

QUESTIONS WITH FLOATED QUANTIFIERS

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1. Introduction

Much of the work on question/quantifier interactions focuses on the interpretation of questions with universally quantified NPs in argument positions. The goal of this paper is to explore the interactions of questions with universal quantifiers in non-argument positions such as the floating quantifiers of (1b) and to compare these interactions with that of their argument counterpart :

- (1) a. Chacun de ces étudiants a lu deux livres
Each of the students read two books
- b. Les étudiants ont chacun lu deux livres
The students have each read two books
- c. Les étudiants ont lu deux livres chacun
The students have read two books each

Given space constraints, the paper will focus on floated quantifiers (FQs) only. Binominal quantifiers as in (1c) are discussed in Déprez (1994).

Questions with FQs are shown to vary significantly in their ability to license characteristic pair-list answers which are standardly taken to signify the wide scope of a universal quantifier over a question term. Two central factors at play in the determination of the observed variation are identified. These are, on the one hand, the number of the question term discussed in section 3 and, on the other hand, the syntactic position of the FQ discussed in section 4. The paper argues that the observed variation in the availability of list answers cannot be attributed to constraints on the scope taking capacities of FQs over question terms. It proposes instead that it derives from the differing binding possibilities of the argument of a function introduced by the question (Groenendijk & Stokhof (1984), Engdhal (1986), Chierchia (1993) Williams (1994) among others) ¹. In a nutshell, it is argued that depending on their syntactic positions FQs can or cannot license binding of the functional argument by individuals in the plural subject. When this binding is possible, it licenses a list readings as in Chierchia (1993). When this binding is impossible, i.e when the plurality is the only binder available, the reading is indistinguishable from the wide scope of the question term and incompatible with list answers.

The variations found in the availability of list answers is moreover shown to correlate with a variation in inner island effects induced by the interaction of FQs with non-argument questions (Déprez 1993). This correlation, which

provides additional empirical evidence for the systematic distinctions drawn will be shown to be predicted by the proposed analysis.

2. The data and the problem

It is well known that questions with universal quantifiers in subject positions such as (2a) are ambiguous in that they admit at least two kinds of answers, an individual answer as in (3a) and a pair-list answer as in (3b). In contrast, questions with universal quantifiers in object positions as in (2b) are unambiguous admitting only an individual answer.

- (2a) a. Who does everyone like ?
 b. Who likes everyone ?
- (3) a. Individual answer: John
 b. Pair-list answer: Mary likes John and Julie likes Bill

This distinction is standardly taken to reflect a distinction in scope, with the pair-list answer signifying the wide scope of the universal term over the question term and the individual answer its low scope. Without presuming as to the correctness of this analysis, I will begin by simply taking lists answers as a diagnostic to investigate FQs/question interactions. As a first observation, note that FQs seem in some cases to contrast strongly with their argument counterpart in failing to license any pair-list answer. Consider for instance (4):

- (4) a. Je veux savoir quel livre chacun de ces enfants a lu. *Faites-en une liste.*
 b. Je veux savoir quel livre ces enfants ont chacun lu. *#Faites-en une liste.*
 I want to know which book (each of) these children has (each) read.
 Please make a list of them.

As the felicity of the continuation sentence, *Faites-en une liste (please make a list)* indicates, (4a) with the argument quantifier can have a reading where the quantifier has wide scope allowing the pairing of individual children with distinct books. But the same continuation sentence is infelicitous with the floated quantifier in (4b). (4b) can only be understood as asking about a single book that each of the children have read, and no pairing of individual children with distinct books is possible. The same contrast can be observed in (5) where the list answer is felicitous only as an answer to (5a) with the argument quantifier, and not to (5b) with the FQ. Here again (5b), is understood to be a question about a single patient which has been examined by each of the nurses :

- (5) a. Dites moi quel malade chacune de ces infirmières a examiné. Marie a examiné Jean et Julie, Pierre.
 Tell me which patient each of these nurses has examined
- b. Dites moi quel malade ces infirmières ont chacune examiné. *#Marie a examiné Jean et Julie, Pierre.*
 Tell me which patient these nurses have each examined

Within a scope theory of lists answers (4) and (5) suggest that in contrast to their argument counterpart, FQs must have low scope with respect to question terms. This concurs with Williams (1982)'s observation that FQs are in general more restricted in scope than their determiner counterpart even in non-question contexts. In (6a), for instance, while the argumental quantifier *each professor* can have wide scope over the matrix subject, this is excluded with the FQ in (6b). Similarly for the French examples in (7), the argument quantifier can have wide scope but the FQ cannot:

- (6) a. Some student believes each professor to be competent in some way
 b. Some student believes the professors to each be competent in some way
- (7) a. Un passant a vu chacun de ces garçons en train d'embrasser une fille
 b. Un passant a vu ces garçons en train de chacun embrasser une fille
 A passer-by has seen (each of) these boys (each) kissing a girl

Since questions with FQs involve the extraction of a properly governed object over a subject related quantifier, the absence of list answers in (4b and 5b) cannot be assumed to follow from the ECP or the Path containment Condition as in May's (1985) account of (2b). Rather, given that at surface structure FQs do not c-command the question terms in (4) and (5) or the matrix subject in (6) and (7), the simplest hypothesis to capture their obligatory low scope is to assume that, in contrast to their argument counterpart, FQs cannot undergo QR and must consequently be interpreted at LF in their surface structure position.

