Topic Interpretation and Wide Scope Indefinites

Christian Ebert and Cornelia Endriss

King's College London and Universität Potsdam

1. Introduction

We aim at an explanation of the fact that the class of quantifiers, which can take wide scope out of islands, coincides with the class of quantifiers, which can inhabit topical positions. The following table illustrates the class of wide scope taking indefinites and its complement class (cf. Kamp and Reyle 1993; Abusch 1994; Reinhart 1997 among others):

(1) a. *Every girl will be sad if some horse falls ill.*
$[\forall > \exists]$ $[\exists > \forall]$
b. *Every girl will be sad if three horses fall ill.*
$[\forall > 3]$ $[3 > \forall]$
c. *Every girl will be sad if at least three horses fall ill.*
$[\forall > at\ least\ 3]$??$[at\ least\ 3 > \forall]$
d. *Every girl will be sad if exactly three horses fall ill.*
$[\forall > exactly\ 3]$??$[exactly\ 3 > \forall]$
e. *Every girl will be sad if at most three horses fall ill.*
$[\forall > at\ most\ 3]$ *$[at\ most\ 3 > \forall]$

Monotone decreasing and non-monotonic quantifiers are excluded from a wide scope interpretation. This leaves the monotone increasing quantifiers, but as the contrast between *three* in b. and *at least three* in c. shows, only a subclass of the monotone increasing quantifiers can actually take exceptional wide scope. This is particularly puzzling if one considers that *three* and *at least three* are standardly assumed to have the same semantics.

In German, there is a topic position for left dislocated elements (cf. Frey 2000; Jacobs 2001). The only DPs that can turn up in this position are referential DPs or specific indefinites (Jacobs 2001):

(2) a. **Jedes / *Kein / ??Irgendein / Ein Pferd, das frisst Bananen.*
**Every / *No / ??Some (or other) / Some horse it eats bananas*
'Every horse / No horse / Some horse (or other) / Some horse eats bananas.'

b. **Höchstens drei / ??Mindestens drei / ?Alle / Drei Pferde, die fressen Bananen.*
**At most three / ??At least three / ?All / Three horse they eat bananas*
'At most three / At least three / All / Three horses eat bananas.'

The same pattern emerges with another topic position in the German middle field above the sentence adverbial according to Frey (2000). This position can only be targeted by constituents that can be interpreted as *aboutness* topics, which are also referential or specific DPs. Left dislocation (2) and middle field topics allow those DPs in topical positions which can also take exceptional wide scope as indicated in (1). For instance, the DP *three horses* can occupy topical positions, whereas *at least three horses* and *at most three horses* cannot. This suggests that there is a strong correlation between the wide scope interpretation and the topical interpretation of DPs.

2. Existing Approaches

2.1. Topicality and Wide Scope

Cresti (1995) correlates the topic interpretation of indefinites to their wide scope interpretation. The same correlation is the basis of Portner and Yabushita (2001), where specificity of an indefinite arises when the restrictor set forms the topic of the sentence. Building on Portner and Yabushita (1998), it is proposed that all information of a sentence is stored under an associated discourse referent which is the sentence's topic. This relates to the ideas of Reinhart (1982) and Vallduví (1992). Both approaches restrict their attention to singular indefinites (i.e. *a* and *some*).

2.2. Deriving the Classification

Existing approaches towards the explanation of exceptional wide scope phenomena either limit their applicability to a certain subclass of wide scope indefinites (singular ones, as e.g. Cresti 1995) or have to stipulate two different interpretation mechanisms – one, which applies to the class of wide scope quantifiers and another, which applies to the remaining ones (as e.g. the Choice Function approaches of Reinhart 1997; Winter 1997 and others). The following two proposals aim at distinguishing the correct class of wide scope takers from other quantifiers by taking the semantic properties of the respective quantifiers into consideration:

Szabolcsi (1997) The main aim of Szabolcsi (1997) is to explain the scope taking behaviour of different quantifiers. While focusing on local scope phenomena, she also makes several predictions concerning exceptional wide scope. Szabolcsi (1997) assumes that there is a specific position (*HRefP*) which can be regarded as a wide scope position. Due to the interpretative mechanism at *HRefP*, only monotone increasing quantifiers can inhabit this particular position (referred to as the *increasingness constraint* by the author). Therefore non-increasing quantifiers are excluded from being interpreted in *HRefP*, but there is still no explanation for the fact that it is only a proper subclass of the increasing quantifiers that can be interpreted with exceptional wide scope.

