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Friederike Moltmann
UCLA

Anna Szabolsci

SCOPE INTERACTIONS WITH PAIR-LIST QUANTIFIERS*

FRIEDERIKE MOLTMANN AND ANNA SZABOLCSI

UCLA

It is standardly assumed that scope assignment to universal quantifiers (QR or some other semantically equivalent device) is clause-bounded. The type of example underlying this claim is (1):

(1) Some librarian or other found out that every boy needed help.
    * 'for every boy, there is some librarian who found out that he needed help'

We observe that the impossibility of a reading in (1) where librarians vary with the boys contrasts sharply with the naturalness of such a reading in (2):

(2) Some librarian or other found out which book every boy needed.
    'for every boy, there is some librarian who found out which book he needed'

Does (2) motivate the assumption of long-distance quantifying in? We submit that it does not. We propose an analysis of (2) according to which it is not <u>every boy</u> but the whole complement clause <u>which book every boy needed</u> that takes scope over the matrix subject. This is possible, we argue, because the phenomenon in (2) is contingent on the availability of a pair-list reading of the complement; this reading, in turn, can be analyzed as a "layered quantifier." Layered quantifiers are themselves scope-bearing elements and, in the relevant cases, inherit their scopal abilities from the internal wide scope quantifier. We observe that the same analysis is motivated in connection with other wh-XP constructions, though not for <u>whether</u> and <u>that</u> complements. Finally, quantification into interrogatives, which the layered quantifier analysis presupposes, will be defended.

1. Pair-list readings as "layered quantifiers"

Our basic claim is that the 'librarians vary with boys' reading is due to the fact that the complement clause allows a particular interpretation: a pair-list reading. As is well-known, sentences like Which book does every boy need? and their embedded counterparts are ambiguous; the second reading concerns a list of boy-book pairs:

(3) John found out which book every boy needs.
 (i) 'John found out that every boy needs Ulysses'
 (ii) 'John found out that Mary needs Dubliners, Bill Lolita, and Frank Amelia.'

Most, though not all, of the current literature assumes that pair-list readings result from the quantifier taking scope over the wh-phrase (e.g., May (1985)). We propose a specific implementation of this idea, according to which the complement pair-list reading denotes a generalized quantifier (over individual questions) of the following format (this is intended to be neutral with respect to details of question interpretation per se):

(4) $\lambda R \forall x[\text{boy}(x) \rightarrow R(\text{which book } y[x \text{ needs } y])]$

When the relevant (ii) interpretation of (3) is derived, the variable R in (4) eventually gets replaced by John found out:

(5) $\forall x[\text{boy}(x) \rightarrow \text{found-out}(\text{john, which book } y[x \text{ needs } y])]$

The quantifier in (4) is of the same kind as the one denoted by every man's mother or more than two men from every city, see (6)-(7). We will call them "layered quantifiers."

(6) $\lambda P \forall x[\text{man}(x) \rightarrow P(\iota y[\text{mother}(y, x)])]$
 John met every man's mother: $\forall x[\text{man}(x) \rightarrow \text{met}(\text{john}, \iota y[\text{mother}(y, x)])]$

(7) $\lambda P \forall x[\text{city}(x) \rightarrow \exists_{>2} y[\text{man}(y) \;\&\; \text{from}(y, x) \;\&\; P(y)]]$
 John met more than two men from every city:
 $\forall x[\text{city}(x) \rightarrow \exists_{>2} y[\text{man}(y) \;\&\; \text{from}(y, x) \;\&\; \text{met}(\text{john}, y)]]$

We propose that, as quantifiers in object position in general, the pair-list reading may scope over a quantificational subject. This is a novel though obvious step. Note that the matrix subject is clause-mate to the complement as a whole. The wide scope reading of (2) is derived as follows:

(8) a. $\lambda R \forall x[\text{boy}(x) \rightarrow R(\text{which book } y[x \text{ needs } y])]$
 $(\lambda v[\exists z[\text{librarian}(z) \;\&\; \text{found-out}(z, v)]]) =$
 b. $\forall x[\text{boy}(x) \rightarrow \exists z[\text{librarian}(z) \;\&\; \text{found-out}(z, \text{which book } y[x \text{ needs } y])]]$

The result in (8b) is exactly the same as what we would get if every boy scoped out on its own. Proof that nevertheless, the syntactic process of obtaining this reading involves the assignment of wide scope to the whole complement clause, as indicated in (8a), comes from pronoun binding. This reading is incompatible with a pronoun in the complement being bound by the matrix subject:[1]

(9) More than one librarian$_1$ found out which book every boy stole from her$_1$.
* 'for every boy, there is more than one librarian who found out which book he stole from her'
* [which book every boy stole from her$_1$]$_2$[more than one librarian$_1$ found out t$_2$]

This analysis also allows us to explain further restrictions on the availability of the critical reading. We will mention two of them. First, not all quantifiers support the relevant reading:

(10) Some librarian or other found out which book few boys needed.
* 'for few boys, there is some libr. who found out which book they needed'

(11) Some librarian or other found out which book more than five boys needed.
* 'for more than five boys, there is some librarian who found out which book they needed'

(10) is impossible because decreasing quantifiers like few boys do not support pair-list readings to begin with (whatever the reason might be). That is, even (10') is unavailable:

(10') John found out which book few boys needed.
* 'John found out about few boys which book each needed'

More than five boys, on the other hand, does support pair-list readings:

(11') John found out which book more than five boys needed.
'John found out about more than five boys which book each needed'

Only the further step by which this pair-list reading as a whole makes the matrix subject some librarian referentially dependent is impossible. But this is reminiscent of a deficiency that quantifiers like more than five N have, in distinction to every N. As observed in Liu (1990), more than five N takes scope in situ but does not scope over a c-commanding quantifier. With Beghelli (1993), they do not undergo QR:

(12) Some man read every book.
'for every book, there is some man who read it'

(13) Some/every man read more than five books.
* 'for more than five books, some/every man read them'

We show below that layered quantifiers "inherit" the properties relevant to scope taking from their internal wide scope quantifier. This predicts that the pair-list reading of which book every boy needed is able to take inverse scope, but the pair-list reading of which book more than five boys needed is not.

But a contradiction appears to be lurking here. If the pair-list reading involves a 'quantifier > wh-phrase' scope relation, and more than five N does not generally take inverse scope, how come the plain pair-list reading in (11') is available at all? The answer seems to be that when the quantifier is in subject position, it is "close enough" to the wh-phrase to scope over it, without making the kind of effort inverse scope normally requires. This is confirmed by the contrast in (14)-(15): as a direct object, <u>every girl</u> still supports a pair-list reading, but <u>more than five girls</u> no longer does:[2]

(14) I know which boy John introduced every girl to.
'I know about every girl which boy John introduced her to'

(15) I know which boy John introduced more than five girls to.
* 'I know about more than five girls which boy John introduced her to'

The second restriction is that not all matrix verbs allow the critical reading:

(16) Some librarian or other wondered which book every boy needed.
(i) 'some libr. wondered which was the unique book needed by every st.'
(ii) 'some librarian wondered about the boy-book pairs'
(iii)* 'for every boy, some librarian wondered which book he needed'

This should derive from the standard assumption that verbs like <u>wonder</u> subcategorize for complement question interpretations as intensional objects. In fact, if the assumption is implemented in the style of Montague (1974), then the complement clause cannot be quantified in and consequently cannot acquire scope over the matrix subject, either.[3]

(17) wonder (john, $^\wedge\lambda R\forall x[boy(x) \rightarrow R(\text{which book } y[x \text{ needs } y])]$)

With this, we take it that our basic analysis of the puzzling data in (2) is substantiated. Now we turn to some of the questions that the analysis raises. Empirically, how general is the phenomenon that we observed? Theoretically, what motivates the non-trivial assumptions we made in the course of sketching the analysis? We are going to touch upon the following issues:

(18) Other wh-constructions exhibit similar scopal properties and are amenable to the proposed treatment

(19) The absence of apparent "long-distance" effects from <u>whether</u> and <u>that</u> complements

(20) Layered quantifiers "inherit" the scopal abilities of their internal wide scope quantifier

(21) The QP in complement pair-list readings contributes real quantificational force, not just a domain restriction

(22) The exceptional unavailability of certain pair-list readings

2. Other wh-constructions

Our account of pair-list readings does not make reference to any specific property of questions. Rather, pair-list readings arise whenever a quantifier takes scope over a wh-phrase. Semantically, such a scope order means that the quantifier will quantify into whatever semantic object the wh-phrase denotes. This analysis predicts that quantifying in of this sort should be possible for other wh-constructions as well.

In fact, Lerner & Pinkal (1992) give precisely this analysis for apparent exceptions to the clause-boundedness of quantifiers in comparatives such as (23). As argued in Chomsky (1977), comparatives involve A-bar movement of an empty operator, as in (24):

(23) a. John is taller than every boy is.
b. John read fewer books than every other boy did.

(24) John is taller than $[_{CP}\ \varnothing_1\ [_{IP}$ every boy is $t_1]]$

Lerner & Pinkal argue that comparatives involve universal quantification over degrees, expressed by the ∅-operator. So (23a) with the interpretation in (25) would imply that every boy has the same height (or else (23a) is trivially false). Hence Lerner & Pinkal assume that <u>every boy</u> scopes over the ∅-operator. This allows <u>every boy</u> to quantify into the universal quantifier over degrees, as in (26):

(25) $\forall d[(\forall x[boy(x) \rightarrow tall(x, d)) \rightarrow \exists d'[tall(john, d') \ \&\ d' > d]]$

(26) $\forall x[boy(x) \rightarrow \forall d[tall(x, d) \rightarrow \exists d'[tall(john, d') \ \&\ d' > d]]]$

We note that also in comparative clauses the quantifier can apparently take scope over some other quantifier outside the clause:

(27) Some professor or other is as tall as every student is.
'for every student, there is a professor who is as tall as he is'

Moltmann (1992) furthermore observes that decreasing subject quantifiers do not allow quantifying in, nor do universals in object position. As was noted by von Stechow (1982), (28a) has no reasonable interpretation at all. A narrow scope reading of <u>no boy</u> would render (28a) equivalent to 'John is infinitely tall,' (for every height <u>d</u> that no boy has, John's height exceeds <u>d</u>). However, (28a) could have a natural reading, given below, if <u>no boy</u> could quantify into the comparative clause. But this is not available. Similarly, (28b) can only involve a comparison between the number of students that asked John and the number of students x such that x asked every other professor. The reading given below is absent, for the quantifier does not c-command the trace of ∅ (cf. May 1985):

(28) a. John is taller than no boy is.
* 'for no boy x, John is taller than x is'
b. More students asked John than asked every other professor.
* 'for every professor x, the number of students who asked x exceeds the number of students that asked John'

To this we can add the observation that quantifiers such as <u>more than five boys</u> also allow quantifying in, but fail to exhibit scope interactions with any other QP in the sentence:

(29) a. John is taller than more than five boys are.
b. Some professor or other is taller than more than five students are.

Thus, comparatives exhibit exactly the same scope pattern as embedded interrogatives.

Also free relatives, as expected, behave the same way. Moltmann (1992) and Schein (1993) note the possibility of quantifying, with the same restrictions as above. Again, we may add the observation of scope interactions with other quantifiers:

(30) a. John read what every boy wrote.
b. John read what no boy wrote.
c. John watched what caused every fire.
d. Some professor or other read what every boy read.

Thus, it appears that exactly the same quantifier scope possibilities are available for all wh-constructions with the relevant properties. But what happens in whether and that-clauses? We turn to these in the next section.