- (8) Floated quantifier cannot undergo QR

Assuming that FQs are adjoined to some projection of VP, May's Scope principle, for instance, will then entail that they can take scope up to their containing IP, but no further. This correctly derives the reading of (4b) and (5b) with the LF structure (9) since the VP adjoined quantifier is unable to form a Σ -sequence with the WH and thus to interact in scope with it.

- (9) LF: [_{CP} WH [_{IP} NP...[_{VP} chacun [_{VP} ..t.]]]]

Similarly, in (6) and (7), the VP adjoined quantifier will correctly fail to have scope over the matrix subject. In sum, within a scope approach to pair-list answers, the contrasts observed in (4) to (7) simply follow, if FQs are assumed to be unable to undergo QR or equivalent scoping mechanisms.

However, despite its appealing simplicity, this approach is quickly undermined by a closer look at the data. Further observations reveal indeed that the facts are more complex and that questions with FQs do not always systematically exclude list-answers. As (10) shows, there are undoubtedly cases in which list answers appear to be possible and, in fact, rather natural even though the FQs still clearly fail to overtly c-command the question term.

- (10) a. Alors, dis nous tout. Qui avez-vous chacune secrètement admiré ?
Moi, j'ai toujours admiré Marie Curie et ma soeur Matahari.
So tell us everything. Who have you each secretly admired ? I have
always admired Marie Curie and my sister Matahari.
- b. Je me demande ce que ces enfants ont chacun reçu pour Noel ? Julie
a reçu un train électrique et Jean un ours en peluche.
I wonder what these children have each received for Christmas ? Julie
received an electric train and John a teddy bear.
- c. Dites-moi, si tout s'était déroulé comme prévu, quels hommes célèbres
ces journalistes auraient-elles chacune du interviewer ? Marie aurait du
interviewer le Président et Sue, le Pape.
Tell me, if things had worked as planned, which celebrity these
journalistes should each have interviewed ? Mary should have
interviewed the President and Sue the Pope.

Within the perspective of a scope approach to list answers, this is a rather disturbing observation as it suggests in contrast to (4) and (5), that FQs must in some cases be able to take wide scope over a question term and thus be able to undergo QR. It is thus apparent that questions with FQs present a dilemma for standard scope approaches to pair-list answers. If on the one hand, FQs are assumed to undergo LF movement, as proposed for instance by Heim, Lasnik and May (1992), the possibility of pair-list answers in (10) is easily accounted for, but special constraints are needed to enforce a low scope reading in cases such as (4) and (5). If, on the other hand, (8) is maintained, (4) and (5) as well as (6) and (7) are immediately accounted for, but the assumption that pair-list answers always derive from the wide scope of a universal quantifier over the question term cannot be maintained. The variation in the availability of list answers in questions with FQs thus clearly raises problems for a May-style approach to pair list answers.² One of the goal of this paper is to argue that an alternative analysis which maintains that FQs do not undergo LF movement and derives the list answers in (10) from operations others than quantifying in is clearly preferable. One obvious reason, already mentioned above, is that FQs appear to generally have lower scope than their argument counterpart even in non-question contexts. In this regard then, it is the pair list readings of (10) which appear anomalous, not their absence in (4) and (5). Another reason, is that, if QR were permitted with FQs, it is unlikely that the special constraint(s) needed to account for the absence of list answers in (4) and (5) could be subsumed under general conditions on (LF) movement, such as the ECP or Subjacency, since there appear to be no relevant difference in the nature of the syntactic position of FQs in either of the contrasting cases. In both, FQs occupy adverb like positions. It is quite likely, on the other hand, that the constraint (8) which prohibits QR of FQs can be naturally subsumed under general constraints on adverbial and adjunct scope, although space here prevents us to discuss how. A third reason is that, as has been independently argued by Krifka (1992) and Srivastav (1992), it appears necessary in any event to recognize two distinct sources for pair-list answers: one which stems from the interactions of questions with quantifiers, which may or

may not result from scope, and the other which involves the interaction of questions with definite plurals and stems from pragmatic considerations. As I show in the next section, list answers to questions with FQs appear to be distinct from the traditional quantificational type and rather similar to the plural type. This then raises yet further doubts that they could stem from the wide scope of FQs over question terms.