de Swart (1999) The aim of de Swart (1999) is to subdivide weak quantifiers into different groups according to certain properties they share. She distinguishes three different classes of indefinites, of which one class is the class of wide scope indefinites we are concerned with in this paper (class II in de Swart 1999). Building on observations of Partee (1987) and by taking discourse anaphora into account, de Swart (1999) singles out monotone increasing quantifiers. By recurrence to a formal notion of referentiality (i.e. type shifting to type e) she explains the difference between wide scope and other increasing quantifiers: for the former there has to be a simple *identity criterion* (cf. de Swart 1999, p. 290ff) on the basis of which a plural individual can be picked. This explanation crucially hinges on what is regarded as a *simple* criterion.

In the following we aim at dealing with all of the above-mentioned issues with one uniform approach: wide scope interpretation, topicality and the correct classification based on inherent semantic properties of the quantifiers involved.

3. Technical Preliminaries

We will briefly review the technical preliminaries we build our system upon. At first, we will make use of the concepts of *Dynamic Semantics* (cf. Staudacher 1987; Groenendijk and Stokhof 1991; Kamp and Reyle 1993). Thus we will speak of *discourse referents* (*DR* in short) and *accessibility* concerning anaphoric reference. Although we phrase our approach in terms of *Dynamic Predicate Logic* (Groenendijk and Stokhof 1991) nothing hinges on this choice. Furthermore we adopt the view that a speaker's utterance leads to an update of a *common ground* (as e.g. Krifka 1992).

3.1. Quantifier Semantics

In this section we review empirical findings concerning the semantics of generalized quantifiers, which are related to anaphoric possibilities and exhaustivity. We propose a modification of the standardly assumed semantics towards a definition using plural dynamic effects to accommodate the facts in the spirit of Kadmon (1985). The following pair of examples illustrates the difference regarding anaphoric possibilities between *three* and *at least three* – the latter allows only for exhaustive anaphoric reference (cf. Kadmon 1985; Kamp and Reyle 1993)[1]:

(3) a. *Yesterday, three men were at the party. They all wore a hat.* (not exhaustive).
b. *Yesterday, at least three men were at the party. They all wore a hat.* (exhaustive)

[1] Reinhart (1997), p. 385 discusses this phenomenon (and assigns its observation to Kamp and Reyle 1993), but she does not come to the conclusion that these findings should be reflected in the semantics of the respective quantifiers.

The first sentence of the statement in (3.a), containing the GQ for *three men*, agrees with a situation in which there were more than three men at yesterday's party. 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 for the statement in (3.b). The first sentence of (3.b) agrees with exactly the same situation as the first sentence of (3.a). However, in contrast to (3.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. To be more precise: if six men were at yesterday's party, the anaphor *They* can only refer to the set of all six men that were at the party and not to a set of five or four.

Our aim is to account for these findings directly by changing the semantics of the respective quantifiers[2]. This has been proposed by Kadmon (1985). The idea is to define the quantifiers in a dynamic setting such that they employ existentially quantified discourse referents which allow directly for the respective (non-)exhaustive reference. This then yields the following semantics for a numeral determiner *n*:

(4) $n \quad \rightsquigarrow \quad \lambda P.\lambda Q.\exists X.|X| = n \wedge X \subseteq P \cap Q$

This definition contains one existentially bound plural variable (of type $\langle e, t\rangle$) which will therefore be dynamically accessible in further discourse. It refers to a *subset* of the intersection of restrictor and nucleus (i.e. to a subset of the set of P which Q) and thus we shall call it a *non-exhaustive quantifier*. For *at least n* the semantics has to be changed only slightly to account for the exhaustivity effects seen above:

(5) *at least n* $\quad \rightsquigarrow \quad \lambda P.\lambda Q.\exists X.|X| \geq n \wedge X = P \cap Q$

Again one existentially bound plural variable is introduced but this time it refers to the *entire* intersection of restrictor and nucleus (i.e. to the entire set of P which Q) and thus we shall call it an *exhaustive quantifier*. This gives us the following quantifier semantics:

