:23)

Prediction: inverse scope is possible in (7-a) but not in (7-b).

(7)   a.   A girl admires every teacher.
      b.   Mary admires every teacher.

Fox uses ellipsis data to show that this condition holds.

Step 1: Parallelism

Parallelism: the scope-bearing elements in the antecedent sentence must receive scope parallel to that of the corresponding elements in the ellipsis sentence (Fox, 2000:31)

(8)   A boy admires every teacher. A girl does, too.

(9)   a.   a boy > every teacher ; a girl > every teacher   *Surface scope*
      b.   every teacher > a boy ; every teacher > a girl   *Inverse scope*
      c.   *a boy > every teacher ; every teacher > a girl   *Mix*
      d.   *every teacher > a boy ; a girl > every teacher   *Mix*

Step 2: Ellipsis data with proper names

If we only have the Parallelism condition, the prediction is that the possible scope configurations for (10) mirror those of (8). As illustrated in (11), this prediction is not borne out.

(10)   A boy admires every teacher. Mary does, too.

(11)   a.   a boy > every teacher ; Mary > every teacher   *Surface scope*
      b.   *<u>every teacher > a boy ; every teacher > Mary</u>   *Inverse scope*
      c.   *a boy > every teacher ; every teacher > Mary   *Mix*
      d.   *every teacher > a boy ; Mary > every teacher   *Mix*

Only the surface scope interpretation is available for the antecedent sentence of (10). Because of parallelism, it follows that surface scope is also the only possible scope configuration for the ellipsis sentence.

Step 3: Scope Economy to the rescue

The pattern in (11) is the result of the Scope Economy condition:

1. Scope Economy prevents *every teacher* from taking scope over *Mary*, so we get only surface scope in the ellipsis sentence in (10)

2. Parallelism prevents scope mismatches between the antecedent sentence and the ellipsis sentence so it forces surface scope in the antecedent sentence

A girl and *every teacher* in the ellipsis sentence (8) are not commutative, so Scope Economy allows inverse scope. Therefore, Parallelism allows inverse scope in the antecedent sentence.

2.1.2   The problem

The structure of the ellipsis sentence in (10) given the two assumptions made above is the one in (12)

(12)   [$_{TP}$ Mary [$_{TP}$ every teacher [$_{vP}$ Mary [$_{VP}$ admires every teacher]]]]

To get the inverse scope configuration, LF can delete the higher copy of the subject and the lower copy of the object:

(13)   [$_{TP}$ ~~Mary~~ [$_{TP}$ every teacher [$_{vP}$ Mary [$_{VP}$ admires ~~every teacher~~]]]]

- Scope Economy cannot prevent QR of *every teacher*, because it is movement forced by type considerations (semantically motivated)

- Scope Economy cannot prevent the lower copy of *Mary* from being interpreted because this does not involve a movement operation

- So: Scope Economy cannot prevent inverse scope

- The prediction is that Scope Economy allows inverse scope in the ellipsis sentence of (10), and therefore Parallelism should allow inverse scope in the antecedent sentence

- This is an incorrect prediction

2.2   Problem 2: Missing readings

Many doubly quantified sentences do not have inverse scope readings:

(14)   a.   Some students read exactly two books.
        b.   No music critic listened to exactly two albums.
        c.   Every child visited exactly two amusement parks.
        d.   Every student attended no parties.
        e.   No child found an Easter egg.
        f.   No boy read every book.
        g.   Two people carried three pianos.

It is not the case that if we were to apply QR here, the resulting reading would be semantically odd. We see this when we change the overt order of the quantifiers:

(15)   a.   Exactly two books were read by some students.
        b.   Exactly two albums were listened to by no music critic.
        c.   Exactly two amusement parks were visited by every child.
        d.   No parties were attended by every student.
        e.   An Easter egg was found by no child.
        f.   Every book was read by no boy.
        g.   Three pianos were carried by two people.

So: we must be dealing with a syntactic constraint on movement.

The problem: given for example the structure in (16) for (14-a), it is impossible to formulate such constraints.