3. Two types of list answers

As has often been noted, list answers are not limited to questions with universally quantified subjects, but are also possible in questions with plural definite subjects as in (11):

- (11) a. What have these boys rented ?
 Plural answer
 b. The Paper and the Piano
 List answer
 c. (In fact) John rented The Paper and Bill The Piano

Krifka (1992) and Srivastav (1992) have independently proposed that the two types of list answers differ significantly. In their view, list answers with plural subjects are simply the pragmatically cooperative spell out of a cumulative relation between two plural groups. In contrast to standard list answer with quantifiers, they do not represent a distinct interpretation of the question than plural individual answers but only a disambiguating strategy which serves to clarify an understood relation between two pluralities. The list in (11c) is simply a more informative variant of the plural answer in (11b) which specifies the relation that members in the group of boys bear to members in the group of rented movies, it does not reflect a different construal of the question. Krifka and Srivastav bring a number of evidence in support of their conclusion which reveals characteristic differences between the list answers with plural subjects, and those with quantifiers. First, since plural list answers are simple variants of individual answers, they are expected to have the same entailments. That this is indeed the case is here shown in (11c) by the possible use of the expression *in fact* which reveals that (11c) is an explication of (11b), not a different construal of the question. In contrast, list answers and individual plural answers in questions with quantifier subjects such as (12) have clearly distinct entailments:

- (12) a. What has each boy rented ?
 Plural answer
 b. The Paper and the Piano
 = (John has rented both movies and Bill has rented both movies)
 List answer
 c. (*In fact) John rented the Paper and Bill the Piano

In (12), while the plural answer entails that each boy rented both movies, the list

answer entails that each boy rented a single distinct movie. Clearly, here the list answer is not an explanation of the plural answer: it involves a different computation of the distribution of boys and movies. A second difference is that list answers with plural subjects, since they spell out cumulative relations require two pluralities. Thus, when the question term is singular as in (13a), list answers are no longer possible:

- (13) a. Which movie have the boys rented ?
 * John has rented the Paper and Bill the Piano
 b. Which movie has each boy rented ?
 John has rented the Paper and Bill the Piano

In contrast again, questions with quantifier subjects as in (13b) allow lists answers with singular question terms. A third difference, shown in (14), is that list-answers with plural subjects manifest no subject/object asymmetry. This again contrasts with the well known asymmetry of questions with quantifiers.

- (14) Who rented these movies ?
 John rented the Paper and Bill the Piano

Since questions with FQs feature both a plural subject and a distributive quantifier, it is important to determine which type of list answer they support. Although the subject/object asymmetry test is not pertinent here since we are concerned only with subject related quantifiers, both the number and the entailment tests are. Returning to the contrast between (4) and (5), on the one hand, and (10) on the other, note that they clearly differ with respect to the number of the question terms used. In (10), where list answers are possible, both plural question terms and question terms such as *who* and *what*, which, although morphologically singular, are semantically compatible with plurality, are used. On the other hand, in (4) and (5) where list answers are not possible, only singular *which* phrases are used. Thus, a first generalization emerges: list answer with FQs appear to be possible only with semantically plural question terms. As (15) shows, this generalisation is supported by the fact that, the mere replacement of the question term by their plural counterpart in (4b) and (5b) is sufficient to make a list answer possible:

- (15) a. Je veux savoir quels livres ces enfants ont chacun lu. Faites en une liste
 par enfant
 I want to know which books these children have each read. Make a list
 per child
 b. Dites moi quels malades ces infirmières ont chacune examiné. Marie
 a examiné Jean et Paul et Sue, Pierre.

Recall that as discussed above, the number of the question terms is relevant only for list answers with plurals subjects not for the ones with quantified subjects. In this regard, then (15) and (10) versus (4,5) suggest that the source of list answers

to questions with FQs may come more from the interaction of the question with the plural subject than from the wide scope of the FQ. This is further supported by the fact that list answers with FQs, like the one with plurals, appear to have the same entailment as individual plural answers. In (16), for instance, the list answer seems able to function as an explication of the plural answer, as the possible use of the expression *c'est à dire* (that is to say) suggests:

- (16) Dis-moi quels élèves elles ont chacune décidé d'aider financièrement.
 Jean, Paul et Pierre. *C'est à dire*, Marie a décidé d'aider Jean et Paul et Sue, Pierre.
 Tell me which students they each decided to help financially. John, Paul and Peter. That is, Mary decided to help John and Paul and Sue, Peter.