(6)
$$
\begin{array}{rcl}
n & \rightsquigarrow & \lambda P.\lambda Q.\exists X.|X| = n \wedge X \subseteq P \cap Q \\
\textit{at least n} & \rightsquigarrow & \lambda P.\lambda Q.\exists X.|X| \geq n \wedge X = P \cap Q \\
\textit{exactly n} & \rightsquigarrow & \lambda P.\lambda Q.\exists X.|X| = n \wedge X = P \cap Q \\
\textit{at most n} & \rightsquigarrow & \lambda P.\lambda Q.\exists X.|X| \leq n \wedge X = P \cap Q
\end{array}
$$

Note that concerning static truth conditions the semantics for *n* and *at least n* are equivalent, as it is commonly assumed. With respect to dynamic semantics however, these definitions account for the facts concerning exhaustivity. Together with the following approach to topic/wide scope interpretation, they allow for the correct classification of topic/wide scope quantifiers to be derived.

[2] This approach differs from the one proposed in Kamp and Reyle (1993), where exhaustivity is accounted for by means of an additional *abstraction* operation.

3.2. Structured Meanings

Following Krifka (1992) and von Stechow (1989), we make use of *structured meanings*. Resembling the treatment of focus in Krifka (1992) the representation of an expression containing a topic-marked constituent is structured into a topic component α_T (representing the semantics of the topic-marked constituent) and a comment component α_C such that the entire representation is of the form $\langle \alpha_T, \alpha_C \rangle$. The conventional meaning of the expression can be derived by applying the comment α_C to the topic α_T. The following definition of functional application with structured meanings is taken from Krifka (1992):

(7)
1. $\langle \alpha_T, \alpha_C \rangle(\beta) \;=\; \langle \alpha_T, \lambda X.[\alpha_C(X)(\beta)] \rangle$ where X is of the same type as α_T
2. $\beta(\langle \alpha_T, \alpha_C \rangle) \;=\; \langle \alpha_T, \lambda X.[\beta(\alpha_C(X))] \rangle$ where X is of the same type as α_T

This definition ensures that the information about topic-marked sub-constituents is inherited to larger constituents while functional application is carried out. In addition, we assume a simple straightforward grammar extended by an additional rule for topic marking, which states that topic-marked phrases are translated as topic-comment-structures:

(8) $[C]_T \rightarrow C$
$[\![[C]_T]\!] = \langle [\![C]\!], \lambda X.X \rangle$ where X is of the same type as $[\![C]\!]$

We illustrate the usage of structured meanings with a simple example:

(9) If [three horses $]_T$ sleep then ϕ.

$$\text{If} \quad \langle \lambda Q.\exists X.|X| = 3 \wedge X \subseteq \mathsf{horse} \cap Q, \lambda \mathcal{R}.\mathcal{R} \rangle \quad \mathsf{sleep} \quad \text{then} \quad \phi$$

$$\langle \lambda Q.\exists X.|X| = 3 \wedge X \subseteq \mathsf{horse} \cap Q, \lambda \mathcal{R}.\mathcal{R}(\mathsf{sleep}) \rangle$$

$$\langle \lambda Q.\exists X.|X| = 3 \wedge X \subseteq \mathsf{horse} \cap Q, \lambda \mathcal{R}.(\mathcal{R}(\mathsf{sleep}) \rightarrow \phi) \rangle$$

The application of the comment component to the topic component yields the conventional meaning, which is the narrow scope reading for *three horses*:

$$\begin{aligned} &\lambda \mathcal{R}.(\mathcal{R}(\mathsf{sleep}) \rightarrow \phi)(\lambda Q.\exists X.|X| = 3 \wedge X \subseteq \mathsf{horse} \cap Q) \\ &\equiv \; ((\exists X.|X| = 3 \wedge X \subseteq \mathsf{horse} \cap \mathsf{sleep}) \rightarrow \phi) \end{aligned}$$

4. A Topic Theory of Wide Scope Phenomena

In our approach, the topical status of the quantifier under consideration is responsible for its wide scope interpretation. According to Reinhart (1982), the topic of a sentence can be taken to be the entity the sentence is *about*. This is called the *aboutness* function of a topic. A topic can then be understood as the *address* (Jacobs 2001) or the *link* (Vallduví

1992) which (sloppily speaking) points to a place where the information conveyed by the sentence will be stored. This explains why only certain entities can function as aboutness topics as they have to be able to provide *sensible* addresses.

