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1 The scope of this paper

It is well known that indefinite phrases are more liberal in taking scope than other quantifying phrases. In general, the scope of indefinites is not limited by the finite clause in which they occur, although the scope of universal quantifiers is. *Wh*-phrases behave very much like indefinites: in languages with *wh* in situ, their scope need not be restricted by something like clause boundedness.

In a recent paper, Tanya Reinhart has proposed to explain the difference between indefinites and *wh*-phrases on the one hand and non-indefinite quantifiers on the other hand by means of the following assumptions (cf. Reinhart (1994)).

- Like Heim (1982) it is assumed that indefinites do not have quantificational force of their own. Whereas Heim assumes that the indefinite article expresses an individual variable, Reinhart proposes that it may express a choice function.
- Whereas individual variables are bound by the nearest c-commanding quantifier at LF in Heim's framework, choice variables can be existentially generalized at any place according to Reinhart.
- *wh* morphemes behave essentially like indefinite articles. The difference is that they are existentially generalized at the COMP position of an interrogative clause.

The rule Quantifier Raising (QR) still exists and obeys island restrictions whatever they are exactly, say clause boundedness (cf. May (1985)). According to Reinhart, indefinite are ambiguous between the choice variable reading and the individual variable reading. Like Winter (1996) I want to investigate the stronger assumption that indefinite articles invariably express choice function variables. Similarly for the *which*-determiner and the *wh* morpheme in general.

Reinhart's proposal can then be viewed a the attempt of giving a principled explanation for the difference between the scoping behaviour of indefinite terms and that of other quantifiers. It seems that there is no semantic reason for LF movement of indefinites or *wh*-phrases.

One might consider the approach as an essential step towards ridding ourselves of QR altogether. Surface syntactician, e.g. categorial grammarians, never have accepted that rule, and recently even advocates of the Minimalist Program have argued against the rule (Lasnik (1993)). The ideal outcome might be that there is no semantically motivated LF movement at all.

In this article I want to discuss some data, notably reconstruction facts and scrambling accross negative polarity items in Korean, which suggest that we cannot get rid of semantically motivated LF movement. In particular, there is a well-motivated analog of *wh*-movement at LF which is restricted by a general filter on LF movement ("Beck's filter"), which will be discussed below. The conclusion of this paper will be that most of the arguments for choice functions in semantics are not compelling. In most cases we can achieve the same results with classical methods when they are combined with reconstruction and the use of Skolem functions. On the other hand, we will see that modern theories, notably the Minimalist Program seem to be only compatible with a semantics that makes use of choice functions. Thus, if these theories are on the right track, the method will considerably gain in importance.

The organziation of the paper is as follows. In the first part I will repeat what has been said about choice functions in the literature. Then I will come to facts which drive the seemingly simple approach into complications. Next, I will come to the reconstruction and scrambling data. Finally I will discuss an alternative formulation of QR which doesn't scope the NP but only the article. Certain anaphora puzzles seem to drive us toward such an analysis. Furthermore, this version of QR seems to be the only one which is compatible with the so-called Miminalist Program. Since this alternative version of QR requires the use of choice functions, most recent development in syntactic theory support this kind of semantics.

The discussion is endebted very much to the lucid representation given in Heim (1994) which, in several respects, is more elaborate than the account given here. Furthermore, I wish to thank Graham Katz, Manfred Kupffer and Wolfgang Sternefeld for discussion and help.

2 Choice functions and indefinites

I start with the interpretation of indefinite terms. For the discussion, I will assume an extensional typed language in the style of Gallin (1975). That means that expressions of type e denote individuals, expressions of type s denote possible worlds, t is the type of the truth values. The symplest choice functions are enties of type $\langle\langle e, t\rangle\, e\rangle$. A choice function f assigns to any non-empty set of individ uals a member of this set.

(1) **Definition.** f is a choice function iff $P(f(P))$, where f is of type $< et, e >$ and P is non-empty.

Let us use the notation ch(f) for "f is a choice function". In first approximation we can represent then the first order existential statement (2-a) as (2-b) or (2-c).

(2) a. $\exists$x P(x) $\wedge$ Q(x)
b. $\exists$f ch(f) $\wedge$ P(f(Q))
c. $\exists$f ch(f) $\wedge$ Q(f(P))

The formulae are equivalent only if P and Q denote non-empty sets. If Q is empty, f(Q) is undefined. Consequently the formula (2-b) is undefined. The same holds for (2-c) if P is empty.

As Winter (1996) points out, this semantics is a problem for the analysis of a sentence like (3-a), which should have the LF (3-b) and the translation (3-c).

(3) a. A unicorn sneezes
    b. $_f$[a$_f$ unicorn sneezes]
    c. $\exists$f ch(f) $\wedge$ unicorn'(f(sneeze'))

In (3-b), the scope marker in front of the sentence may be thought as the existential quantifier over f. Now, if the extension of the concept unicorn is empty, as it happens to be the case, the formula is not defined, but we want it to be false in this case. Winter proposes to type-lift choice functions: the indefinite article doesn't denote an ordinary choice function variable but a higher order choice variable: for a non-empty set P, f gives us the set of properties of a certain invidual in P. If f applies to an empty set P, it delivers the empty generalized quantifier. The formula representing (3-b) would therefore be:

(4) $\exists$f ch(f) $\wedge$ f(unicorn')(sneeze'))

This certainly makes the formula false and equivalent to the usual first order representation. If I am not following Winter's proposal here exactly, it is because a lot of the attraction of working with choice functions in semantics is that we can interpret indefinites in situ. Winter has gone back to the usual Montagovian nominal which we have to move at LF if it occurs in object position and if we forbid type lifting as an interpretive device (see Beck (1996) for relevant arguments). Thus, in Winter's account, sentence (5-a) must have the LF (5-b), whereas Reinhart (and me) would like to have the simpler LF (5-c), which does it without QR:

(5) a. Max is reciting a poem
    b. $_f$[[a$_f$ poem]$_i$[Max is reciting t$_i$]]
    c. $_f$[Max is reciting a$_f$ poem]

To be sure, Winter still can differentiate between indefinites and other quantifiers: QR does the local scoping is a very local rule. Thus, the object cannot move very far. But the article still is a choice function and in virtue of this fact, the indefinite can extend its scope at libitum.

I think, the following "Fregean" account will do for our purposes. Let us assume that * is an object not in any semantic domain (it could be the universe). We then stipulate, that f(P) = * if P is empty and f is a choice function. In other words, the revised definition is:

(6) **Revised definition.** Let f be of type $< et, e >$. f is a *choice function* iff (a) and (b) hold:
    a. P(f(P)) if P is non-empty.

b. $P(f(P)) =^{*}$ if P is empty.

The consequence of the revision is that we can work with choice functions of the simple type. Henceforth, I will assume this semantics for choice variables.

