Background on Interrogative Raising

Movement of embedded interrogatives has been proposed at least twice, for independent reasons:

- Questions containing a quantifier can receive a pair-list reading, and it is usually assumed that this happens when the quantifier takes scope over the wh-phrase (May, 1985). Moltmann and Szabolcsi (1994) propose that in this case the question inherits some properties of the quantifier and can undergo an equivalent of QR.
- Lahiri (2002), among others, proposed an analysis of *quantificational variability effect* (QVE) in which questions embedded under a responsive verb can raise to a position in Spec,IP. Preuss (2001) proposed that movement to Spec,VP is sufficient for this purpose.

Most of the data we will present have already been discussed in Moltmann and Szabolcsi (1994), who proposed an analysis of the movement of questions with quantifiers that we will present shortly. Recent work on QR (Fox, 2000; Cecchetto, 2004) are very relevant and will allow us to build a completely different analysis of the data.

Outline:

1. Present the analysis of Moltmann and Szabolcsi (1994).
2. Propose a new analysis which builds on the proposals of Fox (2000); Cecchetto (2004) for QR.
3. Show that the new analysis is strictly better in that it explains more data and is compatible with recent analyses of QVE.

1 Moltmann and Szabolcsi (1994)

1.1 The principle

The sentence (1) can receive many different readings, including (1d) in which "the professors vary with students". They propose an analysis in which (i) the pair-list reading of the embedded question is due to 'every student' taking scope over 'which books' and (ii) the whole question then takes scope over 'a professor'.

(1) A professor knows which books every student read.

a. $\exists$ professor $x, \forall$ book $y, [\forall$ student $z, \text{read}(y)(z)] \rightarrow \text{know}(x)(...)$

b. $\#\forall$ book $y, [\forall$ student $z, \text{read}(y)(z)] \rightarrow \exists$ professor $x : \text{know}(x)(...)$

c. $\exists$ professor $x, \forall$ student $z, \forall$ book $y, [\text{read}(y)(z)] \rightarrow \text{know}(x)(...)$

d. $\forall$ student $z, \exists$ professor $x, \forall$ book $y, [\text{read}(y)(z)] \rightarrow \text{know}(x)(...)$

e. $\#\forall$ student $z, \forall$ book $y, [\text{read}(y)(z)] \rightarrow \exists$ professor $x : \text{know}(x)(...)$

In this view, the pair-list reading of the interrogative is a general quantifier over questions as in (2a). The variable R is then replaced by the denotation of [A professor knows t_i], as in (2b), yielding the meaning in (2c) for the whole sentence.

(2) a. $[\![$which book every student read$]\!] = \lambda R \forall x[\text{student}(x) \rightarrow R(\text{which books } y[x \text{ needs } y])]$
b. $[\![$a professor knows $t_i]\!] = \lambda Q \exists z[\text{professor}(z) \wedge [z \text{ knows } Q]]$
c. $[\![(1)]\!] = \forall x[\text{student}(x) \rightarrow \exists z[\text{professor}(z) \wedge [z \text{ knows which books } y[x \text{ needs } y]]]]$

This explains why the professors may vary with students but not with books (the readings (1b,1e) are not available). The quantifier in (2a) is called a *layered quantifier* and a crucial assumption of Moltmann and Szabolcsi is that the layered quantifier inherits semantic properties relevant for movement from the QNP which took scope over the wh-phrase.

1.2 Further arguments

Moltmann and Szabolcsi (1994) provide arguments in favor of their analysis which suggest that the whole question and not just the embedded QNP must take scope. First of all, we know that QNPs cannot normally escape finite clause (the so-called 'clause boundedness of QR'), as shown in (3).

Second, they show that when the question contains a pronoun which must be bound by the matrix subject, as in (4), the inverse scope reading becomes unavailable. If one could simply move the QNP 'every boy' above the matrix subject, the pronoun would remain in the scope of the matrix subject.

