

## QUANTIFICATIONAL VARIABILITY EFFECTS WITH PLURAL DEFINITES<sup>\*</sup>

Cornelia Endriss & Stefan Hinterwimmer

University of Potsdam; Humboldt University Berlin

endriss@rz.uni-potsdam.de; stefan.hinterwimmer@rz.hu-berlin.de

### Abstract

In this paper we give evidence that *Quantificational Variability Effects* (Berman (1991)) in sentences containing plural definites come about as an indirect effect of quantification over sum eventualities. Evidence for this claim comes from the fact that those sentences – in contrast to minimally varying sentences where the Q-adverb has been replaced by a quantificational determiner – have to obey two newly observed constraints in order to get QV-readings. We show that those constraints can be explained if an analysis that is based on Nakanishi/Romero's (2004) analysis of the Q-adverb *for the most part* is combined with the results of Endriss/Hinterwimmer (to appear), where we offer an explanation for similar constraints in adverbially quantified sentences that contain singular indefinites.

### 1 Introduction

*Quantificational Variability Effects* (QVEs) (Berman (1991)) do not only occur with adverbially quantified sentences that contain singular indefinites and bare plurals (see Lewis (1975), Kamp (1981), Heim (1982), Diesing (1992), Kratzer (1995)), but also with ones that contain plural definites. The latter then get readings that can be paraphrased by sentences where the respective Q-adverb has been replaced by a quantificational determiner of corresponding quantificational force. This is shown in (1a, b) below:

- (1)    a.    The people that lectured on kangaroos at the conference last summer  
              were usually open-minded.  
          b.    Most people that lectured on kangaroos at the conference last summer  
              were open-minded.

This, however, is not always the case, as is shown by the contrast between (2a) and (3a), on the one hand, and (2b) and (3b), on the other: In both cases, the adverbially

---

<sup>\*</sup> We would like to thank Sigrid Beck, Ariel Cohen, Christian Ebert, Alex Grosu, Andreas Haida, Manfred Krifka, Jens Michaelis, Philippe Schlenker, Peter Staudacher and Malte Zimmermann for discussions and valuable comments. Thanks are also due to the audiences at SuB 9 in Nijmegen in November 2004 and at a talk given at ZAS in Berlin in December 2004 for stimulating discussion. This research was funded by the Deutsche Forschungsgemeinschaft as part of the Sonderforschungsbereich 632 (Information Structure).

quantified sentences are unacceptable<sup>1</sup>, while the corresponding sentences containing quantificational determiners are perfectly fine.

- (2) a. ??The people that lectured on kangaroos at the conference last summer are usually open-minded.
- b. Most people that lectured on kangaroos at the conference last summer are open-minded.
- (3) a. ??The people that listened to Peter's lecture on kangaroos at the conference last summer were usually open-minded.
- b. Most people that listened to Peter's lecture on kangaroos at the conference last summer were open-minded.

Note that (2a) differs only minimally from (1a) with respect to the tense of the matrix predicate. In (2a) – in contrast to (1a) – the tenses of the matrix clause predicate and the relative clause predicate do not agree. (3a) contains agreeing tenses of the matrix and the relative clause predicate, but is still unacceptable for reasons that will be discussed below. We will show that the unacceptability of both (2a) and (3a) can be accounted for under the assumption that Q-adverbs exclusively quantify over eventualities. If Q-adverbs were unselective binders which are able to also quantify over individuals (as in Heim (1982), Kamp (1981), Diesing (1992), and Kratzer (1995)), the contrast above would be completely mysterious. (2a) would then get exactly the same representation as (2b), and (1b) the same as (1a). But sentence (2b) is just as good as (1b), whereas (2a) is distinctly worse than (1a). This means that at the level of semantic interpretation, there would be no means to distinguish between the two versions and this contrast could not be expressed.

## 2 Background assumptions: The interval resolution strategy in adverbially quantified sentences that contain indefinites

### 2.1 Preliminaries

We assume that *QVEs* in adverbially quantified sentences containing indefinites come about via quantification over sets of eventualities/situations (see Berman (1987), de Swart (1993), von Stechow (1994), Rooth (1995), Herburger (2000)). Thus, we take Q-adverbs to denote quantifiers over sets of eventualities. Whereas the arguments of quantificational determiners are provided by the syntax, the arguments of Q-adverbs are determined on the basis of information structure. Their first argument (the *restrictor*) is the denotation of the non-focal or topical part of the clause they are contained in, while their second argument (the *nucleus*) is the denotation of the whole clause minus the Q-adverb (see Rooth (1985), Krifka (1995), Partee (1995), Rooth (1995), Herburger

---

<sup>1</sup> Sentences (1a) and (2a) actually can get a non-QV-reading saying that (all) the people that lectured on kangaroos at the conference last summer are sometimes open-minded and sometimes not. Here, we are only interested in the reading where *open-minded* is interpreted as an individual level predicate in the sense that if a person is open-minded at some point, this property holds for his/her entire life.

(2000) among many others)<sup>2</sup>. Furthermore, we assume that indefinite DPs are ordinary Generalized Quantifiers with existential force.