Graham Katz has asked me how this approach can deal with object opaque verbs, i.e. ? celebrated example *Jones seeks a unicorn.* Montague embeds the intension of a nominal under seek, and we can lift the term *a unicorn* to a nominal in our approach. That would be the term (7-a). Zimmermann (1993) has shown that a simpler solution is available and preferable: we can embed the property in intenso of being a unicorn. In terms of choice functions that would be the term (7-b).

(7) a. $\lambda w \lambda P \exists f\ ch(f) \wedge P(f(unicorn_w))$

b. $\lambda w \lambda x \exists f\ ch(f) \wedge f(unicorn_w) = x$

In each case, we have enough information to implement one or the other analysis of opacity. [1]

Let us apply the approach to some data which have been discussed in the literature. Heim (1982) gives an example where an indefinite occurs in an *if*-clause but has wide scope with respect to the entire conditional. In order to avoid the problem of donkey pronouns, I refer the reader to the simpler sentence (8-b) discussed in Winter (1996), whose LF is (8-c).

(8) a. If a friend of mine likes a cat, I (always) give it to him

b. If some woman comes to the party, John will be happy

c. $\exists$f ch(f) $\wedge$ [if f(woman) comes to the party, John will be happy]

The next application concerns Abusch's (1994) (9):

(9) Every professor rewarded every student who read a book he had recommended

This sentence has a reading where the object of the embeddded clause *a book he had recommended* has intermediate scope between the matrix subject and the matrix object, a violation of the clause boundedness condition which we usually observe for QR. The analysis in terms of choice functions is given in (10-a). (10-b) sketches the classical QR analysis and shows that QR has to violate an island constraint in order to derive this interpretation.

(10) a. Every professor x $\exists$f ch(f) $\wedge$ x rewarded every student who read f(book x had recommended)

b. Every professor x $\exists$y[y a book x had recommended] x rewarded every student who read y

[1] The simplest approach would be assumption that indefinite articles of predicative NPs are semantically empty. Together with the assumption that *seeks* embeds first order properties in intenso, that assumption would make the correct predictions. It would force us, for instance, to analyze *Jones seeks no unicorn* as "There is no unicorn which Jones seeks" or as "It is not the case that Jones seeks a unicorn", but not as "Jones tries to find no unicorn" as the Montague analysis incorrectly predicts.

It should be clear from the paraphrases that we can avoid non local QR. The job is taken over by a non local binding of the choice variable.

The possibility that indefinites widen their scope quite freely has been disputed in the literature Fodor and Sag (1982) and, recently, in Kratzer (1995). Kratzer argues that the scope extension of indefinites requires a bound pronoun somewhere in the indefinite. Kratzer holds the view that the choice variables remain free at LF; the context specifies their value. She observes that in the following pair of examples only (11-a) has an intermediate reading.

(11) a. Every professor rewarded every student who read a book he had recommended.
b. Every professor rewarded every student who read a book Professor K. had recommended.

We can account for the contrast by representing these sentence as (12-a) and (12-b), respectively.

(12) a. Every professor x rewarded every student who read f(a book x had recommended).
b. Every professor x rewarded every student who read f(a book Professor K. had recommended).

Clearly, the choice in (12-a) covaries with the different instances of x whereas in (12-b) there is no such variation.

Kratzer's solution has the consequence that we need an additional device for accounting for the narrow scope reading of the indefinite. Kratzer in her Blaubeuren paper assumes that the indefinite article is ambiguous between the existential quantifier and a choice function.

Yoad Winter and Ede Zimmermann have pointed at the following example which requires a narrow scope existential as well if a particular scenario is given:

(13) a. Every professor invited a lady he knew
b. Every professor x invited f(a lady x knew)
c. $\forall x[\text{professor}(x) \rightarrow \exists y\ \text{lady}(y) \wedge \text{invite}(x,y)]$

Suppose the professors know the same ladies. Then the choice will be the same for each of them if we choose representation (13-b). The first order representation (13-c) makes sure that the choice may be a different for each professor. Clearly, (13-a) has this reading under the scenario. (I think I remember a discussion of the same point by Irene Heim, but I cannot find the reference.)

Winter (1996) correctly observes that the method of choice functions provides an easy explanation for the nonavailability of reading (14-c) for (14-a), an example due to Ruys (1995):

(14) a. If three relatives of mine die, I will inherit a house
b. There are three relatives of mine such that, if each of them dies, I will inherit a house

c. *For each of three relatives of mine, if he dies, I will inherit a house

What we have to do is to assume a distributor D located at the subject (in Heim's work at many places) or located at the predicate (in Link's work). Let us adopt the former option for convenience. The licit LF for (14-b) is (15-a), the illicit LF for (14-c) is (15-b).

(15) a. $\exists$f ch(f) $\wedge$ [if [D f(three relatives of mine)] die, I will inherit a house]

b. *$\exists$f ch(f) $\wedge$ [D f(three relatives of mine)]$_i$ [if t_i die, I will inherit a house]

(15-b) exhibits an unwarranted application of QR: we have scoped the nominal D f(three relatives of mine)] "each of f(three relatives of mine)" out of the entire sentence, a violation of an island constraint. Nothing of the sort happened in (15-a): existential generalization of the choice variable is free.

This discussion concludes the first round of application. Note that the data do not force us to take the choice function approach. We could achieve the same results by analyzing indefinites in the classical way (combined with the insights of Heim (1982)) and adding the stipulation that the QRing of indefinites is simply not restricted by islands. This is essentially the solution advocated by Abusch (1994), at least in my understanding. Thus, in order to convince people (including myself) more conclusive data must come into play.

3 Choice functions and *wh*-phrases

The idea of making use of choice function for the interpretation of questions goes back to Engdahl (1980). It has been revived by Reinhart in recent papers (cf. Reinhart (1992) and Reinhart (1994)). The interpretation of questions by this method is particularly attractive for languages without *wh*-movement like Japanese or Korean. Chomsky (1995, 291) seems to have in mind this method when he writes:

"Suppose that a language has weak Q [= the interrogative feature in COMP]. In that case the structure (63) [= Q [$_{IP}$ John gave DP to Mary]] will reach PF without essential change. If DP = which book, it will remain in situ at PF, (and also at LF, apart from covert raising for Case). The *wh*-feature [= the feature of the *wh*-phrase] does not adjoin to Q; both are Interpretable and need not be checked for convergence. If the language has only the interpretive options of English, it will have no intelligible *wh*-questions and presumably no evidence for a *wh*-feature at all. But languages commonly have *wh* in situ with the interpretation of (65c) [= (guess) which x, x a book, John gave x to Mary]. They must, then, employ an alternative interpretive strategy for the construction Q[... *wh*-...], interpreting it, perhaps, as something like unselective binding. On different grounds, Reinhard (1993) proposes a similar analysis."[2]

For a long time, the standard assumption in Generative Grammar was that *wh*-phrases had to move at LF for semantic reasons, more precisely, for reasons of scope. In recent work, Chomsky seems to hold the view that *wh*-movement serves the purpose of clause typing, i.e., a fronted *wh*-clause marks a construction as an interrogative

[2](Cf. Reinhart (1994))

construction. In other words, *wh*-movement is not motivated semantically but syntactically. The in situ interpretation by means of choice functions seems to provide a method to implement this idea semantically.