This evidence strongly supports the conclusion that list readings of questions with FQs do not result from scoping FQs over the question term since it shows that there are interesting differences between list answers with FQs and the more standard ones with argument quantifiers. If so, then (10) provides no reason to assume that FQs can undergo QR and (8) can be maintained in full, correctly predicting the general low scope of FQs as well as the lack of list answers in (4)&(5). What now remains to be done is to identify the appropriate source of the list answers in (10). Since there appear to be a number of similarities between list readings with FQs and those licensed by plurals subjects, a possibility that first comes to mind is that the pragmatic analysis of Krifka and Srivastav could be extended to the pair list answers in (10). However, despite the similarities, there are obstacles to a straightforward extension of the pragmatic analysis to pairs lists in questions with FQs. A central point of the pragmatic analysis, indeed, is that list answers with plural subjects are the spell out of a cumulative relations between two pluralities. As argued by Roberts (1990) cumulative relations, first discussed in Scha (1984), are subcases of group-group relations or collective readings characterized by a non-uniform or weak distributive relation which allow pairing of subgroups, individuals or a combination of individuals and subgroups in the two pluralities involved. In contrast, sentences with distributive FQs usually imply a strong distributive relation which enforces a uniform one to one pairing between individuals. The difference is here illustrated in examples such as (17) where (17a) can be true in a situation in which two boys together rented 3 movies and the third one rented only two, but (17b) cannot. Under the narrow scope of five movies, (17b) strictly entails that each boy must have individually rented five movies, totalling 15 rented movies, a strong distributive reading parallel to the strong distributivity enforced in (17c) with an argument quantifier:

- (17) a. Three boys rented five movies
 (B1 + B2) R 3 movies & B3 R 2 movies
 b. Three boys each rented five movies
 B1 R 5 movies, B2 R 5 movies, B3 R 5 movies
 c. Each of these three boys rented five movies

In view of this distinction, it is apparent that an extension of the pragmatic analysis to list answers to questions with FQs would require that the distributive force of the floated quantifier be understood to be somehow weakened from strong to weak, and its contribution to the meaning of the question understood as more pragmatic than semantic. Although problematic since it seems to go against the lexical meaning of the FQ, this view may not be unreasonable since non interrogative sentences with FQs which show a certain vagueness in their distributive relation do exist. Consider for instance (18):

- (18) a. Les enfants ont acheté des livres
The children children bought books.
b. Les enfants ont chacun acheté des livres
The children each bought books.
c. Chacun des enfants a acheté des livres
Each of the children bought books

Although (18a) and (18b) still differ since (18a) is true in a situation in which subgroups of children collectively buy books while (18b) is not, both sentences are nevertheless similar in that they can be true in a situation in which individual children buy either a plurality of books or a single book. That is, in a model with three children and four books, (18b) can be true if child-A buys two books and child-B and child-C buy only one book each, as spelled out in (19):

- (19) Jean a acheté Moby Dick et Tom Sawyer, Pierre, Les voyages de Gulliver et Marie, Alice au Pays des Merveilles.
John bought Moby Dick and Tom Sawyer, Peter, Gulliver's travels, and Mary, Alice in the Wonderland

This seems, however, not to be possible with (18c), which implies that each child has bought a plurality of books. This shows that sentences with FQs are sometimes compatible with non-fully uniform distributivity. In cases like these, further spelling out of the understood distribution is informative. Thus, it could be that list answers in questions with FQs are the pragmatically cooperative spell out of this kind of weak distribution (Deprez 1994). Under such a view, FQs appear to be largely equivalent in meaning to distributive adverbs such as *individually*, *separately* or *respectively* which partition the subject down to individuals but are still compatible with pragmatic plural list answers as shown in (20) (Srivastav 1992):

- (20) Dites-moi quels élèves Marie et Sue ont individuellement/ séparément/ respectivement/ décidé d'aider financièrement. Marie a décidé d'aider Jean et Paul et Sue, Pierre.
Tell me which student Mary & Sue individually/ separately/ respectively wanted to help financially. Mary wanted to help John and Paul and Sue, Peter

Summing up, I have provided evidence that list answers in questions with FQs do not stem from the wide scope of the FQ over the question term. One possibility, briefly explored here, is that they result from the pragmatically cooperative spell out of a weakly distributive relation³. This is supported by the fact that they share properties with list answers licensed by plural subjects. A problem for this approach, however, is the fact that the cumulative reading of interacting plurals seems in general to appeal to a much weaker notion of distributivity than the one present in constructions with FQs.

4. The syntactic position of Floating quantifiers

The plausibility of a pragmatic approach is somewhat undermined by evidence that the availability of list-answers in questions with FQs is not solely constrained by the plurality of the question term but also by the syntactic position of the FQ. The various syntactic positions which an FQ can occupy along a string of auxiliaries, modals and VPs are illustrated in (21):

- (21) a. Marie et Sue examineront chacune deux malades
 Mary and Sue will examine each two patients
 b. Elles auraient (chacune) voulu (chacune) pouvoir (chacune) examiner
 (chacune) deux malades
 They wanted each to be able to examine two patients

Comparing (21) with (22) and (23) which respectively give the possible positions of VP adverbs and of sentential adverbs, we see that French FQs can occupy both sentential and VP adverbial positions. This suggests that like VP adverbs, FQs can adjoin to (or be in the specifier of) projections of VP, and like sentential adverbs, they can adjoin to projections of IP.