*QVEs* can be observed if singular indefinites are interpreted in the restriction of *Q*-adverbs, which is the case if these indefinites are de-accented and thus belong to the non-focal part of the sentence. Each eventuality quantified over is assumed to contain one and only one individual that fulfils the predicate denoted by the NP-complement of the indefinite determiner. It is furthermore assumed that the individuals vary with the eventualities quantifier (see Berman (1987), de Swart (1993), von Stechow (1994), and Herburger (2000) for discussion). So there is an indirect effect of quantification over these individuals. According to these assumptions, sentence (4a) is interpreted as in (4b) below<sup>3</sup>:

- (4) a. A police car is usually [blue]<sub>F</sub>.  
 b. Most *e* [ $\exists x$  [ $\text{Arg}(e, x) \wedge \text{police\_car}(x)$ ]  
 $\exists x$  [ $\text{Arg}(e, x) \wedge \text{police\_car}(x) \wedge \text{blue}(e)$ ]

Now consider the contrast between (5a) and (5b) below: (5a), where the relative clause verb is marked for past tense and the matrix verb is marked for present tense, is only marginally acceptable, while (5b), where both verbs are marked for past tense, is fine<sup>4</sup>. This effect has to be explained, which will be done in the following section (see Endriss and Hinterwimmer (to appear) for an in depth discussion of the constraints restricting QV readings).

- (5) a. ??A car that was bought in the eighties is usually [blue]<sub>F</sub>.  
 b. A car that was bought in the eighties was usually [blue]<sub>F</sub>.

## 2.2 The interval resolution strategy

It is commonly assumed that quantifiers come with a covert domain restriction in the form of a free context variable *C* ranging over predicates (cf. von Stechow (1994), Stanley (2000), Marti (2003)) which is added conjunctively to the overtly given predicate that functions as the first argument of the quantifier. As eventualities need to be located in time (cf. Partee (1973), Lenci and Bertinetto (1999)), we assume that the context

---

<sup>2</sup> Due to limitations of space, we will not be able to discuss the compositional details of the required clause separation (see the references above for details).

<sup>3</sup> We follow Chierchia (1995b) and Herburger (2000) in assuming that stage-level as well as individual-level predicates introduce eventuality variables that are bound by *Q*-adverbs (see Kratzer (1995) for a different opinion). Furthermore, we also assume a Neo-Davidsonian event-semantics (see Parsons (1990)), according to which the denotations of verbs are decomposed into a core verbal predicate and thematic role predicates, which are added conjunctively to the core predicate. Note that in this framework the *requantification problem* (von Stechow (1994), s. also Krifka (2001)) is avoided, because theta-roles are assigned exhaustively, i. e. each eventuality quantified over contains one and only one (atomic or plural) individual that fulfils the respective thematic role predicate.

<sup>4</sup> For some speakers, (5a) has a non-QV-reading where *a car* is interpreted specifically. Again, we are not interested in this reading, but assume *be blue* to be an individual level predicate with respect to cars.

variable introduced in the restriction of Q-adverbs is resolved to the predicate given in (6). The eventualities involved are thereby located in a time interval  $i$ . This interval needs to be determined on the basis of contextual information.

- (6)  $\lambda e. \tau(e) \subseteq i_e$ ,  
where  $\tau(e)$  denotes the running time of  $e$  and  $i_e$  denotes a time interval<sup>5</sup>.

Furthermore, we assume the following (simplified) tense semantics:

- (7) a.  $\text{pres}(e) := t_0 \subseteq \tau(e)$ .  
b.  $\text{past}(e) := \tau(e) < t_0$ ,  
where  $t_0$  denotes the speech time.

Now, according to the above assumptions, the initial semantic representation of sentence (5a) is as in (8) below<sup>6</sup>:

- (8) Most  $e$  [ $\exists x$  [ $\text{car}(x) \wedge \text{Arg}(e, x) \wedge \exists e'[\text{buy}(e') \wedge \text{Theme}(e', x) \wedge \text{past}(e') \wedge \tau(e') \subseteq 80s] \wedge \tau(e) \subseteq i_e$ ]]  
[ $\exists x$  [ $\text{car}(x) \wedge \text{Arg}(e, x) \wedge \exists e'[\dots] \wedge \text{pres}(e) \wedge \text{blue}(e)$ ]]

The next step would be to find a value to which the free interval variable  $i_e$  can be resolved. We assume that this is done according to a pragmatic strategy called *interval resolution strategy* (see Endriss and Hinterwimmer (to appear) for details):

- (9) 1. Take overt information, i.e. intervals denoted by temporal adverbials.  
2. If not available: Take (the most specific) contextual information from the same domain (*restrictor* vs. *nucleus*), i.e. the running time of another salient eventuality.  
3. If not available: Take either contextual information from the other domain, or the default interval  $t_{\text{world}}$ , which denotes the whole time axis.

