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The Double Scope of Quantifier Phrases

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0. Introduction

We propose a new approach to the explanation of wide-scope phenomena. Starting out from the assumption that the displacement operation of the computational system of grammar applies uniformly to all quantifier phrases (QPs) and that long covert displacement is possible, we propose an interpretation for the resulting syntactic objects that correctly predicts the possibility and properties of wide-scope readings for different classes of QPs. We assume that a QP, when interpreted in its base position, denotes a Generalized Quantifier (GQ), whereas when interpreted in displaced position it – in effect – denotes a semantic object that is a GQ embedded within two operators: a collectivizing operator *K* that is responsible for the specific / group referring interpretation of a QP and a distributing operator *Dist* responsible for its distributivity. We conceive these operators to be effective in different positions of a QP chain, with the *K*-operator at the head of the chain and the *Dist*-operator at the foot. This is called the *double scope* of QPs. On the basis of the QPs' highly uniform syntactic behaviour, our account predicts different scopal possibilities for different QPs, depending on specific semantic properties of the QPs involved.

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1. Scope-Widening and Wide-Scope Phenomena

1.1 Local Scope Widening

As is evidenced by (1), clause-bound scope inversion of weak and strong quantifiers seems to be generally possible:

(1)
a. Some girl watched every movie. (∃ > ∀) (∀ > ∃)
b. Every girl watched some movie. (∀ > ∃) (∃ > ∀)

1.2 Non-Local Wide Scope

Embedded in a syntactic island, strong and weak quantifiers seem to behave non-uniformly, that is, a strong quantifier within an island cannot take scope over a quantifier which is outside of the island (cf. 2a), whereas weak quantifiers are able to do so (cf. 2b). Consider the next example, where the strong-quantifier phrase *every movie* and the weak-quantifier phrase *some movie* are embedded in a syntactic island formed by an *if*-clause.

(2)
a. Some girl will be happy if every movie is shown. (∃ > ∀) *(∀ > ∃)
b. Every girl will be happy if some movie is shown. (∀ > ∃) (∃ > ∀)

Sentence (2a) has only one reading, namely the one corresponding to the overt c-command relations in which *some girl* takes scope over *every movie*. (2b) on the other hand is ambiguous and has an inverse-scope reading, i.e. a reading in which *some movie* is interpreted specifically with respect to *every movie*.

1.3 Quantifier Classification

Though the QP *some N* and phrases projected by some other weak quantifiers show this exceptional wide-scope behaviour, it is not in general true that weak quantifiers are able to take wide scope out of a syntactic island. In fact, only a small subclass of the weak quantifiers have this ability:

(3)
a. Every girl will be happy if {a | some} movie is shown. (∀ > ∃) (∃ > ∀)
b. Every girl will be happy if three movies are shown. (∀ > 3) (3 > ∀)
c. Every girl will be happy if at least three movies are shown.
(∀ > at least 3) ??(at least 3 > ∀)
d. Every girl will be happy if exactly three movies are shown.
(∀ > exactly 3) ??(exactly 3 > ∀)
e. Every girl will be happy if at most three movies are shown.

($\forall >$ at most 3) *(at most 3 $> \forall$)

f. Every girl will be happy if few movies are shown. ($\forall >$ few) *(few $> \forall$)

QPs with bare numeral determiners such as *three N* form a class with *some N* and *a N* through their common scope abilities (3a,b). We call this class the class of *indefinites*. Modified numeral-QPs cannot be interpreted specifically as is shown in (3c-e) nor can other QPs such as *few N* (cf. 3f).

It can already be estimated that the class of QPs that allow for wide scope readings and / or its complement class will be difficult to define. There is no obvious morphosyntactic or semantic feature that differentiates between the two classes. The QPs which can take scope out of a syntactic island are a subclass of phrases projected by a weak quantifier and they all share features with QPs of the complement class, i.e. the class of QPs that do not allow for wide-scope readings. The QPs of this class also do not seem to be marked by a distinctive feature. Containing monotone decreasing, monotone increasing as well as non-monotonic quantifiers, this class is semantically heterogeneous and thus hard to define in semantic terms.

1.4 Intermediate-Scope Readings

Another phenomenon concerning wide-scope readings of indefinites are the so-called *intermediate-scope readings*. Consider the following example:

(4)

a. Every country's security will be threatened if some building is attacked by terrorists.

b. $\forall x$ (country(x) $\rightarrow$ *IF* $\exists y$ (building(y) & y is attacked by terrorists *THEN* x's security will be threatened)

c. $\forall x$ (country(x) $\rightarrow \exists y$ (building(y) & *IF* y is attacked by terrorists *THEN* x's security will be threatened))

d. $\exists y$ (building(y) & $\forall x$ (country(x) $\rightarrow$ *IF* y is attacked by terrorists *THEN* x's security will be threatened))

The sentence in (4a) has – apart from the unspecific (4b) and the specific reading (4d) – an additional third reading (4c), which is called the intermediate-scope reading of *some building*. This reading can be paraphrased as: For every country there is a specific building (which varies with the countries), and if this building is attacked by terrorists the country's security will be threatened. This means, *some building* does not take the widest scope possible, as in the specific reading, and it is not unspecific with respect to both the conditional and the *every*-QP. It takes intermediate scope which means, it takes scope over the *if*-clause without taking scope over *every country*.

An approach which reduces scope ambiguities to a lexical ambiguity of the indefinite (as in Fodor & Sag 1982) cannot account for these facts.[1]

[1] There have been long discussions about the nature of those sentences that allow for intermediate scope readings. In Kratzer (1998) it is argued that intermediate scope readings do not exist in general. Kratzer tries to show that only a certain class of sentences depending on the indefinites involved have an

1.5 Locality of Distributivity

Specific readings of QPs are possible, but the distributivity stays local. In the following example, the QP *three relatives of mine* can have a specific wide-scope reading, but at the same time its distributive scope remains restricted to the syntactic island.