(16)   [$_{TP}$ Some student [$_{TP}$ exactly two books [$_{vP}$ some student [$_{VP}$ read exactly two books]]]]

2.3   Problem 3: Processing

- It is known that inverse scope is more marked than surface scope (e.g. Reinhart, 2006). For (17), it is easier to get a reading where there is one cat than a reading where there are potentially multiple cats.

  (17)   Some cat ruined every piece of furniture.

- This observation has been confirmed experimentally by e.g. Anderson (2004)

- Offline experiments: doubly quantified sentences and questions designed to reveal which readings the participants got. Participants overwhelmingly favoured the surface scope reading. Even in contexts that favoured the inverse scope readings, surface scope readings were easier to get.

- Online experiments: doubly quantified sentence followed by a sentence that disambiguated the doubly quantified sentence; self-paced reading task. The sentences that disambiguated towards inverse scope were read more slowly than those that disambiguated towards surface scope.

- Anderson concludes:

  The results of the experiments presented here show that assigning an inverse-scope interpretation to a doubly quantified sentence consumes more processing resources than assigning surface scope even when extra-linguistic factors conspire to make the inverse-scope interpretation the preferred one. Assigning inverse scope incurs a processing cost when the discourse context supports the inverse-scope interpretation, when the inverse-scope interpretation is referentially simpler than the surface-scope interpretation, and even when no competing interpretations are available. I attribute this processing cost to the greater linguistic complexity of the inverse-scope representation and conclude that computing quantifier scope relations in real time crucially involves linguistic processing, not just general conceptual inferencing. (p.39-40)

- Before the Copy Theory of Movement, inverse scope configurations were indeed more complex than surface scope configurations:

  (18)   a.   Surface scope:
                [$_{TP}$ some cat $_2$ [$_{TP}$ ever piece of furniture$_1$ [$_{vP}$ t_2 [$_{VP}$ ruined t_1]]]]
          b.   Inverse scope:
                [$_{TP}$ every piece of furniture$_1$ [$_{TP}$ some cat $_2$ [$_{TP}$ t_1 [$_{vP}$ t_2 [$_{VP}$ ruined t_1]]]]]

- Now, there is no difference in complexity:

  (19)   a.   [$_{TP}$ some cat [$_{TP}$ every piece of furniture [$_{vP}$ ~~some cat~~ [$_{VP}$ ruined ~~every piece of furniture~~]]]]
          b.   [$_{TP}$ ~~some cat~~ [$_{TP}$ every piece of furniture [$_{vP}$ some cat [$_{VP}$ ruined ~~every piece of furniture~~]]]]

- Problem: our linguistic model is no longer in line with the processing data

Interim summary

We make two assumptions:

1. The Copy Theory of Movement
2. QR for type reasons

This leads to three problems:

1. Scope Economy no longer blocks semantically vacuous movement
2. We can no longer formulate constraints on QR
3. We no longer predict that inverse scope readings are harder to process than surface scope readings

3 A hybrid account

- Both the Copy Theory of Movement and QR are well-motivated operations.

- Argument for the Copy Theory of Movement: certain types of movement do not feed Condition C (Fox, 2002):

  (20) ??Guess [which friend of John's$_1$] he$_1$ visited [which friend of John's$_1$]?

  (21) ??/*[Every friend of John's$_1$], someone introduced him$_1$ to [every friend of John's$_1$].

  This indicates that there is a full copy of *John* rather than just a trace that is c-commanded by the pronoun *he/him*.

- Argument for QR: Antecedent Contained Deletion
  Parallelism:

  (22)   A cat ruined every piece of furniture. A pig did, too <ruin every piece of furniture>.

  In the case of ACD, attempting to satisfy Parallelism yields infinite regress:

  (23)   Mrs Purrington ruined every piece of furniture Walter did <ruin every piece of furniture Walter did <ruin every piece of furniture Walter did ... etc. >>

  Solution: QR[1]:

  (24)   [Every piece of furniture]$_1$ Mrs. Purrington ruined t_1 Walter did <ruin t_1>.