(3) A professor knows that every student read *Ulysses*.
a. $\exists$ professor $x, \text{know}(x)(\lambda w.\forall$ student $y, \text{read}(w)(U)(y))$
b. $\#\forall$ student $y, \exists$ professor $x, \text{know}(x)(\lambda w.\text{read}(w)(U)(y))$

(4) Some librarian$_i$ or other found out which book every boy stole from her$_i$.
a. $\exists$ librarian x, x found out $(...\iota z.[$ book $(z) \wedge \forall$ boy $y,$ y stole z from $x]...)$
b. $\exists$ librarian $x, \forall$ boy y, x found out which book y stole from x
c. ?? $\forall$ boy $y, \exists$ librarian x, x found out which book y stole from x

Finally, they provide examples with other quantifiers than 'every' (e.g., 'few', 'more than 5') and show that the availability of the inverse scope for the question parallels the availability of wide scope for QNP headed by the same quantifier. This reinforces their assumption that the layered quantifier inherits properties from the QNP in its specifier.

1.3 Shortcomings

As Moltmann and Szabolcsi acknowledge in a footnote, there are cases where a pair-list question and a QNP involving the same quantifier differ in their possibilities to take wide scope. In particular, the contrast between (5a) and (5b) is left unexplained.

(5) a. To which girl did John introduce every boy?
OK: For each boy x, which girl did John introduce to x?
b. To which girl did John mention which book every boy read?
??For each boy x, to which girl did John mention which book x read?

Fox (2000, fn52) argued that Moltmann and Szabolcsi's main argument in favor of the whole question taking scope (rather than the universal QNP alone) is questionable. It seems that the inverse scope is difficult for a surface structure configuration [QP_1...QP_2...$pronoun_1$], independently of whether it involves an embedded question or not:[1]

(6) i. A girl expected every boy to come to the party $\exists > \forall, \forall > \exists$

ii. A $girl_i$ expected every boy to come to her_i party $\exists > \forall, {}^*\forall > \exists$

Finally, the contrast between (8) and (9) suggests that simple wh-questions like (7) cannot take wide scope. However, it is unlikely that they remain embedded under 'know' since in (10) the question must reach the restrictor position of the adverb. It is not clear how theses cases would fit in the analysis presented above, since there is no layered quantifier in (7).

(7) Which students cheated?

(8) A professor knows every student.

a. $\exists$ professor x, $\forall$ student y, ...

b. $\forall$ student y, $\exists$ professor x, ...

(9) A professor knows which students cheated.

a. $\exists$ professor x, $\forall$ student y, ...

b. $\#\forall$ student y, $\exists$ professor x, ...

(10) A professor knows, for the most part, which students cheated.

2 Revisiting the data

Fox (2000); Cecchetto (2004) argued against the clause-boundedness of QR, proposing instead that the reason why QNP cannot usually scope out of finite clauses is due to a set of constraints like (11).

(11) Cecchetto's constraints on QR:

a. Each instance of QR can only cross one of COMP or v (Phase Impenetrability Condition).[2]

b. Each instance of QR or IR must be semantically motivated (Scope Economy).

If we come back to (3), we see that the QNP 'every student' cannot move over the matrix subject with one instance of QR because this would imply crossing the embedded C and the matrix v (violating 11a). One could imagine cyclic movement over the embedded C, and then over the matrix v, but the first sub-link would be semantically vacuous (violating 11b).

Fox (2000, 90 p64) already discussed the fact that constraints like (11a-b) allow QNP to escape embedded questions in sentences like (1), and questioned the analysis of (1d) by Moltmann and Szabolcsi (1994).

Interim summary: arguments against Moltmann and Szabolcsi (1994):

[1] Pica and Snyder (1995) present an analysis of this phenomenon, but it requires denying the possibility for objects to raise higher than Spec,AgroP. This is problematic for independent reasons.