In case of (5a), step 1. is not applicable, as there is no temporal adverbial that applies to the eventuality variable introduced by the matrix verb (although there is of course one that applies to the eventuality variable introduced by the relative clause verb (*the eighties*)). On the other hand, the relative clause introduces a contextually salient eventuality within the same domain (i. e. the restrictor): the buying event  $e'$ . Therefore, step 2. applies, and  $i_e$  needs to be resolved to the running times of the respective eventualities. This has the consequence that the final semantic representation of (5a) is the one given in (10) below<sup>7</sup>:

---

<sup>5</sup> In case of stative verbs, we assume that the largest eventuality of the respective kind that is included in the interval  $i_e$  is picked out (see Endriss and Hinterwimmer (to appear) for details).

<sup>6</sup> In formula (8) and subsequent formulas, [...] abbreviates material of the restrictor that has to be repeated in the nucleus. Here, it stands for the logical translation of the relative clause.

<sup>7</sup> We assume that the second occurrence of  $e'$  in (10) is bound dynamically by the existential quantifier that also binds this variable within the relative clause (see Groenendijk and Stokhof (1990) and Chierchia (1995a) for a detailed discussion of the principles of dynamic binding).

- (10) Most  $e$  [ $\exists x$  [ $\text{car}(x) \wedge \text{Arg}(e, x) \wedge \exists e'[\text{buy}(e') \wedge \text{Theme}(e', x) \wedge \text{past}(e') \wedge \tau(e') \subseteq 80\text{s}] \wedge \tau(e) \subseteq \tau(e')]$ ]  
 $[\exists x$  [ $\text{car}(x) \wedge \text{Arg}(e, x) \wedge \exists e'[\dots] \wedge t_0 \subseteq \tau(e) \wedge \text{blue}(e)$ ]

As can be seen, the tense specification in the restrictor contradicts the one within the nucleus: According to the restrictor, the eventualities quantified over have to be located within the eighties (as they are set to the running times of the respective buying events that took place during the eighties). According to the tense marking of the matrix verb, which is interpreted in the nucleus, the very same eventualities have to include the speech time. But this has the consequence that the intersection between restrictor and nucleus is necessarily empty. We assume that this is the reason why (5a) is highly marked.

Following the same principles, it is predicted that (5b) comes out perfectly fine:

- (11) Most  $e$  [ $\exists x$  [ $\text{car}(x) \wedge \text{Arg}(e, x) \wedge \exists e'[\text{buy}(e') \wedge \text{Theme}(e', x) \wedge \text{past}(e') \wedge \tau(e') \subseteq 80\text{s}] \wedge \tau(e) \subseteq \tau(e')]$ ]  
 $[\exists x$  [ $\text{car}(x) \wedge \text{Arg}(e, x) \wedge \exists e'[\dots] \wedge \tau(e) < t_0 \wedge \text{blue}(e)$ ]

The information contributed by the past tense marking of the matrix verb does not clash with the tense specification in the restrictor.

### 3 QVEs in sentences with plural definites

#### 3.1 The first possibility: Bound eventuality-variables within the NP-complement of the definite determiner

Let us return to sentence (1a), which is repeated below as (12):

- (12) The people that lectured on kangaroos at the conference last summer were usually [open-minded]<sub>F</sub>.

QVEs in sentences with definites cannot arise in the same way as QVEs in sentences with indefinites. In contrast to the indefinite determiner, the definite determiner is not allowed to pick out different individuals from one and the same set. Rather, it has to pick out the maximal sum individual contained in the set it is applied to (see Link (1983)). But the consequence is that co-variation with the eventualities bound by the Q-adverb is excluded if the set denoted by the NP-complement of the definite determiner does not vary itself. To put it the other way around, co-variance would only be possible if the NP-complement of the plural definite included a variable that allows the objects denoted by the plural definite to vary.

There are indeed cases where QVEs come about in precisely this way (see Hinterwimmer (in preparation) for details). Consider the contrast between (13a) and

(13b) below: (13a) gets a QV-reading and is therefore acceptable, while (13b) does not get such a reading<sup>8</sup>.

- (13) a. The people in Peter's class are usually [French]<sub>F</sub>.  
 b. ??The people in Peter's current class are usually [French]<sub>F</sub>.

Intuitively, the contrast between the two sentences can be explained as follows: While in (13a) it is possible that the denotation of the noun *class* varies with the eventualities quantified over, this is excluded in (13b) due to the presence of the adjective *current*, which fixes the denotation of the noun to the speech time. We assume that the co-variation in (13a) is due to the presence of a silent eventuality variable in the noun *class* that may be bound by the Q-adverb contained within the same clause (otherwise it is resolved to a contextually salient eventuality). Furthermore, an eventuality predicate  $\lambda e.\text{school-year}(e)$  is inferred on the basis of clause internal information. (13a) then gets the semantic representation shown in (14) below<sup>9</sup>.

- (14) Most  $e$  [school-year( $e$ )]  
 $[\exists e' \leq e [\text{Arg}(e', \sigma\{X: \text{people}(X) \wedge \text{in}(X, \text{Peter's class}_e)\}) \wedge \text{French}(e')]]$ ,  
 where  $\sigma\{X: P(X)\} =_{\text{def}} \iota X [P(X) \wedge \forall Y [P(Y) \rightarrow Y \leq X]]$  (see Link (1983)).