(5) If three relatives of mine die I will inherit a fortune.

This sentence lacks the wide-scope distributive reading which is: There are three relatives of mine (that I have in mind), and if *one* of them dies I will inherit a fortune. Nevertheless, the sentence still has a specific reading which says that there are three relatives of mine (that I have in mind), and if *all* of them die, I will inherit a fortune. This means that the indefinite can be read specifically, i.e. can outscope the *if*-clause, but its distributive scope seems to be island-restricted and thus stays local. The following table gives an overview of the possible (+) and impossible (–) readings for *three relatives of mine* in (5):

	non-distributive	distributive
unspecific	+	+
specific	+	–

1.6 Wide-Scope Phenomena with Strong Quantifiers

In some configurations, wide-scope effects can be observed even in the case of strong quantifiers. This is evidenced by the possibility of *de-re* readings of strong quantifiers in non-transparent contexts, which in connection with the simultaneous impossibility of scope inversion is a known scope puzzle (cf. Reinhart 1997).

(6) Someone believes that every politician is corrupt.
($\exists > \forall$) *($\forall > \exists$; but: *de-re* reading for *every politician* possible)

The restrictor predicate *politician* of the strong quantifier *every* can be interpreted in the speaker's *believe*-world, which then is the *de-re* reading of the sentence. At the same time, the sentence does not have a reading in which *every politician* takes inverse scope over *someone*. Assuming a displacement mechanism to be also responsible for the *de-re* readings of a sentence, it seems mysterious why the QP can take scope outside of the *believe*-context though it cannot take wide inverse scope over *someone*.

2. Two Theories of the Scope-Taking of Indefinites

2.1 Displacement of a Quantificational Term

intermediate-scope reading. This position has been widely criticized. See Ruys (1999) for a critical review of Kratzer's approach and for a detailed discussion of the intermediate-scope phenomena.

A simplistic way to account for the wide-scope phenomena presented above is to assume a mechanism that covertly displaces the relevant parts of a syntactic structure to form representations that *directly* reflect the semantic scope relations (e.g. via the notion of c-command). Local scope inversion is generally assumed to be achieved by a covert movement operation, e.g. by Quantifier Raising (QR).

If we – as a first approach – assumed that a QP can be adjoined to any maximal projection, the phenomena in (1) and (4) would be easily accounted for. But at the same time, with such an approach one runs into several problems.

2.1.1 Grammatic-Theoretical Problems

<u>*Disobedience of Syntactic Islands*</u>

If we assume that the displacement operation that accounts for wide-scope readings is an operation of the (narrow) syntactic system, the non-locality of wide-scope taking of indefinites contrasts unexpectedly with the locality restrictions that are characteristic for overt movement. Compare the data in (2) and (3) with those in (7).

(7)
a. *Some movie, every girl will be happy [if *t* is shown].
b. *What does John wonder [who bought *t*]?

<u>*How to Find out the Relevant Class of Quantifiers*</u>

As is evidenced by (2) and (3), not all quantifiers show the discussed wide-scope behaviour. So even if one assumed a mechanism of island-free QR, this operation would then have to apply to a subclass of QPs only, which does not seem suitable for an operation of the syntactic system. Moreover, as we have seen in Section 1, this subclass does not seem to be separable from the QPs that do not allow for wide-scope readings by a morphosyntactic or semantic feature.

2.1.2 Empirical Problems

Simply assuming island-free QR cannot explain the locality of distributivity of specifically interpreted QPs. It remains unexplained why the indefinite loses its distributivity when being QRed out of an island. If in (5) QR is applied to *three relatives of mine*, yielding the wide-scope representation sketched in (8a), the standardly assumed interpretation (8b) for the resulting configuration is not adequate.

(8)
a. [[three relatives of mine]$_i$ [if t_i die then I will inherit a fortune]]
b. *three_rel_of_mine(x)* (*IF x* dies *THEN* I will inherit a fortune)

One can easily see that if *three relatives of mine* is interpreted as a GQ (of type <<*e*, *t*>, *t*>) and its trace is interpreted as an individual variable (of type *e*), the resulting expression corresponds to the distributive wide-scope interpretation, which is not empirically attested for the sentence in (5).

The scope puzzle is also not accounted for. If we have to assume that long displacement of strong quantifiers is possible, this would then yield the wrong results for (2). It could also not account for the fact that there exists no inverse-scope reading for (6). On the other hand, in supposing that strong quantifiers are not subject to a long-QR mechanism, we could not explain the *de-re* reading of *every politician* in (6).

2.2 In-Situ Interpretation of a Non-Quantificational Term

Approaches that make use of unselective binding of a variable treat indefinites as non-quantificational expressions. Indefinites then do not possess quantificational force of their own, but introduce a free variable which can be bound by an existential quantifier from an arbitrary position in the sentence. This way, the indefinite itself can be interpreted *in situ* and does not have to be displaced in order to widen its scope.

2.2.1 Unselective Binding of an Individual Variable

An obvious approach to the explanation of scope widening and wide-scope phenomena would be to assume that an indefinite denotes an expression introducing an unbound individual variable. As is known, the unselective binding of an individual variable leads to wrong truth conditions in some configurations (cf. Heim 1982).

Let us again consider the sentence in (2b) (which is repeated in 9a). The representation of its two readings in the unselective binding approach is given in (9b,c) below.

(9)
a. Every girl will be happy if some movie is shown.
b. IF $\exists y$ (movie(y) & is_shown(y)) THEN $\forall x$ (girl(x) $\rightarrow$ is_happy(x))
c. $\exists y$. IF movie(y) & is_shown(y) THEN $\forall x$ (girl(x) $\rightarrow$ is_happy(x))

The expression in (9c) is meant to represent the wide scope reading of (9a). This representation yields wrong truth conditions, though. It is true, in the case that the universe contains entities which are not movies or which are not shown, that because of these circumstances the antecedent of the implication is false. This, of course, makes the implication trivially true.