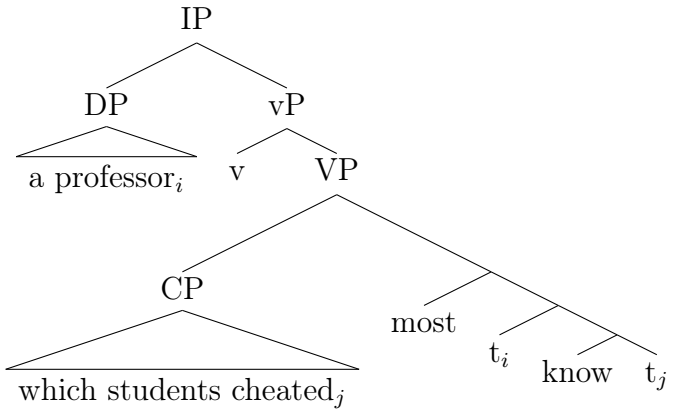
[2] This corresponds to Fox's Shortest Move condition.

- No strict ban on QR out of a finite clause: QNP can *a priori* escape interrogatives.
- The inverse scope reading is unavailable in (4) but in (**??**) as well, so this is not specific to embedded questions.
- Recent analyses of QVE: all interrogatives should be able to move, but they do not seem to be able to escape vP, as shown by (9).

2.1 A new analysis

In this section we will propose a new analysis of the data. We will assume, *contra* Moltmann and Szabolcsi (1994) that embedded interrogatives never escape vP, and that the inverse scope readings they discuss are only due to QNPs taking extra-wide scope. We will see that Cecchetto's restrictions (11) are sufficient to explain all of the data. We will stick to the idea that pair-list readings are due to the QNP taking scope over the wh-phrase in the questions, but we won't need to rely on layered quantifiers.

To conform with theories of QVE, we will still assume that questions can move. However, we won't assume that this movement can reach Spec,IP as it does according to Lahiri (2002); Beck and Sharvit (2002).[3] We will follow a suggestion of Preuss (2001), according to whom the adverb in (10) attaches to VP, and the interrogative only needs to raise to Spec,VP (see the tree below). We will further assume that the question cannot raise higher.[4]

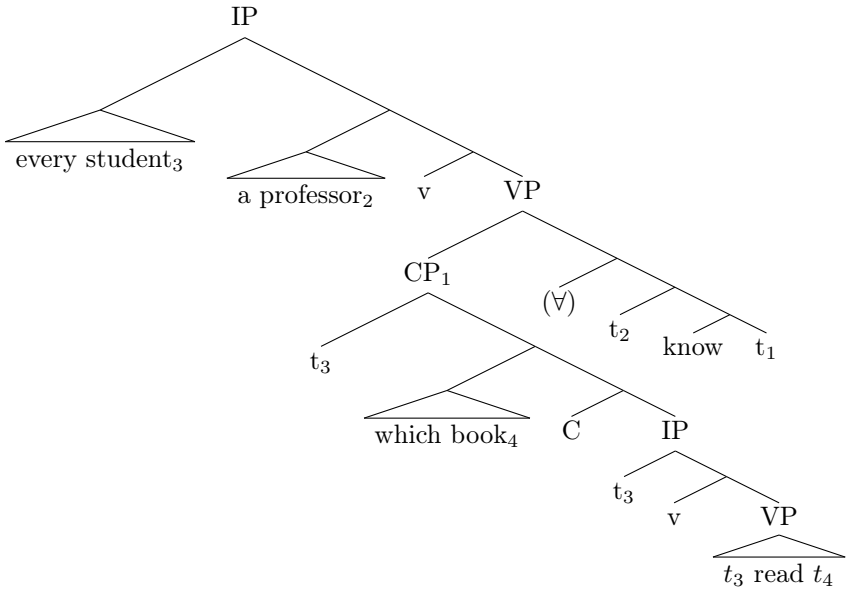


[3]More precisely: Lahiri (2002) proposes that *Interrogative Raising* can target VP or IP. In a sentence live (i), targeting IP will give the usual QVE reading (i-a) while targeting VP will correspond to the focus reading (i-b). This is so because in (i-a) the interrogative is in the restrictor of 'most', while in (i-b) it is in its nuclear scope.