As already mentioned, in the case of (13b), the adjective *current* fixes the denotation of *class* to a single eventuality. This has the effect that the denotation of the whole NP *people in Peter's class* is also fixed. Therefore, each eventuality quantified over has to include the same sum individual, and the sentence is out for the same reason as sentence (15) below, which contains a proper name (cf. de Swart (1993), according to whom predicates like *be French* are *once-only-predicates* that can only be applied once to the same individual):

- (15) ??Peter is usually French.

The acceptability of sentence (12) cannot be explained in the same way. Neither is there an element like *class* that can plausibly be assumed to contain a silent eventuality variable, nor does the hearer get any clue that may help her to accommodate a predicate that characterizes a set of eventualities each of which contains a (different) sum individual of the required kind. Furthermore, at an intuitive level the sentence also does not seem to quantify over eventualities each of which contains a sum individual

---

<sup>8</sup> It can only be interpreted as saying that there is a specific plural individual the elements of which are French most of the time, which would be a non-QV-reading that is of no interest to our concerns.

<sup>9</sup> Note that we assume that definites of which the denotation is relativized with respect to the eventualities quantified over are mapped onto the nuclear scope of Q-adverbs, because they do not contribute anything to the determination of those eventualities. Rather it has to be guaranteed independently that each of those eventualities includes a plural individual of the respective kind, as the existence presupposition associated with the definite article would not be fulfilled otherwise. Therefore, such "relativized" definites are only acceptable if an eventuality predicate that serves as a suitable restriction for the Q-adverb is either explicitly given or can be accommodated easily (s. Hinterwimmer (in preparation) for details).

consisting of all the people that fulfil the relative clause predicate at that eventuality. The intuition is rather that the Q-adverb quantifies over eventualities each of which contains an atomic part of the sum individual denoted by the plural definite.

### 3.2 The second possibility: Quantification over the atomic parts of sum eventualities

Sentence (16) below, which contains the Q-adverb *for the most part*, receives a QV-reading that can be paraphrased as in (17):

- (16) For the most part, the students admire [Mary]<sub>F</sub> (Nakanishi/Romero (2004): 7).  
 (17) Most of the students admire Mary.

Nakanishi and Romero (ibid.) – henceforth NR – assume that a sentence of the form *For the most part NP VP* has the truth conditions given in (17) below, where **p** corresponds to the denotation of the non-focussed part of the clause, while **q** corresponds to the denotation of the focussed part.

- (17)  $\exists e [\mathbf{p}(e) \wedge \exists e' [e' \leq e \wedge |e'| \geq \frac{1}{2} |e| \wedge \forall e'' [e'' \leq e' \rightarrow \mathbf{q}(e'')]]]$  (ibid.: 8).

NR paraphrase the formula above as follows: “There is a general (possibly plural) event *e* for which **p**(*e*) holds and there is a (possibly plural) event *e'* that is a major part of *e* such that, for all subevents *e''* of *e'*, **q**(*e''*) holds” (ibid.: 8). They propose that a QV-reading “with respect to a given NP arises as a side effect of the following choices” (ibid.: 9):

- (18) (i) The semantic content and thematic predicate of the NP are within the restrictor **p**.  
 (ii) The general event *e* is ‘measured’ by counting its atomic event units in  $[[V^0]]$ .  
 (iii) The NP is interpreted distributively in a one-to-one mapping” (ibid.: 9).

Thus, sentence (16) gets the semantic representation in (19a), which can be paraphrased as in (19b) below:

- (19) a.  $\exists e [*admire(e) \wedge Agent(e, \text{the students}) \wedge \exists e' [e' \leq e \wedge |e'| \geq \frac{1}{2} |e| \wedge \forall e'' [e'' \leq e' \rightarrow Theme(e'', \text{Mary})]]]$  (ibid.: 9).  
 b. “There is a general (possibly plural) event *e* such that  $*admire(e) \wedge Agent(e, \text{the students})$  and there is a (possibly plural) event *e'* that is a major part of *e* such that, for all subevents *e''* of *e'*,  $Theme(e'', \text{Mary})$ ” (ibid.: 9).

Note that for this analysis to work it is important that the clause splitting algorithm proposed by Herburger (2000), which we adopted so far without further discussion, has to be slightly altered: It can no longer be assumed that the denotation of the whole clause (minus the Q-adverb) is mapped onto the (equivalent of the) nuclear scope. Then, no QV-reading would be available, as each of the universally quantified events

$e''$  would contain the whole sum individual denoted by the definite DP. This, however, does not cause any harm with respect to the sentences discussed in the first part of this paper, as such an altered mapping algorithm would in these cases generate semantic representations that are truth conditionally equivalent to the ones given<sup>10</sup>.

The idea that QV-readings are derived via quantification over the atomic parts of plural eventualities is attractive with respect to the problem under discussion. On the other hand, the analysis suggested by NR cannot be adopted directly in order to account for QV-readings of sentences that contain the Q-adverb *usually* in general, as it only works for sentences that introduce (a set of) plural eventualities – which is obviously not the case in sentences that include singular indefinites. So, in order to account for the sentences discussed in section (2) of this paper, we still need to analyse *usually* as a quantifier that operates on sets of (possibly atomic) eventualities directly<sup>11</sup>.