- However, QR *for type reasons* does not seem to be empirically motivated.

Solution: Object quantifiers need to be interpreted *in situ*

Implementation

- I propose a hybrid movement type-shifting account, where the type-clash of object quantifiers is resolved through a type-shifting mechanism and QR happens only for scope.

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[1]I use traces here for simplicity, but there are also ways to do this in the Copy Theory of Movement. See e.g. Fox (2002) and Sauerland (1998).

- Type-shifting mechanism à la Montague (1973); Partee and Rooth (1983); Hendriks (1993): a quantifier like *every* is ambiguous between a type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$ and a type $\langle\langle e,t\rangle,\langle\langle e,\langle e,t\rangle\rangle,t\rangle\rangle$ interpretation:

(25)   a. $[\![every]\!] = \lambda P_{\langle e,t\rangle}\lambda Q_{\langle e,t\rangle}.\forall x : P(x) \to Q(x)$
      b. $[\![every]\!] = \lambda P_{\langle e,t\rangle}\lambda R_{\langle e,\langle e,t\rangle\rangle}\lambda y.\forall x : P(x) \to Q(x)(y)$

The two LFs of (26) are now as in (27). An extra movement step is required to get the inverse scope configuration.

(26)   A cat ruined every piece of furniture.

(27)   a.   Surface scope:
        [$_\text{TP}$ some cat [$_\text{vP}$ ~~some cat~~ [$_\text{VP}$ ruined every piece of furniture]]]
      b.   Inverse scope:
        [$_\text{TP}$ ~~some cat~~ [$_\text{TP}$ every piece of furniture [$_\text{vP}$ some cat [$_\text{VP}$ ruined ~~every piece of furniture~~]]]]

This solves the three problems mentioned above in the following way:

- Scope Economy: Inverse scope readings now require a movement operation. Scope Economy can block this operation.

  (28)   A boy admires every teacher. Mary does, too.

  (29)   a.   Surface scope:
          [$_\text{TP}$ Mary [$_\text{vP}$ ~~Mary~~ [$_\text{VP}$ admires every teacher]]]
        b.   Inverse scope:
          [$_\text{TP}$ ~~Mary~~ [$_\text{TP}$ every teacher [$_\text{vP}$ Mary [$_\text{VP}$ admires ~~every teacher~~]]]]

- Missing readings: As QR requires an extra operation, we can now formulate constraints on it. We no longer predict that QR is always possible.

- Processing: The inverse scope configuration in (27-b) involves an extra movement step, which leads to a structure that is more complex than the surface scope structure in (27-a). We correctly predict that inverse scope is more marked and harder to process than surface scope.

4   PF/LF correspondence

Suggestion: the reason why surface scope is less marked and requires fewer processing resources than inverse scope is because it is easier to interpret the same copy at PF as at LF than to interpret different copies at both interfaces:

(30)   Some cat ruined every piece of furniture.

(31)   Surface scope
      a.   PF: [$_\text{TP}$ some cat [$_\text{TP}$ ~~every piece of furniture~~ [$_\text{vP}$ ~~some cat~~ [$_\text{VP}$ ruined every piece of furniture]]]]
      b.   LF: [$_\text{TP}$ some cat [$_\text{TP}$ every piece of furniture [$_\text{vP}$ ~~some cat~~ [$_\text{VP}$ ruined ~~every piece of furniture~~]]]]

(32)   Inverse scope
      a.   PF: [$_\text{TP}$ some cat [$_\text{TP}$ ~~every piece of furniture~~ [$_\text{vP}$ ~~some cat~~ [$_\text{VP}$ ruined every piece of furniture]]]]
      b.   LF: [$_\text{TP}$ ~~some cat~~ [$_\text{TP}$ every piece of furniture [$_\text{vP}$ some cat [$_\text{VP}$ ruined ~~every piece of furniture~~]]]]

Option 1: Building the PF-LF comparison on top of the Y-model

- The structure in (33) is sent to both interfaces

    (33)   [$_{TP}$ some cat [$_{TP}$ every piece of furniture [$_{vP}$ some cat [$_{VP}$ ruined every piece of furniture]]]]