If we forget the availabilty of choice functions and try to implement Chomsky's suggestion, the first idea that comes to mind is to proceed like in Heim (1982): *wh*-questions are indefinites and therefore have a free individual variable, the *wh*-variable. Unselective binding of *wh*-variables means existential quantification of these individual variables from COMP. This is the road Nishigauchi (1990) takes for his analysis of *wh*-questions in Japanese, a *wh* in situ language. The result is that the predicted meanings for questions are not correct, as the following example from Nishigauchi shows:

(16) a. Kimi-wa dare-ga kai-ta hon-o yomi-masi-ta ka?
you-TOP who-NOM write-PAST book-ACC read-do-PAST Q
'For which person x, you read a book that x wrote'

b. Nishigauchi's LF:
$[_{CP}$ [[dare-ga$_j$ kai-ta] hon-o]$_i$$[_{C'}$ kimi-wa t_i yomi-masi-ta ka$_{ij}$]]
$[_{CP}$ [[who$_j$ wrote book]$_i$$[_{C'}$ you t_i read Q_{ij}]]

c. Predicted interpretation:
'For which x,y, x a book, y a person that wrote x, did you read x?'

d. Interpretation wanted:
'For which person x, did you read a/the book that x wrote?'

Nishigauchi's theory predicts that the Japanese question (16-a) is synonymous with "Which book that someone wrote did you read?". But the question doesn't mean that. I rather has the meaning paraphrased in (16-d). Thus unselective binding in the style of Heim (1982) cannot be used for an interpretation of *wh* in situ.

Nishigauchi's account has been discussed in detail in Stechow (1996). Von Stechow defends a standard LF in which the *wh*-phrase undergoes long *wh*-movement.

(17) a. $[_{CP}$ dare-ga$_2$$[[_{NP}$ $[_{CP}$ t_2 kai-ta] hon-o]$_1$$[_S$ kimi-wa t_1 yomi-masi-ta] ka]]

b. $\lambda p \exists x_2[\text{person}(x_2) \wedge p = \exists x_1[\text{book}(x_1) \wedge x_2 \text{ wrote } x_1 \wedge \text{you read } x_1]]$

The LF (17-a) violates the Ross constraint, but it correctly represents the meaning of the question as the one-to-one translation (17-b) shows, which is a Hamblin/Karttunen formula.

As the reader may guess, choice functions provide the resources to overcome this problem. We can interpret *wh*-phrases in situ via unselective binding and nevertheless have the correct semantics. We assume that the *which*-determiner, or the *wh*-morpheme quite generally, expresses a choice function variable, which is existentially bound from COMP. COMP itself contains an interrogativizer meaning "p =", where p is a proposition varialbe λ-bound at the CP level. The correct formulation of Nishigauchi's question is then:

(18) a. Revised LF for Nishigauchi
$\lambda p[_{CP}$ $\exists i[_{C'}$ $\exists i[_S$ kimi-wa [[dare-ga$_j$ kai-ta] hon-o]$_i$ yomi-masi-ta] ka]]

b. Interpretation

$\lambda p \exists f[ch(f) \wedge p = \lambda w \exists g[ch(g) \wedge read_w(you,\ a_g\ book_w\ that\ f(person_{w_0})\ wrote_w)]$

c. Classical LF

$\lambda p \exists x[person_{w_0}(x) \wedge p = \lambda w \exists y[a\ book_w\ that\ x\ wrote_w(y) \wedge read_w(you,y)]$

The LF (18-b) is equivalent to the classical LF (18-c). It is important to realize that the choice function for the noninterrogative indefinite "a book..." is quantified in the scope of the interrogativizer. A similar analysis of Nishigauchi's data is given in Heim (1994).

The method extends to more than one *wh*-phrase in situ. Or we can have a *wh*-phrase in COMP and one or more in situ. In the latter case we may consider the *wh*-phrase moved as a genereralized quantifier, whereas the *wh*-phrase in situ has its choice variable bound from COMP. Here is the analysis of such an example:

(19) a. which book did which student read t_1

b. [which book]$_1$ $_2$did [which$_2$ student read t_1]

c. $\lambda p \lambda P \exists g[ch(g) \wedge P(f(book_{w_0}))]$

$(\lambda x_1 \exists f_2\ ch(f_2) \wedge [p = \lambda w[read_w(f_2(student_{w_0}), x_1)]])]$

$= \lambda p\ \exists g[ch(g) \wedge \exists f_2[ch(f_2) \wedge [p = \lambda w[read_w(f_2(student_{w_0})]]]]$

To be sure, $\lambda P \exists g[ch(g) \wedge P(f(book_{w_0}))]$ is the generalized quantifier phrase which translates *which book*. Its type is the usual type generalized quantifiers, viz. $\langle et, t \rangle$.

The examples given can be analyzed by *wh*-movement at LF. The following example, which contains a *which*-phrase with an embedded *which*-phrase, is a notorious problem for classical accounts:

(20) Which mountain in which country did you climb? The Tödi in Switzerland and Mount Cook in New Zealand.

The answers suggest that we should have two *wh*-variables in the nucleus of the question. But *wh*-movement leaves only one *wh*-trace:

(21) [Which mountain in which country]$_i$ did you climb t_i?

According to the standard semantics, the question means something like "Which mountain in some country did you climb?". A good answer would then be: "I climbed the Tödi and Mount Cook". To be sure, an interpretation by means of the choice function method is not entirely straigthforward, because we have to reconstruct *wh*-phrase, but the rest of the job is easy.

(22) a. $_{ij}[_{C'}$ did you climb which$_i$ mountain in which$_j$ country]

b. $\lambda p \exists f\ ch(f) \wedge \exists g\ ch(g) \wedge p = \lambda w.climb_w(you, f(mountain_{w_0}\ in\ g(country_{w_0})))$

For an analysis along these lines, see Heim (1994). One might think that one could obtain the same result by means of the standard method plus a copy theory of traces in the style proposed by Chomsky (1995). This however is not so. Try to give a paraphrase of the question in conventional terms and you will see the difficulty. The nearest paraphrase that comes to mind is something like this:

(23) For which x, x a mountain and for which y, y a country, you climbed the z which is that x and which is in that y?

It is not at all obvious whether there is a principled way to get that information from a standard LF. If the analysis in terms of choice function is correct, then this example is the only one I am aware of that a classical approach cannot treat.

4 Choice functions for *wh*-phrases are more complicated

A closer inspection of the LFs for questions given so far reveals a problem. Most semanticist hold the view that the predicate in the restriction of a *wh*-determiner is extensional with respect to the interrogativizer. If we consider a direct question, this means that the world variable of the restriction must refer to the actual world. This is the reason why we have represented this variable as w_0 in our extensional language. The choice of this variable does not follow from our formalism and it might be useful to impose some restrictions on the expressive power of the LFs.