- (22) VP adverbs positions:
 Marie et Sue examineront soigneusement deux malades
 Mary and Sue will carefully examine two patients
 Elles auraient * voulu * pouvoir OK examiner OK deux malades
 They would have wanted to be able to examine two patients
- (23) Sentential adverbs positions:
 Elles examineront probablement deux malades
 They will probably examine two patients
 Elles auraient probablement voulu ?? pouvoir * examiner * deux malades
 They would probably have wanted to be able to examine two patients

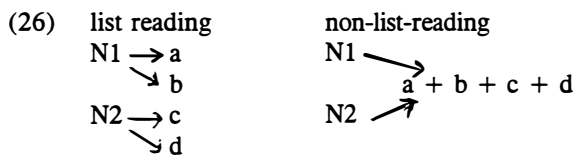
What is of interest to us here, is that the various positions where FQs can occur appear to have differing effects on the possible interpretation of cooccurring questions. For instance, in cases such as (24) where the FQ occurs in a clear (i.e. non ambiguous⁴) sentential adverb positions, list answers are possible:

- (24) Dites-moi quels malades elles auraient chacune voulu pouvoir examiner demain. Marie aurait voulu pouvoir examiner Jean et Paul, et Sue, Luc et Louis.
 Tell me for each nurse which patients she would like to be able to examine tomorrow

In contrast, in cases such as (25) where FQs occur in clear VP adverbs positions, the list reading is impossible under normal intonation, even with a plural question term.

- (25) Dis-moi lesquels elles auraient voulu pouvoir chacune examiner Jean, Paul et Pierre. #C'est à dire, Marie aurait voulu pouvoir examiner Jean et Paul et Sue, Pierre.
 Tell me which are the patients such that each nurse would have liked to be able to examine tomorrow

That is in (25), there is no pairing of individual nurse with individual patients or subgroup of patients. Rather, the only pairing possible is of each nurse with all patients, or more precisely of each nurse with the same group of patients. That is, (25) is understood as a question about a specific group of patients who have the property of having been examined by each nurse. Schematically, the difference between (24) and (25) can be represented as in (26), where N are nurses, a,b,c,d, patients and the arrows symbolize events of examination.



Note, furthermore, that in contrast to (16), the plural answer and the list answer of (25) have clearly different entailments. The plural answer gives a group of patients which have been examined by each nurse, while the list answer attempts to pair individual nurses with individual or subgroup of patients, a pairing which is impossible here. The contrast between (24) and (25) shows that the syntactic position of the FQ has consequences on the availability of the list reading. The overall generalisation discussed in Deprez (1994) is as follows: the closer the floated quantifier to the VP, the more impossible the list reading. Such syntactic effects do not square easily with a pragmatic approach, as it is quite unclear why the position of FQs should have an influence on the strength of their distributive reading, permitting weak distributivity in some positions and enforcing strong distributivity in others. In view of this difficulty, it seems worthwhile to explore a different source for the list answers of questions with FQs. This is what I will do in the next section.

5. Functional list answers

It is useful to begin with the observation that examples such as (27a) containing an FQ and a pronominal are ambiguous, permitting one reading in which patients are divided in two distinct subgroups, the patients of Marie and the patients of Sue, paired individually with members of the subject plurality, as in (27b), and the other in which there is only one group of patients examined by both nurses, as in (27c):

- (27) a. Marie et Sue ont chacune examiné leurs malades
 Marie and Sue each examined their patients
 b. Marie examined her own patients and Sue examined her own patients
 c. Marie examined Marie & Sue's patients and Sue examined them too

Since (27) contains only definite NPs, it is doubtful that this ambiguity could result from the relative scope of the object NP and the FQ. Rather, in the spirit of Heim, Lasnik and May (1992), it is more plausible to assume that the ambiguity stems from two distinct bindings of the possessive pronoun in the object NP, one in which the pronoun, despite its plurality is successively bound by the individual members in the subject group (27b), the other, where the pronoun refers to the subject plurality as a group as in (27c). If we assume that the meaning of the FQ *chacun* translates as in (28a), along the line of Link's (1983) distributive operator, the distinction could be formally represented as in (28). In (28), the pronoun is interpreted either as a variable bound by the universal quantifier introduced in the translation of the FQ as in (28) or as a variable bound to the λ operator standing for subject group as in (28c). This leads to the two readings described:

- (28) a. $\text{chacun} = \lambda P \lambda x [\forall y [y \text{ an atomic part of } x] \rightarrow P(y)]$
 b. $\lambda x [\forall y [y \text{ an atomic part of } (x)] \rightarrow y \text{ examined } (y \text{ patients})]$
 c. $\lambda x [\forall y [y \text{ an atomic part of } (x)] \rightarrow y \text{ examined } (x \text{ patients})]$