- Both interfaces choose which copies to delete and which to interpret/pronounce

- Then a reference set of PF-LF pairs is constructed (Reinhart, 2006) and the best pair is chosen. Say that PF1 is the PF of (30), LF1 is the surface scope LF, and LF2 is the inverse scope LF. Then the pair in (34-a) is compared to the pair in (34-b)

    (34)   a.   ⟨ PF1,LF1⟩
            b.   ⟨ PF1,LF2⟩

- We then need a condition like (35)

    (35)   *PF/LF correspondence*
            When there are two copies of one element, delete the same copy at PF as at LF

- The pair in (34-a) has a higher PF/LF correspondence than the pair in (34-b), so only (34-a) is allowed

- Issue: why should (34-b) be more costly than (34-a)? In this scenario, both QR and reference set computation need to take place for the surface scope LF (LF1) and the inverse scope LF (LF2). These could both be costly operations, but they take place regardless of the outcome: both the inverse scope reading and the inverse scope reading require these steps. After having done all this work, it seems stipulative to suggest that the costly step in this process would be choosing (34-b) over (34-a).
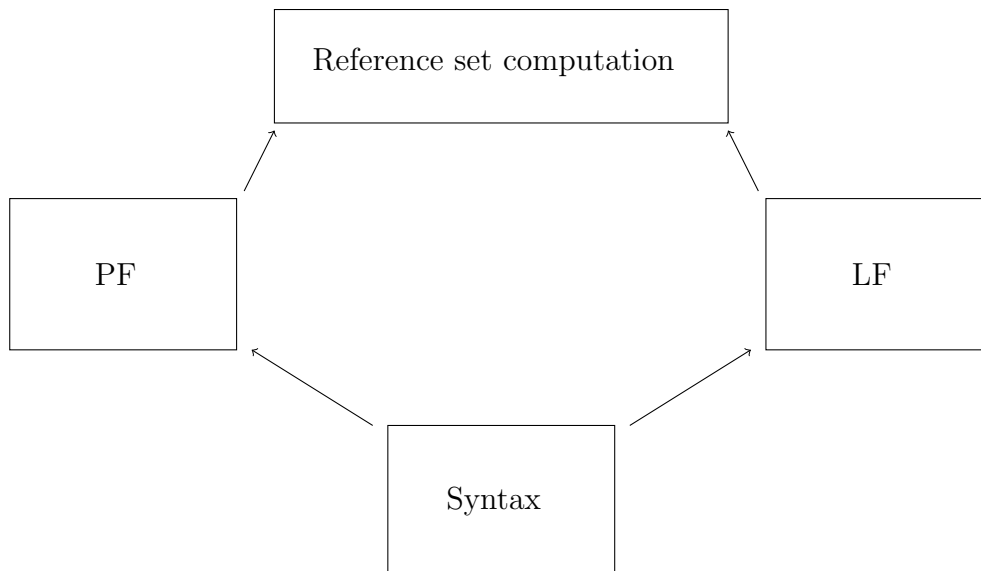

Figure 1: Y-model plus reference set computation

Option 2: Direct link between PF and LF

- A processing model where PF and LF have a direct link

- We again assume (35)

- It takes effort for the speaker to translate the LF in her head to a PF that is very different from this LF, and it takes effort for the hearer to interpret a PF that is very different from the intended LF

- This kind of a model could account for the processing data

Figure 2: Direct PF-LF link

Say that we assume that the three problems above can be solved by assuming (35) and a processing model where PF and LF have a direct link. This has the following three consequences:

1. All kinds of covert movement are predicted to be difficult to process. This means:

   - Reconstruction is predicted to be as costly as QR
   - Given obligatory QR, any any structure with an object quantifier is predicted to be costlier than the same structure with a referential object, even if it has a quantifier in subject position. For instance, (36-a) is predicted to be harder to process than (36-b).

   (36)   a.   Keira liked every play.
          b.   Every girl liked *Hamlet*.