Consider, for instance, the old chestnut (24-a). The standard analysis according to Hamblin/Karttunen is (24-b), which a choice function approach has to represent as (24-c). Nothing, however, prevents us from choosing the representation (24-c).

(24) a. Which students came to the party?
b. $\lambda p \exists x\ \text{student}_{w_0} \wedge p = \text{come-to-party}_w(x)$
c. $\lambda p \exists f\ ch(f) \wedge p = \lambda w.\ \text{come-to-party}_w(f(\text{student}_{w_0}))$
d. $\lambda p \exists f\ ch(f) \wedge p = \lambda w.\ \text{come-to-party}_w(f(\text{student}_w))$

If we did concede that reading (24-d) exist, we would have to concede as well that the following two questions could mean the same, a point made in other context by **?**:

(25) a. Which toys are gifts?
b. Which gifts are toys?

The LFs that make the two equivalent are these:

(26) a. $\lambda p \exists f\ [ch(f) \wedge p = \lambda w \exists g[ch(g) \wedge f(\text{toys}_w) = g(\text{gifts}_w))]]$
b. $\lambda p \exists g\ [ch(g) \wedge p = \lambda w \exists f[ch(f) \wedge f(\text{toys}_w) = g(\text{gifts}_w))]]$

For every choice that gives me a book in w which is a toy in w there is a choice that gives me that toy (which is that book). Thus the two sets of propositions are the same contrary to the facts. Let us assume therefore that the *which*-restriction is extensional with respect to the interrogativizer, i.e., the classical account is correct in this respect.

To be sure, there remain many issues to be discussed: in fact, I believe that none of the existing theories of questions is fully correct. We need a de re approach which guarantees that a *which*-NP has wide scope with respect to the interrogativizer. Nevertheless, a property relating the subject of the attitude to each of the alternatives asked for enters the content of the question. I am not aware of the existence of such a theory.[3] Hence, I will simply assume that *which*-phrases are extensional with respect to the interrogativizer of their clause.

The extensionality of *which*-phrases is guaranteed by taking up a proposal made in Reinhart (1994), who introduces choice functions which operate on properties in intenso and pick up an individual which is in the extension of the property when it is evaluated with respect to the world of a higher [COMP, +wh]. In our extensional framework, we have to say this:

(27) a. Let F be of type $\langle\langle s\langle s,et\rangle,e\rangle\rangle$. F is a *generalized choice function* if for every P in the domain of F, P(w)(F(P)), for some w.

b. F is *a choice for world w* — $\mathrm{ch}_w(F)$ — iff P(w)(f(w)) for any P in the domain of F.

The terminology *generized choice function* is ad hoc. I use it in order to distinguish this kind of choice functions from the ordinary ones. The term *choice for w* is taken from Heim (1994). The requirements on generalized choice functions are rather weak: they are almost as Skolem functions insofar as they assign an individual to something. But not quite so: the individual has to belong to the property to which the function is applied somewhere, i.e., F does not assign any individual to property P, but an individual which is a P in at least one world.

Let us henceforth forbid to use the simple choice functions for *wh*-words. We replace them by generalized choice functions which are w-choices, w is the "world of COMP". We continue to use the simple choice functions for the indefinite articles. This eliminates the intensional readings discussed above because the two sentences (25) only have the following representations:

(28) a. $\lambda p \exists F\ [\mathrm{ch}_{w_0}(F) \wedge p = \lambda w \exists g[\mathrm{ch}(g) \wedge F(\mathrm{toys}) = g(\mathrm{gifts}_w))]]$

b. $\lambda p \exists G\ [\mathrm{ch}_{w_0}(G) \wedge p = \lambda w \exists f[\mathrm{ch}(f) \wedge f(\mathrm{toys}_w) = G(\mathrm{gifts}))]]$

Thus, the slight complication of the type of choice functions increases the descriptive adequacy of the system. Unfortunately, we cannot stop here.

Note that generalized choice functions work on intensions, but they give us a bare

[3]Suppose, Laura and Andreas are the students. John is aquainted with Laura by the description "the smart girl who has studied Mathematics, who wears such and that glasses, who I met a occasion x,...". Call this egocentric description D_1. A similar relation of aquaintance D_2 connects John with Andreas. Suppose Laura came to the party and Andreas didn't. Then John knows which student came to the party, if he knows that the D_1 came to the party and he knows that the D_2 did not come to the party. The point is that neither Laura nor Andreas are part of the proposition known viz. not known by John. Nor is the information that they are students part of these propositions. To be sure, the content of the said propositions should be properties ("being someone who is D_1 related to a unique individual who came to the party") for the reasons given in Lewis (1979). The elaboration of such a theory might actually turn out to be problematic for the choice function approaches discussed here, because de re interpretations allways assume that the res is in a transparent position with respect to the relevant intensional operator, here the interrogativizer.

individual, i.e., nothing intensional. In the literature, it has been argued that sometimes *which*-phrases ask for individual concepts. Heim (1994) gives the following example:

(29) Which of your classmates do you want to be friends with? The one with the best grades (whoever she may be)

Thus, the choice must be an individual concept c, not anyone, c must be a P in any world. Heim (1994) calls this kind of choice functions "intensional choice functions".

(30) Let f be of type $\langle\langle s, et\rangle\langle s, e\rangle\rangle$. f is an *intensional choice function* — i-ch(f)— iff P(w)(f(P)(w)) for every P in the domain of f and every w.

The interpretation for (30) is then the following one:

(31) $\lambda p \exists f[\text{i-ch}(f) \wedge p = \lambda w[\text{want}_w(\text{you}, \lambda w[\text{friend-with}_w(\text{you}, f(\text{your class mates}))]]]$

While this might turn out to be the correct analysis, more would have to be said to justify the formula. Above all we would have to analyze what it means to be friends with an individual concept. Presumably, this means that one is friends with the value of the concept. If we analyze "want" as "In every world where the wishes of the subject are fulfilled", the formula would express that your are friends with f(your classmates) in every wanting world. I will not further investigate the consequences of this analysi here. In most cases, then, *which*-determiners are interpreted as generalized choice functions.

5 Choice functions and LF-barriers

In this section I will discuss phenomena whose explanation requires *wh*-movement at LF. The essential goal of a theory which interprets *wh*-phrases by means of choice functions is of course to get rid of this movement. I will investigate how the effects of LF movement can be simulated in a choice function approach.

Beck (1996) considers the following contrast in German:

(32) a. *Wann hat niemand wem geholfen?
When has no one whom helped?

b. Wann hat wem niemand geholfen?
When has whom no one helped?

The difference between the two structures is that in (32-b), the *wh*-phrase *wem* is scrambled over the subject whereas it is in situ in (32-a). Beck's theory, which derives the contrast, is that LF-movement cannot cross a negation or quantifier in general. Overt movement, on the other hand, can go across a negation or a quantifier. In order to spell out the theory, Beck distinguishes LF-traces from surface traces by means of the superscript *LF*. She formulates the following LF-filter which I will name "Beck's filter" (the original name is "Minimal Quantified Structure Constraint" [MQSC]).