Another concept relating to topics is *familiarity*. If a topic is *familiar* it has been introduced previously. In more formal terms this means that a discourse referent for this topic already exists in the common ground, which in turn means that the information conveyed by the sentence can straightforwardly be added to the common ground. Therefore the common ground can be simply updated with the conventional meaning $\alpha_C(\alpha_T)$. By this definition only individuals (and sets) can be familiar as only they can be referred to by discourse referents. In particular, quantifiers (and other expressions of non-individual and non-set type) cannot be familiar as such.

However, it is known (see (2)) that certain quantifiers can still function as aboutness topics of a sentence. In this case, we assume that a sensible address/link has to be created. More formally this comes down to the creation of a sensible discourse referent that stands proxy for the quantifier in question. Exactly this is the decisive criterion for separating the topical quantifiers from others: while the former allow for the creation of a sensible discourse referent, the latter fail to do so.

In the following sections we will formally spell out these ideas and intuitions. First we will define what it means (for a quantifier) to provide a sensible address/discourse referent, which will lead to a condition on the semantics on quantifiers. This *Topic Condition* will serve to separate the class of topical/wide scope quantifiers from its complement class. Finally an illocutionary operator TopAssert (*Topic Assert*) implements the update of the common ground.

4.1. Creating a Topic Discourse Referent

First we will define what it means for a quantifier to provide a sensible discourse referent, which can be used as the address in the aboutness topic sense. So let us assume that we have to deal with a topic marked quantifier such as in example (9), i.e. with a quantifier that ends up as the topic component α_T of the sentence under consideration. Creating a new discourse referent for the quantifier α_T means:

1. to take a sensible *witness* for the quantifier, then
2. to create a DR P for this witness, and finally
3. to let this DR function as topic in place of the quantifier α_T itself.

This creation of a new topic corresponds to the procedure Szabolcsi (1997) proposes for a DP in *HRefP*.[3] Formalizing these steps we arrive at the following schema:

(10) $\exists P.P$ *is a witness for* $\alpha_T \wedge \alpha_C(P)$

[3] Szabolcsi (1997) speculates that those DPs that can introduce discourse referents over witness sets might be "topics in some generalized sense" (p. 150). Beghelli and Stowell (1997) take it that "it is possible that our Spec of *RefP* position can be identified with the topic position" (p. 76). We take these intuitions seriously and build our proposal on the intuition that topicality and wide scope are closely tied together.

Here the phrase P *is a witness for* α_T is used to describe the operation in 1., which is needed to find a sensible witness P for the topical quantifier α_T. The existential binding of P corresponds to 2., the creation of a DR for P. Finally 3. is implemented by applying α_C to P instead of α_T, which would yield the conventional meaning. A good witness candidate to represent the entire quantifier α_T would be an element of the quantifier which does not contain any 'disturbing' elements. This is a *minimal witness set* in the sense of Barwise and Cooper (1981). For every set P and generalized quantifier q a predicate $\mathsf{min}(P, q)$ can be defined which is true, iff P is a minimal set[4] with respect to the elements of q:

(11) $$\mathsf{min}(P, q) \;=\; \forall Q(q(Q) \rightarrow \neg(Q \subset P))$$

Now we can formalize point 2. and replace the phrase P *is a witness for* α_T in (10) by the formal statement $\alpha_T(P) \wedge \mathsf{min}(P, \alpha_T)$ saying that P is a minimal (witness) set of α_T:

(12) $$\exists P.\alpha_T(P) \wedge \mathsf{min}(P, \alpha_T) \;\wedge\; \alpha_C(P)$$

As α_C is necessarily of a type that can be applied to α_T, there will be a type conflict whenever α_C is applied to the set $P \in \alpha_T$. These type conflicts are resolved by type shifting P as follows:

(13) $$P \quad \rightsquigarrow \quad \lambda Q.\forall x.P(x) \rightarrow Q(x)$$

Note that this type shift corresponds to inherent distribution of P over Q, which will basically distribute P over the predicate in α_C (such as *sleep*), to which the quantifier α_T applies.