This is due to the fact that the *restrictor set* of the indefinite, i.e. the set of movies, remains *in situ*. The individual variable *x* is existentially bound outside of the *if*-clause and therefore any individual of the universe can be assigned to it. The restrictive predicate, which could limit the possible assignments at the scope position of the indefinite, is interpreted in the antecedent of the implication, where it trivializes the implication.

2.2.2 Unselective Binding of a Choice Function Variable

In the *Choice-Function* (CF) approach to wide-scope phenomena, indefinites do not introduce an unbound individual variable, but an unbound function variable. An indefinite then denotes a function – the Choice Function – which, when applied to a set, returns an arbitrary member of this set as its value. Leaving out the empty set as a possible argument, a definition of a Choice Function could be the following:[2]

(10) $\mathrm{CF}(f) \Leftrightarrow \forall X\, (X \neq \emptyset \rightarrow f(X) \in X)$

This approach then yields representations with correct truth conditions in configurations that are problematic for wide-scope interpretation (cf. 9). This is exemplified with the wide-scope reading of (2b) (repeated as 11a):

(11)
a. Every girl will be happy if some movie is shown.
b. $\exists f$ (CF(f) & *IF* is_shown(f(movie)) *THEN* $\forall x$ (girl(x) $\rightarrow$ is_happy(x)))

The expression in (11b) is an adequate wide-scope representation for (11a). As a Choice Function is defined to return elements of the argument set only, the above-mentioned problem concerning inadequate truth conditions cannot arise. Due to the restriction expressed by the CF-predicate, only Choice Functions can be assigned to the function variable *f* in (11b). This means that the assignments to the function variable can be properly restricted at the scope position of an indefinite without reference to the restrictor set of this indefinite.

In the CF-approach, the phenomena shown in (1), (2), and (4) are accounted for in a straight forward way. The locality of distributivity (cf. 5) falls out directly as is shown below.[3]

(12)
a. If three relatives of mine die I will inherit a fortune.
b. $\exists f$ (CF(f) & IF f(three relatives of mine) die THEN I will inherit a fortune)

As the QP *three relatives of mine* itself stays *in situ* even under a specific construal, its distributivity is also expected to remain inside of the island, which corresponds to the empirical observations.

2.2.3 Grammatic-Theoretical Problems

The Unselective-Binding Approaches do not have to assume island-free QR. They still have to assume two different mechanisms which are responsible for assigning scope to QPs, i.e. the Unselective-Binding Mechanism which applies to indefinites only and the

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[2] Cf. Geurts (2000)

[3] To be more precise, one would have to assume a CF-definition which forces CFs to take an argument of type <<*e*, *t*>, *t*> and return an element of this set, which is a set of type <*e*, *t*> containing three relatives of mine. This is just a technical problem which can easily be overcome by defining Choice Functions of the appropriate type.

QR-Mechanism which applies to all remaining QPs. As discussed before, there is no semantic or morphosyntactic feature which seperates these two classes from each other.

2.2.4 Empirical Problems

As has been shown by Winter (1997), Ruys (1999), and Geurts (2000), the *in-situ* interpretation of indefinites leads to various unwanted semantic effects, i.e. wrong predictions concerning presupposition, non-transparent contexts, and pronoun binding. Additionally, the CF-approach cannot account for the scope puzzle.

The mechanisms layed out in section 2.2 thus cannot account for all the different wide-scope phenomena. Beyond that, they run into the same grammatic-theoretical problems as the mechanism sketched in section 2.1, in that different mechanisms for expressions which are not distinguishable from each other on independent grounds have to be assumed.

For this reason, we propose an alternative approach to the explanation of wide-scope phenomena. We suggest to generalize the displacement mechanism, that is, to assume long displacement for non-indefinites as well as for indefinites. We thus propose a mechanism for scope assignment that is uniform for weak and strong quantifier phrases.

3. The Double-Scope Approach

We propose a semantics for (non-trivial) QP chains that consists of a GQ collectivized by an operator *K*, and of a distributing operator *Dist* (where GQ is the denotation of the *in-situ* QP). We neither assume that the displacement of QPs is restricted to certain subclasses of QPs nor that covert displacement is island-restricted.

If certain configurational conditions are met,[4] QP chains are subject to a specific interpretation, the *Double-Scope* (DS) interpretation. We assume that under DS-interpretation the Generalized Quantifier *GQ* lexically determined by the QP has to be interpreted collectively in displaced position at the head of the chain, i.e. as *K*(*GQ*). Furthermore, we assume that the distributing operator *Dist* applies to the QP's plural trace at the foot of the QP chain. That is, *K*(*GQ*) and *Dist* contribute to the interpretation of a QP at different chain positions, where *K*(*GQ*) contributes to the existential scope of a QP and *Dist* to its distributive scope. This is called the *double scope* of quantifier phrases. With this conception, existential wide-scope readings are possible without the widening of distributive scope.

From the assumptions above, the (LF-)structure in (13a) represents the wide-scope reading of the sentence in (5), which under DS-interpretation results in the expression given in (13b), which is the desired specific non-distributive reading: There is a group of three relatives of mine, and if *each* of them dies, then I will inherit a fortune.