(28b) is a property which when applied to a group entails that each atomic part of the group has examined their own patients. (28c) on the other hand, is a property which when applied to a group entails that each atomic part of the group has examined the patients of the group. In the spirit of Heim, Lasnik and May (1992), the ambiguity between (28b) and (28c) could be syntactically represented by distinct coindexings of the pronoun either with the FQ or with the subject NP as indicated in (29):

- (29) [Marie et Sue]_i ont chacune_j examiné leurs_{s,yj} patients

Returning to questions. I now want to propose that the reading in (28b) is in fact very close to what is needed to account for the list readings with FQs. The similarity between the ambiguity noted in the pronominal case and the availability of list answers in questions can be expressed if following Chierchia (1993) among

others, we assume that questions under their functional readings are interpreted as introducing a function variable whose argument can be bound by an appropriate c-commanding NP. More specifically, Chierchia proposes that wh-movement leaves a complex trace representing on the one hand a function variable bound by an existential operator which corresponds to the wh-operator, and on the other hand, its argument which can be either free or bound locally by a suitable c-commanding NP. Under this view, (30a) for instance, has the structure in (30b) where the double indexing represents the complex trace and receives the interpretation in (30c). In (30c), quantification is over variables whose values are functions like "mother of", "sister of" etc, whose domain is the set of men and whose range is the set of people they love. Lists answers are assumed to be the spell out of such functions.

- (30) a. Who does every man love ?
 b. $\text{Who}_i [\text{every man}_j [t_j \text{ loves } t'_i]]]$
 c. $\{p: \sim p \exists f [\forall y (\text{person}(s)'(f(y)) \ \& \ \text{every man}_x, p = \hat{\text{love}}(x, f(x))]\}$

Adapting this proposal to questions with FQs the pair-list reading can now be obtained as in (31b), where the argument of the function introduced by the question term is bound by the universal quantifier introduced by the floating quantifier and understood as mapping individual members in the subject plurality to their own patients.

- (31) a. Quels patients Marie et Sue ont elles chacune examiné
 b. $\{p: \sim p \exists f [\forall x (\text{patient}(s)) f(x) \ \& \ \forall y [y \text{ atomic part of } (M+S)] \text{---} \> \hat{\text{examined}}(y, f(y))]\}$

(31b) leads a reading which asks which function is such that it maps atomic members in the subject plurality to their own patients, that is in the case at hand, Mary to her patients and Sue to her patients. This is the desired list reading. The other possibility, given in (32), is for the function introduced by the wh-element to be bound either to the plural subject itself or following a proposal by Williams (1994) to some contextually relevant plurality, here noted k.

- (32) $\{p: \sim p \exists f [\forall x (\text{patient}(s)) f(x) \ \& \ \forall y [y \text{ atomic part of } (M+S)] \text{---} \> \hat{\text{examined}}(y, f(M+S/k))]\}$

(32) leads a reading asking about a function which maps a plurality into another plurality, that is in the case at hand, a function which maps the group Marie and Sue to a group of their common patients or simply picks a contextually relevant group of patients. This reading yields a single specific group to which the property of having been examined independently by Marie and by Sue applies. This second possibility then leads the reading represented in (26b) which arises when the list reading is either impossible or not chosen. Note that in effect, this reading is indistinguishable from one which would give wide scope to the question term and low scope to the quantifier, the desired result.

Assuming that (31)&(32) provide the appropriate readings, we still have to account for the syntactic restrictions on their respective availability. As a first step, I will follow again Chierchia (1993) in assuming that the relevant readings are represented syntactically with the double indexing the complex wh trace left by wh-movement. I follow here his convention in taking the subscript to represent the functional variable bound by the wh-operator and the superscript the binder of the argument. The two readings can then be represented as in (33) where the superscript is coindexed with the FQ in (33a) leading the reading in (31b) and with the subject in (33b) leading the reading in (32):

- (33) a. Quels patients_i Marie et Sue ont-elles chacune_i examinés t_i
 b. Quels patients_i [Marie et Sue]_k ont-elles chacune examinés t_k_i

However, this does not yet suffice to explain the contrast created by the differing structural positions of the FQ. Moreover, it requires a slight extension of Chierchia's proposal since we now have a non-NP, i.e. the FQ itself, as a 'binder' for the functional argument. A slight enrichment of the syntactic structure can solve both of these problems. Following much recent work, let us postulate a VP internal subject position. This opens the possibility that the binder of the functional argument is this VP internal subject or more exactly its trace, now in the closest available NP position. With this assumption, not only can binding of the functional argument be limited to NP/A-positions⁵, but more importantly, an elegant explanation for the role played by the syntactic position of the FQ in the licensing of list readings is now possible. The central idea is as follows. When the FQ is in a sentential adverb position, i.e. attached to some IP-projection, it clearly c-commands the VP internal subject position. As a consequence, the trace of the VP internal subject can be compositionally interpreted as an individual variable bound by the universal quantifier as in (31) above. In such cases, we can assume that binding of the wh-function by individuals in the subject plurality is possible and the availability of list answers follows as in Chierchia (1993). When the FQ occurs in VP adverbial position on the other hand, that is, presumably below the VP internal subject, c-command does not obtain. If so, the trace of the subject is compositionally interpreted as bound by the subject itself, namely as a plurality and the binding of the wh-function by the VP internal subject is no different than binding by the plural subject itself. As a consequence, the wh-function maps a plurality to a plurality, i.e. the common group of patients, and no list reading is possible.