3. *Whether/that* complements and the clause-boundedness of QR

How general is the phenomenon we are concerned with? Notice that if all complement clauses containing a universal could be interpreted as layered quantifiers and quantified into the matrix clause, as we suggested above, the effects of clause-boundedness of QR would be mostly obscured. Essentially, only the cases with unbindable pronouns would signal that we do not have free scoping out, cf. (9).

But apparent "long-distance" phenomena like in (2) are rather scarce. May's (31) is one further example that clearly belongs here. Tim Stowell (p.c.) suggests that (32) from Lebeaux (1983), and (33) from Lasnik and Saito (1992, 4.2) may belong here, too.

(31) Who_1 do you think everyone saw t_1 at the rally?
'for everyone, who do you think he saw at the rally'
(32) John and $Mary_1$ didn't know what each $other_1$ had done.
(33) Who wonders what who bought? LF: who_1 who wonders what t_1 bought
'for what pair of persons, the one wonders what the other bought'

Let us tentatively assume that in (31) a pair-list reading is formed in the complement clause but the wh-phrase moves on, to clear the CP-complement of think of wh-content. (32) might be derived by first assigning each other scope over what, and then raising the whole complement to the matrix INFL, if these steps are independently justifiable. A similar analysis of (33) is more uncertain since what who bought itself is unacceptable.

Whatever the exact analysis of these examples might be, it is striking that apparent "long-distance" phenomena are limited to constituent wh-complements, that is, they do not arise in either whether-clauses or that-clauses. Every N never appears to scope out of that-clauses; whether-clauses have no pair-list readings; Lebeaux notes that (32) is surprisingly better than examples with that or if, and Stowell remarks a similar contrast in connection with (33):

(34) Some librarian or other found out that every boy needed help. (=(1))
* 'for every boy, there is a librarian who found out that he needed help'

(35) Mary found out whether every boy needed help.
* 'Mary found out about every boy whether he needed help'

(36) a.?? John and Mary think that each other will win.
b.? John and Mary wondered if each other would win.

(37) a.? Who thinks that who left?
b.? Who wonders whether who left?

Nothing that we have explicitly said excludes these. Restricting our attention to the types (34) and (35), recall that in (4) we formulated the interpretation of the pair-list reading using a generalized quantifier inside which the QP takes scope over the wh-phrase. As Groenendijk & Stokhof (1984) point out, interpreting interrogative complements as generalized quantifiers is independently necessitated by disjunctions. The reading on which matrix material distributes over the members of the disjunction can only be derived by interpreting where I live or where you live as in (39):

(38) He found out where I live or where you live.
'he found out where I live or he found out where you live'

(39) $\lambda R[R(\text{where I live}) \vee R(\text{where you live})](\lambda v[\text{found-out}(he, v)])$

But the same argument carries over to whether and that-clauses, e.g.,

(40) He found out whether the painting was authentic or whether the princess was alive.
'he found out whether the painting... or he found out whether the princess...

If these clauses take the same format as constituent wh-complements, then quantification into them is in principle equally possible; and in view of the "inheritance" argument, the layered quantifier should be able to take wider scope, too.

(41) a. whether every girl walks: $\lambda P \forall x[\text{girl}(x) \rightarrow P(\text{whether } x \text{ walks})]$
b. that every girl walks: $\lambda P \forall x[\text{girl}(x) \rightarrow P(\text{that } x \text{ walks})]$

At this point we are not sure why this does not happen; we tentatively suggest two lines of explanation. Both capitalize on the same basic distinction that Lahiri (1991) and Chierchia (1993) make between wh-XP and whether in accounting for the absence of pair-list readings in whether-clauses, namely, that wh-XP is a variable binding operator, but whether and that are not.