(13)

[4] For example, these conditions are met in configurations that result from long covert displacement of a QP, i.e. 'wide-scope configurations'.

a. [[three relatives of mine]$_i$ [if t_i die then I will inherit a fortune]]
b. (K($GQ_{3\_rel\_of\_mine}$))$_i$ (*IF* Dist(t_i) dies *THEN* I will inherit a fortune)

3.1 The Formalization of the DS-Approach

As far as the semantic part of our approach is concerned, we make use of standard assumptions about GQs. In our framework, a QP in a chain is interpreted as the semantic object *Dist*(*K*(*GQ*)) where

- the Distributor
  $Dist_{<<e,t>,<<e,t>,t>>} = \lambda P.\ \lambda Q.\ \forall x\ (P(x) \rightarrow Q(x))$
  distributes the set *P* over the set *Q*,

- the Collector
  $K_{<<<e,t>,t>,<<<e,t>,t>,t>>} = \lambda \mathrm{R}.\ \lambda \mathrm{S}.\ \exists P\ (\mathrm{R}(P)\ \&\ min(\mathrm{R}, P)\ \&\ \mathrm{S}(P))$
  takes a GQ R and yields a plural type GQ. It finds a minimal witness set *P* for the Generalized Quantifier R for which S holds, and

- the Minimizer
  $min_{<<e,t>,<<<e,t>,t>,t>>} = \lambda P.\ \lambda \mathrm{R}.\ \forall Q\ (\mathrm{R}(Q) \rightarrow |P| \leq |Q|)$
  requires *P* to be a minimal element of a Generalized Quantifier R. The Minimizer takes care that *P* only contains elements which are members of the GQ's restrictor set.

The type incompatibility of *K*(*GQ*) as an argument of *Dist* is removed through associated interpretation of different copies of the QP in a (non-trivial) chain: *K* is applied to the upper copy of the QP, which is interpreted as GQ. *Dist* is applied to the lower copy of the QP, which is interpreted as the set resulting from collectivizing the GQ.[5]

3.2 The Phenomena Explained

3.2.1 Wide-Scope Readings

The long displacement of a QP invokes DS-interpretation. One can see that when this operation is applied to an indefinite (which then crosses another QP) this yields a logically non-equivalent LF-expression. Consider (2b) again the DS-representations of which are given in (14):

(14)
a. *IF* $\exists x$ (movie(x) & is_shown(x)) *THEN* every girl will be happy
b. $\exists P$ ($\exists x$ (movie(x) & P(x)) & *min*(…, P) & *IF* $\forall z$ (P(z) $\rightarrow$ is_shown(z)) *THEN* every girl will be happy)

[5] One can think of this associated interpretation as movement of the QP to a *Dist*-external position leaving an <*e*, *t*>-trace.

As can easily be verified, the expression in (14a) representing the narrow-scope reading of (2b) is *logically not equivalent* to (14b), which represents the wide-scope reading of (2b).

The representation in (14b) shows clearly that the minimizer condition *min*(*GQ*, *P*), is in fact a necessary part of the collector *K*. In this case, the GQ is lexically realized as *some movie*. The minimizer guarantees that the wide-scope construal of an indefinite in a sentence such as (2b) results in an expression with adequate truth conditions. It requires the set *P*, which has to be a member (i.e. a *witness*) of the GQ, to be *minimal* with respect to all the other members of the GQ. Had we not chosen the *minimal* witness set of this GQ, but any member *P* of it, this set *P* could also contain elements which are not members of the restriction set *movie*. The antecedent of the implication in (14b) would then be trivially false if the set of entities that are shown does not exhaust the universe of entities. That is, we would run into a similiar problem as with the mechanism of unselective binding of an individual variable: The truth conditions of the resulting representations would be plainly wrong.

In contrast to (14), the corresponding displacement operation applied to the non-indefinite phrase *every movie* yields a representation that is *logically equivalent* to the narrow-scope construal of *every movie*. This explains the difference between (2a) and (2b). The representation in (15b) gives the analysis of long displacement of the *every*-QP in (2a) which is logically equivalent to the representation in (15a) resulting from the *in-situ* interpretation of *every movie*.

(15)
a. IF $\forall x$ (movie(x) $\rightarrow$ is_shown(x)) THEN some girl will be happy
b. $\exists P$ ($\forall x$ (movie(x) $\rightarrow$ $P(x)$) & *min*(…, *P*) & IF $\forall z$ ($P(z)$ $\rightarrow$ is_shown(z))
THEN some girl will be happy)

This can be verified by instantiating *P* in (15b) with the restrictor set *movie*. The first two conjuncts of this expression are then trivially true, and the whole formula reduces to the second part which is obviously equivalent to the narrow-scope representation in (15a). We therefore get the impression that a wide-scope reading for *every movie* does not exist in (2a).

3.2.2 (Non-)Distributive Readings

The same dislocation mechanism can be applied to the GQ lexically determined by *three relatives of mine*[6] in (5). DS-interpretation yields the intended specific reading, that is, the specific reading in which distributivity stays local. The (semantic) derivation of this reading (Φ = "I will inherit a fortune") proceeds as follows:

(16)

a. $[\lambda R.\lambda S.\ \exists P\ (R(P)\ \&\ min(\ldots, P)\ \&\ S(P))]$
$([\lambda P.\lambda Q.\ |P \cap Q| = 3](\lambda x.\ \text{rel\_of\_mine}(x)))$
$(\lambda L.\ IF\ [\lambda P.\ \lambda Q.\ \forall z\ (P(z) \rightarrow Q(z))]\ (L)\ (\lambda x.\ \text{dies}(x))\ THEN\ \ \Phi)$

b. $[\lambda R.\lambda S.\ \exists P\ (R(P)\ \&\ min(\ldots, P)\ \&\ S(P))]\ (\lambda Q.\ |\lambda x.\ \text{rel\_of\_mine}(x) \cap Q| = 3)$
$(\lambda L.\ IF\ \forall z\ (L(z) \rightarrow [\lambda x.\ \text{dies}(x)](z))\ THEN\ \ \Phi)$

c. $[\lambda S.\ \exists P\ ([\lambda Q.\ |\lambda x.\ \text{rel\_of\_mine(x)} \cap Q| = 3](P)\ \&\ min(\ldots, P)\ \&\ S(P))]$
$(\lambda L.\ IF\ \forall z\ (L(z) \rightarrow \text{dies}(z))\ THEN\ \ \Phi)$

d. $\exists P\ (|\lambda x.\ \text{rel\_of\_mine}(x) \cap P| = 3\ \ \&\ min(\ldots, P)\ \&$
$[\lambda L.\ IF\ \forall z\ (L(z) \rightarrow \text{dies}(z))\ THEN\ \ \Phi](P))$

e. $\exists P\ (|\lambda x.\ \text{rel\_of\_mine}(x) \cap P| = 3\ \ \&\ min(\ldots, P)\ \&\ IF\ \forall z\ (P(z) \rightarrow \text{dies}(z))$
$THEN\ \Phi\ )$