The assumption that the VP internal subject can serve as a binder for the functional argument permits an interesting account of how the syntactic position of FQs influences the availability of list readings. However, in contrast to the pragmatic approach briefly considered above, this analysis now faces a problem to account for the importance of the number factor in the licensing of list answers. Recall that as (4&5) showed, singular questions are incompatible with the list readings. This is not predicted, here, since it is unclear why a wh-function interacting with an FQs should not be able to map individuals in the plural subject to singular individuals since it clearly can when it interacts with an

argumental universal quantifiers. This problem is all the more puzzling since FQ constructions usually permit a distributive pairing of individuals in the subject NP to singular objects, at least with an overt pronoun. In (34), Mary and Sue can each be paired with a different childhood friend:

- (34) Marie et Sue ont chacune invité leur amie d'enfance
Mary and Sue have each invited their childhood friend

It is thus surprising that this possibility should become unavailable in questions with singular question terms. Although I cannot at this point offer a full account of this fact, a few remarks should help point to the possible direction of a solution. Note that in the analysis proposed, binding of the functional argument is not done directly by a quantified NP but rather by the trace it binds in the VP internal subject position. That is binding is here somewhat more indirect. This suggests that, in such cases, binding of the functional argument may be more akin to a case of dependent plural than to a case of true quantificational binding. If so, it may be that when the question word is singular this affects the binding possibility just as the presence of an intervening singular can disrupt dependent plurals in examples such as (35), from Roberts (1990):

- (35) a. The boys bought cars that had steering wheels with leather covers
b. The boys bought cars that had steering wheels with a leather cover
c. #The boys bought cars that had a steering wheel with leather covers

It is clear, moreover, that the binding of a functional argument although very similar to pronominal binding is nevertheless not fully equivalent. Licensing of distributive dependencies involving a singular definite NP with no overt pronoun such as (36a) appear to be distinctly more difficult for FQs than for subject quantifiers. In (36a), indeed, while the argument quantifier can license a reading in which a definite NP, the office, is understood to covary with each man considered, this reading is rather difficult (may be impossible) with the FQ.

- (36) a. Chacun de ces hommes quittera le bureau à trois heures
Each of these man will leave the office a 3 o'clock.
b. Ces hommes quitteront chacun le bureau à trois heures
These man have each left the office at 3 c'clock

It has often been observed that definite determiners and singular which phrases are similar in presupposing uniqueness. If so, this may be what is at the source of the lack of pair list reading with singular questions. Note that if such effects are indeed at stake, the expectation is that the presence of an overt distributive pronoun could facilitate a list reading with a singular wh-question. Although the data is rather delicate, I believe it goes in the right direction as it appears that in (36') a pair-list reading is more possible than in examples such as (4)&(5):

- (36') Je voudrais savoir quel livre ils ont chacun emporté dans leur chambre
I would like to know which book they each brought to their room

6. Inner island effects

An interesting confirmation for the proposed analysis comes from the consideration of the effects of FQs on non-argument questions. Déprez (1993) has shown that FQs variably induce inner island effects depending on the syntactic positions in which they occur⁶. As recently proposed by De Swart (1991), Szabolcsi and Zwart (1993) and Williams (1994), inner island effects, illustrated here in (40), arise whenever a non-argument *wh* is extracted over an intervening scope bearing element.

- (37) How did few people/noone do it ?
How_i [few people]_j [do it]_{S:i;j}

In Williams's (1994) view, inner islands are but one illustration of a more general constraint stated in (38) which he dubs the Nested Scope Constraint (NSC). The NSC requires that whenever the scope of an element XP (here encoded by indexing, following Williams' convention) is contained within the scope domain of another element YP, the XP itself must also be in YP's scope domain.

- (38) The Nested Scope Constraint (Williams 1994)
* XP_i...[... YP:i ...]:k

Assuming that the scope of an adjunct is the maximal projection to which it attaches, (37) illustrates a violation of the NSC since the scope domain of the adverbial adjunct *how*, i.e the VP, is contained in the scope domain of the subject quantifier, but *how* itself is not. Consider, however, (39) which manifests no inner island effect.