4.2. The Topic Condition

Now that the creation of a discourse referent from a quantifier has been defined by (12) we can derive a formal condition on the semantics of quantifiers which tells us wether this operation yields a sensible result. This condition is called the *Topic Condition* (TC), because by checking for a sensible result it determines wether the quantifier in question (i.e. the quantifier which is topic-marked and ends up in the topic component α_T) can actually function as an *aboutness* topic. To achieve this, the *aboutness* case

$$\exists P.\alpha_T(P) \wedge \mathsf{min}(P, \alpha_T) \wedge \alpha_C(P)$$

(i.e. the case where a DR has to be created) is compared to the simpler *familiarity* case $\alpha_C(\alpha_T)$ for certain *simple comments*. The intuition behind the test is that the aboutness function of a topic should differ only minimally from the familiarity function, i.e. only in the creation of an additional address/link/discourse referent which serves to store the information of the sentence. Spelled out more technically, for simple comments the two cases should not at all differ concerning truth conditions and they should only differ in a *non-destructive* way concerning anaphoric potential.

[4] We actually define only minimal sets, but it can be shown that for every quantifier minimal and minimal witness sets coincide.

Definition (Topic Condition)
A quantifier q fulfills the *Topic Condition* if for all sets Y

(14) a. $\exists P.q(P) \wedge \mathsf{min}(P,q) \wedge (\lambda\mathcal{R}.\mathcal{R}(Y))\,(P) \quad \equiv \quad (\lambda\mathcal{R}.\mathcal{R}(Y))\,(q)$ and
b. all anaphoric possibilities which are available in $c + (\lambda\mathcal{R}.\mathcal{R}(Y))\,(q)$ remain available in $c \; + \; \exists P.q(P) \wedge \mathsf{min}(P,q) \wedge (\lambda\mathcal{R}.\mathcal{R}(Y))\,(P)$.

Here $\lambda\mathcal{R}.\mathcal{R}(Y)$ takes the place of α_C and is what we regard as a simple comment.

According to this definition a quantifier q fulfills the TC if for certain general simple cases 1., the creation of the DR has no truth conditional effect w.r.t. a standard context update. 2., dynamically speaking, the introduction of a new DR does not destroy already existing anaphoric possibilites, but only adds a new possible topic that can be referred to in subsequent discourse.

4.3. Quantifier Classification

Note that by this definition the Topic Condition is a condition on the semantics of a quantifier and thus is independent of the actual configuration the quantifier appears in. In the following we will show that the TC is capable of deriving the correct classification of quantifiers into topical/wide scope quantifiers and their complement class.

Non-increasing Quantifiers Monotone decreasing and non-monotonic quantifiers do not pass point 1. of the Topic Condition. After application of the type shift (13) we arrive at the equivalence

(15) $$\exists P.q(P) \wedge \mathsf{min}(P,q) \wedge P \subseteq Y \quad \equiv \quad q(Y)$$

which does not hold for all sets Y. For instance, taking *at most three horses* as an example for a monotone decreasing quantifier q this reduces to

(16) $$\exists P.P = \emptyset \wedge P \subseteq Y \quad \not\equiv \quad \exists X.|X| \leq 3 \wedge X = \mathsf{horse} \cap Y$$

Here it is obvious that the equivalence does not hold: the left hand side is tautological whereas the right hand side is the (non-tautological) semantics of *at most three horses*.

This fact about non-increasing quantifiers follows directly from findings in Barwise and Cooper (1981) where it is shown that the assumed procedure of existential quantification over a minimal witness set has no truth conditional effect for monotone increasing quantifiers only. The above mentioned *increasingness constraint* of Szabolcsi (1997) aims at an explanation along the same lines.