One explanation may be quite syntactic. Sloan (1989) notes that the examples in (42) have no pair-list reading, and Schein (1993) extends the observation to other wh-constructions:

(42) a. Who_1 do you think [everyone saw [Mary talk to t_1]]? *pair-list
b. Who_1 does everyone think [t_1 saw you]]? *pair-list
c. Who_1 did everyone say [that Bill saw t_1]? *pair-list

Sloan's generalization, somewhat modified by Schein, is that the quantifier must be clause-mate to the wh-trace. With a slight modification, this can be restated as follows: Quantification into a lifted domain is possible only if that domain contains a clausemate variable. This rules out (41a,b), where whether and that are not variable binding operators.

Another explanation may be that QP cannot scope over that or whether. QP scoping over CP is an is an instance of inverse scope taking. Inverse scope is well-attested in the interaction of QP with wh-XP or another QP. On the other hand, inverse scope over non-variable binding operators is more limited. Many speakers find (43) and (44) unambiguous:

(43) I didn't read every book. [as opposed to: I didn't read any book.]
'not > every'

(44) You may$_{deontic}$ buy every book. [as opposed to: You may buy any book.]
'may > every'

Since that and whether fall together with not and may in not being variable binding operators, these data indicate that we must not expect inverse scope to be automatically available. We remain agnostic on what the rules of the game here are.

4. The scopal abilities of layered quantifiers

We assumed above that layered quantifiers "inherit" the semantic properties relevant for scope from the internal wide scope quantifier.[4] Some further data that support this are as follows:

(45) a. Two boys know every girl's birthday.
'for every girl's birthday, two boys know it'
b. Two boys know more than three girls' birthdays.
* 'for more than three girls' birthdays, two boys know them'
c. Two boys know fewer than three girls' birthdays.
* 'for fewer than three girls' birthdays, two boys know them'

(46) a. John read most of the books.
(i) * 'for each book, John read most of it'
(ii) 'John read the majority of the books'
b. John read most of every book.
(i) 'for each book, John read most of it'
(ii)* 'John read the majority of the books'

(47) a. John read most of what Mary wrote.
b. John read most of what every boy wrote.
(i) 'for each boy, John read most of what he wrote'
(ii)* 'John read the majority of boy-written things'

(45) shows that the ability of DP's N to take inverse scope matches the ability of DP's to take inverse scope. The contrast in (46a,b) shows that in most of DP, DP must be a definite, not a universal. (47a) shows that the free relative what Mary wrote is definite. In (47b) we assume that the boys did not write one piece collectively, i.e., we have a pair-list interpretation of the free relative. The contrast in (47b) parallels that in (46b), showing that what every boy wrote is no more a definite than every book.

How can layered quantifiers inherit the scopal properties of the internal wide scope quantifier? Concerning the data in (45) we can make the following simple observation, suggested to us by Makoto Kanazawa. The layered quantifiers here can be paraphrased as below, where the determiner of the possessor becomes the determiner of the whole quantifier:

(48) a. every girl's birthday = every birthday that belongs to some girl
b. more than three girls' birthdays = more than three birthdays that each belong to some girl
c. fewer than three girls' birthdays = fewer than three birthdays that each belong to a girl

Given that a noun phrase's semantic properties and, we assume, scopal abilities depend on what its determiner is, the availability of these paraphrases predicts that the scope behavior of every girls' birthday will be the same as that of every girl, and similarly for the other examples.

These paraphrases are available because in the examples above there is a one-to-one function from girls to birthdays. Note that this function need not map individuals to individuals, it can also map individuals to sets or groups. So the same holds for (49), an example that may appear problematic at first sight:

(49) a. few girls' books ≠ few books that belong to some girl
b. few girls' books = few maximal book-sets that each belong to some girl

The generalization in formula:

(50) $\lambda P_2 \mathit{DET} x[P_1(x), P_2(fx)] = \lambda P_2 \mathit{DET} y \exists x[(P_1(x) \& (y=fx)), P_2(y)]$ iff f is 1-1

On the other hand, consider the following quantifier: exactly three poems by every poet. Here no similar one-to-one function can be constructed, e.g.,

(51) exactly 3 poems by every poet ≠ every poem by some/every/exactly 3 poet(s)

Correspondingly, the internal and the layered quantifiers differ in crucial, scope-influencing logical properties. For instance, every poet is increasing, but [every poet$_1$ [exactly three poems by t_1]], like exactly three poems, is non-monotonic. Thus we do not get object wide scope in the following example (whether every poet by itself can take widest scope does not concern us here):

(52) a. Some boy or other read exactly three poems by every poet.
* 'for every poet, there are exactly three poems by him/her such that a potentially different boy read them'

This layered quantifier and its internal wide scope quantifier will still exhibit weaker similarities (see Keenan & Faltz (1985)), but these do not concern us here.