3.2.3 Wide Scope Phenomena with Strong Quantifiers

The DS-approach can also account for the scope puzzle:

(17)

a. Someone believes [$GQ_{\text{every\_politician}}$ is corrupt]

b. Someone $[[(K(GQ_{\text{every\_politician}}))_{\text{i}}]$ [believes [$Dist(t_i)$ is corrupt]]]

c. $[[(K(GQ_{\text{every\_politician}}))_{\text{i}}]$ [Someone believes [$Dist(t_i)$ is corrupt]]]

The GQ lexically determined by *every politician* can have a *de-re* interpretation. We predict that distribution over *someone* is impossible even if it takes wide scope over the existential quantifier, as in (17c). The long displacement of *every politician* in (17c) results in collective / existential wide scope and in local distributive scope.

3.2.4 Intermediate Scope Readings

As we do not assume the displacement mechanism to be restricted, intermediate-scope readings are predicted.

4. Elaboration of the DS-Approach

In this section, we will show that the DS-approach correctly predicts anaphoric possibilities with respect to the reference to QPs in certain configurations. Furthermore,

[6] Below, we will propose a different GQ-semantics for a phrase such as *three relatives of mine* than is assumed in (16).

we will state conditions referring to semantic properties of a collectivized GQ that allow for predicting the scopal possibilities of the corresponding QP.

4.1 Dynamic Interpretation

If we supplement the representations resulting from the DS-interpretation with a theory of dynamic meaning of higher-order PL[7], we predict that the displacement of a QP is not only relevant for truth conditions, but also for the anaphoric possibilities it provides for the surrounding discourse. Thus, we predict that anaphoric reference to a QP is possible in contexts that allow for dynamic interpretation of the existentially bound set variable introduced by *K*[8].

4.1.1 Unexpected Anaphoric Possibilities

Although an *every*-QP disallows anaphoric reference to the individuals of its domain (cf. (18a), which is not a coherent discourse), an anaphoric link between a plural pronoun and an *every*-QP under collective interpretation is possible in the appropriate dynamic context (cf. 18b,c).

(18)
a. Every man walked in the park. *He whistled.
b. Yesterday, every student (I know) was at the party. They (all) had fun.
c. {Every teacher should leave immediately, but…}
Every student, I want to come to my office. I will reward them for good performance.

Our approach predicts this exact behaviour, because the universal quantifier itself is externally static, i.e. it blocks reference to the individual variable that it ranges over, whereas the existentially bound set variable of the collectivized *every*-QP is accessible to plural anaphors. The account for the data in (18) presupposes that the chain of the *every*-QP resulting from optional covert displacement in (18b) and topicalization in (18c) respectively is subject to DS-interpretation.

4.1.2 Plural-Type Generalized Quantifiers

Besides GQs such as *every N*, there are GQs such as *three N* which have been suggested to introduce plural set variables themselves (cf. Carpenter 1997). We call these GQs *plural-type GQs*. Accordingly, a plural anaphora can anaphorically be linked to a QP that lexically determines a plural-type GQ even if this QP is interpreted *in situ*. Nevertheless, the DS-approach predicts that the anaphoric possibilities of (a subclass) of these QPs go beyond what is deduceable from their lexical specification.

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[7] We suppose that the first-order system of Groendijk&Stokhof (1991) can be extended to higher-order PL preserving the properties of the relevant logical notions of meaning inclusion ($\prec$) and meaning equivalence ($\cong$) that we make use of in the following.

[8] Below we will introduce the class of plural-type GQs, that according to our assumptions introduce an existentially bound set variable as part of their lexical specification. From this specification additional anaphoric possibilities arise.

(19)
a. Three men walked in the park. They (all) whistled.
b. If three students know the answer, I will invite them for lunch. They are very clever.
c. {Normally, I don't reward students for good performance, but…}
If three students prove a theorem I always invite them for lunch. They are very clever.

As (19a) shows, anaphoric reference to *three men* is possible by the use of a plural anaphora, which can be explained by the standard mechanism of DPL under the assumption that a plural anaphora denotes a set variable and that *three N* lexically determines the GQ below.[9]

(20) $GQ_{\text{three\_N}} = \lambda Q.\ \exists X\ (X \subseteq N \cap Q\ \ \&\ \ |X| = 3)$

The discourses in (19b,c) show that anaphoric reference to an indefinite in a conditional is possible if and only if the indefinite is interpreted specifically. This is predicted by the DS-approach because the set-variable antecedent for *they* is accessible only if it is existentially bound outside of the scope of the implication, i.e. if *three students* has been displaced out of the *if*-clause.

4.2 A Classification of Quantifiers

As we have shown above, DS-interpretation of a QP chain yields empirically correct results for a subclass of QPs, which lexically determine monotone increasing GQs. In the following sections, we will present the effect of collectivization of monotone decreasing and non-monotonic GQs, respectively. As we will show, the collectivization of these GQs yields an interpretation that is arguably *semantically deviant*, and we argue that this deviancy rules out any chain subject to DS-interpretation that is headed by a corresponding QP.

4.2.1 Monotone Decreasing Quantifiers

In the following, it is shown that collectivization of a monotone decreasing GQ, e.g. as lexically determined by *less than three N*, does not yield an adequate result.