Increasing Quantifiers As mentioned before monotone increasing quantifiers pass point 1. of the Topic Condition. However, point 2. is only passed by *non-exhaustive* quantifiers (cf. section 3.1). Therefore *exhaustive* quantifiers such as *at least three horses* fail point 2. because

(17) $$c \; + \; \exists P.|P| = 3 \wedge P \subseteq \mathsf{horse} \wedge P \subseteq Y$$

does not have all of the anaphoric possibilies of

(18) $c \ + \ \exists X.|X| \geq 3 \wedge X = \mathsf{horse} \cap Y$

The standard quantifiers semantics shown in (18) allows X to refer to sets of cardinality greater than three (cf. 3). Introduction of a topic DR in (17) destroys these anaphoric possibilities for P. P can only refer to a minimal witness which contains exactly three horses. In this respect, the introduction of a new topic would be destructive and thus *at least three horses* fails the Topic Condition. On the other hand, *three horses* as a non-exhaustive quantifier passes the TC because the lexical semantics only allows for reference to sets of three horses, which are the minimal witness sets of the quantifier.

Thus the Topic Condition rules out monotone decreasing, non-monotonic, and monotone increasing exhaustive quantifiers. These quantifiers cannot be interpreted as topical quantifiers and therefore the Topic Condition yields the desired classification:

TC failed/non-topical	TC passed/topical
at most n	*n*
exactly n	*some*
at least n	*a*
...	*every*
	all

It might be surprising that the strong quantifiers *every* and *all* are classified as topical quantifiers by the TC, but it will be shown that this assumption does no harm.

4.4. Topic Assert

Eventually we propose an illocutionary operator TopAssert (*Topic Assert*) which applies to a common ground c and a structured meaning representation $\langle \alpha_T, \alpha_C \rangle$ of a sentence. It performs the update of the common ground by taking the status of the topic marked constituent α_T in consideration as follows[5]:

(19) $$\mathsf{TopAssert}(\langle \alpha_T, \alpha_C \rangle)(c) = \begin{cases} c \ + \ \alpha_C(\alpha_T) & \text{if } \alpha_T \text{ is accessible in } c \\ c \ + \ \exists P.\alpha_T(P) \wedge \mathsf{min}(P, \alpha_T) \wedge \alpha_C(P) & \text{if } \alpha_T \text{ fulfills the Topic Condition} \\ \text{undefined} & \text{else} \end{cases}$$

The first case of the TopAssert definition deals with familiar topics: if the DR for α_T is already accessible in the common ground then an update with the conventional meaning $\alpha_C(\alpha_T)$ is carried out. The second case formalizes what it means to be an aboutness topic: if the topic-marked expression α_T passes the TC a new DR is created (as explained above) and the appropriate update is performed. Thus the application of TopAssert is only defined if the topic-marked constituent is either familiar or fulfills the Topic Condition. By this definition only constituents that pass the Topic Condition can be unfamiliar aboutness topics in this sense. As can be seen the update in the aboutness case leads to a wide scope reading of the respective quantifier which will be illustrated in the following section.

[5] Here, P is a new discourse referent.

5. Deriving Wide Scope via Topicality

To illustrate our proposal let us start with a simple example.

(20) [Three horses $]_T$ sleep.

The application of the illocutionary operator TopAssert to the structured meaning representation and to some common ground c yields the following update.

$$\begin{aligned}&\mathsf{TopAssert}(\langle \lambda Q.\exists X \ldots, \lambda \mathcal{R}.\mathcal{R}(\mathsf{sleep})\rangle)(c)\\&\quad = c + \exists P.(\exists X.|X| = 3 \land X \subseteq \mathsf{horse} \cap P) \land \mathsf{min}(P, \lambda Q.\exists X \ldots) \land \lambda \mathcal{R}.\mathcal{R}(\mathsf{sleep})(P)\\&\quad = c + \exists P.(\exists X.|X| = 3 \land X \subseteq \mathsf{horse} \cap P) \land \mathsf{min}(P, \lambda Q.\exists X \ldots) \land P \subseteq \mathsf{sleep}\end{aligned}$$

In this example *three horses* is the sentence topic. Being a quantifier, *three horses* cannot already have been established, i.e. cannot be accessible in the common ground. For this reason, the first case of the TopAssert definition (19) is not applicable. Therefore the second case comes into play, because *three horses* is a non-exhaustive, increasing quantifier which passes the TC. Thus a new discourse referent P which refers to a set of three horses is established and the respective update is performed.

To see how exceptional wide scope readings of the type discussed in the first chapter can be derived we consider example (9) again, repeated as (21).

(21) If [three horses $]_T$ sleep then ϕ.