What does all this imply for pair-list readings like which book every boy needs or which book more than five boys need? Corresponding to each of the (more than five) boys, we have a unique question asking what that boy needs. In other words, in pair-list readings we always have a one-to-one function from individuals to questions about those individuals. Thus schema (50) applies to pair-list readings, and it is predicted, as desired, that their scope behavior is identical to that of the quantifier that scopes over wh.

5. Quantification into interrogatives?

Interpreting wh-complements as generalized quantifiers is widely accepted. On the other hand, "quantification into questions" is not the option adopted in most current literature, so the choice needs to be justified. Justification will be provided in two steps. First, we show that the analysis of the 'librarians vary with the boys' reading that we proposed cannot be implemented using the standard alternative formalizations; we would need to develop a significantly different analysis if we wanted to stick with them. Second, we observe that the choice we make is both necessary and harmless, for independent empirical and theoretical reasons.

The current view in the literature is that in pair-list readings the QP does not act the same way as in other contexts. Rather than quantifying in, it contributes a domain restriction to the question.[5] To illustrate, (53) is interpreted similarly to (54):

(53) which book every boy needs (matrix or complement)
(54) which boy needs which book (matrix or complement)

On this view, every boy contributes its minimal witness set, the set of boys, which serves to restrict the domain of the question. Abstracting away from now irrelevant differences between authors, the pair-list reading quantifier takes the following general format:

(55) $\lambda R \exists A[\text{min.witness}(A, \| \text{every boy} \|)$ & $R(\text{which } x \in A \text{ needs which book})]$

Let us see now what happens if, as was proposed at the outset of the paper, we wish to analyze (2) by assigning wide scope to the pair-list quantifier over the matrix subject some librarian -- but, instead of (4), we use (55):

(56) $\lambda R \exists A[\text{min.witness}(A, \| \text{every boy} \|)$ & $R(\text{which } x \in A \text{ needs which book})]$
$(\lambda v[\exists z[\text{librarian}(z)$ & $\text{found-out}(z, v)]]) =$
$\exists A[\text{min.witness}(A, \| \text{every boy} \|)$ &
$\exists z[\text{librarian}(z)$ & $\text{found-out}(z, (\text{which } x \in A \text{ needs which book})]$

We quantified (55) in, but the librarians do not end up varying with the boys. The reason why (55) gives this result is that except for the selection of the witness set A, all the relevant action takes place inside the argument of the variable R. Thus, when quantifying in replaces R with some librarian found out, the latter remains outside the scope of that action. In sum, this formalization of the pair-list reading (in distinction to (4)) cannot feed our analysis.

It may be added that simple attempts to revise (55) may encounter a further problem. The librarians vary with boys, not with boy-book pairs, contrary to what the pair-list / multiple interrogation parallelism may suggest. (57) does not mean that if Billy needed two books, then two separate librarians found out about them; it had to be the same librarian for all Billy's book needs:

(57) Some librarian or other found out which books [plural!] every boy needed.