(33) **Beck's LF-filter** (Beck (1996)) No structure may exhibit the following configuration:

$\alpha_i \ldots$ Neg or Quant $\ldots t_i^{LF} \ldots$,
t_i^{LF} an LF-trace of α.

These are Beck's LFs for (32-a) and (32-b):

(34) a. *Wann$_1$ wem$_2$ [$_{C'}$ hat **niemand** t_2^{LF} t_1 geholfen]
when$_1$ whom$_2$ has no one t_2^{LF} t_1 helped

b. Wann$_1$ wem$_2$ [$_{C'}$ hat t_2^{LF} **niemand** t'$_2$ t_1 geholfen]

(34-a) violates Beck's LF-filter, (34-b) doesn't. The LF-barrier is indicated in boldface print. Obviously, the theory presupposes a classical analysis of interrogatives, where the *wh*-phrases in situ undergoes movement to COMP at LF. This immediately raises questions which a theory that doesn't assume LF movement of *wh*-phrases has to answe and the interpretation of *wh*-phrases by means of choice function variables is precisely such a theory.

Before I take up the challenge let me mention some more examples of Beck's (1996) which are explained by the filter. The following sentences require reconstruction of pied-piped material:

(35) a. Wieviele Bücher hat Karl nicht gelesen?
How many books has Karl not read?

b. For which n, there are n books which Karl did not read?

c. *For which n, ¬ there are n^{LF} books which Karl did not read?

If one assumes an LF along the lines of the paraphrase (35-c), the ungrammaticality follows, for the structure violates Beck's filter. To be more concrete, let us consider the derivation of the two LFs in more detail. To facilitate the understanding, I give an interlinear translation of German into English:

(36) a. S-structure: [How many books]$_i$ has Karl not t_i read?

b. [How many$_n$[t_n^{LF} books]$_i$] has Karl not t_i read?
(QR-ing *how many* to its NP)

c. LF1: [How many$_n$ has [t_n^{LF} books]$_i$ Karl not t_i read?
(Reconstruct [t_n^{LF} books]$_i$ to the highest adjunction site of IP)

d. LF2:*How many$_n$ has Karl not [t_n^{LF} books]$_i$ t_i read?
(Reconstruct [t_n^{LF} books]$_i$ to the highest VP adjunction site under the negation)

LF2 is the structure that contains the offending trace for the relation between *How many$_n$* and t_n^{LF} crosses a negation. It should be obvious that the two LFs have a straightforward translation into a Hamblin/Karttunen formula. In order to make the theory work we need a number of auxiliary assumptions. One is that reconstruction leaves no trace. This is mentioned in Beck (1996) and Stechow (1996). Another assumption that seems required is that the offending trace t_n^{LF} is not present at S-structure already. Suppose, the adjunction of *how many* to its own NP were an admissible S-structure operation, i.e. (36-b) were an S-structure and would therefore not contain a trace with the superscript *LF*. Then LF2 would not contain a trace with the superscript and would therefore not violate Beck's filter. As far as I know, Beck (1996) does not discuss this detail. We for the time being, let us assume a principle like the following:

(37) No string vacuous adjunction at S-structure.

This ban against local QR is rather reasonable, because local QR merely serves the purpose of potentially binding a variable by means of λ-abstraction. Thus, it is a genuine interpretive operation. I will come back to this point below.

Other examples illustrating the same point are these:

(38) a. Wieviele Bücher hat jeder gelesen?
how many books has everyone read?

b. For how many$_n$: there are $t_n{}^{LF}$ books everyone read them ?

c. *For how many$_n$: everyone there are $t_n{}^{LF}$ books read them ?

In (38-c), the relation betwen the antecedent an its LF-trace crosses "everyone", again a violation of Beck's filter.

Beck (1996) notices that (38-a) can have a distribuitive interpretation, i.e., it can mean something like:

(39) a. For everyone, how many books did he read?

b. For everyone$_i$, for how many$_n$: for $t_i{}^{LF}$ there are $t_n{}^{LF}$ books read them ?

(39-b) is a somewhat more explicit paraphrase of the reading. Never mind how distributive questions are exactly interpreted, a notoriously difficult problem, the paraphrase suffices for an illustration of Beck's explanation of the availability of the distributive reading: the possible intervener "everyone" is scoped over the CP and is no barrier anymore between *many* and its LF-trace.

The theory has an unexplained residue which should be mentioned here. If we look at the reconstruction data, we see that the reconstructed nominal "t_n books" is always interpreted as "there is a group/set of t_n books". Now, "there is" is obviously an existential quantifier. How is it possible, then, that this quantifier doesn't give rise to a violation of Beck's filter? In each case, the binding relation between the LF-trace and its binder crosses this quantifier. Beck (1996) solves the problem by stipulation: indefinites do not count as quantifiers in the sense of the filter. This move weakens the explanatory adequacy of the filter, because Beck has in mind a semantic definition of quantifiers. Anything that expresses a second order relation, i.e., a relation between sets, including the existential quantifier, should therefore be a quantifier.

One might think that the choice function approach could help to overcome the problem because the indefinite article is function variable and hence not LF intervener. This, however, is an illusion. The choice variable has to be bound and, for the critical example, at a lower position than the antecedent of the LF-trace. The result is an LF configuration which is alike to the one assumed by Beck in the relevant respects. Thus, I have nothing better to offer, and we have to continue to live with the stipulation that existentially interpreted indefinites are not LF barriers.

A further example discussed in Beck's theory is *wer-alles*-split in German.

(40) a. [Wen alles]$_i$ hat niemand t$_i$ gesehen?
Whom all has nobody seen?

b. *Wen$_i$ hat niemand [t$_i$ alles] gesehen?

c. Wen$_i$ hat [t$_i$ alles]$_j$ niemand t$_j$ gesehen?

(40-a) and (40-c) mean the same: we ask for the people which are a seen be nobody and we want to have an exhaustive answer. The exhaustivity operater is *alles*. (40-b) is ungrammatical, but the grammaticality is restored if we scramble the object before we extract the *wh*-phrase. In both cases, *alles* is stranded.

Beck explains the contrast by assuming the following two LFs for (40-b) and (40-c), respectively.