   - Under a covert movement account of *wh-in-situ*, a sentence with *wh-in-situ* is predicted to be costlier than a sentence with a moved *wh*-element. For instance, the French sentence in (37-a), where *qui* stays *in situ*, should be harder to process than (37-b), where the *wh*-element has been moved.[2]

   (37)   a.   Tu as   vu   qui?
              You have seen who?
              'Who did you see?'
          b.   Qui as-tu   vu?
              Who have-you seen?
              'Who did you see?'

2. To solve the Scope Economy problem, Scope Economy should be reformulated as a processing constraint, as in (38).

   (38)   *Scope Economy in the PF/LF approach*
          When there are two copies of one element only delete a different copy at PF than at LF if this results in different truth conditions of the LF

   As we saw, Scope Economy determines whether inverse scope is allowed for the ellipsis sentence in (39) and then Parallelism ensures that both sentences have the same scope configuration.

   (39)   A boy admires every teacher. A girl does, too.

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[2]Both phrasings appear to me to be very common. A Google search on 11 May 2017 yielded 16.700 hits for (37-a) and 18.900 hits for (37-b). This difference does not seem very large. Of course, Google is not a corpus and frequency cannot be equated with processing difficulty, so a far more rigorous study is needed to check whether the prediction that (37-a) is harder to process than (37-b) is borne out.

Therefore, if Scope Economy is a processing constraint, it follows that Parallelism must be, too.

3. To solve the missing readings problem, it must be assumed that some inverse scope readings do not exist because of some processing problem. It is not clear why, for example, inverse scope in (40-a) would be harder to process than inverse scope in (40-b).

   (40)   a.   No cat destroyed every piece of furniture.
          b.   Some cat destroyed every piece of furniture.

   Furthermore, there are also cases where inverse scope is obligatory, and the PF/LF approach has no hope of dealing with those cases:

   (41)   a.   I can wait no more.
          b.   You may have at most three biscuits.

In sum: the PF/LF correspondence approach could be part of the solution and it can explain some of the data, but it does not solve all problems that optional QR solves.

5   QR vs. Reconstruction

- In the Copy Theory of Movement, Reconstruction simply involves interpreting the lower copy of the subject (Chomsky, 1993; Hornstein, 1995; Bobaljik, 1995).

  (42)   A senator is likely to attend the event.

  (43)   [$_{TP}$ A senator [$_{TP}$ likely [$_{vP}$ a senator [$_{VP}$ attend the event]]]]

  (44)   a.   Surface scope reading: there is a specific senator, say Senator Elizabeth Warren, who is likely to attend the event.
         b.   Inverse scope reading: it is likely that some senator will attend the event (but there is not necessarily a specific senator who will)

- In section 2.2 I mentioned that we need to be able to constrain QR, because QR does not always take place, as in e.g. (45).

  (45)   No boy read every book.

- The same can be said for Reconstruction (Chomsky, 1993, 1995; Lasnik, 1999). The following sentences appear to lack reconstructed readings:

  (46)   a.   Everyone seems not to be there yet. $\forall > \neg; *\neg > \forall$
         b.   Someone didn't show up. $\exists > \neg; *\neg > \exists$

- So: maybe the same problems observed for QR also exist for Reconstruction

- Obvious solution: going back to the Quantifier Lowering account of Reconstruction (May, 1977):

  (47)   LF (simplified): [t_1 [not [someone$_1$ show up]]]

- However: Quantifier Lowering goes against the No Tampering Condition and traces go against the spirit of the Minimalist Program

- Open issue

6   Conclusion

- The Copy Theory of Movement in conjunction with the assumption that object quantifiers must move for type reasons gives rise to three problems: the Scope Economy problem, the missing readings problem, and the processing problem

- I have argued that these issues can be remedied by assuming a type shifting mechanism that allows object quantifiers to be interpreted *in situ*

- Open issues:

  1. The extent to which some PF/LF correspondence mechanism at the level of processing plays a role in accounting for the data

  2. How we should account for the fact that Reconstruction appears to be constrained, just like QR

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Acknowledgements

7 Appendix: Reconstruction revisited

7.1 Will solving the Reconstruction issue solve the QR issue?

- Section 4: Reconstruction is also constrained

- The problem of automatic inverse scope in QR cases like (48) that I have discussed occurs in part because Reconstruction is freely available in the Copy Theory of Movement.