We propose that there is a uniform semantics for the adverb *usually* (it relates the cardinalities of two sets of eventualities). But in case of sentences that introduce (sets of) plural eventualities, the relation between the respective set and the denotation of *usually* is a little more indirect than in the case of sentences that introduce (sets of) atomic eventualities: We assume that in the former case it is also possible to insert a covert version of the  $\sigma$ -operator first, which turns the set of plural eventualities into the maximal plural eventuality contained within this set<sup>12</sup>. Only after this operation, and after the resulting object has been split up according to the mapping algorithm assumed by NR, the denotation of *usually* is applied to the two newly created plural eventualities. In (21) below it is shown how this works in the case of sentence (12) (repeated below as (20)): (21a) shows the result of applying the covert  $\sigma$ -operator to the denotation of the clause (minus the Q-adverb), and (21b) shows the result of mapping the non-focussed part of this object onto the restrictor, and the focussed part onto the nuclear scope of *usually*:

(20) The people that lectured on kangaroos at the conference last summer were usually [open-minded]<sub>F</sub>.

- (21) a.  $\sigma\{e: \text{Argument}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Agent}(e', X) \wedge \text{lecture\_on\_k}(e') \wedge \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0]\}) \wedge \text{open-minded}(e) \wedge \tau(e) < t_0\}$
- b.  $\text{Most} [\sigma\{e: \text{Argument}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Agent}(e', X) \wedge \text{lecture\_on\_k}(e') \wedge \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0]\}) \wedge \text{open-minded}(e) \wedge \tau(e) < t_0\}]$

---

<sup>10</sup> There is problem, however, with both the mapping algorithm assumed by Herburger (2000) and the one assumed by NR: It is unclear how the denotation of the respective clause can be split up in the required way in a compositional manner, as the solution suggested by Herburger (ibid.) is problematic (see Hinterwimmer (in preparation) for discussion, where a different mapping algorithm is proposed).

<sup>11</sup> Of course, it would also be possible to assume that *usually* is simply ambiguous – which is of course less desirable than offering a unified semantics.

<sup>12</sup> We assume that this is just a principally available alternative to the more standardly assumed option of inserting a covert existential quantifier (cf. Herburger (2000)).



As the quantifier in (21) cannot be applied directly to its two arguments, we assume that the next step consists in shifting the respective plural eventualities into the set of atoms they consist of<sup>13</sup> (cf. Link (1983), Landman (2000)). The result of this operation is shown in (22) below, where furthermore the context variable  $C(e'')$  introduced by *usually* has been added:

$$(22) \quad \text{Most } e'' [e'' \in \text{Atom}(\sigma\{e: \text{Arg}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Agent}(e', X) \wedge \text{lecture\_on\_k}(e') \wedge \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0\}]\}) \wedge C(e'')]) \\ [e'' \in \text{Atom}(\sigma\{e: \text{open-minded}(e) \wedge \tau(e) < t_0\})]$$

In the case of the restrictor, the atoms of the plural eventuality are most plausibly determined via the atomic parts of the plural individual that functions as its argument, i.e. we get the set of eventualities each of which has an atomic part of the plural individual denoted by the definite DP as its argument. In the case of the nuclear scope, the atoms have to be the smallest eventualities that fulfil the verbal predicate. Remember from section (2.2) that the context variables introduced by Q-adverbs are resolved to the predicate  $\lambda e. \pi(e) \subseteq i_e$ , where  $i_e$  is a variable that ranges over time intervals. This results in (23) below:

$$(23) \quad \text{Most } e'' [e'' \in \text{Atom}(\sigma\{e: \text{Arg}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Agent}(e', X) \wedge \text{lecture\_on\_k}(e') \wedge \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0\}]\}) \wedge \tau(e'') \subseteq i_{e''}] \\ [e'' \in \text{Atom}(\sigma\{e: \text{open-minded}(e) \wedge \tau(e) < t_0\})]$$

In the next two sections we will see that the resolution of the free interval variable in the restrictor of *usually* provides the key to the explanation of the acceptability differences noted at the outset of this paper.

### 3.3 The interval resolution strategy revisited

Recall from section 2.2 that we assume a pragmatic strategy which regulates the resolution of the free interval variable in the restriction of Q-adverbs. It is repeated below as (24):

- (24)
1. Take overt information, i.e. intervals denoted by temporal adverbials.
  2. If not available: Take (the most specific) contextual information from the same domain (*restrictor* vs. *nucleus*), i.e. the running time of another salient eventuality.
  3. If not available: Take either contextual information from the other domain, or the default interval  $t_{world}$ , which denotes the whole time axis.