(41) a. alles$_j$ [$_{\text{CP}}$ [Wen t$_j^{LF}$]$_i$? niemand t$_i$ gesehen hat]

b. *alles$_i$ [$_{\text{CP}}$ Wen$_i$? niemand [t$_i$t$_j^{LF}$] gesehen hat]

In other words, *alles* is scoped to the CP adjunction site at LF. (41-b) is ruled out by Beck's filter because *niemand* "nobody" is an LF-barrier. To make the movement of *alles* to CP plausible, let us introduce Beck's semantics for the "exhaustor" *alles*:

(42) $\text{ALL}(Q) = \{\bigcap X \mid X \subset Q\}$

Thus, (42-a) is roughly translated as:

(43) $\text{ALL}(\lambda \text{p} \exists \text{x}[\text{p} = \text{nobody saw x}])$
$= \{\bigcap X \mid X \subset \lambda p \exists x[\text{p} = \text{nobody saw x}]\ \}$

Inspection of the formula reveals that we do not find any reflex of the trace t$_j^{LF}$, which figures in (41). Beck has to say that the LF-movement of *alles* is type driven: the exhaustor requires the question type. Therefore it must adjoint to the interrogative CP. A trace is not interpretable, but the theory requires that there is one, otherwise we could not explain the contrast. The reader might not be satisfied by this stipulation, but it is the best account known to me. Faute de mieux, let us therefore assume that it is correct.

The theory is corroborated by data from Korean. Exactly as in German, Scrambling can rescue an ungrammatical structure. The following data are from Beck and Kim (1996).

(44) a. *amuto muôs-ûl sa-chi anh-ass-ni?
anyone what-ACC buy-CHI not-do-PAST-Q

b. muôs-ûl$_i$ amuto t$_i$ sa-chi anh-ass-ni?
what-ACC$_i$ anyone t$_i$ buy-CHI not-do-PAST-Q
"What did nobody buy?"

The LFs offered which explain the contrast according to Beck and Kim are roughly these:

(45) a. *muôs-ûl$_1$ [$_{C'}$ **NEG** amuto $t_1{}^{LF}$ sa-chi anh-ass-ni?]

b. muôs-ûl$_1$ [$_{C'}$ $t_1{}'^{LF}$ **NEG** amuto t_1 sa-chi anh-ass-ni?]

It is important to be aware of the fact that these LFs mean exactly the same under the standard analysis for questions. (45-a) is translated into the formula (45-b), which is equivalent to the former by λ-conversion:

(46) a. $\lambda p[\lambda P \exists x_1[\text{thing}_{w_0}(x_1) \wedge P(x_1)] (\lambda x_1[p = \lambda w \neg \exists x_2 \text{ person}_w(x_2) \wedge \text{buy}_w(x_2,x_1)])]$
$= \lambda p \exists x_1[\text{thing}_{w_0}(x_1) \wedge p = \lambda w \neg \exists x_2 \text{ person}_w(x_2) \wedge \text{buy}_w(x_2,x_1)]$

b. $\lambda p[\lambda P \exists x_1[\text{thing}_{w_0}(x_1) \wedge P(x_1)] (\lambda x_1[x_1 \lambda x_1[p = \lambda w \neg \exists x_2 \text{ person}_w(x_2) \wedge \text{buy}_w(x_2,x_1)]])]$
$= [a]$

Thus there are no semantic reasons for the ungrammaticality of (44)[a]. The structure simply violates an LF output condition. The same point can be made with questions that require a functional answer:

(47) a. *Amuto [chaki-ŭi tonglyo-change nuku-lŭl] chochoha-chi anh-ni?
anyone self-GEN colleague-among who-ACC like-CHI not-do-Q.
Chaki-ŭi kyŏchaengcha
Self's competitor.

b. [chaki-ŭi tonglyo-change nuku-lŭl]$_i$ amuto t_i chochoha-chi anh-ni?

The question means "Which of his colleagues does nobody like?". An answer may be "His competitor". This might be interpreted as the Skolem function which assigns to any person his competitor among the real person, or the intensional version thereof, i.e., the Skolem function which assigns to any x and w the competitor of x among x's colleagues in w. Adapting the theory of Engdahl (1986) to the example, we can represent the two readings as (48-a) and (48-b).

(48) a. $\lambda p \exists f \forall x$ [among x's $\text{colleagues}_w(f(x))$]
$\wedge\ p = \lambda w \neg \exists x[\text{person}_w(x) \wedge \text{like}_w(x,f(x))]$,
f of type $\langle e, e \rangle$.

b. $\lambda p \exists f \forall w \forall x$ [among x's $\text{colleagues}_w(f_w(x))$]
$\wedge\ p = \lambda w \neg \exists x[\text{person}_w(x) \wedge \text{like}_w(x,f_w(x))]$,
f of type $\langle s, \langle e, e \rangle \rangle$.

The explanation of the ungrammaticality of (47)[a] is exactly as before: if "who among his colleagues" has to undergo LF movement to COMP, it has to cross a negation and thus violates Beck's filter. If, on the other hand, we scramble the nominal to a position higher than the negation, we have circumvented the LF-barrier and the question is grammatical. The LFs for the ungrammatical sentence and the grammatical one are (49-a) and (49-b), respectively.

(49) a. *[who among self's$_j$ colleagues]$_f$? **NEG** anyone$_j$ likes $t_{f(j)}{}^{LF}$

b. LF for scrambled object:
[who among self's$_j$ colleagues]$_f$? $t_f{}^{LF}$ λf[**NEG** anyone$_j$ likes $t_{f(j)}$]

I think these few examples show that Beck's (1996) theory can derive a number of rather disparate, hitherto unexplained facts. The theory relies on LF movement, an idea against the spirit of a semantics that uses choice functions for the interpretation of indefinites and *wh*-phrases. Let us therefore ask ourselves whether we can mimic Beck's filter in a choice function approach.

The idea that comes to mind is that the relation of existentially generalizing (EG) the choice variable must not cross an LF intervener. Unfortunately, such a principle would not be correct in the general case, because indefinite NPs can outscope universal quantifier as we know from previous discussion. If we interpret indefinites by means of choice variables, EG must be able to cross an LF intervener in such cases. We therefore have to restrict the principle to the existential generalization of *wh*-variables. Let call this version of Beck's filter ***wh*-filter**.

(50) **The *wh*-filter**: Existential generalization of function *wh*-variables, i.e., choice function variables indexed with *wh*, is not possible across Neg or Quant.
$* \exists F \ldots$ Neg or Quant $\ldots wh_F \ldots$,
where F is a variable for generalized choice functions.

This filter can account for the examples discussed so far with the exception of (41)[b]. Before I comment on the reasons, let us look at some of the examples from the choice function perspective. Here is the alternative analysis for (35)[a].

(51) a. Wieviele Bücher hat Karl nicht gelesen?
How many books has Karl not read?

b. $\lambda p \exists F\ ch_{w_0}(F) \wedge p = \lambda w \exists g\ ch(g) \wedge g([how_F\ many]\ books_w)_i$ **not** Karl $read_w$ t_i

c. $*\lambda p \exists F\ ch_{w_0}(F) \wedge p = \lambda w$ **NOT** $\exists g\ ch(g) \wedge$ Karl $read_w\ g([how_F\ many]$ books)

In both cases we have reconstructed the entire nominal. (51-a) is a well formed structure but (51-b) violates the *wh*-filter.

Some comments are in order. The precise structure of *how many books* is this: $[_{NP} [_{Det}$ SOME$_g] [_{N'} [_{Num}$ how$_F$ many] books]]. "many" is the set of numbers. "SOME" is the invisible indefinite plural article. Note that the requirement that the choice is made for w_0 is redundant in this particular case because the set of numbers is the same in each world.