Let $GQ_<$ be a monotone decreasing GQ. Then $GQ_<(\varnothing)$ holds. Since for every Generalized Quantifier GQ and every set P:

$GQ(\varnothing) \Rightarrow [min(GQ, P) \Leftrightarrow P = \varnothing]$, it holds that $GQ_<(\varnothing)\ \&\ min(GQ_<, \varnothing)$.

Moreover, $Dist(\varnothing)(Q)$ is true for every set Q. This means that the following expression is tautological for every set Q:

[9] In the following we use set-theoretical notations, e.g. $P \subseteq Q$ instead of $\forall x\ (P(x) \rightarrow Q(x))$.

$$K(GQ_{<})(\lambda M.Dist(M)(Q))$$

That is, collectivization and immediate distribution of a monotone decreasing GQ yields a tautology.

Notice that this deviancy results from choosing a minimal set from the elements of a GQ (i.e. a minimal witness set), which means that the condition which guarantees adequate truth conditions for wide-scope construals in cases such as (2b) explains more in the DS-approach than e.g. in the CF-approach: It enables one to state a condition that correctly predicts that a QP which lexically determines a monotone decreasing GQ does not allow for wide-scope readings.[10]

4.2.2 Conditions on Semantic Adequacy of Collectivization

In this section, two conditions on the semantic adequacy of collectivization of a GQ are stated. The first condition, which has been motivated above, accounts for the unavailability of wide-scope readings for QPs that lexically determine monotone decreasing and non-monotonic GQs. The second condition explains the lack of wide-scope readings for a subclass of QPs which lexically determine monotone increasing GQs.

Truth-Conditional Equivalence Condition[11]

A Generalized Quantifier *GQ* (of type $<<e, t>, t>$) satisfies the *Equivalence Condition* (EC) if

$$K(GQ)(\lambda M.Dist(M)(Q)) \Leftrightarrow GQ(Q) \quad \text{holds for every set } Q \text{ (of type } <e, t>\text{).}$$

A QP chain that is subject to DS-interpretation is semantically deviant, if the GQ lexically determined by its head does not satisfy the EC.

Intuitively speaking, the EC demands that collectivization with immediate distribution does not have a truth-conditional effect. This, as has been shown in the preceding section, means that monotone decreasing GQs do not conform to the EC. In the above statement, “immediate distribution” ought to mean that the *Dist*-operator is not within the scope of operators, with the exception of those introduced by *K*. This means that under DS-interpretation the displacement of a QP can have a truth-conditional effect only if it crosses another scope-inducing element.

[10] In addition, the minimizer condition enables the identification of the subclass of monotone increasing GQs which are not eligible for wide-scope interpretation. This will be shown below.

[11] The EC is meant to hold with respect to the notion of equivalence of standard PL, which in terms of DPL can be expressed with the corresponding truth-conditional notion $\cong_S$.

<u>*Anaphoric Reference Condition*</u>[12]

A Generalized Quantifier *GQ* satisfies the *Anaphoric Reference Condition* (ARC) if the following holds for every set *Q*:

$$\text{If } GQ \text{ is a plural-type GQ,} \quad K(GQ)(\lambda M.Dist(M)(Q)) \cong GQ(Q).$$

A QP chain that is subject to DS-interpretation is semantically deviant if the GQ lexically determined by its head does not satisfy the ARC.

Intuitively speaking, the ARC demands that a collectivized plural-type GQ has to allow for the same anaphoric links as to the GQ alone. With the ARC we make use of the fact that in DPL truth conditions do not exhaust dynamic meaning. The ARC characterizes another aspect of semantic deviancy, which can result from collectivized interpretation of a GQ. As will be shown below, the ARC partitions the class of monotone increasing GQs into two subclasses, one of which allows for wide-scope construals of the corresponding QPs, and one that does not.

In the following, it will be shown that all GQs and only those GQs that do not allow for wide-scope readings of the corresponding QPs do not satisfy the EC and the ARC.

4.2.3 Non-monotonic Quantifiers

In the case of a non-monotonic GQ, a similiar situation arises as with monotone decreasing ones: The truth conditions of a collectivized non-monotonic Generalized Quantifier *GQ* distributed over a set *Q* are weaker than those of *GQ*(*Q*) alone.

This is exemplified by the non-monotonic GQ lexically determined by *exactly three N*. Obviously, the GQ *exactly three N* is a proper subset of the GQ *at least three N*. Nevertheless, existential generalization of the set argument of these GQs yields logically equivalent expressions, i.e. the following holds:

$$\exists Q.GQ_{\text{exactly\_three\_N}}(Q) \Leftrightarrow \exists Q.GQ_{\geq\text{ three\_N}}(Q)$$

As the collectivization of a GQ brings about existential generalization, $K(GQ)(\lambda P.Dist(P)(Q))$ has weaker truth conditions than *GQ*(*Q*) in the case of a non-monotonic GQ. Therefore, a non-monotonic GQ does not satisfy the EC.

[12] The relation labelled "≅" is the relation of *meaning equivalence* as defined in Groenendijk&Stokhof (1991). The restriction towards plural-type GQs is necessary in order to prevent *every*-QPs from not satisfying the ARC. In a later section, we will specify under which circumstances the reference to plural-type GQs can be omitted. The ARC is noted somewhat sloppily, because the use of different variable names has far reaching consequences in DPL. In a precise statement, the existentially bound set variable of the plural-type GQ has to be embedded in a static context and it is then to be understood *modulo* variable renaming. The conditional statement of the ARC would then be e.g. as follows: If *GQ* is a plural-type GQ, $K(\lambda P\,(GQ(P) \vee P \neq P))(\lambda M.Dist(M)(Q)) \cong GQ(Q)$ (modulo variable renaming).