According to (24), the free interval variable  $i_{e''}$  in (23) needs to be resolved to the running time of the plural eventuality introduced by the relative clause verb. There is no

---

<sup>13</sup> It is important not to confuse this set of atoms with the set of plural eventualities the  $\sigma$ -operator previously was applied to.

temporal adverbial within the matrix clause, but there is contextual information available within the same domain (i.e. the restrictor) – namely the running time of the relative clause eventuality  $e'$ . The final semantic representation of sentence (20) is thus the one given in (25) below:

$$(25) \text{ Most } e'' [e'' \in \text{Atom}(\sigma\{e: \text{Arg}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Agent}(e', X) \wedge \text{lecture\_on\_k}(e') \wedge \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0\})\}) \wedge \tau(e'') \subseteq \tau(e')]) \\ [e'' \in \text{Atom}(\sigma\{e: \text{open-minded}(e) \wedge \tau(e) < t_0\})]$$

But what does it mean to resolve the running time of an atomic eventuality to the running time of a plural eventuality? In order to answer this question, we first have to define the running time of a plural eventuality itself. We assume the running time of a plural eventuality to be the smallest interval such that the running times of all the atomic parts of the respective plural eventuality are contained in this interval. Note that we take this interval to be discontinuous, i.e. we assume that it does not include the stretches of time lying in between the running times of the atomic eventualities. The formal definition is given in (26) below:

$$(26) \quad \tau(e^*) \text{ if } e^* \text{ is a plural eventuality:} \\ \text{it s. t. } \forall e' \in \text{Atom}(e^*) [\tau(e') \subseteq t] \wedge \forall t' [\forall e' \in \text{Atom}(e^*) [\tau(e') \subseteq t'] \rightarrow t \subseteq t'].$$

Furthermore, we define that the running time of a plural eventuality  $e^*$  contains the running time of an atomic eventuality  $e'$  (i.e.  $\tau(e') \subseteq \tau(e^*)$ ) iff:

$$(27) \quad \exists e'' \in \text{Atom}(e^*) [\tau(e') \subseteq \tau(e'')]$$

This has the consequence that resolving the running time of an atomic eventuality to the running time of a plural eventuality means resolving it to the running time of some atomic eventuality that is contained within the plural eventuality. With respect to (25) above this means that each of the eventualities quantified over has to correspond to one of the atoms contained within the lecturing event introduced by the relative clause. Those eventualities thus have to take place during the conference mentioned in the relative clause. The meaning of sentence (12) can therefore be paraphrased informally as follows: “Most of the eventualities which have one of the people who lectured on kangaroos at the conference last summer as argument, and which furthermore took place during that conference, are eventualities of being open-minded”. This accounts for the QV-reading the sentence intuitively gets.

Let us now return to the marked sentence (2a), repeated below as (28):

$$(28) \quad ??\text{The people that lectured on kangaroos at the conference last summer are usually [open-minded]}_F.$$

It should be obvious what goes wrong here: The interval resolution strategy forces the eventualities quantified over to be resolved to the running time of the relative clause event, which means that they have to be located during the conference mentioned in the relative clause. But this contradicts the tense specification in the nuclear scope: The

tense marking of the matrix verb forces the eventualities in the set that the  $\sigma$ -operator operates on to include the speech time. This has the consequence that the atomic parts of this maximal sum eventuality picked out by the  $\sigma$ -operator also include the speech time. But then, the intersection between restrictor and nucleus is empty, as an eventuality cannot at the same time take place one year before the speech time, and include the speech time. The ill-formed semantic representation for (28) is given in (29) below:

- (29) Most  $e''$  [ $e'' \in \text{Atom}(\sigma\{e: \text{Arg}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Agent}(e', X) \wedge \text{lecture\_on\_k}(e'), \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0\})\}) \wedge \tau(e'') \subseteq \tau(e')\}$ ]  
 $[e'' \in \text{Atom}(\sigma\{e: \text{open-minded}(e) \wedge t_0 \subseteq \tau(e)\})]$

This reasoning is exactly along the lines of the one for the indefinite cases illustrated in (10) and (11).

### 3.4 The coincidence constraint

Let us finally return to the question why sentence (3a) – repeated below as (30a) – is unacceptable: According to everything said so far, it gets the semantic representation in (30b), which is not ill-formed in any obvious way.

- (30) a. ??The people that listened to Peter's lecture on kangaroos at the conference last summer were usually [open-minded]<sub>F</sub>.  
 b. Most  $e''$  [ $e'' \in \text{Atom}(\sigma\{e: \text{Arg}(e, \sigma\{X: \text{people}(X) \wedge \exists e'[\text{Experiencer}(e', X) \wedge \text{listen}(e') \wedge \text{Theme}(e', \text{P's\_lecture\_on\_k}) \wedge \text{at}(e', \text{conference\_last\_s}) \wedge \tau(e') < t_0\})\}) \wedge \tau(e'') \subseteq \tau(e')\}$ ]  
 $[e'' \in \text{Atom}(\sigma\{e: \text{open-minded}(e) \wedge \tau(e) < t_0\})]$

Note that there is no conflict between the tense specification in the restrictor and the one in the nucleus, as the matrix verb is marked for past tense. The illformedness of (30a) must therefore be due to something other than the tense conflict referred to in the examples above – namely the nature of the sum eventualities introduced in the relative clause.