Now we show, following Szabolcsi (1993), that the domain restriction approach fails in an entirely independent way as well. Fundamental to this approach is that you pick a set A and restrict your attention to its members. But this is possible only if the quantifier that induces the pair-list question is monotone increasing. To illustrate the issue with a non-interrogative example:

(58) Two men walk = There is a set A of two men who walk MON↑
[it does not matter whether men outside A also walk]

(59) Few men walk ≠ There is a set A of few men who walk MON↓
[we must guarantee that men outside A do not walk]

(60) Exactly two men walk ≠ There is a set A of exactly two men who walk
[we must guarantee that men outside A do not walk] ¬MON

All the examples we have looked at so far were increasing. The problem of decreasing quantifiers seems irrelevant because, as is well-known, decreasing quantifiers do not support pair-list questions at all:

(61) Mary found out which book few / at most two boys needed.
* 'Mary found out about few / at most two boys which book each needed'

However, non-monotonic quantifiers are never considered in the literature although, as (60) shows, they pose the same logical problem. Besides exactly three boys, examples like between three and ten boys, more than two but certainly fewer than ten boys, etc. belong here. Now, given an appropriate context, these do support a pair-list reading:

(62) Mary found out which book exactly three boys needed.
'Mary found out about exactly three boys which book each needed'

But we now know that domain restriction inescapably misinterprets examples like (62). E.g., if Mary found out about ten boys' book needs, (62) is false but (55) makes it true.

(55) can be fixed by imposing a maximality condition. Interestingly, it turns out

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that any non ad hoc way of doing this yields a formulation that is equivalent, in every respect relevant to us in this paper, to the layered quantifier schema (4).

We have thus given two independent reasons for using a quantificational treatment of complement pair-list readings. But what about the arguments that militate against such a treatment? Szabolcsi (1993) observes that the main arguments have a full force in matrix questions only,[6] and points out that, contrary to popular belief, the range of pair-list readings in the matrix and in the complement contexts is quite different.

Essentially, matrix pair-list readings are supported only by universals. The following contrasts are suggestive:

(63)	a.	Which book(s) did every boy read?	pair-list
		and: I found out which book(s) every boy...	pair-list
	b.	Which book(s) did more than five boys read?	* pair-list
		but: I found out which book(s) more than five boys...	pair-list
	c.	Which book(s) did exactly three boys read?	* pair-list
		but: I found out which book(s) exactly three boys...	pair-list

It is true that some matrix questions involving bare numeral indefinites can be answered in a pair-list fashion. It is argued, however, that these should be analyzed as cumulative questions in the sense of Krifka (1991), Srivastav (1991), who discuss questions with plural definites. The mark of cumulative readings is that they need to contain two semantically plural expressions capable of denoting groups, and they do not exhibit subject-object asymmetries characteristic of pair-list readings. If cumulative questions are answered in the pair-list format, it is for Gricean reasons, not for grammatical reasons.

The fact that only universals support genuine matrix pair-list questions is significant because Which book does every boy need? can be indeed interpreted analogously to Which boy needs which book?. Moreover, when we know that the schema does not need to cater to other quantifiers, this interpretation can be formulated in the simplest domain restriction fashion, without invoking generalized quantifiers of any sort. Without commitment to details, such a representation may be as follows:

(64) $?x \in boy\ ?y \in book\ [read(x,y)]$

We will make use of this last observation in the next section.

6. The exceptional unavailability of pair-list readings

Since our analysis treats the denotation of pair-list questions as quantifiers, we should expect the same scope interactions with other quantifiers in the sentence as in the case of quantified noun phrases. However, there are some differences which we briefly discuss in this section.

So far we have only discussed interrogatives in object position, and observed that in this position they can take scope over the subject. Interrogatives in subject position, however, behave somewhat differently. Let us first look at subject interrogative clauses with universal quantifiers. Here we get pair-list readings as well as scope interactions with a quantifier in object position:

(65) Which book every boy read was obvious to some professor or other.
'for every boy, there is a possibly different professor to whom it was obvious which book the boy read'

However, other quantifiers, for instance <u>more than five boys</u> or <u>exactly five boys</u>, do not allow for pair-list readings (66a), and hence for interaction with another quantifier (66b):

(66) a. Which book more than five boys read was obvious to me.
* 'for more than five boys, which book each read was obvious to me'
b. Which book more than five boys read was obvious to some professor or other.
* 'for more than five boys there is a possibly different professor to whom it was obvious which book the boy read'

We suggest an explanation of these rather unexpected data. Following Koster (1978), we assume that sentential subjects are not in argument position (Spec of IP), but rather in topic position. Quantifiers are generally barred from topic position:

(67) a. John, Mary likes.
b.* Every boy, Mary likes.