(i) John mostly knows who cheated.
  a. John knows most cheaters.
  b. John's knowledge mostly consists of the list of cheaters.

[4]This assumption is purely *ad hoc*. One could try to build a more principled explanation. Most likely, we would need to posit that embedded CPs cannot move past v.

Cecchetto (2004) argues that there is no *a priori* ban on QR out of finite clauses. We explained why the inverse scope reading is unavailable in (3), but we now need to explain why it is available in (1). The tree below shows the hypothetic LF for (3d):



It is possible for 'every student' to reach the matrix Spec,IP with a cyclic movement in which each sub-link satisfies the constraints in (11):

1. Embedded VP to IP: movement of subject to Spec,IP, crosses embedded v.

2. Embedded IP to CP: taking scope over the wh-phrase to yield a pair-list reading, crosses embedded C.

3. Embedded CP to matrix IP: taking scope over the matrix subject, crosses matrix v.

The crucial difference between (1) and (3) is that the QNP taking scope over the embedded C has a semantic effect in (1) but not in (3).

Since we now assume that the inverse scope is due to the QNP, it is obvious why the availability of the inverse scope depends on the quantifier, and we don't need to assume layered quantifiers which inherit the semantic properties of the QNP in their specifier.

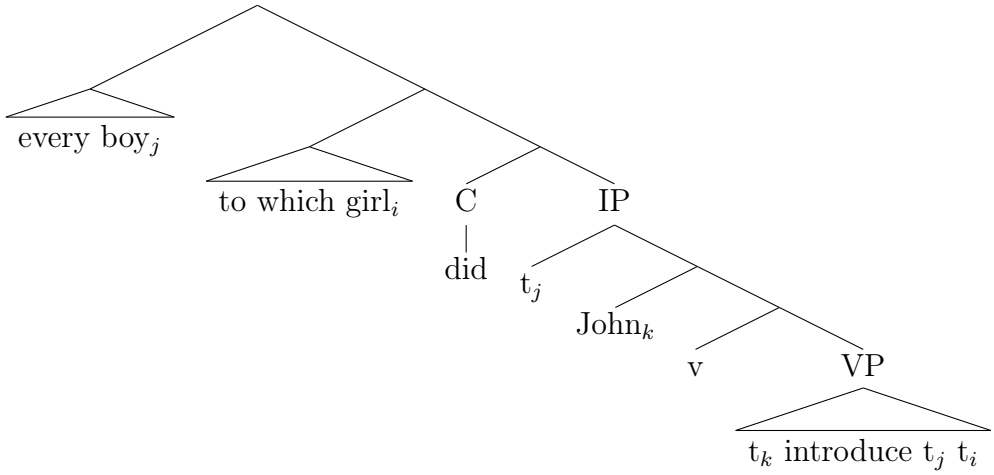
2.2 Advantages and further predictions

This analysis allow us to get rid of the assumption that questions with pair-list readings inherit their ability to move from the embedded quantifier, which was rather *ad hoc*. The reason why inverse scope with embedded question correlates with the inverse scope for QNP headed by the same quantifier is now very simple: it's the same QNP which moves in both cases.