Next let us take up the Korean examples. The formula which is equivalent to (48)[a] is (52).

(52) $\lambda p \exists F\ ch_{w_0}(F) \wedge p = \lambda w. \neg \exists x[person_w(x) \wedge like_w(x,$ F(among x's colleagues))]

The LF which expresses this formula violates the *wh*-filter. We expect that scrambling of the *wh*-phrase in front of the negative quantifier can circumvent the filter, but we cannot use generalized choice functions for the interpretation of the LF because then we would have the variable x free, whereas it should be bound by "nobody". In other words, (53) does not render one of the readings of (47)[b].

(53) $\lambda p \exists F\ ch_{w_0}(F) \wedge p = \lambda w.F(\text{among x's colleagues})\lambda y \neg \exists x[person_w(x) \wedge like_w(x, y)]$

We have to complicate the functional type somewhat: We need functions Φ which operate on two-place relations in intenso R of type $\langle e, \langle s, et\rangle\rangle$ and choose a Skolem function which picks up an R(x) in some world for any x. Let us call such functions CHOICE functions. More accurately, we have this:

(54) a. Let Φ be of type $\langle\langle e, \langle s, et\rangle\rangle, ee\rangle$. Φ is a CHOICE function iff for any R in the domain of Φ, $\Phi(R)$ is a Skolem function f such that for any x in the domain of f, R(x)(w)(f(x)) for some w.

b. In analogy to what we did earlier, we introduce for any such function the predicate "CHOICE for w" — CH_w — :
$CH_w(\Phi) = 1$ iff for any R in the domain of Φ and any x in the domain $\Phi(R)$: $R(x)(w)(\Phi(R)(x)) = 1$.

We can now formalize our Korean examples:

(55) a. $\lambda p \exists \Phi\ CH_{w_0}(\Phi) \wedge p = \lambda w.\ \Phi(\lambda x.\text{among x's colleagues})\lambda f \neg \exists x[person_w(x) \wedge like_w(x, f(x))]$

b. $^*\lambda p \exists \Phi\ CH_{w_0}(\Phi) \wedge p = \lambda w.\ \neg \exists x[person_w(x) \wedge like_w(x, \Phi(\lambda x.\text{among x's colleagues})(x))]$

Here, Φ is of the type of the CHOICE functions, whereas f is of the Skolem function type. The two formulae are equivalent by λ-conversion. (55-a) is the translation of the sentence where the nominal "who among his colleagues" is scrambled over the negation, the admissible LF. The equivalent LF (55-b) violates the *wh*-filter.

As mentioned already, the approach doesn't cover yet every example treated by Beck's filter. The ungrammaticality of (40)[b], here repeated as (56) does not follow from the *wh*-filter.

(56) *Wen$_i$ hat niemand [t$_i$ alles] gesehen?

Recall that we have to scope the exhaustor *alles* at the adjunction site of CP. This movement is not *wh*-movement and therefore not ruled out by the *wh*-filter. On the other hand, Beck's filter derives the impossibility of this particular *alles*-movement. Hence we have at least one case of semantically driven movement which the theory cannot eliminate. The result of this section is that a theory that works with choice functions can explain almost all of the data, but it cannot do it with fewer stipulations than a theory which works with LF movement.

6 Choice functions and QR

In this section I want investigate the thesis defended recently in the literature that either there is no rule QR or this rule just scopes the quantifier head, i.e., the article expressing the higher order relation "every", "most" and so on. If this thesis is true, then we seem to have a compelling argument for the use of choice functions in semantics, because choice functions are the only method known to me that can make sense of the thesis, as far as the semantic side of language is concerned.

Chomsky (1981) observes that QR and LF *wh*-movement cannot repair violations of principle C at S-structure.

(57) a. Which book that John_i read did he_i like
b. *He_i liked every book that John_i read
c. *Who said that he_i liked which book that John_i read

The relevant LF configuration which should rescue the C violation observed in (57-b) is this:

(58) [every book that John_i read$]_j$[he_i liked t_j]

Lasnik (1993, 29) makes the same point with principle A:

(59) a. John_i wonders which picture of himself_i Mary showed to Susan
b. *John_i wonders who showed which picture of himself_i to Susan
c. John_i said that every picture of himself_i, Mary likes
d. *John_i said that Mary likes every picture of himself_i

Since we have been discussing *wh*-movement for a while , let us take up QR here. The LF for (59-d) generated by QR is identical with the grammatical structure (59-c), but (59-b) isn't grammatical. In the GB framework we can say that A and C are satisfied at S-structure, whereas LFs can violate the principles. In the minimalist framework (cf. Chomsky (1995)), where the LF is the only syntactic interface, no such move is possible. Therefore, Lasnik (1993) formulates the following hypothesis:"If the general program [= the minmalist program] is correct, either there is no QR, or QR raises just the quantifier head, and not the entire quantificational expression. Similarly for LF *wh*-movement."

A version of QR which moves just the D-part of the quantifier has been proposed in Hornstein and Weinberg (1990). Their LF for (59-d) would be the following structure:

(60) *John_i said that $[_S\ \text{every}_j[_S$ Mary likes t_j picture of $\text{himself}_i]]$

Clearly, this structure still violates principle A. Hornstein and Weinberg (1990) don't offer an interpretation for the structure. Adopting the standard methods, no interpretation seems possible because the determiner *every* expresses the subset relation and requires two sets of arguments. The first argument, i.e. the restriction of the quantifier, is obviously expressed by *picture of himself*$_i$. The representation (60) suggests, however, that the quantifier has only one argument, viz. the S to which it is adjoined. There seems no way to have access to the restriction *picture of himself*$_i$.

With choice functions in the semantic domain we have a method for interpreting Hornstein and Weinberg's version of QR, for we can say that the QRed determiner quantifies over choice functions. For instance, the wide scope reading of (61-a) would be represented as in (61-b).

(61) a. Someone or other read every book by professor K.
b. every' λf[someone read f(book by professor K.)]

The translation of *every* is given in (62-a), and (61-b) is therefore equivalent to the formula (62-b).

(62) a. *every*' = $\lambda P \forall f[ch(f) \rightarrow P(f)]$,
where P is of type $\langle\langle et,e\rangle,t\rangle$.
b. $\lambda P \forall f[ch(f) \rightarrow P(f)]$ λf[someone read f(book by professor K.)]
= forall f[ch(f) $\rightarrow$[someone read f(book by professor K.)]

Recall our convention that a choice functions picks out the falsifying object in case the property it applies to is empty. This makes the formula equivalent to the first order formalization.

Note, however, that the method doesn't allow us to get rid of QR entirely, because we still need it for binding pronouns.

(63) [every professor]$_1$ read a report about himself$_1$

The binding of the reflexive requires λ-abstraction, i.e., we need at least an extremely local version of QR, where the NP is adjoined to the the XP in which it is contained. We can combine this local QR with the operation that scopes the determiners, and we obtain (64-a), which is translated as the formula (64-b).