Now if an interrogative is interpreted as a layered quantifier as in (4), it should not be able to appear in topic position. Hence, as a general condition, quantifying in will be impossible for "subject" interrogatives. This excludes both (65) and (66a,b).

But why then do universals as in (65) allow for pair-list readings? Here we invoke a result of the last section: in non-complement interrogatives universals provide pair-list readings in another way, namely, by a simple domain restrictor interpretation, cf. (64). Thus we can say that the "subject" interrogative in (65) does not denote a quantifier, but rather a single question analogous to <u>Which boy read which book?</u>.

The final question to answer is, why is then quantifier scope interaction with a QP in object position possible? We suggest is that this is simply due to an independently available distributive interpretation of the VP (cf. Link (1983), Roberts (1987), Moltmann (to app.)), as in (68):

(68) The children bought an ice cream.

For interrogatives, this means the following. A question with a domain restrictor is like a plural object: it has the questions about the individuals in the domain as its parts. When a VP is interpreted distributively, the property it expresses has to hold of every part of the group it is predicated of. In (68) then, every part of the (single) question denoted by which book every boy read, that is, every question of the form 'which book a read' where a is a boy, has the property 'was obvious to some professor or other.' Thus professors can vary with boys.

Notes

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1. For some speakers, (9) may be acceptable with some ... or other, which allows coreference with a singular pronoun.

2. To derive this descriptive generalization one possibility is to assume with Kayne (1993) that specifiers of XP are essentially adjuncts to that XP. It follows then that the subject, standardly thought to sit in the specifier of IP, qualifies as an IP-adjunct instead, and thus automatically has the same scopal properties that are ascribed to QR'd quantifiers. What is relevant to us is that in May's (1985) terms, its scope extends to the next maximal projection, CP, where the wh-phrase is located. On the other hand, making the object, say, a VP-adjunct will have no effect on its ability to interact with CP. The problem with this explanation is that other features of Kayne's theory are not quite compatible with May's definition of scope.

3. Two remarks. (i) Care must be taken when data like (16) are compared with ones having a noun phrase in object position. Some man or other seeks a unicorn from every city may have men varying with cities on the intensional reading. But this will be obtained by letting every city scope out on its own. This does not violate any rule of syntax: quantifying in is clause-bounded, but not noun phrase bounded. (ii) Keenan & Faltz's (1985) and Groenendijk & Stokhof's (1989) treatments of intensionality differ from PTQ and in fact make different empirical predictions. We refrain from adopting these proposals as they are since they appear to yield too many readings elsewhere as well.

4. Caveat: there are some data that do not conform to our preliminary generalization, and we do not yet understand why. Compare:
   (i) To which girl$_1$ did John introduce every boy t_1?
   'for every boy, which girl did John introduce him to'
   (ii) To which girl$_1$ did John mention which book every boy read t_1?
   * 'for every boy, to which girl did John mention which book he read'

   The missing reading would arise if the pair-list reading of which book every boy read behaved scopally exactly like every boy. These examples differ from those in the text only in that the layered quantifier should scope over a wh-phrase, not a QP.

5. This is undoubtedly true of Groenendijk & Stokhof (1984, 1989) and Chierchia (1993), but it holds even of Higginbotham (1991), since he formulates quantification into questions in terms which in the relevant respects are equivalent to G&S's.

6. There are further, subtler arguments against the quantificational approach in Groenendijk & Stokhof (1984) and Chierchia (1993). The absence of pair-list readings with whether-complements has been discussed in Section 3. The issues of de dicto restrictor readings, quantificational variability, and the non-uniform behavior of quantifiers are discussed in Szabolcsi (1993).

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