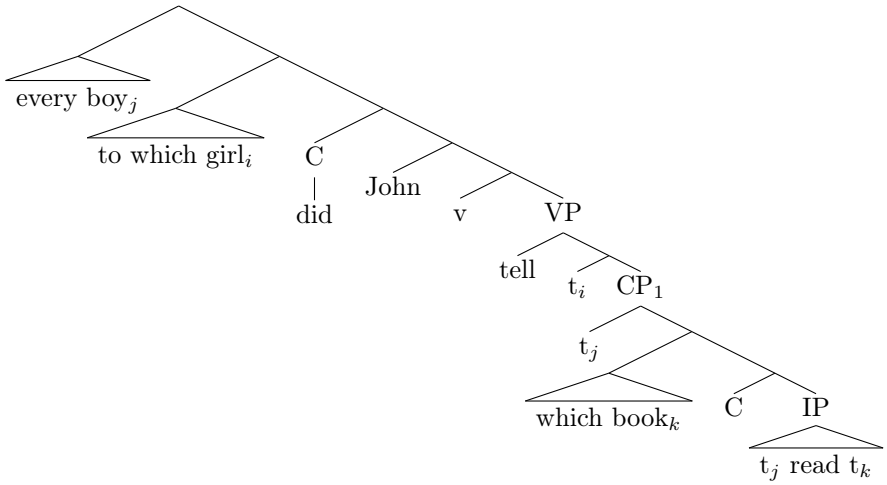
Furthermore, we can now explain the contrast between (5a) and (5b). In these sentences, the wh-phrase 'to which girl' is in the matrix Spec,CP. The QNP in (5a) must raise to Spec,IP to be interpreted (obligatory QR of an object QNP to fix the type mismatch), and from this position it only needs to cross the matrix C in order to take scope over the wh-phrase. In

(5b), the QNP can reach the embedded Spec,CP, but from this position it would have to cross both the matrix v and C in order to take wide scope.

a. Sentence (5a). The inverse scope is possible:



b. Sentence (5b). The LF for the inverse scope is ill-formed because it requires a sub-link through matrix C and v:



This also makes a simple prediction: if some element between the matrix v and C motivated an additional sub-link, the inverse scope should become available again. One possibility is to replace 'John' with a quantified DP, such as 'a professor':

(12) To which girl did a professor tell which book every boy read?
?For each boy x, to which girl y did a professor mention to y which book x read?

Unfortunately, the sentence becomes very complicated and introspective judgments are difficult. We can somehow facilitate the processing of such sentences by using lighter wh-phrases such as 'when' or 'where', as in the sentence (13).

(13) When did a professor tell where every student left?
?For each student x, when did a professor tell where x left?

French speakers I asked did see a contrast between the French equivalent of this sentence with a proper name (14a) or an indefinite (14b) for the matrix subject.

(14) a. Quand est-ce que Jean a dit où chaque étudiant était parti ?
b. Quand est-ce qu'un professeur a dit où chaque étudiant était parti ?

3 Quantificational Variability Effects

(15) John knows, for the most part, which books every student read.
a. For most books that every student read, John knows...
b. For most students x, John knows which books x read.
c. For all students x, John mostly knows which books x read.

(16) A professor knows, for the most part, which books every student read.
a. There is a professor y such that for most books that every student read, y knows...
b. There is a professor y such that for most students x, y knows which books x read.
c. There is a professor y such that for each students x, y mostly knows which books x read.
d. For each student x, there is a professor y such that y mostly knows which books x read.
e. ?? For most students x, there is a professor y such that y knows which books x read.

(17) A professor knows, for the most part, which book every student read.

Preuss (2001) argues that sentences like (15) have two possible pair-list readings, presented in (15b,c). She proposes a denotation for the question which allows such ambiguity when the which-phrase is plural.

If the QNP 'every student' escapes the question to take scope over the matrix subject, leaving a trace of type e, the question should denote a regular question, not a pair-list (this applies equally to any theory of pair-list readings). In this case, it should be impossible to have QVE over students and the reading (16e) should not be available. Similarly, the sentence (17), with a singular wh-phrase, should have only one reading (namely: there is a unique professor who knows of most students x which book x read.)

Conclusion

Theories like Fox (2000); Cecchetto (2004), together with the assumption that the movement of embedded questions is very restricted (no higher than v) fare even better than Moltmann and Szabolcsi (1994) on their own data. As a conclusion, our survey provides:

- a further argument in favor of theories such as Cecchetto (2004).
- an argument for a theory of QVE with questions where quantity adverbs attach to VP and not IP, as in Preuss (2001).

- an argument for a theory of pair-list readings where the embedded quantifier does QR over the wh-phrase at LF.

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