  (48)   [$_{\text{TP}}$ some cat [$_{\text{TP}}$ every piece of furniture [$_{\text{vP}}$ some cat [$_{\text{VP}}$ ruined every piece of furniture]]]]

- So if we somehow constrain Reconstruction, this will also constrain QR, therefore solving the problems discussed here.

- Yes, but:

  – Easier said than done; see next section

  – In cases where Reconstruction *is* available, we still do not get inverse scope readings automatically, as attested by (49). Thus, QR still needs to be optional.

  (49)   a. Exactly two shop attendants are likely to bother every customer.
             likely > exactly 2 > every
          b. Some shop attendant is likely to bother every customer.
             likely > some > every
          c. Every CEO didn't fire exactly two people.[3]
             not > every > exactly 2

7.2 Alternative accounts of Reconstruction

- As discussed in section 4, Quantifier Lowering is an account of Reconstruction that enables us to constrain it, but it involves the very un-minimalist operation of lowering as well as traces

- Two other possibilities: the semantic account and the PF movement account

- Neither option allows us to constrain Reconstruction in the desired way

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[3]This sentence should be read with the *hat contour* intonation (Büring, 1997).

7.2.1 The semantic account of Reconstruction

The trace left by the subject can be interpreted as a trace of type e, resulting in a surface scope reading, or a trace of type $\langle\langle e,t\rangle,t\rangle$, which results in the inverse scope, 'reconstructed' reading (Chierchia, 1995; Cresti, 1995; Rullmann, 1995; Ruys, 2015).[4]

(50)   A student is required to attend the meeting.

(51)   a.   LF 1: [A student [λx_e [required [x_e attend the meeting]]]]
        b.   LF 2: [A student [$\lambda X_{\langle\langle e,t\rangle,t\rangle}$ [required [$X_{\langle\langle e,t\rangle,t\rangle}$ attend the meeting]]]]

(52)   a.   Surface scope: $\exists x[\text{student}(x) \wedge \Box \, [\text{attend-the-meeting}(x)]]$
        b.   Inverse scope: $\Box[\exists x \, [\text{student}(x) \wedge \text{attend-the-meeting}(x)]]$

As in the Copy Theory of Movement account, Reconstruction does not involve any movement, so there is nothing to constrain.

7.2.2 The PF movement account of Reconstruction

EPP is a requirement that holds at the level of PF rather than at the level of syntax (Merchant, 2001; Sauerland & Elbourne, 2002; van Craenenbroeck & den Dikken, 2006).

If this is the case, the syntactic structure and PF of (53) look as in (54).

(53)   Every employee is required to attend the meeting.

(54)   a.   Syntax: [$_{TP}$ [$_T$ is] [$_{VP}$ [$_V$ required] [$_{V'}$ [$_{DP}$ every employee] [$_{TP}$ attend the meeting]]]]]]
        b.   PF: [$_{TP}$ [$_{DP}$ every employee] [$_{T'}$ [$_T$ is] [$_{VP}$ [$_V$ required] [$_{V'}$ [$_{DP}$ ~~every employee~~] [$_{TP}$ attend the meeting]]]]]

It follows that to get the surface scope, non-reconstructed reading, a movement operation is needed at the level of narrow syntax or LF:

(55)   [$_{TP}$ [$_{DP}$ Every employee] [$_{T'}$ [$_T$ is] [$_{VP}$ [$_V$ required] [$_{V'}$ [$_{DP}$ ~~every employee~~] [$_{TP}$ attend the meeting]]]]]

So: the prediction would be that surface scope is more costly than inverse scope, contrary to fact.

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[4]Technically the type should be $\langle s, \langle\langle e,t\rangle,t\rangle\rangle$ to allow lambda conversion into the scope of the modal, but I ignore this here for simplicity.