In the case of (20a), the atomic parts of the relative clause eventuality are most naturally understood to be temporally distributed, i.e. one does not normally expect the lectures given at a conference to take place at the same time. This, however, is different in the case of (30a): Due to the definiteness of the DP *Peter's lecture on kangaroos*, there can only be one lecture on kangaroos given by Peter that took place during the conference last summer. Furthermore, people usually listen to a lecture from start to finish. Now, these two things taken together imply that the running times of the atomic parts of the relative clause eventuality all coincide temporally. We assume that this difference provides the key to understanding the contrast in acceptability between (20a) and (30a). That this speculation is on the right track is further evidenced by the fact that (31) below is only acceptable under the assumption that the atomic parts of the plural meeting event

introduced by the relative clause did not all coincide temporally, i.e. under the assumption that Mary did not meet all people at the same time:

- (31) The people that Mary met yesterday afternoon usually had [black hair]<sub>F</sub>.

Consider furthermore the unacceptable example (32) below: Also in this case, the atomic parts of the relative clause eventuality naturally coincide temporally.

- (32) ??The people that were killed in the car accident yesterday afternoon were usually famous.

The argument for the illformedness of sentence (30a) now runs as follows: The running times of the eventualities quantified over are resolved to the running time of the plural eventuality introduced by the relative clause. Furthermore, the running time of a sum eventuality according to (26) is the smallest interval that includes the running times of all the atomic parts of this sum eventuality. This has the consequence that for each eventuality quantified over in (30a) there has to be a corresponding atomic eventuality contained within the sum eventuality introduced by the relative clause. Now remember that the running times of all the atomic parts of the relative clause eventuality in (30a) necessarily coincide. It is therefore necessarily the case that the running times of all the eventualities quantified over also coincide. Let us now assume that there is a constraint that prevents Q-adverbs from applying to sets of eventualities the running times of which coincide. This constraint is given formally in (33)<sup>14</sup>.

- (33) A Q-adverb may only be applied to a set of eventualities if the following condition holds:  $\neg \forall e, e' \in E: \tau(e) = \tau(e')$ .

Let us finally compare the behaviour of *usually* to the behaviour of the Q-adverb *for the most part*: Interestingly, neither the interval resolution strategy nor the coincidence constraint seem to apply in the latter case, as is evidenced by the acceptability of (34a,b) below.

- (34) a. For the most part, the people that lectured on kangaroos at the conference last summer are [open-minded]<sub>F</sub>.  
b. For the most part, the people that listened to Peter's lecture on kangaroos at the conference last summer were [open-minded]<sub>F</sub>.

---

<sup>14</sup> Note that Zimmermann (2003) – based on Lasersohn (1995) – has proposed a similar, but stronger constraint in his analysis of the Q-adverb *occasionally*. This constraint requires there to be no two overlapping eventualities in the respective set. This, however, would be too strong for our purposes: It does not seem to be the case that sentence (20) is only acceptable under the condition that *none* of the lecturing events coincide. Rather, it seems to be required that *not all* of them coincide. It is therefore very well possible that (33) is too general, because different Q-adverbs come with related, but slightly different constraints concerning the temporal distribution of the eventualities they operate on. Due to limitations of space, we can not pursue this interesting question any further in this paper (but see Hinterwimmer (in preparation) and Endriss and Hinterwimmer (in preparation) for further discussion).

This difference between *usually* and *for the most part* can be explained in two ways: Under the assumption that eventualities are nothing but spatio-temporal slices (cf. Kratzer (1995)), it would be conceivable that there are Q-adverbs which are only able to operate on the temporal parameter of the eventualities they are applied to, while others may operate on the temporal as well as on the spatial parameter. The fact that *usually* is sensitive to the two constraints discussed in this paper could then be explained as a consequence of its membership to the first class, while *for the most part* would be a good candidate for the second class. This hypothesis gains plausibility if one furthermore takes the fact into account that there are also Q-adverbs like *everywhere*, which are only able to quantify over spatial locations, as is suggested by (35):

(35) A horse is loved everywhere.

Following this track, the coincidence constraint would no longer be stipulated, but the ungrammaticality of (30a) would directly follow as a consequence of the constraint against vacuous quantification (Kratzer (1995)).

Another possibility would be to assume that *for the most part* (contra NR) does not quantify over plural eventualities in the sentences above, but over plural individuals. This, however, would necessitate finding an alternative explanation for the differences between *for the most part* and *most* with respect to distributivity observed by NR (see NR for details) – something we cannot do within the limits of this paper.

## 4 Conclusion

In this paper we have given additional evidence for the assumption that Q-adverbs like *usually* are only able to quantify over (sets of) eventualities. Our main concern has been the restricted availability of QV-readings in adverbially quantified sentences that contain plural definites. First, we have shown that such readings can plausibly be analysed as resulting from quantification over the atomic parts of sum eventualities. Furthermore, we have identified two constraints, which the respective sentences have to fulfil in order to get QV-readings. First, the tense markings of the matrix verb and of the relative clause verb contained within the definite DP have to agree. Second, the sum eventualities introduced by the relative clause have to consist of atomic eventualities the running times of which do not necessarily coincide. We have shown that the first constraint directly follows if the results of Endriss and Hinterwimmer (to appear) are combined with the analysis of adverbially quantified sentences containing plural definites mentioned above. Furthermore, we have shown that a second constraint can naturally be explained if this analysis is furthermore combined with the assumption that Q-adverbs like *usually* only operate on the temporal component of the eventualities quantified over.