4.2.4 Monotone Increasing Quantifiers

The key observations that enable us to discriminate between monotone increasing GQs that are lexically determined by QPs, which allow for wide-scope readings and those that do not, are found in the divergence of referential properties of indefinites in truth-conditional terms on the one hand and anaphoric properties in terms of dynamic binding on the other.

(21)
a. Yesterday, three men were at the party. They all wore a hat.
b. Yesterday, at least three men were at the party. They all wore a hat.

The first sentence of the discourse in (21a) is in accord with a situation of there being more than three men at yesterday's party. But with the second sentence, the speaker does not assert that more than three men wore a hat: *They* in the second sentence refers to a set of three men, irrespective of how many men were at yesterday's party.

The facts are different with the discourse in (21b). Although the uttering of the first sentence of (b) is in accord with exactly the same situation as the first sentence of (a), in contrast to (a), the speaker asserts with the second sentence that more than three men wore a hat, given that more than three men were at yesterday's party.

This difference can be captured, if we assume the following for the GQ lexically determined by *at least three N* (compare (22) with the definition of $GQ_{\text{three\_N}}$ in (20)):

(22) $GQ_{\geq\text{ three\_N}} = \lambda Q.\ \exists X\ (X \subseteq N \cap Q\ \&\ |X| \geq 3)$

The GQ lexically determined by *at least three N*, being monotone increasing, satisfies the EC. However, it does not satisfy the ARC: In a dynamic context, the GQ defined in (22) allows for dynamic reference to the set variable *X*. The definition allows for the assignment of sets of cardinality greater than three to this variable (in the appropriate models). In contrast to this, the collectivized Generalized Quantifier $GQ_{\geq\text{ three\_N}}$ only allows for the assignment of sets of cardinality equal to three, as is shown below.

The reduction (under meaning equivalence) of $K(GQ_{\geq\text{ three\_N}})(\lambda M.Dist(M)(Q))$ yields

$$\exists P\ (GQ_{\geq\text{ three\_N}})(P)\ \&\ min(GQ_{\geq\text{ three\_N}}, P)\ \&\ Dist(P)(Q))$$

$=$

$$\exists P.\exists X\ (X \subseteq N \cap P\ \&\ |X| \geq 3\ \&\ P \subseteq N\ \&\ |P| = 3\ \&\ P \subseteq Q)$$

$\cong$

$$\exists P.\exists X\ (X = P\ \&\ P \subseteq N \cap Q\ \&\ |P| = 3)$$

In the last expression it is impossible to assign sets with cardinality greater than three to *X*. For this reason, the ARC does not hold.

4.2.5 Unifying the EC and the ARC

If the empirical claim that anaphoric reference to *at least three N* is exhaustive (i.e. that *they* in Example (21b) can only be used to refer to the complete set of men at yesterday's party) is correct, then we could capture this with the following definition for the corresponding GQ:

(23) $GQ_{\geq \text{three\_N}} = \lambda Q.\ \exists X\ (X = N \cap Q\ \ \&\ |X| \geq 3)$

According to the definition in (23), only the complete set of N that are Q can be assigned to the set variable X. But if the GQ in (23) is collectivized, it does not permit assignments of sets of any cardinality to the set variable introduced by K, but only of three-membered sets. That is, with respect to the definition given in (23), $K(GQ_{\geq \text{three\_N}})(\lambda M.Dist(M)(Q)) \prec GQ_{\geq \text{three\_N}}(Q)$[13] does *not* hold for every set Q (nor does the inverse relation hold).

But $K(GQ)(\lambda M.Dist(M)(Q)) \prec GQ(Q)$ holds for any Generalized Quantifier GQ lexically determined by the indefinites, *every N*, and *all N*. This then allows us to unify the EC and the ARC and to replace these conditions with the following condition:

<u>*Meaning Inclusion Condition*</u>[14]

A Generalized Quantifier *GQ* satisfies the *Meaning Inclusion Condition* (MIC) if

$$K(GQ)(\lambda M.Dist(M)(Q)) \prec GQ(Q) \qquad \text{holds for every set } Q.$$

A QP chain that is subject to DS-interpretation is semantically deviant if the GQ lexically determined by its head does not satisfy the MIC.

The MIC demands that the dynamic meaning of a collectivized GQ is included within the dynamic meaning of the GQ alone. That is, according to the MIC, the notion of specificity is relational in two ways. A QP in a non-trivial chain which is subject to DS-interpretation can be more specific than the *in-situ* QP in the following two cases: 1. The QP chain spans another scope-inducing element. 2. The collectivization of the GQ which is lexically determined by the head of the QP chain yields a dynamic meaning that is properly included within the dynamic meaning of the GQ alone.

We may emphasize that the GQs for *a N*, *some N*, *every N*, *all N*, and unmodified numeral QPs fulfill the EC and the ARC (or alternatively the MIC). Thus, our classification cross-cuts monotonicity and the weak / strong distinction. It also predicts the existential wide-scope behaviour of these QPs on the one hand and the restricted existential import for the remaining QPs (i.e. for QPs such as *at least n N*, *exactly n N*, *at most n N*, *few N*, *no N*, and so forth) on the other hand.

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[13] The relation labelled with "$\prec$" is the relation of *meaning inclusion* as defined in Groenendijk&Stokhof (1991).

[14] With respect to the MIC, the same proviso holds as for the ARC.

4.3 The QP Chains Subject to DS-Interpretation.

Until now, we did not specify exactly which QP chains are subject to DS-interpretation. One of the primary goals of the DS-approach is to support a modular conception of the system of grammar. We assume that the (narrow) syntactic system derives representations governed by principles which cannot refer to properties which result from interpreting the outcome of a derivation in a subsequent component. According to the DS-approach, specificity / collectivity of a QP results from interpreting certain QP chains in a special way and therefore these properties cannot be referred to within the syntactic system. From this, we conclude that there are no syntactic positions that – when targeted by a movement operation – directly reflect the property of a resulting QP chain to be subject to DS-interpretation.[15] We therefore have to characterize the relevant chains on independent grounds. Using notions of the *Phase*-system of Chomsky (1998, 1999), the relevant QP chains can (descriptively) be specified as follows.