- (39) How did everyone leave ?
How_i [everyone_k [leave]_{S:i;k}

Here the situation appears identical since the scope of the extracted adjunct, i.e the VP, is again contained within the scope of the subject quantifier. The difference is that (39) is fully acceptable, showing that there are systematic exceptions to the NSC. As Williams notes, these exceptions occur precisely in cases where binding of the functional argument as in Chierchia (1993) is possible. Williams thus proposes to revise the NSC as in (40), now predicting that it will have no effects just in case binding of the functional argument is possible.

- (40) The Revised Nested Scope Constraint
* XP_i...[... YP:i...]:k unless XP depends on k, i.e k bind the functional argument of XP

(41) and (42) illustrate further examples the same type, this time, however, with the French construction of split *combien* extraction, the relevant case for our purpose. As shown in (41a), the extraction of *combien* from within an object NP is excluded by the NSC when it crosses over an intermediate scope bearing element, here, the adverbial quantifier *beaucoup* (a lot) :

- (41) a. *Combien ont-ils [*beaucoup*_k lu [t_i de livres]_{NP:i}]_{VP:j}
 How many did they a lot read of books ?
 b. Combien chacun de ces enfants a-t-il lu de livres
 How many has each of these children read of books

As shown in (41b), however, this extraction is licenced when binding of the functional argument by the subject quantifier is possible, leading a reading in which individual children are paired with distinct numbers of books.

Returning to questions with FQs, consider the examples in (42)/(43) which illustrate split *combien* extraction from within the scope domain of FQs.

- (42) a. *Dis-moi combien elles ont du [_{VP} (chacune) examiner de malades
 Tell me how many they had to each examine of patients yesterday
 b. *Dis-moi combien elle ont [examiné chacune de malades] hier
 Tell me how many they have examine each of patients yesterday
- (43) a. (?)Dis-moi combien elles ont chacune du examiner de malades
 Tell me how many they each had to examine of patients
 b. (?)Dis-moi combien elles ont chacune examiné de malades
 Tell me how many they have each examined of patients

In (42) FQs occur in a VP adverbial position, presumably within VP, and split *combien* extraction is strongly deviant. In (43), however, FQs occur in sentential adverbial positions and the extraction although not perfect for all speakers, is markedly better. Since in both (46)&(47) extraction occurs from within the scope domain of the FQ, this contrast is particularly challenging for various scope approaches to inner islands. But the analysis of FQ/question interactions proposed here, in conjunction with Williams NSC correctly predicts it. Recall that I have argued that only FQs c-commanding the VP internal subject position can licence binding of the functional argument introduced by a question term. Since FQs in VP adverbial positions do not c-command the VP internal subject, it follows that extraction from within their scope domain is unable to escape a violation of the NSC, since binding of the functional argument is not licenced. Thus extraction in these cases will correctly be ruled out. In contrast, FQs in sentential adverb positions can c-command the VP internal subject position and, as a result, licence binding of the functional argument by the atomic members in the subject plurality. This suffices to counteract the effects of the NSC and to license split *combien* extractions in these cases. In short, there is a striking parallelism between cases in which list answers are licenced and inner island effects escaped and cases in which neither are possible. Both are determined by the overt

syntactic positions of FQs and can thus not be assumed to result from QR of the FQ over the *wh*-element at LF or from scope over its trace. I have proposed, instead, that scope of the FQ over the VP internal subject position is what licenses appropriate binding of the functional argument introduced by questions determining in turn the availability of list answer and the lack of inner island effects in non-argument extractions over FQs.

To conclude, the paper has shown that the availability of list readings in questions with FQs are influenced by two factors, the number of the question term and the syntactic position of the FQ. I have argued that this could not be accounted for under a theory which would derive the list reading from the wide scope of FQs over question terms. The proposed analysis instead, argues that it is scope of the FQ over the VP internal subject position which determines whether a function introduced by the question term can or cannot map the individual/atomic members of in the plural subject to subgroups in the question denotation. When this is possible pair list answers are licensed and correlatively, FQs do not induce inner island effects. When this is not possible, list answers are not available and extraction of non arguments from within the scope domain of FQs violate the NSC, thus creating inner island effects.

Notes

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1. See also Jacobson (1992) for a reanalysis of functional readings in a variable free semantics.
2. Note that an approach such as Aoun and Li's (1993) in which the scope of a quantifier is calculated on the basis of *c-command* over a member of the chain left by movement fares no better in this respect. Contrary to a May-style approach, Aoun and Li would predict that FQs should always have wide scope over extracted objects, a prediction which our data clearly shows to be incorrect.
3. See Déprez (1994) for a more thorough discussion of this option.
4. Some syntactic positions such as the one immediately following a tensed verb or auxiliary appear to be possible for both sentential and VP adverbs.
 - (i) Elles ont probablement/soigneusement examiné ces deux malades
They have probably/carefully examined these two patients
 As discussed in Déprez (1994), however, adverb ordering can disambiguate such positions and when so, the generalisation is confirmed.
5. See Williams (1994) for interesting support for this limitation
6. See Déprez (1993) and references cited there for a more extensive discussion of this phenomenon.

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