(64) a. every$_2$ [[t$_2$ professor]$_{13}$[t$_1$ read a$_3$ report about himself$_1$]]
b. $\forall f[ch(f) \rightarrow \exists g[ch(g) \wedge f(professor)\lambda x[read(x, g(report\ about\ x))]]]$

One might think that superlocal QR is spurious, because it automatically reconstructs to its base position via λ-conversion, given that *f(professor)* is of type e. A closer inspection, however, reveals that this is not so: *f(professor)* is "reconstructed" both to the subject position and to the position of the reflexive:

(65) $\forall f[ch(f) \rightarrow \exists g[ch(g) \wedge [read(f(professor), g(report\ about\ f(professor)))]]]$

But, of course, "every professor" was never at that position. Thus, QR does an indispensable job for binding. The classical rule QR would then split into two operations:

(66) **Modularizing QR**
a. **Binding**: The adjunction of α_i to the smallest XP in which α_i occurs, leaving trace t$_i$, where α_i is an NP (or DP) with movement index i.

b. **Determiner Scoping**: Scoping is done via movement of the determiner to an adjunction position, leafing a coindexed trace.

In both cases, the created configuration $\alpha_i[\ldots \mathrm{t}_i \ldots]$ is translated as $\alpha\ \lambda \mathrm{x}_i[\ldots \mathrm{x}_i \ldots]$.

Binding is a remnant of QR, though an extremely local version. The new shape of the theory should disappoint everyone who believed that the use of choice functions would enable us to have LFs much nearer to the surface forms. On the contrary: the new LFs are even more abstract than the classical LFs. On the other hand, the modification is compatible with Lasnik's (1993) hypothesis.

A semantically equivalent formulation of the rule Binding would be a type lifting rule for the verb. Suppose we are given an NP α_i and an intransitive verb of type $\langle e, t\rangle$ which expresses the predicate P. In order to combine the two, we lift the verb to the type $\langle\langle et, t\rangle, t\rangle$ and interpret the lifted predicate as $\lambda \mathrm{Q}.\mathrm{Q}(\lambda \mathrm{x}_i.\mathrm{P}(\mathrm{x}_i))$. It is crucial that the index of the NP corresponds to the bound variable, because it is precisely this correspondence which achieves the binding. In other words, a lifting operation which doesn't depend on the index of the argument NP could not do the job. In other words, we cannot interpret the verb independly of the argument NP, contrary to what is generally assumed by theorists who advocate this kind of lifting operation. To my mind this shows that QR is indispensable for doing the binding.

It is an interesting question whether the modularization of QR increases the expressive power of the system in comparison to the traditional account. For instance, we can now have the following situation: the object contains a pronoun bound by the subject, but the quantifier of the object has wide scope with respect to the quantifier of the subject:

(67) a. Every student$_1$ read a report mentioning him$_i$

b. $\mathrm{a}_4[\mathrm{every}_2[[\mathrm{t}_2 \text{ student}]_1[\mathrm{t}_1 \text{ read } \mathrm{t}_4 \text{ report mentioning him}_1]]]$

c. $\exists \mathrm{g}[\mathrm{ch}(\mathrm{g}) \wedge \forall \mathrm{f}[\mathrm{ch}(\mathrm{f}) \rightarrow \mathrm{f}(\text{student})\lambda \mathrm{x}[\text{read}(\mathrm{x}, \mathrm{g}(\text{report mentioning x}))]]]$

As we mentioned earlier, this is not always equivalent with the classical reading in which the subject has wide scope with respect to the object. Suppose that there are two reports mentioning each student. Then the LF can only be true if each student read the same report. It is not clear to me what the empirical criteria could be for finding out whether this reading is real.

Next, consider sentence (68-a), which should have the LF (68-b) with interpretation (68-c) if the proposal discussed here were correct.

(68) a. Some student or other$_1$ read each report mentioning him$_1$

b. $\mathrm{each}_3\exists 2[[\mathrm{some}_2 \text{ student}]_1[\mathrm{t}_1 \text{ read } \mathrm{t}_3 \text{ report mentioning him}_1]]$

c. $\forall \mathrm{g}[\mathrm{ch}(\mathrm{g}) \rightarrow \exists \mathrm{f}[\mathrm{ch}(\mathrm{f}) \wedge \mathrm{f}(\text{student})\lambda \mathrm{x}[\text{read}(\mathrm{x}, \mathrm{g}(\text{report mentioning x}))]]]$

The formula (68-c) is not equivalent with (67-c) and it is well formed. We have to investigate what the formula means exactly and whether the reading it expresses is a real one. Be that as it may, for the time being we can conclude that choice functions provide a semantics which is compatible with Chomsky's, Hornstein and Weinberg's and Lasnik's findings.

There is much more to say about the matter, however. We have to restrict the range of the rule Determiner Scoping by something like Beck's filter. Consider the following standard pattern:

(69) a. Everyone read some book professor K. wrote ($\exists \succ \forall$)
b. Noone read some book professor K. wrote ($\exists \succ \neg\exists$)
c. Noone read every book professor K. wrote (*$\forall \succ \neg\exists$)
d. Everyone read no book professor K. wrote (*$\neg\exists \succ \forall$)

The impossibility of scoping a universal quantifier or a negative quantifier over a negative universal quantifier and a universal quantifier, respectively, is not explained in May (1985), as far as I know. The pattern shows once more that indefinites play a special role, they do not block the scope widening of other determiners nor is their scope restricted by other determiners. Thus, we might speculate that non-indefinite determiners are scope barriers for non-indefinite determiners. Whatever the correct generalization may be, it should be obvious that it doesn't fall out from the fact that indefinites articles can be interpreted by means of choice functions. In a number of articles, Urs Egli and Klaus von Heusinger have argued that the method extends to the interpretation of the definite article. In this paper I haven't touched this issue at all. See, for instance, Egli and Heusinger (1995). The point made in this section is that we can extend the analysis to determiners such as the universal quantifier, and if the authors quoted in this section are right, we even have to do this.

7 Conclusion

I have investigated a number of phenomena which might give support to the view that indefinite articles and *wh*-determiners should be analyzed in term of choice functions. While this might turn out to be the correct approach, the data do not force us to such a conclusion, it seems to me. In almost each case, we can have an alternative account in terms of traditional scoping (QR), provided, we work with somewhat sophisticated methods. I don't think that a framework that works with choice functions can describe the facts with less stipulations than traditional accounts which assume *wh*-movement at LF and QR. To be sure, I have investigated only a particular range of data and other data might give more empirical support for deciding which view is the correct one, but I am not aware of such data. For the time being, the arguments for or against choice functions in semantics remain highly theory internal: the treatment of *wh*-movement and of quantification a minimalist framework seems to require this technique. In any case, the method provides a genuine alternative to the usual way of theorizing and might shed new light on quantification. Therefore it should be studied in greater detail and it should be tested against a greater set of data.

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