(24) A QP chain is subject to DS-interpretation if and only if it results from (optional) displacement to an edge position of a phase.

In the overt case, the chains resulting from Topicalization (e.g. in English) and Object Shift (e.g. in Icelandic) are subject to DS-interpretation (as opposed to e.g. IP-Scrambling in German which allows for inversion of distributive scope). For the relevant covert case, we assume that long displacement is optional and that it targets the immediate phrasal projection of a phase head. That is, a QP chain resulting from long covert displacement is subject to DS-interpretation in general.

In order to arrive at an explanative account for the generalization in (24), further research is necessary.

5. The Range of Reinhart's Argument

As noted above, an analysis of wide-scope phenomena as being effected by long covert displacement, results in a non-uniformity of overt and covert displacement with respect to the obedience to island constraints. In Reinhart (1997), this fact is conceived of as a conceptual problem for the theory of grammar. In the following, we argue that Reinhart’s objection against a movement analysis of wide-scope phenomena is restricted to a specific architecture of the system of grammar and does not constitute a sufficient argument against a movement analysis *per se*.

Within the *GB*-framework, the non-uniformity of overt and covert movement was interpreted by some researchers to be evidence for a specific architecture of the system of grammar (cf. e.g. Huang 1982). The architecture that they argued for was a T-Model including the grammatical level of S-Structure, mediating between an overt and a covert

[15] That is, we assume that e.g. a position such as the *Ref*-position of Beghelli&Stowell (1996) does not exist.

syntactic cycle.[16] This conception allowed for the statement of S-Structure conditions that restricted the outcome of overt movement only, with the Subjacency condition that accounted for the island constraints being just one of those conditions.

The elimination of S-Structure as a grammatical level and the simultaneous retention of the T-Model architecture in Chomsky (1993) made it impossible to differentiate between overt and covert movement in representational terms. It is only such a system of grammar with regard to which Reinhart's conceptual argument is conclusive. Beyond that, the strength of her argument is dependent on a conception of islandhood in which the obedience to the island constraints is a property of the operation *Move*.

Looking at different conceptions of the system of grammar, the strength of Reinhart's argument dwindels as soon as the basic conceptions which her argument depends on are dropped. The system of grammar conceived in Chomsky (1998, 1999), the *Phase*-system, is a single-output system. It does not provide for a covert displacement operation as belonging to the narrow syntactic system. Therefore, as in the *GB*-framework, the non-uniformity of the operation *Move* and a (hypothesized post-cyclic) covert displacement operation can be taken as evidence for this conception of grammar. In addition, the account for the island constraints on movement that is given in the *Phase*-system even provides an argument *against* the uniformity of the outcome of *Move* and a covert displacement operation, however it may be integrated into the *Phase*-system (i.e. either as a cyclic or as a post-cyclic operation): Islandhood does not result from a constraint on the operation *Move*, but is an epiphenomenon of the conception of cyclic Spell-Out at the phase level.[17] That is, even if covert displacement were a cyclic operation, it would not be expected to be sensitive to the islands for overt movement (given that the *Phase Impenentrability Condition* is a fact to be explained and is reducible to real properties of the computational system such as adherence to cyclic Spell-Out).

From the considerations above, we conclude that Reinhart's conceptual argument against a movement analysis of wide-scope phenomena is highly dependent on a specific conception of the system of grammar and that the elaboration of an account that disregards the objection made with this argument is appropriate.

References

Beghelli, F., and T. Stowell. 1996. Distributivity and Negation. In A. Szabolsci, ed., *Ways of Scope Taking*, Dordrecht, 1997.

Carpenter, B. 1997. Type-Logical Semantics. MIT Press

Chomsky, N. 1993. A Minimalist Program for Linguistic Theory. In K. Hale and S. J. Keyser, eds., *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*, 1-52. Cambridge, MA: MIT Press

[16] The parlance of a "syntactic cycle" is not quite adequate for a system of grammar within the *GB*-framework, due to its pronounced representational character. But it still seems to be innocuous in the context of the current discussion.

[17] This does not hold for *wh*-islands that arguably result from a defective intervention constraint over and above that.

Chomsky, N. 1998. Minimalist Inquiries: The Framework. Ms., MIT, Cambridge, MA.

Chomsky, N. 1999. Derivation by Phase. Ms., MIT, Cambridge, MA.

Fodor, J, and I. Sag. 1982. Referential and Quantificational Indefinites. In *Linguistics & Philosophy* 5, 355-398.

Geurts, B. 2000. Indefinites and Choice Functions. To appear in *Linguistic Inquiry*.

Groenendijk, J., and M. Stokhof. 1991. Dynamic Predicate Logic. *Linguistics & Philosophy* 14, 39-100.

Heim, I. 1982. The Semantics of Definite and Indefinite Noun Phrases. Doctoral Dissertation, UMass, Amherst.

Huang, C. T. J. 1982. Logical Relations in Chinese and the Theory of Grammar. Doctoral Dissertation, MIT, Cambridge, MA.

Kratzer, A. 1998. Scope or Pseudoscope? Are there wide-scope indefinites? In S. Rothstein, ed., *Events and Grammar*, 163-196.

Reinhart, T. 1997. Quantifier Scope: How Labour is divided between QR and Choice Functions. *Linguistics & Philosophy* 20, 335-397.

Ruys, E. G. 1999. Unexpected Wide Scope Phenomena. Ms., Utrecht University.

Szabolcsi, A. 1996. Strategies for Scope Taking. In A. Szabolsci, ed., *Ways of Scope Taking*, Dordrecht, 1997.

Winter, Y. 1997. Choice Functions and the Scopal Semantics of Indefinites. *Linguistics & Philosophy* 20, 399-467.

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