The structured meaning representation of this example has been derived in (9) and the application of TopAssert yields the following result:

$$\begin{aligned}&\mathsf{TopAssert}(\langle \lambda Q.\exists X \ldots, \lambda \mathcal{R}.(\mathcal{R}(\mathsf{sleep}) \rightarrow \phi)\rangle)(c)\\&\quad = c + \exists P.(\exists X.|X| = 3 \land X \subseteq \mathsf{horse} \cap P) \land \mathsf{min}(P, \lambda Q.\exists X \ldots) \land \lambda \mathcal{R}.(\mathcal{R}(\mathsf{sleep}) \rightarrow \phi)(P)\\&\quad = c + \exists P.(\exists X.|X| = 3 \land X \subseteq \mathsf{horse} \cap P) \land \mathsf{min}(P, \lambda Q.\exists X \ldots) \land (P \subseteq \mathsf{sleep} \rightarrow \phi)\end{aligned}$$

Here the reasoning is analogous to the above example (20). However, due to the structure of the sentence, an interpretation is generated, in which *three horses* takes wide scope over the *if*-clause. The formula the context is updated with can be paraphrased as: there is a minimal witness set P of *three horses* (i.e. a set containing exactly three horses) and if each of the elements in P sleeps, then ϕ. This is the desired wide scope reading, where the distributivity stays local.

As mentioned above the universal quantifiers *every* and *all* pass the Topic Condition by definition. Therefore, in a case like

(22) If [every horse $]_T$ sleeps then ϕ.

the second (aboutness) case of the TopAssert definition is applicable[6] just as in the case of (21). The result of the application of TopAssert is as follows:

[6] Beghelli and Stowell (1997) as well as Szabolcsi (1997) also assume that universal quantifiers can be interpreted in *DistP* where they pick a witness set from the quantifier.

(23) $\mathsf{TopAssert}(\langle \lambda Q.\forall x \ldots, \lambda \mathcal{R}.(\mathcal{R}(\mathsf{sleep}) \to \phi)\rangle)(c)$

$$= c + \exists P.(\forall x.\mathsf{horse}(x) \to P(x)) \wedge \mathsf{min}(P, \lambda Q.\forall x \ldots) \wedge \lambda \mathcal{R}.(\mathcal{R}(\mathsf{sleep}) \to \phi)(P)$$

$$= c + \exists P.(\forall x.\mathsf{horse}(x) \to P(x)) \wedge \mathsf{min}(P, \lambda Q.\forall x \ldots) \wedge (P \subseteq \mathsf{sleep} \to \phi)$$

The unique minimal witness set of the quantifier *every horse* is the set of horses. Therefore P can be replaced by this set in the last conjunct and the existential quantification together with the first two conjuncts can be omitted. This yields the following result:

(24) $c + (\mathsf{horse} \subseteq \mathsf{sleeps}) \to \phi$

Obviously this represents the narrow scope interpretation of the sentence. Thus we predict that *every horse* can be topic marked, but because of the equivalence of the wide scope and the narrow scope reading, it only *seems* as if there was no wide scope reading.

In an ill-formed case of topic-marking such as

(25) If $^*[$ at most three horses $]_T$ sleep then ϕ.

the reasoning is as follows. Again *at most three horses* as a quantifier cannot be familiar as such and thus the first case of TopAssert is not applicable. But in this case the second (aboutness) case is not applicable either, because *at most three horses* does not pass the TC (as explained above). Therefore only the third case remains and the result of any potential update is undefined. This explains why *at most three horses* cannot function as topic, i.e. cannot be topic marked and in turn cannot be interpreted in a wide scope reading.

6. Conclusion

In our system the ability to be a topic and to be interpreted specifically is reduced to the application of one and the same operation to the respective constituents.We are able to 1. simultaneously account for the exceptional wide scope behaviour and topicality of certain indefinites (without assuming in-situ-interpretation as e.g. in the Choice Function approaches), 2. give a purely semantic criterion (the Topic Condition) to single out this class of indefinites, and 3. provide a formal definition of the notion of aboutness topic.

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Department of Computer Science
King's College London
The Strand
London WC2R 2LS
United Kingdom

ebert@dcs.kcl.ac.uk

Institut für Linguistik
Universität Potsdam
Postfach 601553
14415 Potsdam
Germany

endriss@rz.uni-potsdam.de