## References

- Berman, S.: 1987, Situation-Based Semantics for Adverbs of Quantification. In: J. Blevins and Anne Vainikka (eds), *University of Massachusetts Occasional Papers* 12, GLSA, University of Massachusetts, Amherst.

- Berman, S.: 1991, *The Semantics of Open Sentences*. PhD thesis, University of Massachusetts, Amherst.
- Chierchia, G.: 1995a, *Dynamics of Meaning*, University of Chicago Press, Chicago.
- Chierchia, G.: 1995b, Individual Level Predicates as inherent Generics. In: G. Carlson and F. J. Pelletier (eds): *The Generic Book*. Chicago: University of Chicago Press.
- de Swart, H.: 1993, *Adverbs of Quantification: A Generalized Quantifier Approach*, Garland, New York.
- Diesing, M.: 1992, *Indefinites*, MIT Press, Cambridge Mass.
- Endriss, C. and Hinterwimmer, S.: to appear, Tense and Adverbial Quantification. In: J. Doelling and T. Heyde-Zybatow (eds.), *Event Structures in Linguistic Form and Interpretation*, Mouton de Gruyter, Berlin.
- Endriss, C. and Hinterwimmer, S. (in preparation): The Quantificational Variability of Bare Plurals, Plural Definites and Singular Indefinites, ms., University of Potsdam, Humboldt University Berlin.
- von Fintel, K.: 1994, *Restrictions on Quantifier Domains*. PhD thesis, University of Massachusetts, Amherst.
- Groenendijk, J. and M. Stokhof: 1990, Dynamic Predicate Logic, *Linguistics and Philosophy* **14**, 39-100.
- Heim, I.: 1982, *The Semantics of Definite and Indefinite Noun Phrases*. PhD thesis, University of Massachusetts, Amherst.
- Herburger, E.: 2000, *What counts. Focus and Quantification*, MIT Press, Cambridge Mass.
- Hinterwimmer, S. (in preparation): Q-adverbs as selective binders: The Quantificational Variability of Singular and Plural Definites and Free Relatives. PhD thesis, Humboldt University Berlin.
- Kamp, H.: 1981, A Theory of Truth and Semantic Representation. In: J. A. G. Groenendijk, T. M. V. Janssen and M. B. J. Stokhof (eds), *Formal Methods in the Study of Language*, 277-322. Mathematisch Centrum, University of Amsterdam, Amsterdam.
- Lenci, A. and P. M. Bertinetto: 1999, Aspect, Adverbs, and Events: Habituality vs. Perfectivity. In: F. Pianesi, J. Higginbotham and A. C. Varzi (eds), *Speaking of Events*, 245-287, Oxford University Press, Oxford.
- Lewis, D.: 1975, Adverbs of Quantification. In: E. L. Keenan (ed.), *Formal Semantics of Natural Language*, 3-15, Cambridge University Press, Cambridge.

## QUANTIFICATIONAL VARIABILITY EFFECTS WITH PLURAL DEFINITES

- Kratzer, A.: 1995, Stage-Level Predicates and Individual-Level Predicates. In: G. Carlson and F. J. Pelletier (eds), *The Generic Book*, 125-175, University of Chicago Press, Chicago.
- Krifka, M.: 1995, Focus and the Interpretation of Generic Sentences. In: G. Carlson and F.J. Pelletier (eds): *The Generic Book*, 238-264, University of Chicago Press, Chicago.
- Krifka, M.: 2001, Non-Novel Indefinites in Adverbial Quantification. In: C. Condoravdi and G. Renardel de Lavelette (eds), *Logical Perspectives on Language and Information*, CSLI Publications, Stanford.
- Landman, F.: 2000, *Events and Plurality*, Kluwer, Dordrecht.
- Laserson, P.: 1995, *Plurality, Conjunction and Events*, Kluwer, Dordrecht.
- Link, Godehard: 1983, The logical analysis of plurals and mass terms: A lattice-theoretical approach. In: Bäuerle, R. et al. (eds.), *Meaning, Use and Interpretation of Language*, 302-323.
- Marti, L.: 2003, Contextual Variables. PhD thesis, University of Connecticut, Connecticut.
- Nakanishi, Kimiko and Maribel Romero: 2004, Two constructions with Most and their Semantic Properties, Proceedings of *NELS 34*.
- Partee, B.: 1973, Some Structural Analogies Between Tenses and Pronouns in English. *The Journal of Philosophy*, 70, no. 18, 601-609.
- Partee, B.: 1995, Quantificational structures and Compositionality. In: A. Kratzer, E. Bach, E. Jelinek and B. Partee (eds), *Quantification in Natural Languages*, 541-602, Kluwer, Dordrecht.
- Rooth, M.: 1985, Association with Focus. PhD dissertation. University of Massachusetts, Amherst.
- Rooth, M.: 1995, Indefinites, Adverbs of Quantification and Focus Semantics. In: G. Carlson and F. J. Pelletier (eds), *The Generic Book*, 265-299, University of Chicago Press, Chicago.
- Stanley, J.: 2000, Context and Logical Form, *Linguistics and Philosophy* **23**, 391-434.
- Zimmermann, Malte: 2003, Pluractionality and Complex Quantifier Formation, *Natural Language Semantics* **11**, 249 – 287.